USC DESIGN STANDARDS AND GUIDELINES

2022 V3.1

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DOCUMENT CONTROL

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Document Name	USC Design Standards and Guidelines
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Summary	This document defines the specific requirements including technical standards, specifications, and principles to be following for the building and construction of new works at the University of The Sunshine Coast
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APPROVALS

The following signatures represent acceptance of this document:

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BUILDER ACCEPTANCE

The following signature represent acceptance of this document:

Name	Title	Signature	Date

DOCUMENT HISTORY

Issue Number	Date	Change Details	Section Updated
1.0	01/12/2019	An initial version of the document	
2.0	28/10/2021	Addition of comments from the Department - Facilities Management - Capital and Commercial - Technical Operations teams	Entire document
3.0	6/12/2021	Additional details added to Electronic Security and Access Control Systems	Section 9. Electronic Security and Access Control Systems
3.1	05/08/2022	Additional details to *Document Naming Conventions* added to match with Aconex Requirements	Appendix E – USC CAD Standards, E.7 File Naming

Contents

Forward

USC was founded by its community in 1996 in the belief that opportunity is everywhere, and especially in regional Queensland. The first green field university to open in Australia since 1971, USC has helped unlock the innovation, productivity and potential of its regional communities and its impact on economic, social, cultural, and environmental development is clear.

USC has planned its growth carefully in response to its region's needs to obtain and improve knowledge, skills, and resources, to effect social change and to meet 21st century challenges. This regional focus has now expanded well beyond the original Sunshine Coast campus to encompass the region between Moreton Bay and Fraser Coast. While the needs and aspirations of these geographic communities occasionally differ in detail, the greatest opportunities for building community prosperity lie in drawing together the complementary expertise, efforts, and assets of the entire region. The University seeks to contribute to and, where appropriate, to lead this regional advancement in a sustainable way, and in doing so truly become an unsurpassed community asset.

USC's history offers firm foundations to build upon as we pursue continued growth. Our commitment to environmental sustainability is reflected in teaching and research, as well as award-winning campus infrastructure and operations. This commitment includes acknowledgement of the University's sub-tropical context and a clear understanding of the mechanisms available to help reduce its environmental impacts within that context.

This document will provide the framework around which all future infrastructure projects on USC sites are designed and managed with a view to ensuring the University remains at the forefront of innovative, sustainable development.

1 ADMINISTRATION

1.1 Introduction

The design guidelines describe the specific requirements including technical standards, specifications, and principles to be followed, for building and construction works at *the University*. The design guidelines document collates the detailed requirements for the design and construction of USC projects for the understanding and use of *Consultants* and *Contractors*.

1.2 Interpretation and Definitions

The following abbreviations are used throughout this document:

AS	Australian Standard
BCA	Building Code of Australia
BMS	Building Management System
CO^2-e	Carbon Dioxide equivalent
DDA	Disability Discrimination Act
HVAC	Heating, Ventilation and Air Conditioning
USC FM	USC Facilities Management Department
USC IT	USC Information Technology Department
NCC	National Construction Code (incorporating the BCA and PCA)
PCA	Plumbing Code of Australia
PWD	Persons with disabilities
QFES	Queensland Fire and Emergency Services
RCD	Residual Current Device
RPEQ	Registered Professional Engineer of Queensland
SAA	Standards Association of Australia
USC	University of The Sunshine Coast
WH&S	Work, Health & Safety

Throughout this document, the following terms shall have the meanings described herein:

'the University'	Shall mean the University of the Sunshine Coast
'project manager'	Shall mean the person or entity appointed to manage the delivery of the project on behalf of the university
'superintendent'	Shall mean the person or entity appointed to manage the delivery of the works on behalf of the university
'consultant(s)'	Shall mean the person or entity appointed to design and/or manage the design of the works;
'contractor(s)'	Shall mean the person or entity appointed to construct the works
'Independent Commissioning Agent'	Shall mean the person or entity employed by the University to examine the entire design and construction to ensure that the building meets its operational targets.
'Design Brief' or 'Functional Design Brief'	Shall mean a document produced either by *the University* or by *a Consultant* appointed by *the University*, outlining the scope, timeframes, budget, and deliverables of the project
'approved'	When used in relation to a particular material selection, product selection, supplier, brand, manufacturer, colour, size, or method of construction shall mean approved in writing by *the University* or *the Project Manager* on behalf of the *University*.
'minor project'	Shall mean any capital project with the project value less than $1m.
'major project'	Shall mean any capital project with the project value of $1m or more.
'Building Energy Model'	shall mean a physics-based software simulation of building energy usage.

1.3 The University of the Sunshine Coast Act

As a statutory authority under the University of the Sunshine Coast Ace in Queensland, the *University* must comply fully with the Building Act 1975 [1](Include the Building Regulation 2006, and the National Construction Code). *The University* performs the duties of a local authority, as defined in the Building Act, for building works carried out for University purposes.

[1] https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1975-011

1.4 Designated Development – Sunshine Coast Campus

The University has achieved the 'designation' (as defined by the act) of much of its land – on the Sunshine Coast campus only – as 'Community Infrastructure' under the Planning Act 2016[2]. Developments on designated land do not require Council approval, providing they are in accordance with the approve Masterplan for that site, which has been developed in consultation with the Council and other stakeholders. *Consultants* are to confirm eh status of the land that they are preparing proposal for at the start of the project.

Any proposed development on all other *University* property and leased premises will need to follow due process and be approved by the applicable regulatory authorities.

1.5 Codes and Regulations

All work is to meet the requirements of current versions of Australian Standards, the Building Act (1975), the NCC and any other relevant legislation governing building works I the state of Queensland **at a minimum.**

Where a *University* requirement exceeds an Australian Standard or regulation, *the University* requirement shall take precedence over the Australian Standard or regulation.

Conversely, where a stated *University* requirement is exceeded by an Australian Standard or regulation, the higher requirement will apply, and the *Consultant* is to immediately notify the *University* on the inconsistency.

Where a version of a standard or code nominated in this document has been superseded, the current version applies unless advices otherwise, in writing, by the *Project Manager.*

1.6 Minimum Recognized Design Qualification

All design work carried out for or on behalf of the *University* is to be carried out by a person or entity suitably qualifies to do so.

The minimum requirements for the carrying out of such work are as follows:

- Architectural – A person duly qualified and registered to practice as an Architect in Queensland by the Board of Architects of Queensland
- Engineering – A person duly qualified and registered for the appropriate area of practice as an Engineer in Queensland by the Board of Professional Engineers of Queensland

In the case of work being carried out by an entity, that entity must have satisfied the requirements of the relevant registering authority to enable it to appropriately practice in Queensland.

Form 15 Design Certification is to be obtained.

[2] https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2016-025

1.7 Guideline Requirements

Other than requirements that are designated as being **'Mandatory'**, all requirements outlined within this document are guideline requirements only and alternatives will be considered provided that the intent is not compromised.

1.8 Equal and Approved

Where a specific project or brand name is nominated in this document, alternatives will not be allowed without the express written approval of *the University* or it's nominated representative.

The onus will be on the *Consultant* or *Contractor* to prove that the proposed alternative meets the requirements of this document, the drawings, and specifications will not compromise the project in anyway, included ongoing maintenance considerations.

1.9 Building Handover Requirements

Mandatory

Refer to the latest version of the USC Building Handover requirements – Appendix A.

It is a requirement of the *University* that all aspects of the USC Building Handover Requirements are addressed to the satisfaction of the *Project Manager* prior to the issue of Practical Completion on all building projects

1.10 Drawing Formats and CAD standards

Mandatory

Refer also to the latest version of the USC CAD Standards at Appendix E.

All drawings produced for all projects shall comply with the USC CAD Standards and shall follow the basic principles of drawing practice set out in AS 1100, drawn to scale in S.I. metric units.

The *Consultant* or *Contractor* shall submit to *the University* a copy of all tender documents in both electronic format and hard copy, for all disciplines.

Specifications shall be provided to *the University* in both MS Word and .pdf formats, and hard copies shall be printed on A4 size paper on both sides.

1.11 Building Information Model

At the completion of all major projects and some minor projects, at the discretion of the *University*, a complete, up to date Building Information Model (BIM) is to be submitted to the *University*. Unless advised otherwise in writing by the *Project Manager*, the required minimum detail level for all BIM models is LOD 400 – for architectural and structural elements, and LOG 500 for services elements.

1.11.1 Building Information Model – Design Phase

A design phase BIM Manager is to be appointed by the *Consultant* and will assume responsibility for the co-ordination, development and upgrading of the BIM model during the design phase of the project.

The design phase BIM Manager will coordinate the inputs of all services and building element sub-consultants in the BIM model in preparation of co-ordinated construction drawings, utilizing Navisworks or alternative software as *approved* by the *Project Manager.*

The BIM Manager shall undertake a clash detection process to highlight any clashes between services, structure, steelwork, partitions, and ceilings including any other trades that these are affected by, to allow resolution prior to commencing construction.

1.11.2 Building Information Model – Construction Phase

On issue of For-Construction documents by the Design *Consultants*, the *Contractor* shall become the construction phase BIM Manager and assume responsibility for the ongoing development and revisions to the BIM model to reflect shop drawings and as-built conditions.

Produce a fully dimensioned set of drawings, including cable tray, bus duct, pipework, items on ceiling and penetration drawings, and modify the 3D drawings to as constructed status on completion for inclusion within as constructed submissions.

1.12 Building Management System Integration

Mandatory

All new and refurbished building are to incorporate the requirements of *the University's* Building Management System in accordance with the details outlined in Section 11 – Building Management System

2 PLANNING AND DESIGN PRINCIPLES

2.1 Site Planning Principles – Generally

The University has developed approved Master Plans for its Sunshine Coast and Moreton Bay Campuses. All proposed development on these Campuses is to adhere strictly to the principles contained within these Master Plans. Copies of these Plans are available upon request from the University.

Development on all other Campuses is to be designed in accordance with the Design Brief and local planning constraints. Granting of the Local Authority's approval will be a condition of approval of the design by the University.

Development on all University sites is to be an integrated response, encompassing site planning principles that consider the following:

- The site's landscape and natural ecological systems including local soil and topography, water bodies and hydrology, flora, and fauna
- Solar access and orientation
- Prevailing winds and breezes
- Noise sources, both internal and external
- Vehicular and pedestrian access and movement, including sustainable transport opportunities
- Opportunities to minimise environmental impacts and benefit the wider environment, as well as furthering the University's goal of achieving carbon neutrality by 2025.

2.2 Design Principles – Generally

The University of the Sunshine Coast is renowned for its distinctive architecture. The Sunshine Coast campus has been recognised nationally and internationally with well over 30 awards for construction, architecture, and environmentally sustainable design.

All buildings shall focus on innovative, environmentally sustainable design to suit the sub-tropical climate of the Sunshine Coast. All campus developments shall adhere to the principles outlined in the various University Campus Master Plans, the Sustainability Governing/Operational Policy and Sustainability Procedures and those embodied within this document.

Building C*ontractors* and design teams are expected to understand and follow these principles for proposed developments on all USC Campuses and Study Nodes and develop integrated designs that consider context, place, user needs and how various elements interact to create complete design outcomes.

Innovative design is strongly encouraged, provided that proposed design solutions meet all other requirements, or approved departures from, this document and the Design Brief.

2.3 Placemaking

The University's vision is to become a University of international standing and an unsurpassed community asset, embracing and emphasising partnership and collaboration to achieve meaningful outcomes. One of the key elements required to strengthen engagement with its communities is the development of a clear and robust sense of place.

The principles outlined in the various University masterplans are designed to inspire designs that create and reinforce a vibrant and comfortable community space with a strong sense of place that is welcoming and encourages people to stay and participate in the community in a positive way. This should include design ideas that help to establish a clear sense of arrival, as well as elements such as seating and landscaping, and well considered pedestrian circulation patterns, and developing more effective relationships between the surrounding uses and the activities going on in the public spaces. The goal is to create a place that has both a strong sense of community and a comfortable image, as well as a setting, activities and uses that collectively add up to something more than the sum of its often-simple parts.

2.4 Whole of Life Design Considerations

Mandatory

Refer to section 2.16 – Design for Sustainability and Section 3 – Sustainability

All facilities are to be designed with due regard given to lifecycle cost considerations including the following:

- Serviceability and maintenance
- Removal and replacement of plant equipment
- Long term operating performance and costs
- Energy efficiency strategies
- Water conservation strategies
- Building material selection including renewable, recycled, reused elements, embedded energy, and recyclability
- Manageability
- Durability
- Flexible user and re-use
- Disposal/Recovery/Deconstruction

Low capital cost designs that result in inherently high on-going operational and maintenance costs will be deemed unacceptable.

2.5 Design for People with Disabilities

Mandatory

All University facilities, including outdoor area, shall be designed to provide free and equitable access to all users in accordance with the Disability Discrimination Act (DDA[3]) and are to comply fully with all requirements of the BSA, AS 1428.1 and the Disability (Access to Premises – Buildings) Standards 2010[4], as a minimum.

Where practicable or where directed by the *Project Manager*, designers are to include enhanced or additional provisions, such as those contain n AS 1428.2, in their designs. Notwithstanding the requirements outlined in the BCA, all new buildings shall include at least one PWD amenity on each level provisioned with toilet facilities.

All new car parking facilities shall include PWD car parks in accordance with BCA requirements at a minimum. Notwithstanding BCA requirements, additional PWD car spaces may be required at the discretion of the *Director, FM*.

All new buildings incorporating a change in level or more than 1 meter in height shall incorporate at least one lift. The number of lifts required in major projects is to be determined by a Vertical Transportation *Consultant* based on an assessment of the expected building occupancy.

2.6 Design for Personal Safety and Crime Prevention

Mandatory

All facilities and outdoor areas within the *University* campus shall be designed to incorporate Crime Prevention Through Environmental Design (CPTED) principles and strategies.

Designers are to familiarise themselves with the CPTED Guidelines for Queensland[5], available at the following hyperlink/website:

2.7 Wayfinding

Designers shall incorporate wayfinding solutions within their designs which are consistent with strategies that have been developed for all University campuses and study nodes. These strategies include a hierarchy of signage as well as a strategy for location or placement of signage and proposals for both 'static' and 'dynamic' wayfinding solutions.

All wayfinding solutions are governed by the requirements of the USC Brand Guide, upon request from the *Project Manager* will be made available to Designers.

[3] https://www.legislation.gov.au/Details/C2018C00125

[4] https://www.legislation.gov.au/Details/F2010L00668

[5] https://www.police.qld.gov.au/programs/cscp/safetyPublic/Documents/CPTEDPartA.pdf

2.8 Design for Project and Future

A holistic approach shall be taken to any new or refurbishment design and the effect on the existing campus services and buildings shall be well understood.

All designs must identify how the project specific requirements and any additional areas served by systems serving the project areas will impact on the existing services, possible future fit outs/reworking of the project area, and future expansion such as master plan items, items advised etc. These impacts are to be clearly articulated in the design documentation.

All aspects of the building or structure shall be designed to allow for future growth. The design shall identify how future expansion will be simply implemented.

2.9 Design for Sub-Tropical Areas

The University of the Sunshine Coast's campuses and study nodes are in a sub-tropical environment. All designs must specifically deter the growth of mould.

Care is required to ensure necessary measures are taken to prevent the formation of condensate on surfaces such as cable trays, ceilings, walls, windows etc. Necessary measures are also to be taken to prevent the growth of mould in buildings, materials, switchboards, transmission, or cold tracking inducing condensation.

Particular attention is required for insulated chilled water pipes and supply air ducts located in non-air-conditioned areas which are prone to condensate on other surfaces or on or withing building elements. Ensure that lift shafts and basements are adequately water-proofed and ventilated.

The design team shall work together to minimise moisture migration into buildings via penetrations and services which can lead to adverse effects such as infiltration.

2.10 Design for Bushfire Prone Area

All buildings in bushfire-prone areas with the Universities campuses will be designed in accordance with the principles outlined in AS 3959, 2009 'Construction of Buildings in Bushfire-prone Areas' and SAA HB 36, 'Buildings in Bushfire-prone Areas'.

2.11 Wind Around Buildings

Mandatory

All buildings within the Universities Campuses will be designed to minimise the impact of window concentration, tunnelling, and turbulence in surrounding spaces.

Designers are to conduct wind tunnel testing on their proposed designs, either by way of a physical scaled model or a digital model, prior to final approval being granted to proceed with further design development or construction documentation.

2.12 Natural Light and Solar Control

Design principles that provide for maximisation of daylighting in building whilst minimising glare and heat load are to be adopted in all new buildings on *University* sites.

Designers are to achieve a design solution that minimises energy consumption by reducing reliance on artificial lighting and air conditioning whilst maximising user comfort and wellbeing. This shall be provided by addressing measure such as appropriate orientation, maximising external views, solar control devices (both fixes and operable), space design, lighting, such as daylight harvesting lighting control, and glazing selection in an integrated approach.

2.13 Natural Ventilation

Refer to Section 10 - Mechanical Services

Design principles that reduce the reliance on conditioned air in buildings whilst maintaining a high degree of occupant comfort are to be adopted. Designs shall provide the occupants with a choice of methods for heating and cooling spaces, ceiling fans and air conditioning with window and door switches.

2.14 Noise Controls

Refer to Section 2.26 - Building Acoustics

Designers shall address ambient external noise levels from things such as vehicular traffic, aircraft, other buildings, and external pedestrian/gathering places when designing external facades. Materials selection as well as placement of windows and doors shall be carefully considered to avoid unwanted noise impact on internal spaces.

Internal noise from things such as communications and AV racks, air conditioning, such as in ceiling fan coil units and cassette units' fan and air noise, plant rooms, services pipes, drainage pipes, waste pipes, and water supply shall be mitigated within the overall design.

2.15 Design for Flexibility

Mandatory

Teaching spaces shall be designed to provide appropriate interactions between staff and students to encourage the potential for collaboration.

Flexibility of use of building spaces is an important design parameter and the probable effect on the building and services requirements is to be assessed in relation to future change of use. A range of alternative furniture layout options in spaces that are specifically designated as 'Multi-Purpose' spaces shall be provided.

2.16 Design for Sustainability

Mandatory

Refer to section 3 – Sustainability

The University is committed to supporting the creation of a sustainable future through its teaching, research, community engagement, and operations through the provision of leadership at the local, nation and international Level.

Environmentally Sustainable Design and Circular Economy principles shall be incorporated in the planning and development of all new and existing buildings and supporting infrastructure.

2.17 Design for Maintainability

Mandatory

All selections are to be made with consideration given to longevity and lifecycle maintenance costs. The Consultant must undertake a review of maintainability during the design process and ensure that all elements of the building fabric and services required regular inspection, maintenance or replacement are easily accessible and maintainable. For example, Fan Coil Units need to be replaced or removed from an area without cutting a set or plastered ceiling.

Ongoing services and maintenance must be facilitated in the installation. At the completion of all projects, the Consultant shall provide a Building Maintenance Guide that describes the maintenance procedures required to maintain the correct operation of the buildings systems as the building progresses through its lifecycle.

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 (For example, painting)
- Reduction of specialised products
- Properties which affect the ability to apply surface finishes

Building Services (mechanical, electrical, lighting, hydraulic):

- Physical access to building services (For example, duct work, air handling units, fan-coil units, heater elements, 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
- 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

Provide service access spaces, easily workable arrangements, and clear unencumbered walkways of minimum width 1200mm or as otherwise required by legislation and/or Standards (whichever is the larger width).

Roof mounted equipment is to be avoided. Where roof areas must be accessed for maintenance, suitable stairs, walkways, railing, fall protection measure etc. are to be provided.

2.18 Corrosion Prevention and Protection

USC Campuses are generally located in or near coastal areas. The prevention of corrosion must be addressed in the design. Plant should be located under cover (preferably in plantrooms).
Exposed plant should be avoided.

Fixings should be stainless steel. Dissimilar metals should be electrically separated. Pay particular attention to elements such as switchboards, control panels etc. which shall be stainless steel where exposed to weather. All external sensors or control devices shall be provided with sun / weather covers.

Identify additional service recommendations to mitigate or minimise corrosion where the particulars of the installation may produce corrosion in the installation.

2.19 Coordination of Services

Take particular care with arrangement of services and ensure full co-ordination of the project to prevent services compatibility clashes and access issues.

A particular requirement is the separation of mechanical services from electrical services and electrical services from data infrastructure. Ensure any mechanical plant which can cause condensation or water damage is not located above or in the same riser as the electrical services.

2.20 Inground Services

All inground services shall have traceable identification tape installed above the service. All inground services shall be co-ordinated and common trenched where possible. All inground services shall be designed to suit the soil conditions as described by the geotechnical engineer.

2.21 'Smart Campus' Technologies

The University is committed to encourage innovative design solutions that support its aim of creating 'Smart Campuses'

Support for and the use of emerging and innovative technologies is encouraged and shall be incorporated in designs were appropriate, but must be supported by research demonstrating advantages, disadvantages costs, impacts and projected lifespan of the technology, and where relevant, must alight/integrate with existing systems (for example, BMS)

2.22 Work Health and Safety

Mandatory

The University is committed to providing a safe environment for work and study in accordance with the WHS Act 2011.

Designers must comply with the requirements of WHS legislation in the design of spaces in and around buildings, along with furniture selection, equipment selection and placement, building operation and maintenance.

The University approaches health and wellbeing issues based on the World Health Organisation Healthy Workplace Framework and Model (2010). Designers are to familiarise themselves with this document and apply the principles contained therein where appropriate.

In addition to specific requirements noted under various work sections in this document, *the consultant* shall address the following in the design of new buildings and infrastructure:

- Elimination, as far as practicable, of the need for any spaces deemed to be 'Confined Spaces' under the Workplace Health and Safety Queensland Confined Spaces Code of Practice. Any Confined Spaces incorporated in the building(s) are to be designed in accordance with that Code
- Elimination of slip and trip hazards both internally and externally on paths, roadways, walkways, and general pedestrian areas
- Providing defined pedestrian (and cycling/scooter/active transport) paths clearly delineated from vehicular traffic (minimise shared zones)
- Provision of adequate numbers of easily accessible power and data points in work areas and student areas to minimise the need for portable extension cords and leads (floor boxes are not to be used in areas with loose furniture unless no other alternatives are available)
- Provision of adequate services and storage areas in external spaces for events
- Provision of sufficient break-out spaces for both staff and students
- Provision of adequate spaces for waste streaming (landfill, comingled recycling, paper/cardboard, organics, clinical), both at the point of disposal and at the point of collection, including clear and visible signage
- Locations of service entrances, loading docks etc to reduce clashes with other traffic and pedestrians
- Control of rainwater runoff to eliminate or reduce impact on pedestrians and vehicles
- Ensure that a safe level of lighting is maintained generally throughout the campus

- Ensure that noise generated by equipment, vehicles and other external sources is mitigated and does not adversely impact teaching and work areas
- Ensure there is adequate provision for first aid rooms/facilities (refer to WH&S legislation)
- Provision of sufficient facilities for parents for breast feeding, feeding generally and nappy changing
- Provision of sufficient facilities for active transport commuters including showers and lockers

Designers shall engage with USC's internal Work health and Safety team during the design process to ensure compliance with USC WHS Policies and Guidelines.

2.23 Safety in Design

Mandatory

Safe design refers to the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of a product being designed. It encompasses all design including facilities, hardware, systems, equipment, products, layout, and configuration.

The Work Health and Safety Act (2011), together with the accompanying Work Health and Safety Regulation (2011), imposes obligations on anyone involved in the design, manufacture, importation, supply, installation and construction of plant or structures as well as building owners, to manage, eliminate or minimise risks to workers and others within workplaces and includes provisions for all stages of the product's lifecycle, including construction, operation, and end-of-life.

Eliminating building hazards at design and planning stages reduces downstream life cycle costs through reduced need for PPE, retrofitting of add-on safeguarding systems, extraction and ventilation systems, minimised testing and maintenance of equipment and added administrative workloads.

Issues that affect occupants or users and their work-life health and safety quality, such as safe access, safe plant and equipment, layout and space, acoustics, choice of building materials, work systems and ergonomics of human interaction must be addressed throughout the project through consultative processes.

2.24 Legibility

Designers must provide building legibility early in the design process to ensure that buildings are readily identifiable and effective way-finding measures are implemented to make navigation around the campus as easy as possible. This has important implications in terms of a design response to the CPTED considerations.

2.25 Lighting and Finishes

Lighting selections must comply with the energy efficiency requirements of Section J of the BCA, as well as the University's commitment to a sustainable campus.

Designers shall allow for safety and occupant comfort when considering the type, style and output of lighting fixtures.

The minimum reflectance values of all surface finishes shall be addressed in the lighting design and must not compromise illumination levels required for safety.

2.26 Building Acoustics

The design shall provide appropriate acoustic attenuation measures to suit the anticipated uses of spaces. Attention shall be given to the potential for noise transmission between offices, meeting rooms, corridors/walkways, gathering spaces, plant areas and teaching spaces.

Acceptable limits of noise intrusion into usable spaces shall be in accordance with the below Table 1.

ACCETABLE NOISE INTRUSION LIMITS

Room Type	LAeq	LA01
School Offices and all other individual offices	37dBA	45dBA
Administrative/clerical office (open space), post graduate student areas	37dBA	50dBA
Counselling Room	45dBA	55dBA
Meeting Spaces (enclosed)	37dBA	45dBA
Learning Spaces (enclosed) – other than Auditorium/Lecture Theatres	37dBA	45dBA
Auditorium/Lecture Theatres	45dBA	55dBA
Library	40dBA	50dBA
Video-conferencing Room	37dBA	45dBA
Recording Studios/Micro-studios	45dBA	55dBA
Corridors, Lobbies	32dBA	40dBA

Table 1 - Noise Intrusion Limits

Noise emissions from services and plant are to be adequately attenuated to limit noise intrusion into spaces in accordance with the above table. Attention is to be given to very low and very high frequency noise and vibration generated by plant and equipment. Provide additional attenuation at the source of the noise or vibration if necessary.

Designers shall ensure that reverberation times in spaces are appropriate to the use of those spaces. Excessive distortion and reverberance will not be acceptable.

The acoustic design of the building shall be integrated with all other architectural requirements. The overall building design and function shall be reviewed in terms of desirable acoustic qualities. Noise sources should be placed as far as possible from quiet areas. The internal acoustics of individual rooms must be reviewed. For special acoustic issues, an acoustic consultant should be brought into the process as early as possible.

2.27 The Functional Design Brief

A Functional Design Brief (FDB) shall be prepared for each major project by the USC Project Manager (or Architectural Consultant if appointed) in consultation all relevant USC stakeholders

The technical section of the FDB is to be preceded by a Strategic Statement provided by the University, contextualising the project, and providing a general overview of the purpose and expected outcomes of the project.

The FDB will include the following requirements at a minimum:

- Outline of the proposal
- Description of the site
- Connections to other University facilities
- Building Entry points
- Circulation
- Lobbies and Foyers
- Space functions and their relationships
- Building Services
- Life cycle costing analysis
- Schedule of areas
- Indicative programme
- Budget statement

Special Use areas such as laboratories will require a targeted brief, prepared by a person fully conversant with applicable legislation, best practice, and standard procedures.

The FDB will be a formal contractual document and must be agreed and approved by the University before any design work is undertaken on the Project. It will form the basis of the design response but will remain a living document that can grow and change over time subject to further consultation, agreement, and approval by University.

2.28 Space Guidelines

Designers should refer to the recommendations published in the latest edition of the TEFMA Space Planning Guidelines as a guide. These are 'guidelines' only and from time to time the University will impose requirements that may differ from those in the TEFMA document, in which case, the University requirements will take precedence.

Legislative and building code requirements, along with recommendations of the University's WHS team, must always be complied with.

2.29 General Building Layout Considerations

Building designers shall address the following:

- Office areas are to be provisioned with or be within proximity of suitably equipped meeting spaces
- Unless advised otherwise by the Project Manager, at least one medium sized meeting space shall be provided within each building for common use
- Where open-plan offices are proposed, a suitable number of breakout spaces are to be provided for quiet work or private consultation
- Additional breakout spaces are to be provided in all office areas for group or project work as nominated by the Project Manager

- Large teaching spaces and auditorium are to be within proximity of suitable breakout spaces provisioned with tea/coffee making facilities and services for catering
- All work areas are to include access to tea/coffee making facilities as well as refrigeration and re-heating facilities and a suitably sized lunchroom. Where possible, an outdoor, undercover lunch area should be provided in addition to an internal area.
- Student use parts of buildings are to be adequately provisioned with suitable breakout areas that are separate to staff breakout areas, provisioned with tea/coffee making facilities as well as refrigeration and re-heating facilities.

3 SUSTAINABILITY

MANDATORY

3.1 Introduction

From its outset, the University has maintained high aspirations for sustainable growth, incorporating environmentally sensitive design principles and protection of the natural environment. The University values a commitment to supporting sustainability and capacity building across social, economic, cultural, and environmental domains. This is seen as a core responsibility of the University.

To this end, USC is committed to achieving exemplary sustainability practices for higher education institutions and will meet or exceed where possible in relation to its legislative responsibilities and regulatory requirements for sustainability.

In 2017, The University adopted a Carbon Management Plan which requires the University to be carbon neutral by 2025.

To achieve the outcomes outlined in the Carbon Management Plan, environmentally sustainable design and circular economy initiatives are to be implemented throughout the design and construction process for all projects undertaken on all University property.

The Carbon Management Plan, together with the USC Design Standards and Guidelines, draws on experience gained both in Australia and overseas with the aim of aligning with 'world's best practice'. However, these are minimum requirements, and all consultants are encouraged to explore opportunities to go beyond these requirements and present options for consideration by the University.

As the University grows and the impacts of climate change become more tangible, the expectation is that sustainability targets and aspirations will need to adapt to meet and overcome challenges posed by these changes. Also, as technological advances drive further innovation, the University will remain at the forefront of new developments in sustainable practices and environmental responsibility. This dynamic environment will necessitate regular updates to this document, the carbon management plan and other University standards and guidelines.

3.2 Targets

All new projects are to meet the following environmental targets either through building-specific design measures or through connection to infrastructure designed to provide site-wide environmental outcomes that will deliver these targets:

- Net zero annual energy consumption within the project boundary
- Carbon neutrality within the project boundary
- Embodied carbon to be less than 0.3 tonnes of CO^2-e (global warming potential) by gross floor area A, demonstrated via life-cycle assessment to EN15978, excluding module B6
- 1kL/m^2 gross floor area annual maximum potable water consumption demonstrated via water modelling
- 3kg/m^2 gross floor area annual maximum operational waste to landfill

At the end of the defects liability period and prior to issue of the final certificate on each new building project, a comprehensive audit will be undertaken by Builders Project Consultants to verify that targets have been achieved. Where targets have not been achieved, Consultants are to provide, at no cost to the University, options designed to remedy the shortcomings.

3.3 General Requirements

Sustainability initiatives are to be implemented generally in minor, major or operational projects in accordance with the following table:

SUSTAINABLE INITIATIVES

Section	Sustainability Initiative	Minor	Major	Operational
3.4	Sustainability Modelling	–	●	–
3.5	Metering and Monitoring	–	●	–
3.6	Building Commissioning and Tuning	●	●	●
3.7	Pre- and Post-Occupancy Evaluation	●	●	–
3.8	Building Occupant Guide	●	●	–
3.9	Maintainability	●	●	●
3.10	Environmental and Waste Management	●	●	●
3.11	Fresh Air	●	●	–
3.12	Carbon Dioxide Equivalent Monitoring	●	●	–
3.13	Daylight	●	●	–
3.14	Shading	●	●	–
3.15	External Views	●	●	–
3.16	Hazardous Materials	●	●	●
3.17	Volatile Organic Compounds	●	●	●
3.18	Floor Coverings	●	●	●
3.19	Formaldehyde Minimisation	●	●	●
3.20	Indoor Plants	●	●	●
3.21.1	Minimum Insulation Values	●	●	●
3.21.2	Glazing Performance	●	●	–
3.21.3	Building Sealing	●	●	–
3.22.1	Power Factor	●	●	●

3.22.2	Electrical Sub-metering	–	●	–
3.22.3	Internal Lighting	●	●	●
3.22.4	External Lighting	●	●	●
3.22.5	Passive & Low Energy Heating, Ventilation & Cooling	●	●	–
3.22.6	Heating, Ventilation, and Air Conditioning	●	●	●
3.23	Domestic Hot Water	●	●	●
3.24	Appliances	●	●	●
3.25.1	Fittings and Fixtures	●	●	●
3.25.2	Rainwater	–	●	–
3.25.3	Water Sub-metering	–	●	–
3.25.4	Heat Rejection Water	●	●	–
3.25.5	Condensate Water			
3.25.6	Landscaping Water Use	●	●	–
3.25.7	Fire System Water	●	●	–
3.26	Transport	●	●	–
3.27	Materials	●	●	●
3.27.5	Furniture Standards	●	●	●
3.27.7	PVC Avoidance	●	●	●
3.27.8	Joinery	●	●	●
3.27.10	Refrigerant Selection	●	●	●
3.27.11	Local Sourcing	●	●	●
3.28	Landscape	●	●	●
3.40	Community Engagement	●	●	–

Table 2 - Sustainable Initiatives

*Consultant*s must liaise closely with the University's Sustainability team to establish the specific requirements specific requirements for each project. Provide a Sustainability Report at Schematic Design stage, outlining all measures taken to address the requirements of this Standard, for review and approval by the University before proceeding to design development.

3.4 Sustainability Modelling

Modelling should be completed in accordance with relevant Australian Standards and the Green Star Greenhouse Gas Emissions Calculator Guide and to industry best practice. Performance verification shall be undertaken in accordance with one of the methods outlined in the NCC, 2019.

Modelling is to be undertaken early in the design process and subsequently updated to reflect the final design.

The minimum requirements for the sustainability model are:

- Thermal performance of building envelope and subsequent thermal comfort conditions
- Daylight modelling
- Shading analysis
- Energy usage and carbon emissions
- Water use and efficiency

3.4.1 Environmentally Sustainable Design

For all major capital works projects including refurbishments (such as a whole floor of an existing building), a project specific building energy study derived from the Building Energy Model is to be prepared during the schematic design stage and must be provided to the University.

Energy management measures to be considered should include, but not be limited to, the following:

- A thermal comfort studies
- The effect of various fenestration and building construction alternatives on both operating and capital cost of air-conditioning systems should be carefully considered and quantitative analyses undertaken.
- The use of the lowest energy lighting solutions currently available.
- The use of thermal storage strategies including full, partial and demand limiting approaches consistent with demand side management of the site. Historical data for the existing site should be considered by the design team as part of the overall assessment.
- Demand side management and automatic scheduling of hot water systems, chilled water drinking units and the like.
- Use of HVAC economy or free cooling design to utilise ambient air when conditions are favourable.
- Use of energy recovery from exhaust and still air systems by means of heat exchanger-based enthalpy recovery systems or other technologies as appropriate.
- Use of occupancy sensor detectors to control air-conditioning system operation and daylighting for spaces with intermittent use.
- Full analysis of low energy solutions to achieve high level humidity control in areas requiring direct control over space RH levels

Any recommendations should have an appropriate payback period for consideration of incorporating in the project. In principle, sustainable & energy-efficient initiatives are most likely to be adopted where they can be supported by positive fully tested life-cycle cost analysis and payback periods of less than 10 years.

3.5 Metering and Monitoring

Suitable meters are to be installed and connected to the campus wide BMS

The following must be implemented at a minimum:

- Meters are to be installed to measure the consumption of all services within each building, including:
  - Electricity – HVAC, power & lighting
  - HVAC – chilled water, chilled water energy metering (retail outlets)
  - Water - (Potable, Grey, Black and Rain), irrigation, and amenities
  - Gas
  - Renewable energy systems
- Submeters are to be installed for electricity, chilled water, and any other utility supplies, if relevant, water for each leased space.
- Each meter must have the capacity to perform data logging at intervals no greater than 15 minutes.
- All meters must have on-board memory to ensure data is not lost in the event of connectivity issues with the BMS.
- All energy meters and sub-meters must be connected to the campus wide BMS
- Water meters and sub-meters must be connected to the campus wide BM
- The BMS must:
  - provide alarms that alert relevant USC staff via email, SMS, or other communication method if an alarm is triggered
  - enable all data to be transferred via real time BACnet protocol, Native IP Direct (not through a gateway or converter) connected to the site wide BMS to enable centralised data acquisition; and
  - Enable real time interaction with display systems.

3.6 Building Commissioning and Tuning

All building services installers (BMS, mechanical, electrical, fire and hydraulic) are required to perform comprehensive pre-commissioning, commissioning, and quality monitoring. Commissioning works are to be completed and reported in accordance with CIBSE (Chartered Institution of Building Services Engineers) Commissioning Codes.

At Practical Completion, the contractor must provide a Commissioning Report compliant with the relevant code, witnessed by an Independent Commissioning Agent (ICA).

Tuning of all building services is 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

- Monitoring of utility data (electricity, gas and water) and comfort conditions (include user feedback) is to be undertaken and the outcomes reported to relevant USC staff
- 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 to be 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 the University via a final Building Tuning Report

3.7 Pre and Post Occupancy Evaluation

A pre-occupancy survey will be undertaken to assess the current occupant satisfaction/comfort levels and to identify specific issues that can be addressed in the design of the new works. This survey will help inform the Functional Design Brief (FDB).

A post-occupation evaluation (POE) survey is to be undertaken 4 weeks prior to the end of the DLP for the works. The POE survey must cover occupant perception of Indoor Environment Quality (IEQ) factors and their interaction with building systems.

Unless agreed otherwise with the Project Manager, the Building Use Studies (BUS) survey, or a BOSSA survey is to be used. The NABERS Indoor Environment rating may also be used. The same survey type is to be used for both the pre- and post-occupancy surveys.

3.8 Building Occupant Guide

Refer to Appendix A, Section A.4 – Building Occupant Guide and Education

3.9 Maintainability

Refer to Clause 2.17 - Design for Maintainability

3.10 Environmental and Waste Management

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 the Qld Environmental Protection Act 1994. The EMP must also explicitly address landscape conservation issues, such that University grounds suffer minimal impacted by the construction process.

For Major Works, the Head Contractor must have valid ISO 14001 Environmental Management System (EMS) accreditation prior to commencement and for the duration of the project.

3.11 Fresh Air

Buildings should be either mechanically ventilated or a combination of mechanically ventilated and naturally ventilated spaces. To meet these requirements projects must:

- For mechanically ventilated and air-conditioned spaces, the design ventilation rates (based on actual occupancy) represent a 100% increase on AS1668.2-2012.

3.12 Carbon Dioxide Monitoring

For mechanically ventilated spaces, the HVAC return air system must be equipped with carbon dioxide equivalent (CO^2-e) sensors, connected to the building management system, such that the outside air flow rates can be adjusted for each area controlled by an individual air conditioning unit. CO^2-e sensors are to be continuously monitored by the building management system so that outside air flow can be modulated based on occupancy.

3.13 Daylight

Desirably, a minimum of 70% of the floor area of all offices, laboratories, teaching spaces (except auditorium/lecture theatres), library spaces, student commons spaces and informal gathering spaces should achieve a daylight factor >2.0%, achieved at desk-height level (720mm above finished floor level). Designs should incorporate sensor-controlled switching of lighting, with manual override, adjacent to windows to automatically adjust lighting levels according to the ambient daylight levels coming through those windows.

Spaces which have a specific use that precludes the provision of daylight (For example, laboratories that utilise Class 3a, 3b or 4 lasers, visualisation spaces, certain simulation spaces, recording studios and the like) need not comply with this initiative.

3.14 Shading

Refer to section 5.6 – Sun Shading Devices for additional requirements.

To avoid discomfort from direct glare and unwanted heat gain, building facades must be designed such that for 80% of direct solar radiation is precluded from entry into buildings.

3.15 External Views

A minimum of 60% of staff and student work and study areas, must have the following:

- A direct line of sight to vision glazing not greater than 8 metres to the outdoors, or into an adequately sized and day-lit atrium.
- Line of sight must be greater than 45-degree angle of incidence on vision glazing.
- The line of sight should not be interrupted by any object greater than 1.5 metres 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 be greater than 8 metres in every dimension.

Spaces which have a specific use that precludes an external view (For example, Auditorium, Laboratories that utilise Class 3a, 3b or 4 lasers, visualisation spaces, certain simulation spaces, recording studios and the like) need not comply with this initiative.

3.16 Hazardous Materials

The use of hazardous materials, such as asbestos, lead or PCBs, is prohibited on all University projects.

For projects that utilise some or all 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.

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

STANDARDS FOR REMOVAL OF HAZARDOUS MATERIALS	
Material	**Applicable Standard**
Asbestos	Occupational Health and Safety (OH&S) legislation and relevant environmental legislation
Lead	Australian Standard 4361 'Guide to Lead Paint Management'
Polychlorinated Biphenyls (PCBs)	ANZECC Polychlorinated Biphenyl Management Plan

Table 3 - Standards for Removal of Hazardous Materials

3.17 Volatile Organic Compounds

All paints, sealants and adhesive products used on all projects shall be restricted to those that comply with the limits specified in this section and provide product specific data sheets or MSDS which state the total volatile organic compound (TVOC) content and test method used to determine the stated TVOC value.

In addition, provide project specific documentation to demonstrate the products used on the project are in accordance with these requirements.

3.17.1 Paints

Any paint applied on-site, must be ultra-low VOC (<50g/L) and 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.

TVOC CONTENT LIMITS: PAINT PRODUCTS	
Product Type – Subcategory	Max TVOC Content
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 sealers, primers, and prep-coats	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 4 - TVOC Limits for Paint Products

3.17.2 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 5. This includes both exposed and concealed applications.

TVOC CONTENT LIMITS: ADHESIVES AND SEALANTS

Product Type	Max TVOC Content
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and laminate adhesive and sealants	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, acoustic sealants, waterproofing membranes, and fire - retardant sealants and adhesives	250

Table 5 - TVOC Limits for Adhesives and Sealants

3.18 Floor Coverings

3.18.1 Carpet

Required certification 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 v3.14 Level A

3.18.2 General Floor Coverings

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

- GECA 25-2011 v2- 'Floor Coverings'
- GreenTag GreenRate v3.15 Level A

3.19 Formaldehyde Minimisation

Formaldehyde is a common VOC found in most engineered wood products (For example, 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.

3.20 Indoor Plants

REMOVING THIS SECTION or waiting for information regarding Should be more about planter boxes and green walls. Indoor plant landscaping etc. not individual sections.

Green roofing systems? Probably not for the Moreton Bay sections.

3.21 Building Envelope

3.21.1 Minimum Insulation Values

Building insulation is one of the primaries means available to help in achieving the University's sustainability outcomes. Consultants are therefore encouraged to design for greater outcomes than the minimum values specified in Section J of the BCA where possible.

3.21.2 Glazing Performance

The size, orientation, shading and type of glazing is to be carefully considered in the building design to minimise heat gain in buildings.

Consultants are to ensure that all buildings comply with the requirements for glazing as specified in Section J of the BCA at a minimum and consultants are encouraged to design for greater outcomes where possible.

3.21.3 Building Sealing

All conditioned spaces are to be sealed in accordance with the requirements of the current version of NCC and pressure tested to verify compliance. Pressure testing is to be carried out in accordance with UK Air tightness Testing and Measurement Association (ATTMA) Technical Standard 1 – Measuring Air Permeability of Building Envelopes, 2007

The buildings shall be fully sealed and constructed to meet or better an air leakage target of 50Pa, in line with the Air Tightness Testing & Measuring Association (ATTMA) standards.

All external facades must be certified to hold pressure, and all junctions to the façade, roof, and external walls shall be fully and completely sealed.

All services penetrations shall be fully sealed with all pipe penetrations through pressurised zones sealed and fitted with sealed escutcheon plates.

All internal partitions shall be constructed in a similar manner to the requirements for smoke walls.
Window and door frames shall be completely sealed.

3.22 Energy Systems

3.22.1 Power Factor

All buildings shall achieve a unity power factor 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.

3.22.2 Electrical Sub-metering

For all new building projects sub-metering of general power and lighting, and mechanical services will be required.

All meters must be BACnet protocol and be Native IP Direct (not through a gateway or converter), connected to the site wide BMS to enable centralised data acquisition.

3.22.3 Internal Lighting

Refer also to USC Audio Visual Systems Standards and Specification

Refer also to Section 3.13 – Daylight

Lighting designs must conform to the following requirements:

- Lighting power density < 2W/ per 100 lux

- All internal office area lighting to be 4,000 – 5,000K LED
- All internal lab or workshop areas can be 5,000K LED
- Light switching zones no more than 100m²
- 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 with manual override.
- Lighting design must address glare according to AS 1680.2:2006

3.22.4 External Lighting

External lighting must conform to the following requirements:

- All external lighting must have a light source efficacy of at least 65 lumens/watt
- 95% of outdoor spaces meet or exceed the minimum requirements of AS1158 for illuminance levels
- All external lights are connected to a single daylight sensor via the site wide BMS
- Downlighting is to be installed in preference to up lighting
- Light poles are to be installed in preference to bollard lighting
- The path of any direct light's angle of incidence directed to the sky must be obstructed by a non-transparent surface. Refer also local aviation rules and regulations
- The lighting design complies with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting'
- All external lighting is to be 4,000 – 5,000K LED
- Consideration should be given to reduce the number of lighting poles while providing adequate illumination levels

3.22.5 Passive and Low Energy Heating, Ventilation and Cooling

To reduce HVAC capacity, all projects are to be assessed for opportunities to provide passive or low-energy heating, cooling, and ventilation systems.

These are to be incorporated into buildings in addition to traditional HVAC system. The assessment must review, at a minimum, the options of:

- External shading or internal blinds (also refer section 3.14 - Shading above)
- Building Envelope thermal performance (walls, windows, floor, and roof)
- Operable windows/louvers to provide natural ventilation and night purge
- Ceiling fans

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 9pm).
- Lifecycle costing to include capital, maintenance, and operational costs.

3.22.6 Heating, Ventilation, and Air Conditioning

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

- All HVAC designed to use >50% fresh air is to utilise heat recovery units (HRU)
    - If HRU not used a detailed argument must be provided to demonstrate why HRU cannot be applied.
- Internal and 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 the NCC
- A 20% reduction in the maximum pump power allowed under the NCC
- 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 the NCC
- A 20% increase on the minimum energy efficiency ratio (COP) of refrigerant chillers allowed under the NCC
- All motors servicing A/C or 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 pumps >3kW shall have variable speed drive
- All infrequently occupied spaces (laboratory, classroom, lecture theatre, office) are designed to have the ability to automatically either set back, go to dehumidification mode, or shut down when not in use

3.23 Domestic Hot Water

To ensure that the most energy (and greenhouse) efficient systems are installed the following will apply:

- Permitted hot water systems include:
    - Solar hot water systems
    - instantaneous electric hot water
    - If none of the above are applicable, heat pump systems
- 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 either (in order of preference)
    - Heat reclaims from A/C systems
    - If available, co/tri generation (or a combination)
    - Passive solar hot water heating
    - Heat pump with reverse cycle option to cool pool in summer

3.24 Appliances

Appliances required to carry energy star ratings 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 (For example, if the highest rating possible for a dishwasher was 4 stars all dishwashers purchased must be 3.5 stars and above).

3.25 Water

3.25.1 Fittings and Fixtures

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)
- showers maximum resultant flow of 9L per minute

All toilet flushing in new buildings must be supplied via a header tank such that recycled water can be supplied to the header tank (avoiding issues of cross contamination). Where a header tank is already installed in existing buildings, any new fixtures are to be supplied via that tank.

3.25.2 Rainwater

Rainwater collection is to be installed on all major projects and used within and around the building to replace use of potable water. A site-wide collection strategy is preferred such that a minimum of 2 months of average annual rainfall can be captured and stored for use in all buildings on the site.

Captured rainwater is to be provided for use in the following:

- Irrigation
- Process cooling or heat rejection systems
- Toilet and urinal flushing
- External taps
- Swimming pool and water feature top-up

All accessible taps utilising captured rainwater are to be labelled ‘Non-Potable’.

3.25.3 Water Sub-metering

All major uses of water must be individually metered. Major uses are:

- Amenities
- Evaporative heat rejection systems.
- Irrigation systems
- Rainwater supply
- Hot water
- Laboratories
- Recycled grey water

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

3.25.4 Heat Rejection Water

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 (For example, 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).

3.25.5 Condensate Water

All HVAC condensate water should be run to sewer.

3.25.6 Landscaping Water Use

Permanent potable irrigation systems installed in landscaping are to be avoided where possible.
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 waterlogging that will result in prolonged anaerobic soil conditions
- Non-potable water sources to be maximised where irrigation is utilised.

3.25.7 Fire System Water

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.

3.26 Transport

3.26.1 Provision for Electric Vehicles

Planning for new buildings shall include a minimum of 10% new car parking spaces provided with vehicle charge points, with a further 10% provided with electrical infrastructure (such as pits and pipes, etc) to enable the creation of 100% future electric vehicle charge points. Consideration must be given to the mix of charging points (For example, Type-1, Type-II, CHAdeMO, Tesla) and the charging speed (AC vs. DC).

3.26.2 End of Trip Facilities

Secure bicycle storage is to be provided within the building footprint at the minimum 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 5% 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.

3.26.3 Telecommuting and Videoconferencing

Refer to IT STANDARD DOCUMENT

To reduce staff and student travel suitable tele/videoconferencing facilities must be provided.

3.27 Materials

3.27.1 Generally

Each major new building project shall include a third-party certified life cycle assessment (LCA) analysis in line with EN15978, excluding operational energy/water consumption in Module B6

3.27.2 Recycling Waste Storage

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

- Is separate from, but adjacent to, general waste facilities
- Provides a clearly marked, sign-posted, convenient, level, and guaranteed access route
- Be located well clear of occupied and heavily trafficked areas and suitably screened from view
- Be sufficiently sized to accommodate the storage equipment for the following recyclables (where produced), as a minimum:
    - Cardboard
    - Paper
    - Comingled
    - Polystyrene
    - Soft Plastics
    - Metals
    - Pallets
    - Batteries
    - Light bulbs (fluorescent)
    - Used cooking oil
    - Organic (compost) materials

Consideration should be given to the provision of a space for an organic waste composter or digester based on the measured volume of organic waste, number of food and beverage venues and student and staff numbers on the campus.

3.27.3 Concrete and Masonry

Where possible, industrial waste products such as blast furnace slag or fly ash are to be substituted for Portland Cement at the following rates:

- 40% cement replacement for in situ concrete
- 30% cement replacement for pre-cast concrete (including concrete block); and
- 25% cement replacement for stressed concrete.

Where concrete is used for non-structural purposes (curbs, gutters, and pathways) a minimum of 40% of the aggregate must be a recycled aggregate.

Where clay brick is used, 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 (kilns co-fired with landfill gas)

3.27.4 Structural Steel

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
- 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.

3.27.5 Furniture Standards

Furniture selections are to meet one or more of the following requirements:

- Supplier of furniture to confirm >80% by mass of the furniture is reused, OR
- Australasian Furnishings Research and Development Institute (AFARDI) Standard 150 Green Tick, either level A or B;
- Good Environmental Choice Australia (GECA) 28-2011 v2- 'Furniture and Fittings';
- GreenTag GreenRate v3.17 Level A.

3.27.6 Sustainable Timber

All timber products are to be either post-consumer recycled timber or Forest Stewardship Council/Australian Forestry Standard (FSC/AFS) certified with documented chain of custody to the building site. 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.

3.27.7 PVC Avoidance

The use of PVC is to be avoided wherever possible. Specifications must state this as a general principle, and specifically wherever possible.

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

3.27.8 Joinery

All joinery must comply with the sustainability requirements of the Green Building Council Australia.

All joinery materials must meet Green Tag certification, Forest Stewardship Council (FSC) certification and meet formaldehyde content requirements.

3.27.9 Insulant ODP

All insulation must be zero ODP in manufacture and composition.

3.27.10 Refrigerant Selection

All refrigerants must have <10% global warming and zero ozone depletion potential.

3.27.11 Local Sourcing

All materials are to be sourced in accordance with the Buy Queensland Procurement Policy.

3.28 Landscape

Refer to section 6 – Landscaping

3.29 Community Engagement

Consultants shall include areas such as tea rooms, common rooms, barbeque areas, external activation areas, , external teaching spaces and external seating areas early in the design process for all new buildings and major refurbishments.

Placement of these spaces is to integrate with building usage patterns and encourage engagement with local community groups. All areas shall be supplied with relevant power 10amp, 15 amp, 3phase power, portable water and data required as approved by the UUSC Project Manager

4 ARCHITECTURAL DESIGN – GENERAL REQUIREMENTS

4.1 Teaching Spaces

4.1.1 Generally

Teaching spaces are classified broadly into the following categories:

- Auditorium/Lecture Theatres (see 4.1.2)- defined as large, multi-purpose spaces with flexible configurations of furniture to suit a range of scenarios including teaching, functions, performances, and public or university events.
- General Teaching Spaces – Flexible (see 4.1.3) – defined as spaces for collaborative activities not reliant on fixed computers, with the ability to be shaped to accommodate 'rooms within a room' for different group configurations.
- General Teaching Spaces – Fixed (see 4.1.3) – defined as spaces for collaborative activities requiring 1 computer per group table and 'bring-your-own-devices' (BYOD).
- Technology Teaching Spaces (see 4.1.4) – defined as spaces used for computer-based instruction with collaborative activities requiring 1 computer per student with collaboration table configurations.
- Laboratories/Workshops (see 4.1.5) – defined as spaces focused on "hands-on" learning as well as spaces used for lecture recording.
- Visualisation Technology Teaching Spaces (see 4.1.6) – defined as immersive AV environments such as virtual reality, used for teaching and research purposes.
- Simulation Spaces (see 4.1.7) – defined as spaces designed to simulate real world scenarios for the purpose of hands-on teaching.
- Clinical Teaching Space (see 4.1.8) – defined as spaces where students perform clinical tasks (under direction from University staff) dealing with real clients.

Refer to section 5.9.1 - Walls and Partitions Generally projection surface requirements.
Refer to section 5.16.5 - Glass Whiteboards/Writable Walls for writing surface requirements.
Refer to section 5.19 - Loose Furniture and Equipment for additional furniture requirements.

All teaching spaces identified in section 4.1 are to be in accordance with the latest version of USC's Audio-Visual Systems Standards and Specifications for technology requirements in teaching spaces.

4.1.2 Auditorium and Lecture Theatres

Including small and large auditoriums, lecture theatres, performance spaces, drama practice spaces and the like.

The design of all auditorium and lecture theatres is to be in accordance with the below outlined.

Auditorium and lecture theatres are to be multi-purpose spaces with flexible configuration options including:

- Retractable tiered seating
- Fixed tiered seating
- Cabaret style tables and chairs
- Standing tables
- Flip-top tables for up to 6 and mobile chairs

- Stackable chairs in rows
- Or any combination of the above

Auditorium and lecture theatres are to accommodate several different uses including:

- Discipline based learning such as:
  - Performing Arts (music, drama, fashion) performances and recitals
  - Multi-disciplinary with video conferencing and guest speakers
  - Lectorials with collaboration capabilities
- Community
  - Conference and corporate events
- Pedagogies:
  - Didactic and discursive
  - Didactic and discursive, collaborative (active space- project-based, problem-based, enquiry-based, peer learning, case-based, collaborative learning)
- Graduation and Exams

The specific requirements for each auditorium shall be nominated by *the University* in the design brief.

Auditorium and lecture theatres shall be provided with sufficient storage space for tables and chairs when not in use. They are also to be within proximity of suitable breakout spaces that include catering set-up facilities, seating areas, amenities, and display areas for special events.

The acoustic performance of all auditorium shall be verified by a suitably qualified acoustic consultant. Sound transmission between auditorium/lecture theatres and surrounding spaces is to be in accordance with Table 1

The front wall of auditorium and lecture theatres shall be capable of being used for projection. The projection surface shall allow for a minimum projection image size of 4 meters wide unless *approved* otherwise by *the University*.

The number of projection surfaces required will be in accordance with USC's Audio-Visual Systems Standards and Specifications unless otherwise *approved*.

Writing surfaces shall be provided in all Auditorium on the front wall of the room on either side of the projection surface. Each writing surface shall extend from 900mm to 2400mm AFL and have a minimum width of 3m, except as otherwise agreed and noted in the Functional Design Brief.

Auditorium and lecture theatres with more than 250 seats may require a Projection Room/Bio Box. This must be confirmed with USC IT.

The design of the seating layout shall be governed by the requirements of Section 4 of the Association for Audio-visual Education Technology Management (AETM) Design Guidelines.

Tiered seating shall be fabric upholstered on plush foam, rated to a load bearing of 240kg minimum, with integrated minimum A3 sized folding tablet.

4.1.3 General Teaching Spaces

General typology: includes tutorial rooms, classrooms, GLA's, GPL's, Collaboration Spaces and Studios, and the like, and can be either flexible or fixed.

The design of all general teaching spaces shall be in accordance with the below outlined.

Flexible teaching spaces shall include the following:

- They shall include a range of seating type and layout options designed to meet the needs of different pedagogical styles in a flat floor space.
- All furniture shall be movable and reconfigurable. Seating options are to include lounges and standard flip-top tables and chairs, subject to the specific requirements outlined in the design brief for the project.
- shall include a single projection surface located at the front of the room.
- At least one writing surface shall be provided on the front wall of the room beside the projection surface. The writing surface shall extend from 900mm to 2400mm AFL and have a minimum width of 1.8m, except as otherwise agreed and noted in the function design brief
- Spaces may include several collaboration points on several walls around the room. This could include projection surfaces, writing surfaces or AV monitors, individually or in any combination, as outlined in the functional design brief.
- Could be used for video-conferencing purposes.
- shall include flat floor space- furniture may be tiered in specific instances.
- Allowances are to be made for the suitable storage of furniture when not in use.
- Power for student use is to be distributed along perimeter walls.

Fixed teaching spaces:

- may include different seating types suitable for both general, large group discussion in a casual lounge type arrangement, and/or collaboration in smaller groups in a fixed desk arrangement, subject to the specific requirements outlined in the design brief for the project.
- shall include a single projection surface located at the front of the room.
- At least one writing surface shall be provided on the front wall of the room beside the projection surface. The writing surface shall extend from 900mm to 2400mm AFL and have a minimum width of 1.8m, except as otherwise agreed and noted in the functional design brief
- potentially with additional writing surfaces on perimeter walls (subject to the design brief requirements).
- shall include a single computer located at each fixed desk (subject to the design brief requirements).
- shall include flat floor space- furniture may be tiered in specific instances.
- could be used for video-conferencing purposes.
- shall include power and data available for student use at each fixed desk (subject to the design brief requirements).

General teaching spaces are to accommodate several different uses including:

- Discipline based learning such as:
  - Multi-disciplinary with video conferencing and guest speakers,
  - General teaching/tutorial delivery
  - Lectorials with collaboration capabilities
- Community
  - Conference and corporate events
- Pedagogies:
  - Facilitator-led, collaborative activities structured for BYOD participation
  - Collaborative (active space- project-based, problem-based, enquiry-based, peer learning, case-based, collaborative learning)
- Exams

The acoustic performance of all General Teaching Spaces shall be verified by a suitably qualified acoustic consultant. Sound transmission between General Teaching Spaces and surrounding spaces is to be in accordance with Table 1

Large Collaborative Learning Spaces are to be within proximity of suitable breakout spaces that include catering set-up facilities, seating areas, amenities, and display areas for special events.

The projection surfaces shall allow for a minimum projection image size of 4m wide unless *approved* otherwise by *the University*. The number of projection surfaces required will be in accordance with USC's Audio-Visual Systems Standards and Specifications unless otherwise *approved*.

4.1.4 Technology Teaching Spaces

General typology: computer laboratories with sub-classifications of 'Digi-Labs' or Digital Innovation Labs and 'Digital Workspaces'.

The design of all Technology Teaching Spaces shall be in accordance with the below outlined.

Digi-Labs are computer laboratories designed for intensive instruction in the use of digital software and technology, with multiple presentation points around the room. They shall:

- have furniture arrangements that allow teaching staff to move freely around and between tables and all students to be seen from anywhere in the space.
- have furniture of sufficient size to allow for an individual computer for each student with adequate space beside for books, laptops, taking notes etc.
- have multiple projection points and writing surfaces around the room enabling students to easily view content from any location within the room.

Digital Workspaces are computer laboratories designed for intensive instruction in the use of digital software and technology, with a single presentation point at the front of the room. They shall:

- have furniture arranged in rows with students facing a single presentation point that includes both a projection point and a writing surface, like the requirements for general teaching spaces.
- have the rows arranged so that students can be clustered in groups, allowing teachers to freely move around the room to access all students and computers.

The acoustic performance of all Technology Teaching Space shall be verified by a suitably qualified acoustic consultant. Sound transmission between Digital Innovation Labs and surrounding spaces shall be in accordance with Table 1

Designers shall consider the impact of lighting, both artificial and natural, on computer monitors and projection screens.

All power and data outlets shall be located above benchtop level for ease of access. Services reticulation via umbilicals or posts shall be avoided wherever possible.

Additional power and data for student use shall be provided at all work desks.

Retractable computers and monitors shall be installed where directed by the *University* to facilitate flexibility of use of the spaces.

The projection surfaces shall allow for a minimum projection image size of 4m wide unless *approved* otherwise by *the University*. The number of projection surfaces required shall be in accordance with USC's Audio-Visual Systems Standards and Specifications unless otherwise *approved*.

4.1.5 Laboratories and Workshops

General typology: includes wet-labs, super-labs, dry-labs, general workshops, engineering workshops, design studios, maker spaces and project spaces

The design of all laboratories and workshops is to be in accordance with the below outlined.

Laboratories and Workshops are to comply fully with all requirements of the NCC, AS 2982, AS 2243 Parts 1-10 inclusive, AS 1940, AS 4332 and AS 2430, together with any referenced or related documents. Designs are to comply fully with all WH&S standards, acts and regulations and are to be reviewed by the *University* WH&S team prior to approval.

The design shall provide appropriate teacher stations, along with adequate circulation spaces for both teacher and student movement around the laboratory. Furniture may consist of fixed or mobile benches with flexibility being an important consideration.

Consideration is to be given to the location and size of writing surfaces for teaching purposes as well as audio/visual fit out solutions, including display monitors strategically located around the laboratory for ease of view, projection facilities and audio facilities. The location of these items is to be considered in conjunction

with all other requirements of a fully functioning laboratory, together with requirements for flexibility of the layout and use.

In most instances, multiple projection and writing surfaces will be required in various locations in teaching laboratories.

All services reticulation is to allow for ease of connection, disconnection and modification and shall allow for requirements for flexibility of the layout and use.

The location of all support facilities and spaces shall ensure compliance with Australian Standards and regulations.

Access for use of the laboratory by disabled people is to be considered in the design.

The layout of laboratories and workshops, along with all loose furniture selections in those spaces, is to be submitted for approval by *the University's* WH&S team.

Sound transmission between laboratories and workshops and surrounding spaces is to be in accordance with Table 1. Where equipment identified for use in laboratories is known to generate high noise volumes, the design of the space and surrounding enclosure is to be verified by a suitably qualified acoustic consultant.

Laboratories and workshops are to accommodate several different uses including:

- Discipline based learning such as:
  - Multi-disciplinary with collaboration capabilities
- Pedagogies:
  - Facilitator-led, collaborative activities structured for BYOD participation
  - Collaborative (active space- project-based, problem-based, enquiry-based, peer learning, case-based, collaborative learning)
  - To foster exploration and participatory learning
  - Collaborative learning where educators and students pool their skills and knowledge and share in the tasks of teaching and learning
- Exams

The projection surfaces shall allow for a minimum projection image size of 4m wide unless *approved* otherwise by *the University*. The number of projection surfaces required will be in accordance with USC's Audio-Visual Systems Standards and Specifications unless otherwise *approved*.

4.1.6 Visualisation Technology Teaching Spaces

General typology: visualisation studios, VR spaces and immerse spaces.

Visualising Technology Teaching Spaces are specialised spaces with specific requirements on a project-by-project basis addressed in the Design Brief.

4.1.7 Simulation Spaces

General typology: nursing simulation spaces, medical applications simulation spaces, paramedic simulation spaces, occupational therapy simulation spaces, counselling simulation spaces, moot courts, and the like.

Simulation Spaces are specialised spaces with specific requirements on a project-by-project basis addressed in the Design Brief.

4.1.8 Clinical Teaching Spaces

General typology: psychology clinics, counselling clinics, nursing clinics, prosthetics and orthotics clinics, occupational therapy clinics and the like.

Clinical teaching spaces will generally be spaces where students engage with and offer clinical services to the public under the guidance of USC teaching staff.

Clinical Teaching Spaces are specialised spaces with specific requirements on a project-by-project basis addressed in the Design Brief.

4.2 Instrument Laboratories

Instrument labs support teaching laboratories and research laboratories with instruments that require permanent setup and may be used for both teaching or research purposes.

Instrument labs are to comply fully with all requirements of the NCC, AS 2982, AS 2243 Parts 1- 10 inclusive, AS 1940, AS 4332 and AS 2430, together with any referenced or related documents. Designs are to comply fully with all WH&S standards, acts and regulations and are to be reviewed by the University's WH&S team prior to approval.

4.3 Research Laboratories

Research laboratories are to comply fully with all requirements of the NCC, AS 2982, AS 2243 Parts 1- 10 inclusive, AS 1940, AS 4332 and AS 2430, together with any referenced or related documents. Designs are to comply fully with all WH&S standards, acts and regulations and are to be reviewed by the University's WH&S team prior to approval.

All services reticulation is to allow for ease of connection, disconnection and modification and should take into consideration requirements for flexibility of the layout and use.

The location of all support facilities and spaces shall ensure compliance with Australian Standards and regulations.

Access for use of the laboratory by disabled people is to be included in the design.

The layout of research laboratories, along with all loose furniture selections in those laboratories, is to be submitted for approval by the University's WH&S team.

As laboratories generate clinical waste, appropriate on and under counter clinical waste bin storage should be incorporated, as well as space for mobile clinical waste bins. Additional space for pick up and drop off clinical waste bins, and for storage of spare clinical waste containers, should be included in areas that allow for easy and protected movement of clinical waste. Any laboratories on upper levels of buildings should allow for easy access to appropriately sized lifts for transfer of clinical waste to collection areas.

4.4 Micro-Studios

Micro-studios are small, acoustically treated spaces fitted with digital AV technology used by teaching staff and students to record presentations for coursework.

The design of all Micro-studios is to be in accordance with the below outlined.

Sound transmission between Micro-studios and surrounding spaces is to be in accordance with table 1 .

The acoustic performance of Micro-studios is to be optimised for the purpose of digital recording, verified by a suitably qualified acoustic consultant.

Lighting levels are to be adjustable to suit a variety of different video recording needs.

HVAC is to be designed for low noise and the heat load from occupants an equipment.

Designs are to comply fully with all WH&S standards, acts and regulations and are to be reviewed by the University's WH&S team prior to approval.

All services reticulation is to allow for ease of connection, disconnection and modification and should take into consideration requirements for flexibility of the layout and use.

Access for use of the Micro-studio by disabled people is to be considered in the design.

4.5 Student Common Areas

Student Commons areas are areas designed for social gatherings and learning based activities outside of the classroom. They are to be designed to encourage collaboration, together with options enabling use for individual private study.

Student Commons areas are to offer flexible, inviting, and engaging space options that may include any of the following:

- Flexible group spaces
  - for 2 or more occupants
  - can be achieved with a furniture solution alone
  - can include writing surfaces and AV screens or projection surfaces
- Small group open booths
  - for 1- 6 occupants

    - potentially used as breakout spaces
    - can include writing surfaces and AV screens or projection surfaces
- Enclosed booths
    - Quiet space suitable for recording and videoing
    - Fitted with video conferencing technology
    - Potentially used as project space
- Communal Space
    - A variety of comfortable seating options
    - Facilities for refrigeration and heating food
    - Vending machines
    - Digital Information
    - can include writing surfaces
    - Waste streaming for landfill, comingled recycling, and compost
- Wellness spaces
    - Sleeping pods/slouch furniture
    - Bean bags
- Digital Commons
    - Concentration of untimetabled, student use computers
    - Quiet area for individual computer use/project work
    - Digital information
    - can include writing surfaces and AV screens or projection surfaces
- Facilities for tea/coffee making, refrigeration and re-heating of food.

Student Commons areas are to include a range of seating and collaboration options and are to be technologically enabled to allow access to the internet and USC's network, along with the ability to collaborate on coursework.

Allow for a certain number of 'Smart' booths, as nominated by *the University.* 'Smart' booths are to include a video display monitor, along with a range of video and audio connection options for different portable devices, as well as facilities for recharging batteries.

Student Commons should be contemporary in design, comfortable and welcoming. Consideration is to be given to finishes, furniture selection, colours, lighting, thermal comfort, and acoustics to create a commons area that is conducive to both individual and small group study. Consideration should also be given to ease of access to food and drink preparation areas or retail outlets, including vending machines.

4.6 Meeting Rooms and Huddle Spaces

Meeting rooms can accommodate up to 24 people at a meeting table, with facilities for an audio-visual presentation.

Huddle spaces are designed to accommodate up to 4 people around a table, with or without audio-visual facilities. Meeting rooms and huddle spaces can include writing surfaces.

Consultants shall review the acoustic qualities of meeting spaces to ensure that reverberation times are kept to acceptable limits. Sound transmission between enclosed meeting spaces and surrounding spaces is to be in accordance with Table 1

All proposed furniture selections in meeting spaces are to be submitted for approval by the University's WH&S team.

Where requested, meeting rooms are to incorporate facilities to enable catering services to be provided within the space. In such instances, a bench should be provided for the serving of pre-prepared food, together with lockable storage space under. Access is to be available, either within the meeting room or in an adjoining room, to a sink with an ambient/chilled/boiling water outlet.

4.7 Video Conferencing Facilities

Consultants are to review the acoustic qualities of video conferencing spaces to ensure that reverberation times are kept to acceptable limits. Sound transmission between video conferencing spaces and surrounding spaces is to be in accordance with table 1

4.8 Offices

Office space allocations shall be generally in accordance with TEFMA Space Planning Guidelines and as nominated by the University.

Consultants are to review the acoustic qualities of office spaces to ensure that reverberation times are kept to acceptable limits and background noise from outside sources is attenuated. Additional acoustic attenuation may be required in open plan office spaces to limit noise disturbance.

All proposed furniture selections in office spaces are to be submitted for approval by the University's WH&S team. Built-in or fixed joinery type office furniture is to be avoided and only to be used with the approval of the Project Manager.

The minimum furniture requirements for each occupant are as follows:

- A workstation
- An *approved*, fully ergonomic gas lift task chair on castors
- A lockable 3 drawer pedestal on castors, consisting of one file drawer and two stationary drawers
- Studded vinyl chair mat (carpet protector) in areas with carpet floor coverings

Any shelving located above workstations shall be set at a minimum height of 700mm above the work surface, and no shelving is to be located above adjustable height workstations.

Straight work desks are preferred over 'L' shaped or other configurations. Where required, partitions are to be provided between work desks in open-plan office areas as directed by the Project Manager. Work surface types and lengths will be determined by the University in accordance with specific requirements for the work area.

Several adjustable height work desks will be required in each new or refurbished office area. The number and location of adjustable height work desks will be advised by the Project Manager, but at the very least are to be provided at a rate of 10% of workstations within a particular work area. Adjustable height work desks are to match the appearance of the remainder of work desks within that work area. The entire desktop is to be adjustable, not only a section of the desktop, with motorised adjustment controls.

Additional furniture requirements in work areas such as whiteboards, pinboards, visitor chairs and tables, bookshelves and filing cabinets will be advised by the Project Manager. The type, style and colour of these additional items shall be selected to coordinate with the remainder of the office furniture.

Workstations are to meet the following criteria:

- They are to carry Blue Tick Product Certification from the Australasian Furnishing Research and Development Institute
- The work surface is to have a minimum depth of 750mm
- The work surface is to be set at a height between 680 and 720 AFL or be height adjustable with a range of 650 through to 1250mm;
- The thickness of any work surface at seating positions shall be no more than 40mm, including the height of any attachments or structural elements that may obstruct the legs of a person seated at the workspace
- A separate, adjustable keyboard tray, if provided, must be at least 620mm wide to accommodate standard keyboard and mouse
- Horizontal work surfaces are to have shark-nose edge details where possible and practical.
- Consideration should be given to reduce glare by not selecting bright and glossy surfaces.

Cable access is to be considered and should be coordinated with the hardware and equipment locations. Cable management systems are to be utilised to minimise the amount of cable left on top of the work surface and control cables draped beneath the workstation.

Where staff are provided with laptops for use at their place of work, workstations must be provided with either:

- A laptop riser with separate keyboard and mouse
- A docking stations

Partition screens are to be as follows:

- Lightweight, fabric-faced, with self-healing pin board type acoustic material
- Maximum 1200mm in height unless advised otherwise by the Project Manager
- Securely fixed to workstations.

Where it is not possible to fix partitions to workstations, any supporting legs are to be located such that they do not constitute a hazard within the work area.

To ensure the ability to accommodate most workers in accordance with ergonomic principles, the standard ergonomic task chair should fit the following requirements:

- The chair can be lowered to a seat height of 400mm
- The chair can be raised to a seat height of 580mm

- The backrest is height adjustable, providing adjustable lumbar support
- The backrest can be adjusted back and forward independently of pan movement
- In neutral position, the front of the pan is at the same level or lower than the back
- Recommended- the pan angle is adjustable, independently of the backrest, such that the front of the pan can be dropped by at least 5º.
- The chair pan depth must be approximately 450mm
- Recommended – pan depth adjustability of 50mm
- If chairs are provided with arm rests, they must be removable
- If the chair is on castors, must have five prong castors
- Chairs used on carpets should have hard castors
- Chairs used on hard surfaces should have soft castors and semi lock mechanism

Where there is a specific requirement for fixed, higher work surfaces, desk heights shall not exceed 900mm and task chairs are to be fully ergonomic, extended lift drafting stools with full 360° foot-rings.

4.9 Libraries

Library design is to draw upon the principles outlined in the Australian Public Library Standards Guidelines and Outcomes, 2016 published by the Australian Public Library Alliance.

Libraries are to provide opportunities for individual or group learning and collaboration within a comfortable and welcoming environment. A variety of study space types and sizes are to be offered, including outdoor spaces.

A variety of seating and work area options are to be provided within libraries to allow for several different uses. Seating is to be comfortable and hardwearing. Lounge areas are to include beanbags, sofas, and ottomans along with soft floor coverings suitable for lying on.

Noise control measures are to be incorporated in the design to minimise the impact of both external and internal noise on study spaces. The preferred method for achieving this is through the creation of graduated noise zones throughout the building. Physical sound barriers are to be avoided to help maintain openness and visibility.

Study spaces are to be provisioned with power and data outlets and there is to be at least one meeting space within the library or within proximity to the library capable of accommodating up to 12 people at a meeting table, fitted with a computer, large format monitor and writing surface.

4.10 Retail Premises

The design of food premises is to comply with the NCC, AS 4674, Australia New Zealand Food Standard Code – Standard 3.2.3 – Food Premises and Equipment, as well as the requirements of Safe Food Australia and local government codes.

All retail premises fit out proposals are to be submitted to the University along with the appropriate approval authorities for approval prior to any work commencing on site.

Submit drawings and specifications indicating:

- proposed goods receiving and storage areas
- proposed joinery and fittings
- proposed alterations or additions to USC infrastructure
- proposed services reticulation
- equipment layout, size and type including electrical loadings and noise ratings
- proposed method of liquid waste disposal/discharge
- proposed exhaust equipment location and ductwork route
- proposed method of waste disposal
- location of any proposed air conditioning plant including electrical loadings and noise ratings
- service areas
- seating areas
- furniture selections
- all internal floor, wall, and ceiling finishes
- internal and external lighting details
- internal and external colours
- signage details

4.11 External Venues

Where nominated by the *University*, provision should be made in the design of new buildings for suitably designed external venues for on-campus events. Such spaces are to:

- Be fully or partially rain and sun protected
- Be positioned to maximise winter sun and be protected by prevailing winds
- Include adequately lighting for night-time events
- Include adequate 10amp and 15amp single phase, and 20amp and 32amp 3 phase power and water services suitable for catering setup. Designers are to confirm power requirements with the Project Manager
- Include data coverage either via Wi-Fi of hardwired access points
- Have floor/pavement finishes suitable for large congregations of people, including tables and chairs, as well as catering facilities
- Have adequate storage facilities located within proximity for storage of tables, chairs etc.
- Be located within proximity to amenities, including PWD amenities
- Located within proximity to car parking facilities, including PWD parking facilities
- Be wheelchair accessible, with a continuous accessible path of travel between any PWD amenities, PWD carparking facilities and the external venue

- Have an easily accessible location for waste streaming (landfill, comingled recycling, and compost).

4.12 Car Parking Facilities

Car parking areas are to be designed in accordance with the NCC, the AS 2890 suite of standards and any other standards that may apply to the project site.

All parking areas are to be clearly designated and sign-posted, hard sealed, water shedding and parking spaces line-marked in accordance with the standards.

Liaise with the Project Manager to establish the requirements for Paid Parking as required. Parking payment machines shall be located under cover.

EV charging stations should take into consideration the type of charger and the EV plug location to design spaces that suit the vehicles.

4.12.1 Parking Signage

Signs at the main entries to car parks and the campus shall have the following additional messages: The type of parking restrictions, USC Conditions of Parking and That vehicles must park only in marked bays.

Paid Parking Technology

Payment for parking at selected USC Campuses is through a combination of systems included CellOPark's PAYG phone app and E-permits, GIS Ezicom cloud-based Ticket Parking Machines (TPM) and USC's OneStop payment Gateway

4.12.2 Boom Gates

Boom gates shall have the following features: Have the ability to be integrated and controlled by both Gallagher and Cellopark technology. Connected to the University network and so that the University can control access. The specifications shall be tailored to the specific needs of the job. The boom gate will be located at the entry and exit points.

4.12.3 Exit Machine

An exit machine will be installed at the exit. The exit machine will be a box pedestal design incorporating a credit/debit card reader, an LCD display screen and intercom.

4.12.4 Intercom

The payment machines and exit machine will contain an intercom station. An intercom station will be installed on a pedestal on the external plinth for after-hours communications.

The intercoms will be high quality Jacques audio intercoms with noise cancellation technology and remote volume control of the microphones and speakers. The intercom will have the ability to be diverted to a fixed or mobile phone number after hours. Remote access can be provided to a caller by pressing a button on the intercom or diverted phone.

Jacques intercom will be required to ensure compatibility with USC's control rooms.

4.12.5 Licence Plate Recognition (LPR)

LPR cameras to be located at the entry and exit of the car park. The cameras will capture images of the licence plate of each car as it enters and exits the car park. The entry time and date as well as the exit time and date are recorded and communicated to the management system to determine the fee, if any, that is to be charged by the access system.
LPR Preferred Equipment & Technology:

- Genetec Mobile LPR Cameras & Genetec Barrier-less FIXED camera LPR OR
- Compatible with Global Integrated Solution (GIS)equipment (Ezicom).

4.12.6 Vehicle Detection Loops

Vehicle detection loops to be installed consisting of electrical wiring laid and sealed within a cut in the concrete slab which is configured in a rectangular shape and connected to boom gates and LPR camera banks. Designed to detect vehicles and activate systems upon detection.
The entry vehicle detection loop will detect the presence of a vehicle above it. It will then activate the entry boom gate and trigger the licence plate recognition camera. The exit loop will activate the exit machine if required. They will also be used as a safety device to prevent the boom gates lowering until a vehicle has cleared the loop detection area.

4.12.7 Bollard Protection

Bollards will be installed on the concrete equipment plinths to protect the equipment from being struck by a vehicle.

4.12.5 Payment Machine

GIS Ezicom TPM's will be installed where required. The central payment machines will incorporate a credit/debit card reader, an LCD display screen and intercom.

4.12.6 Credit/Debit Card Reader

A credit/debit card reader will be incorporated in the payment and exit machines. The readers will be both pay wave and insert type and unregistered parkers will use them to make payment for parking if the driver did not pay prior to exiting.

4.12.7 Management station and software

CellOpark and GIS Ezicom systems are to be used for all carpark management systems.
The car park management system will be cloud hosted with web access by USC parking management, USC finance and the USC control room including off-site access for authorised USC staff and vendors. The management system will have the flexibility to remotely create and alter multiple tariffs to cater for staff, students and visitor rates, weekday, weekend and night rates, etc.

Have the capacity to record all LPR transactions, boom gate activations and the times and dates of entries and exits. Determines fees and exit rights and communicate any system or hardware alarm to the USC control room. It will also need to be compatible with CellOPark's Pay As You Go (PAYG) App technology.

4.12.8 Wayfinding

Variable message signs (VMS) to be installed at entry point and provide dynamic LED sign capable of displaying the number of vacant parking spaces available, when the car park is full as well as redirecting drivers to alternative parking. The available spaces displayed on the VMS will be adjustable to cater for fleet and executive vehicles including partitioning to vary the staff / student / visitor ratio and
be Application Programming Interfaces (API)compatible with the Holman and Cellopark systems.

4.13 Circulation Spaces

Circulation spaces are to be located and designed with due consideration given to accessibility and flow of traffic, together with minimising noise intrusion into work areas and allowing for maximum natural light penetration into the centre of buildings.

Foyers, corridors, lobbies, and the like shall be designed with no unnecessary alcoves or recesses that could present security issues or be used for storage.

Adhesive fixed rubber or plastic tactile indicators are not to be used without prior written approval from the Project Manager.

Refer to section 4.24 - Waste Collection and section 4.25 - Vending Machines and Water Dispensers

4.14 Links and Walkways

The design of external links and walkways is to be considered as an integral part of the design of new buildings or major alterations. Links and walkways should be extensions of internal spaces or potentially as outdoor student commons areas.

Designers shall consider interactions between foot traffic and vehicular traffic, and in particular, emergency and service vehicle traffic. Care shall be taken to ensure pedestrian safety is not compromised.

Covered, enclosed and overhead links are to be complimentary to the design of the buildings with which they connect.

4.15 Toilets

Toilet facilities shall be provided in accordance with the requirements of the NCC at a minimum. Notwithstanding, the University may elect to provide facilities more than the minimum requirements to meet the needs of the expected building occupancy. Any additional requirements over and above the NCC minimums will be outlined in the function design brief.
Consideration shall be given to travel distances between alternative facilities, particularly for people with disabilities, along with proximity to large gathering spaces and food outlets.

Noise transmission between toilet facilities and adjoining spaces shall be appropriately attenuated to ensure noise intrusion levels at or below those listed in above.

The University, through the Strategic Plan, promotes access, equity, and diversity. As such, designers shall incorporate gender neutral facilities, or facilities that can be readily adapted, in the design of all new buildings. The function design brief will include details about how this requirement is to be achieved in individual building projects

Interiors of toilet facilities are to be adequately screened from view and air locks are to be employed where noise may impact on adjoining spaces. This provision may be relaxed in the case of PWD facilities where compliance with this requirement would result in access difficulties.

Provide a ledge, minimum 100mm wide behind all basins where no vanity bench is provided, and any wall hung urinals provided.

All proposed sanitary fixtures and fittings selections are to be submitted to the Project Manager for approval.

4.16 Shower Facilities

Shower facilities shall be provided in accordance with the requirements of the NCC at a minimum. Notwithstanding, the University may elect to provide facilities more than the minimum requirements to meet the needs of the expected building occupancy. Any additional requirements over and above the NCC minimums will be outlined in the function design brief.

At least one PWD facility in each new major project is to be provided with a compliant shower facility.

All proposed shower facility fixtures and fittings selections are to be submitted to the Project Manager for approval.

4.17 End of Trip Facilities

End-of-trip facilities are designated places that support cyclists, joggers, scooter riders and walkers in using alternative ways to travel to work or classes rather than driving or taking public transport. These types of facilities also benefit people who exercise during their lunch break.

End of Trip Facilities shall be provided in line with Queensland Development Code requirements.

End of Trip facilities are to include secure bicycle parking and storage facilities, lockers and change rooms as required to meet the requirements of the code or as otherwise specified by the University.

CPTED principles shall be incorporated in the design and location of all End of Trip facilities.

4.18 Baby Change and Feeding Facilities * check with names above in section1 or 2

The number and location of baby changing and feeding facilities to be provided in new buildings shall be determined in consultation with University staff.
Baby change and feeding facilities shall be designed in accordance with the Queensland Active Healthy Communities Breastfeeding and Baby Care Facilities code. Specific requirements for new facilities will be addressed by the University in the function design brief.

Proposed sanitary fixtures and fittings selections are to be submitted to the Project Manager for approval.

4.19 Cleaner's Stores

Provide one room with a floor area of 6m² on each floor in each new major project building, fitted with a cleaner's sink, floor waste, cold water supply, mop racks, broom racks, and shelving for the storage of consumables and adequate space for a cleaner's trolley to be stored.

Storage areas should be easily accessible by cleaning staff but out of the way of USC staff and students.

If deemed necessary by the University, additional facilities for the storage of cleaning equipment may be required on other floor levels in the building. Any additional requirements will be defined in the function design brief.

4.20 Communications Rooms

Refer to section 8.6 - Gas Suppression Systems

In all new building projects, allowance is to be made for Communications Rooms in accordance with the minimum requirements outlined in the USC ICT Infrastructure Specification, latest edition.

Noise transmission between Communication Rooms and adjoining spaces shall be appropriately attenuated to ensure noise intrusion levels at or below those listed in above.

4.21 Switch Rooms

Switch Rooms shall be sized and designed to always allow for clear and safe access with minimum clearances provided in accordance with AS/NZS 3000.

4.22 Plant Rooms

Plant rooms are to be as follows:

- Service access is to be shown on as built drawings
- Drawings are to include service clearance zones, travel paths for maintenance and
- the like
- Safe access and clearance zones are to be clearly line-marked on floors where applicable
- Provision for expansion must be considered in the design for new builds. Allowance should be made for potential expansion of equipment in the order of 25%
- Provision is to be made for cleaning and maintenance and adequate space to be able to replace major components of each piece of equipment
- Plant room lighting, including to external plant decks, is to be designed in accordance with Australian Standards – refer section 7.3 Lighting of this documents for further details

4.23 Vertical Risers

All services traversing vertically through the building are to be concealed within sealed, accessible shafts. Where required, shafts are to be fire and/or acoustically rated in accordance with NCC requirements.

Notwithstanding NCC requirements, all shafts intended for the carriage of liquid waste, including any access panels incorporated within, shall be appropriately attenuated to ensure noise intrusion levels at or below those listed in above.

Access panels incorporated in shafts are to be appropriately located and sized to ensure easy access to critical parts of the service or services contained within them. Avoid locating access panels in permanently occupied spaces such as offices where practicable.

4.24 Waste Collections

Waste collection points shall be included in the design of all buildings and outdoor areas at the concept design stage. Consultants are to consult with Director, FM to confirm the size, number and location of waste collection bins and make appropriate allowance for them in the design. Waste bins are not to be in corridors or rooms unless in a specifically designed alcove or enclosure.

The University uses four different identifiers for the sorting and collection of waste on its properties:

- Green – Compostable waste
- Yellow – Recyclable waste
- Blue – Cardboard and paper waste
- Red – Landfill waste

Additional waste streams are located on campuses as necessary, including Confidential waste, Containers for Change, batteries, clear plastics, sanitary and clinical waste, metals, lighting, and smalls (mobile phones, coffee capsule).

Allowance is to be made for a suitable display panel to be located on the wall above the bins within the alcove or above the enclosure. Waste bins are not to be located where they could impede pedestrian or vehicular traffic flow.

4.25 Vending Machines and Water Dispensers

Vending machine locations are to be provided for in the design of all buildings and outdoor areas at the concept design stage, with due consideration given to 24-hour access and security. Vending machines will be supplied and installed by external providers and are to be housed in alcoves designed specifically to accommodate machines of varying sizes and types. Allowances are to be made for lighting, power, drainage, and data connections as required, along with suitable security camera monitoring of the machines.

As part of USC's Water Refill Campus initiative, single use plastic water bottles are not available for purchase on campus and instead, water dispensers including water fountains, bottle refill stations and refill vending machines are located throughout the campus. Consultants shall consult with Director, Facilities Management and Sustainability staff to confirm the size, number, and location of water dispensers, and make appropriate allowance for them in the design.

Vending machines and water dispensers are not to be located where they could impede pedestrian or vehicular traffic flow. Chilled, filtered water refill stations should be in shaded, covered, or protected areas.

4.26 General Storeroom

Allowance is to be made in all new major building projects for at least one general storeroom with a minimum floor area of 10m^2.

Consultants shall consult the Project Manager to confirm the size, number and location of other storerooms as required.

5 ARCHITECTURAL DESIGN – DETAILED REQUIREMENTS

5.1 General Structural Requirements

Mandatory

As a general principle, all structures and materials used in structures deign for the *University* shall be:

- Fit for purpose
- Structurally sound
- Weathertight (where required to be)
- Sustainable
- Safe
- Design to be in struct conformance with the requirements of the National Construction Code and relevant Australian Standards

No banned, unsafe, or highly flammable materials or finishes are to be used.

No materials or finishes containing asbestos are to be used under any circumstances.

A safety data sheet (SDS), material safety data sheet (MSDS), or product safety data sheet (PSDS) is an important component of product stewardship, occupational safety and health, and spill-handling procedures. Safety data sheets shall be provided for all materials specified for a project where required by law or as otherwise requested.

5.2 Building Floor Levels

Building floor levels are to be determined within the following parameters:

- Alignment generally with floor levels in adjacent/adjoining buildings to avoid excessive changes in level requiring elaborate or costly accessibility solutions
- Ceiling heights are to be appropriate for the use of spaces, with a minimum height generally of 2700mm. Ceiling heights in rooms with projection equipment are to be determined in accordance with USC's Audio-Visual Systems Standards and Specifications
- Sufficient space is to be provided in ceiling voids to accommodate all the services requirements for the building, allowing sufficient access for maintenance, without excessive dropped panels and bulkheads
- Consideration is to be given to the acoustic qualities of rooms when determining ceiling heights

5.3 Roofs

The roof design is to be considered integral to the design of the building, in addition to being respectful of other buildings on the campus or study node.

All roofs shall be:

- Weathertight
- Easily serviceable
- Designed and installed strictly in accordance with the roofing manufacturer's standards and recommendations

- Designed and installed strictly in accordance with Australian Standards and the BCA
- Insulated to exceed the minimum requirements of the BCA where possible, in line with the University's sustainability initiatives (see 3.21.1 Minimum Insulation Values)
- Warranted by the manufacturer against defects for a minimum period of 25 years.

All metal roofing decks are to either colour coated (Colorbond) metal with a minimum BMT of 0.48mm, aluminium sheet, stainless steel sheet, zinc sheet or copper sheet.

All roofs on buildings located within 5km of the ocean, a salty or industrial environment shall be Colorbond Ultra steel.

Membrane roofs will only be acceptable with the approval of the University in special circumstances.

All flashing material, capping material and the like are to match the roof deck material. Roofs are to be designed and installed in a manner that eliminates all contact between incompatible metals, with minimal penetrations.

All roofs are to be provided with fall-restraint safety systems as required by any applicable legislation, code or standard. Where access is required for the maintenance and servicing of plant and equipment, provide access stairs, ladders and walkways complying with AS 1657, fabricated using materials compatible with the roof deck. Provide access hatches or doorways to provide safe access to the roof and to all serviceable equipment located on roofs.

5.4 Roof Gutters and Downpipes

Roof gutters and downpipes are to be designed and installed strictly in accordance with Australian Standards and the BCA.

Shapes, sizes and locations of all gutters and downpipes are to be calculated in accordance with the Standards and confirmed by a Certified Engineer.

Internal box gutters will not be acceptable unless approved in writing by the University. All box gutters are to be provided with overflows located at high points in the gutter, with the outlets visible from the ground below. Overflow materials shall match the gutters and shall extend a minimum 150mm beyond the external face of the building.

The aggregate cross-sectional area of any overflows shall be equivalent to the aggregate cross-sectional area of any downpipes required in that length of gutter.

Unless approved otherwise by the Project Manager, all eaves' gutters, and downpipes, together with associated brackets and fixings, are to be fabricated from 316 marine grade stainless steel. Box gutters and associated brackets and fixings are also to be fabricated from 316 grade stainless steel Do not allow contact (either direct or indirect via water runoff) between incompatible metals.

All Colorbond finished roof drainage on buildings located within 5km of the ocean, a salty or industrial environment shall be Colorbond Ultra steel.

Gutters are to have a minimum material thickness of 0.9mm.

Downpipes are to have a minimum material thickness of 1.6mm.

50mm wide expansion joints are to be incorporated in all gutters at maximum 20m intervals.

Leaf guards are to be installed in all gutters located in heavily wooded areas or where roof water is harvested for re-use.

5.5 External Walls

External walls are to be:

- Weathertight
- Designed to reflect the purpose and function of the project
- Designed to reflect the sustainability initiatives of *the University*
- Designed for long service life (minimum 25 years) and low life-cycle cost with minimal maintenance requirements

Designers are encouraged to propose innovative design solutions within the above parameters.

5.6 Sun Shading Devices

The use of external sun shading devices is strongly encouraged to reduce heat loads on buildings.

The effectiveness of sun shading devices is to be demonstrated on drawings produced by the Consultant to show how the devices impact on solar penetration into the building at specific times of day and year.

Sun shading devices shall be considered integral to the design of the building and should not present the appearance of being an afterthought. They should be structurally sound, with robust, corrosion-resistant fixings securely fixed to a structural element. Horizontal components of any sun shading device are to be fixed such that they are supported from the underside.

Materials used in shading devices shall be complementary to the remainder of the building and shall be selected to provide for a long service life (minimum 25 years) and low life-cycle cost with minimal maintenance requirements.

5.7 Windows

The amount, location and type of glazing used in buildings shall be determined as a function of the aesthetic requirements together with the use of the building.

Consideration shall also be given to the capital cost, life-cycle costs, heat and glare reduction, energy reduction, maintenance, and cleaning costs.

All windows shall be of commercial quality, designed and installed in accordance with manufacturer's recommendations along with relevant codes and standards. Glazing assemblies shall be tested and certified as resistant to water penetration in accordance with the BCA and AS 2047. All glazing used shall be in accordance with AS 1288.

Designs that utilise external shading devices to limit solar heat loads will be preferred over the use of special glazing or glazing treatments, however, where the use of such devices is not viable, the Consultant is to produce satisfactory evidence that the proposed glazing will make a significant impact on heat load and, therefore, energy usage in the building.

Where buildings are to be air conditioned, any openable windows are to be connected through the BMS to the air conditioning system to prevent the system running whilst any of the windows are open.

Any glazing that could be mistaken for a doorway or opening shall be clearly identified in accordance with Australian Standards requirements. Any applied identification shall be approved by the University prior to manufacture.

Proposed window types shall be easy to operate, functional and appropriate for the use of the building. Unless approved otherwise by the Project Manager, openable sashes are to be fitted with locks, keyed alike, and keys handed to the Superintendent upon Practical Completion.
Windows shall be located to avoid direct sunlight falling on projection surfaces or visual displays. Where required, blinds may be installed to provide privacy or blackout for projection.

Blinds shall be 'Verosol' or equal, manual controlled roller blinds. Fabric type and colour is to be submitted for approval by the Project Manager.

MDF architraves, sills and reveal linings are not to be used under any circumstances.

5.8 Doors and Door Hardware

Refer also to section 2.5 – Design for People with Disabilities

5.8.1 Doors Generally

Doors are to be fit for purpose, with consideration being given to aesthetics, maintenance, and longevity of service. Door types, sizes and opening actions are to be appropriate for their use.

Except where not suitable for the purposes of meeting statutory requirements, door frames are to be generally clear anodised aluminium, however, other frame types will be considered and must be agreed in writing by the Project Manager before inclusion in the project. Frames are to be securely fixed to the adjacent wall structure.

Where metal frames are used in masonry walls, they are to be fully grouted all round. Glazing assemblies shall be tested and certified as resistant to water penetration in accordance with the BCA and AS 2047. All glazing in doors and sidelights is to be in accordance with AS 1288.

Any glazing that could be mistaken for a doorway or opening shall be clearly identified in accordance with Australian Standards requirements. Any applied identification shall be approved by the University prior to manufacture. The jambs and heads of aluminium framed doors are to be reinforced to minimise the risk of twisting and misalignment. All doors are to be fitted with a minimum of 3 sets of stainless-steel hinges. Notwithstanding, all doors are to be fitted with hinges appropriate for the size, weight and use of the door.

Consideration is to be given to the requirements for electronic access control systems when selecting door types. Door stiles and jambs shall be sufficient to accommodate the required locking mechanism.

MDF is not to be used for doors or architraves under any circumstances.

All timber doors used externally are to be solid core, marine grade plywood faced both sides, with hardwood edge strip all round, suitable for paint finish, and fitted with weather seals to prevent water ingress into the building. Glue used in timber doors is to be Type A bond, 'waterproof' glue.

External doors are to be of aluminium framed material fully sealed with no open extrusions, cladded with aluminium sheet, powdered coated to match, fully fitted with weather seals to prevent ingress into the building.

Any louvred panels in external doors or sidelights are to be fitted with insect screens.

Internal doors shall be suitable for either clear or paint finish. Where doors are to be clear finished, they shall be faced in Tasmanian Oak veneer with matching 2mm thick mitred edge strips all round.
Fire doors shall comply with Australian Standards and the BCA and, if located in general access passageways, are to be fitted with devices to hold them open linked to the fire alarm system to release the door automatically on alarm.

Acoustic, fire, smoke and weather seals equal to 'Raven' are to be fitted to doors as required to meet the design criteria for the door.

Vision panels are to be fitted in all doors to teaching spaces other than lecture theatres, and to all doors where there exists the danger of impact with others on the opposite side of the door and all offices that open up into a non-air-conditioned space and or has a door switch installed. Vision panels in other doors will be as directed by the University on a project requirement basis. Vision panels are to comply with Australian Standards and the BCA.

Doors into conditioned spaces are to be connected through the BMS to the air conditioning system to prevent the system running whilst any of the doors are open.

All main access doors to new buildings as well as doors to heavily trafficked areas within those buildings shall be fitted with automatic door operators. Where major upgrade works are being undertaken, the installation of automatic door operators shall be incorporated within the design.

5.8.2 Door Furniture

Door furniture shall be Lockwood 1800/1900/70 Series, stainless steel finish with PWD compliant lever handles.

5.8.3 Door Closers

Door closers are to be heavy duty, commercial grade Lockwood or equal, fit for purpose, finish to match door frame. Hold-open door closers are to be avoided where possible.

5.8.4 Automatic Door Operators

Automatic door operators are to be Dorma and connected to the fire indicator panel where required.

Doors to all new PWD amenities shall be fitted with DORMA ED 100 Swing Door Operators with push button controls, indicator lights and electromagnetic locking devices, or approved equal.

All ancillary egress devices are to be readily accessible and recognisable to users. All auto doors and egress doors shall have a minimum of 48-hour battery backup and be connected to essential power were provided to the building.

5.8.5 Ancillary Door Hardware

All ancillary door hardware is to be heavy duty, commercial grade stainless steel.

5.8.6 Keying Systems

See Section 9 – Electronic Security Services and Access Control Systems

5.9 Internal Walls and Partitions

5.9.1 Walls and Partitions Generally

The layout and type of internal walls and partitions is to allow for maximum flexibility in future use of the spaces. Loadbearing and masonry walls should be avoided where possible.

Exposed brick or concrete block masonry walls will not generally be allowed other than in service, storage, or plant areas or where the masonry has a decorative finish. Any exposed concrete walls shall have a minimum Class 2 off-form finish. Framed walls and partitions are to be constructed using minimum 76 x 0.55 BMT steel stud and track systems, designed, and engineered for the height and imposed loads.

Also refer section 2.26 - Building Acoustics for specific requirements for certain spaces. Provide tested systems as specified by the lining manufacturers, fixed, and finished strictly in accordance with the manufacturer's recommendations. Obtain a certificate from the installer stating that the walls have been installed in accordance with the tested system.

Unless approved otherwise by the Project Manager, all internal framed internal walls and partitions should extend up to the underside of the slab above or a minimum of 100mm past the ceiling lining. Where not otherwise prescribed to meet the requirements of section 2.26 - Building Acoustics, or specified by the Acoustic Consultant, all continuous internal partition walls shall achieve a minimum rating of Rw43.

If walls do not extend to the underside of a concrete slab and a suspended ceiling is installed, provide insulation over the ceiling to prevent flanking noise transmission in accordance with the manufacturer's recommendations for the nominated partition system and any recommendations of the Acoustic Consultant.

All framed walls and partitions are to be sheeted both sides with minimum 13mm recessed edge, flush set plasterboard.

Linings in wet areas are to be minimum 6mm fibre cement sheet (plasterboard linings will not be accepted), fixed strictly in accordance with the manufacturer's recommendations.

All penetrations in walls are to be properly sealed to maintain the acoustic and/or fire and smoke ratings as required. Rated walls are to be re-sealed to restore the required rating whenever any works are carried out requiring installation of or alterations to existing cables, conduits, and the like.

Provide noggings in all framed or battened walls at selected locations for fixing of fixtures and fittings. In galleries and elsewhere where a significant number of fixtures require fixing to or support by the wall or partition,

noggings shall be substituted by 12mm structural plywood linings fixed over the full extent of the wall with 10mm plasterboard sheeting over.

Where used for projection, walls shall be level 5 plasterboard finished with a Class A paint finish.

5.9.2 Operable Walls

Operable walls are not favoured by the University and shall be used only with the written approval of the Project Manager or where specifically nominated in the functional design brief.

Where the use of operable walls is approved, provide evidence of the acoustic qualities of the walls, and ensure that they are installed strictly in accordance with the manufacturer's recommendations to maintain required acoustic separation.

Operable walls may be used to afford flexibility in space use and may comprise one of the following systems:

- Top hung, folding, or accordion door systems
- Top hung, side stacking operable wall systems
- Top hung, stacking, sliding door/wall systems
- Top hung, vertically folding operable wall systems

Operable wall systems shall be easy to use, with automatic acoustic seals, requiring minimal effort to open and close and low maintenance. Consideration is to be given to the use of motorised systems to operate operable walls. Floor tracks will not be acceptable.

Consideration is to be given to minimum acoustic requirements when selecting the type of operable wall system to use situations.
Wall and door finishes, and materials are to be appropriate for the location and use of the wall and should be easy to maintain and clean.

5.9.3 Glazing Partitions

Full height and width glazed internal partitions shall be used wherever possible to promote natural light penetration into the middle of buildings as well as providing opportunities for better surveillance. Additionally, transparency of teaching spaces, workshops and laboratory spaces is encouraged in line with current trends in teaching practices.

Where it is not possible or impractical to make the whole of a wall glazed, a minimum 300mm wide glazed sidelight panel should be provided beside the entry door.

Where privacy concerns are identified by the Project Manager, applied frosting film should be used over part of the glazing to prevent casual surveillance.

Unless approved otherwise by the Project Manager, all glazed partitions shall be clear anodised aluminium framed. Glazing is to comply with AS 1288.

Any glazing that could be mistaken for a doorway or opening shall be clearly identified in accordance with Australian Standards requirements. Any applied identification shall be approved by the University prior to

manufacture. Framing systems, seals and glass selection shall be specified to meet the acoustic requirements of the wall and suitable evidence of the expected acoustic performance is to be provided to the Superintendent.

Where required, blinds may be installed to provide privacy or blackout for projection. Blinds shall be 'Verosol' or equal, manual controlled roller blinds. Fabric type and colour is to be submitted for approval by the Project Manager.

5.9.4 Washroom Partitions

Washroom partitions shall be equal to Laminex Partitioning Systems, style FAOB with 13mm Laminex Multipurpose Compact Laminate panels, with privacy strips to doors.

Provide a matching seat in shower cubicles.

Provide modesty panels between wall hung urinals, minimum 300mm wide.

5.10 Floor Coverings

5.10.1 Generally

Floor coverings are to be appropriate for the location, with consideration being given to aesthetics, cleaning, and longevity of service.

In general, coverings should be selected in accordance with the following table:

FLOOR FINISHES

Room Type	Finish Type
Offices	Carpet
Auditorium/Lecture Theatres	Carpet/Timber
General Learning Spaces	Carpet/Vinyl
Digital Technology Teaching Spaces	Vinyl
Laboratories/workshops – engineering workshops (including associated back-of-house spaces, links, corridors and the like)	Sealed Concrete
Laboratories/workshops – all other (including associated back-of-house spaces, links, corridors and the like)	Vinyl
Visualisation Technology Teaching Spaces	Carpet/Vinyl
Simulation Spaces	Carpet/Vinyl
Meeting Spaces (enclosed) and VC Rooms	Carpet
Libraries	Carpet
Corridors, Links, Lobbies and the like	Carpet/Timber/Concrete
Wet areas, End of Trip Facilities	Tiles/Epoxy/Vinyl

Food Preparation Areas	Vinyl/Epoxy
Retail Premises (other than food preparation parts)	Carpet/Timber/Tiles/Concrete
Storerooms, Plant Rooms, Service Areas, and the like	Vinyl or sealed concrete
Lift Cars	Studded Rubber/Carpet

Table 6 - Floor Finishes

Consideration will be given to alternative floor coverings in special circumstances with the written approval of the *Project Manager*.

All floor finishes used in *University* projects shall have been tested and classified for slip resistance in accordance with AS 4586, verified by a NATA accredited testing facility. Selections are to comply with the slip resistance requirements specified in Standards Australia guides HB 197:1999 and HB 198:2014

All floor finishes used in *University* projects shall have been tested and shown to comply with the fire hazard properties requirements outlined in the BCA.

Provide copies of test certificates as required to the certifying authority and the *Project Manager*.

5.10.2 Carpet Flooring

Unless approved otherwise by the Project Manager, all carpet is to be carpet tiles, adhesive fixed direct to the substrate.

Carpet selections are to be as follows:

- Solution dyed nylon
- Rubber backed
- Anti-Static
- Sustainable- ECS Certified Level 4 under the Australian Carpet Classification Scheme
- Commercial Extra Heavy Duty - Contract Extra Heavy Duty rated under the Australian Carpet Classification Scheme
- Carry a minimum 15-year commercial application warranty

Carpets are to be selected from the standard ranges supplied by Ontera, Interface, Godfrey Hirst, or Nolan Carpets, installed strictly in accordance with the manufacturer's recommendation.

Before specifying a particular carpet, the Consultant is to obtain a guarantee from the manufacturer of supply from the same batch and dye lot sufficient to meet the needs of the project. Allow for the supply of 5% additional tiles to be kept in storage to replace any tiles damaged post practical completion.

All substrates are to be prepared in accordance with the vinyl manufacturer's recommendations. In areas likely to be affected by liquid spillages (For example, meeting rooms with catering capability), the substrate is to be sealed against moisture penetration in accordance with the carpet manufacturer's recommendations prior to fixing carpet.

5.10.3 Vinyl Flooring

Unless approved otherwise by the Project Manager, all vinyl flooring is to be in sheet form, with all joints fully welded.

Vinyl selections are to be as follows:

- 100% recyclable
- Low VOC (≤150g/L VOC)
- Easily maintained
- Sustainable
- Certified slip resistant as required for individual applications
- Anti-Static (Dissipative with a surface resistivity ≥ 1 x 10^5 Ω/sq but less than 1 x 10^12 Ω/sq or a volume resistivity ≥ 1 x 10^4 Ω-cm² but less than 1 x 10^11 Ω-cm²)
- Durable- commercial extra heavy duty rated
- Carry a minimum 15-year commercial application warranty

Vinyl used in laboratories and food preparation areas is to be chemical and stain resistant.

All vinyl used in University projects is to be selected from the standard ranges supplied by Tarkett, Forbo, Armstrong or Polyflor, installed strictly in accordance with the manufacturer's recommendation.

In areas where staff or students are standing for long periods of time, or areas where additional acoustic attenuation is required, provide 4mm noise reducing vinyl.

Before specifying a particular vinyl, the Consultant is to obtain a guarantee from the manufacturer of supply from the same batch sufficient to meet the needs of the project. If vinyl tiles are approved, allow for the supply of 5% additional tiles to be kept in storage to replace any tiles damaged post practical completion.

All substrates are to be prepared in accordance with the vinyl manufacturer's recommendations.

5.10.4 Ceramic Tiles

Ceramic tiles are to have the following properties:

CERAMIC TILE CHARACTERISTICS

Physical Properties	Standard	Values
Surface qualities	ISO 10545-2	Length and width + or- 0.6%, Warpage of edges + or- 0.5%, Thickness + or- 0.5%, Wedging + or- 0.6%, Flatness + or- 0.5%
Water absorption	ISO 10545-3	> 0.5%
Modulus of Rupture	ISO 10545-4	≥ 27 N/mm²

Deep Abrasion	ISO 10545-6	> 205 mm²
Coefficient of Linear or Thermal Expansion	ISO 10545-8	> 9^0 K^{-1}
Resistance to Thermal Shock	ISO 10545-9	No visible defects
Moisture Expansion	ISO 10545-10	> 0.05%
Crazing Resistance	ISO 10545-11	No visible defects
Chemical Resistance	ISO 10545-13	No visible defects
Resistance to Stains	ISO 10545-14	No visible defects
Slip Resistance	AS 4586-2013	Refer to ABCB Advisory note 2014-1 'Slip-resistance for Stairways, Landings and Ramps' dated August 2014, as well as HB 197:1999 and HB 198:2014

Table 7 - Ceramic Tile Characteristics

Rectified, large format tiles are preferred for ease of maintenance.

Provide expansion joints as required, caulked in a colour to match grout.

Before specifying a particular tile, *the Consultant* is to obtain a guarantee from the manufacturer of supply from the same batch sufficient to meet the needs of the project. Allow for the supply of 5% additional tiles to be kept in storage to replace any tiles damaged post practical completion.

5.10.5 Timber Flooring

Provide samples of proposed timber flooring for approval by *the University* prior to specifying.

Timber for timber flooring is to be from a certified sustainable source – provide evidence to the *Project Manager* for approval.

Timber for flooring is to have chain of custody certification meeting the Australian Forestry Standard (AFS) AS 4707-2006 as recognised by the Programme for the Endorsement of Forest Certification Scheme (PEFC)

Engineered timber flooring products will not be accepted without the approval of the *Project Manager.*

Timber for flooring is to be a hardwearing, hardwood species, preferably sourced from a managed Australian forest. Boards are to be allowed to acclimatise within the space they are to be laid in for a minimum of 5 days prior to installation.

All timber flooring is to be kiln dried, select grade tongue and grooved boards, secret nail fixed, finished in clear polyurethane.

5.10.6 Timber Decking

Provide samples of proposed timber decking for approval by *the University* prior to specifying.

Timber for timber decking is to be from a certified sustainable source – provide evidence to the *Project Manager* for approval.

Timber for decking is to have chain of custody certification meeting the Australian Forestry Standard (AFS) AS 4707-2006 as recognised by the Programme for the Endorsement of Forest Certification Scheme (PEFC)

Timber for decking is to be a hardwearing, hardwood species, preferably sourced from a managed Australian forest. Boards are to be allowed to acclimatise within the space they are to be laid in for a minimum of 5 days prior to installation.

All timber decking is to be min. 140 x 35, kiln dried, select grade stainless steel screw fixed, finished in clear oil finish.

5.10.7 Resin Based Seamless Flooring

Provide samples of resin based seamless flooring proposed for use in the project for approval by the University prior to specifying.

Flooring selections are to be as follows:

- Low VOC (≤150g/L VOC)
- Easily maintained
- Non-flammable
- Certified slip resistant as required for individual applications
- Anti-Static where required (Dissipative with a surface resistivity ≥ 1 x 10^5 Ω/sq but less than 1 x 10^12 Ω/sq or a volume resistivity ≥ 1 x 10^4 Ω-cm² but less than 1 x 10^11 Ω-cm²)
- Durable- commercial extra heavy duty rated
- Certified chemical resistant where required in certain applications
- Applied strictly in accordance with manufacturer's recommendations
- Carry a minimum 10 -year commercial application warranty

All substrates are to be prepared in accordance with the manufacturer's recommendations.

5.10.8 Concrete Flooring

Concrete floors in storerooms, plant rooms, service areas and the like may be machine floated steel trowel finished grey Portland cement, finished to give a smooth, even surface.

The steel trowel finish shall have a maximum out of tolerance of 5mm when measured in any direction under a 3m straight edge. Fill hollows and remove any dags or inconsistencies as required to achieve the required

finish. Where floor drains are provided, such as plant rooms, there should be adequate fall provided to the floor drains.

Concrete floor finishes elsewhere are to be honed or polished decorative finish concrete. Test panels are to be prepared under full site conditions for approval by the *Project Manager* prior to commencement of the work. Test panel sizes are to be sufficient to display the full character of the proposed finish.

All concrete floor finishes are to have a sealant applied in strict accordance with the manufacturer's recommendations. Sealants are to be hardwearing and long lasting. Exposed concrete floors in Storerooms, Plant Rooms, service areas and the like shall be finished with an *approved* paving paint.

5.10.9 Skirtings

Unless *approved* otherwise by the *Project Manager*, skirtings are to be provided at the junctions of all walls and floors in buildings.

Skirtings may be the following types, dependent upon location:

- Timber
- Aluminium
- Vinyl
- Ceramic tile

Timber skirtings should be avoided and should generally only be used in low value buildings (such as demountable buildings) with restricted or no public access. Timber skirtings may also be used where clear finished timber flooring is used.

Timber skirtings used at clear finished timber floors shall be clear finished timber to match flooring. Elsewhere, timber skirtings are to be finger-jointed, pre-primed pine. MDF skirtings are not to be used.

Aluminium skirtings are to be equal to Bris Aluminium, concealed fix, 100mm flat, clear anodised aluminium skirtings. Where required, ducted skirtings shall be equal to ECD, sized to accommodate the services to be reticulated with adequate separation.

Vinyl floor coverings in all science laboratories, wet areas and food preparation areas is to be coved up walls to a height if 150mm to form the skirting. Coves shall be to a maximum 25mm radius and shall be fully backed with a rigid cove former.

Vinyl skirtings elsewhere shall be black, feather edge 150mm high skirtings fixed in strict accordance with manufacturer's recommendations.

Tile skirtings are to be to match wall tiles where any of the walls within the room are tiled to floor level, or otherwise to match floor tiles. Skirting tiles are to be coved for ease of cleaning.

5.10.10 Nosing, Junctions, and Thresholds

Provide AS 1428 compliant, tapered, clear anodised aluminium thresholds to all external doors except where the external pavement finish meets the internal floor finish in which case a brass angle set flush with the floor finish may be used.

Provide AS 1428 and BCA compliant nosing(s) at all steps, treads, and landings.

At junctions of dissimilar floor finishes, provide a brass angle or strips set flush with the floor finishes. Cover strips are to be avoided.

All nosing(s), angles, strips, and the like are to be securely screw-fixed to the slab with compatible fixings, in accordance with the manufacturer's recommendations.

5.10.11 Door Mats

Provide internal door mats at all entry doors, recessed into specially prepared, brass, or stainless-steel angle trimmed mat wells.

Mats are to be one-piece coir, a minimum of 900mm long and the full width of the door opening

5.10.12 Tactile Ground Surface Indicators

Provide Tactile Ground Surface Indicators (TGSIs) generally in accordance with the BCA and AS 1428.

Where required, employ the services of a qualified Access Consultant to advise on the location and type of TGSI's required.

TGSI's are to be selected from the following list and *approved* by the *Project Manager* prior to specifying:

- Concrete or clay paving units
- Individual Stainless steel or aluminium studs, with carborundum inserts
- Stainless steel or aluminium studded plate, with carborundum inserts

The use of adhesive fixed rubber or plastic pads, such as PolyGuide plastic Peel&Stick tiles, may be permitted in circumstances where other options are impractical and only with the prior approval of the *Project Manager*.

All TGSI paving units or plates are to be set into the floor so that the body of the paving unit or plate finishes flush with the surrounding surfaces.

TGSI used externally are to be UV and fade resistant and any adhesives used are to be waterproof.

5.11 Stairways and Ramps

5.11.1 Generally

Provide stairways and ramps as required to provide free and continuous paths of travel through and between buildings, in accordance with BCA and AS 1428 requirements.

The design of all stairways and ramps is to be in accordance with the BCA and AS 1428.

5.11.2 Locations

Stairways and ramps are to be located to maximise their visibility, accessibility and use as a preferred means of circulation in lieu of the use of lifts.

The use of fire isolated stairways and ramps as the main form of vertical access is to be avoided, but where there is no alternative, doors to the fire stair or ramp are to be held open on a magnetic hold-open device.

Stairways generally should be wide and open, and should form an important, integral part of the design of the spaces they occupy.

5.11.3 Finishes

Stairway and ramp finishes are to be appropriate for their location and use, and as follows:

- Comply with slip resistance requirements
- Comply with the requirements of the BCA and AS 1428
- They are to be hardwearing and easy to maintain
- They are to be compatible with adjacent floor/pavement finishes
- They are not to include any sharp edges that may cause injury

Where carpet is used on stairs, it is to be rated for use on stairs with a minimum 15-year warranty.

Anti-slip nosing(s) are to be installed to all stairs in contrasting colours in accordance with AS 1428

5.11.4 Handrails and Balustrades

Handrails and balustrades generally shall follow the BCA and AS 1428.

Handrails and balustrades to fire isolated stairs and ramps that are not intended to be used for general access may be unpainted galvanised steel.

Elsewhere, handrails are to be either 316 grade stainless steel or select clear finish hardwood. All brackets and fixings are to be stainless steel.

Hardwood handrails are not to be used externally unless approved by the Project Manager.

Balustrades are to be designed utilising 316 grade stainless steel, timber, or glass either alone or in any combination, or in other materials as approved by the Project Manager. All glass used in balustrades is to follow AS 1288

Handrails and balustrades are not to incorporate any sharp edges that may cause injury.

5.12 Vertical Transportation

Mandatory

Refer to Section 13 - Vertical Transportation

Lifts are to be provided in all new buildings with a rise in storeys of 2 or more, or where access to or within the building involves a change in level of more than 1 metre.

Unless approved otherwise by the Project Manager, all buildings with a rise in storeys of more than 3 and all buildings 2 storeys or more with floor plates exceeding 1,000m ² are to be provided with a minimum of 2 lifts.

5.13 Ceilings and Soffits

5.13.1 Generally

Unless approved otherwise by the University, provide suspended ceilings to all occupied areas in buildings.

Ceiling suspension systems are to be consistent within individual buildings. Hanger rod fixing clips are to be securely fixed to the structure above. Explosive or pneumatic shot fixings are strictly forbidden.

Internal ceilings at a height of eight meters or more above floor level are to be a pre-finished metal such as ‘Colorbond’.

5.13.2 Suspended Tile Ceilings

Unless approved otherwise by the Project Manager, drop-in panels shall be equal to Armstrong Fine Fissured, High NCR HumiGuard Plus mineral fibre panels. Product Code 1714MEX, in white finish.

Ceiling tiles in wet areas and science laboratories shall be Armstrong Bioguard Acoustic. Tiles in PC3 laboratories are to be fully vinyl wrapped.

Grid system shall be equal to Armstrong 24mm galvanised steel or aluminium exposed tee grid system, with white baked polyester paint or powder coat finish, to suit 600 x 1200 drop-in panels.

Provide matching standard wall angle to perimeter of all ceilings in wet areas, food preparation areas and science laboratories. Provide matching standard shadow line wall angle to perimeter of all other ceilings.

Where tiled ceilings are subject to uplift, provide hold-down clips and bracing as recommended by the manufacturer.

Suspended tile ceiling systems are to be fixed strictly in accordance with the manufacturer's instructions and accompanied by a 30-year manufacturer's warranty covering the ceiling system against panels sagging or warping and rusting of the grid components.

5.13.3 Flush Set Ceilings

Flush set ceilings should only be used where unavoidable due to specific requirements or where a particular aesthetically driven result is required, and in any case, with the approval of the Project Manager.

Careful consideration should be given to accessibility of services above the ceiling, with adequate access being provided for maintenance, including complete removal and replacement of the piece of equipment without dismantling, whilst minimising the impact of access panels on the appearance of the ceiling.

Suspension systems and furring channels shall be equal to Rondo, fixed strictly in accordance with the manufacturer's recommendations.

Except where a complete seal is required, provide shadow line wall angle trims to the perimeter of all flush set ceilings. Where a completely sealed ceiling is required, provide adhesive-fixed coved plasterboard cornices.

Ceiling linings are to be flush set, 13mm recessed edge plasterboard (or 10mm Supaceil), or 6mm Villaboard fixed and finished strictly in accordance with the manufacturer's instructions.

5.13.4 Acoustic Attenuation

Ceilings are to be designed to provide the required level of acoustic attenuation as noted in Section 2.14 - Noise Controls and Section 2.26 - Building Acoustics

Designers shall consider the combination of materials, insulation, air gaps, substrate, and fixing methods as a whole ceiling system that is equivalent to a tested manufacturer's system, installed and finished strictly in accordance with the manufacturer's instructions, and provide copies of test certificates as required.

5.13.5 Thermal Insulation

Provide insulation batts above ceilings as required to form part of the roof/ceiling thermal barrier system to meet the requirements of the BCA.

5.13.6 External Soffits

External soffits at heights greater than 8m are to be a pre-finished metal such as 'Colorbond' profiled sheeting or cladding system, with no light fittings or other fixtures installed in the sheeting.

Other soffits may be painted fibre cement sheet with plastic joining strips or shadowline joining beads, fixed, and sealed strictly in accordance with manufacturer's recommendations.

Flush-set external soffits are to be avoided.

5.14 Colours

Consultants shall prepare a schedule of finishes and finishes display boards for all *major projects*, for approval by the *Project Manager*.

Where required, *Consultants* may be asked to allow in their fee proposal a sum of money for the preparation of a schedule of finishes and/or finishes display boards for *minor projects*.

Schedules and display boards are to identify:

- The Item or material
- Location of the item or material
- Proposed finish
- Proposed colour (including any manufacturer's codes)
- Brand/Supplier
- Any special conditions that need to be met in order that the finished item to complies with the specification

All paint colours are to be selected from the manufacturer's standard ranges. No special runs will be accepted without the prior approval of *the University*.

Careful consideration is to be given to colour and finishes selections to ensure longevity of the design.

5.15 Applied Finishes

5.15.1 Generally

All applied finished are to be *approved* by the *Project Manager* prior to construction.

Applied finishes may consist of any of the following:

- Built-up membrane system
- Cement render
- Ceramic tiles
- Other systems as *approved* by the *Project Manager*

Consideration is to be given to the longevity of the proposed applied finish, along with ongoing maintenance requirements, environmental considerations, fit for purpose in the location and design integration.

Consideration is also to be given to the comfort of building users, particularly in relation to the surface texture in pedestrian traffic areas.

5.15.2 Built-up Membrane Systems

Built-up membrane systems are generally high build, multi-coat, roller applied systems comprising a primer or 'skim' coat followed by a minimum of 2 finish coats, equal to Rockcote 'Armour Flex'.

The system is to be water resistant, flexible, and hardwearing.

The system shall be applied and finished strictly in accordance with the manufacturer's instructions. The completed system shall be covered by a minimum 10-year unconditional guarantee.

5.15.3 Cement Render

Cement render finishes shall generally comprise an acrylic or polymer modified cement render system, applied strictly in accordance with the manufacturer's recommendations.

Render systems should be water resistant, applied in multiple coats to achieve an overall finished thickness of 10mm

Newly applied render is to be kept moist for 5 days by mist spray applied 24 hours after completion and every 24 hours thereafter. Apply more frequently in hot weather. In temperatures exceeding 27° C, apply a mist spray to masonry prior to render application.

Allow the completed render to cure for a minimum of 14 days prior to the application of water-based paints and 28 days before applying oil-based paints.

5.15.4 Ceramic Tiles

Ceramic tiles may be used as feature applications in approved circumstances.

Tiles are not to be used at heights greater than 3m and/or in areas exposed to prolonged direct sunlight.

Tiles are not to be fixed directly to concrete masonry, masonry block or brick walls without first applying a sand/cement, wood float finished render with a minimum 12mm thickness.

Tiles are to be adhesive fixed over fully cured render using a rubberised, flexible adhesive applied strictly in accordance with the manufacturer's instructions. Provide adequate expansion joints.

5.16 Fitments and Joinery

5.16.1 Generally

All fitment and joinery designs are to be approved by the Project Manager prior to documentation.

Shop drawings are required for all fitments and joinery units for approval by the Superintendent prior to fabrication and installation in the project. All proposed finishes and colours are to be submitted for approval prior to fabrication.

Fixed office furniture is not encouraged by the University as it restricts flexibility. Proposals that include fixed office joinery are to be approved by the Project Manager.

5.16.2 Joinery Cupboards

Cupboard finishes are to be one of the following:

- Plastic low-pressure laminate (Melamine)
- Plastic high-pressure laminate (Laminate)
- 2 Pac polyurethane (spray finished)
- Timber veneer.

2 Pac polyurethane and timber veneer finishes should only be utilised in areas requiring a high-quality corporate appearance.

Melamine should not be used on external surfaces without the approval of the *Project Manager*.

Cupboard carcasses and interiors are to be finished all round in black or white melamine, on 16mm moisture resistant grade MDF or particleboard substrate, with matching edgestrips to all edges. All other exposed surfaces are to be either a laminate, veneer or 2 Pac polyurethane.

All edges to laminated surfaces are to be finished with matching 2mm ABS edgestrips.

Edges to veneered surfaces are to be finished with matching veneer edgestrips.

All cupboards are to sit on 130mm high laminated plywood kicks and be fully sealed to walls all round.

Provide adequate ventilation in cupboards containing audio/visual equipment, together with cable access cut-outs.

Doors and drawers are to be fitted with soft-close hardware and keyed locks (keyed alike within each joinery unit, unless advised otherwise by the Project Manager). All handles are to be satin chrome finished, AS 1428 compliant. All furniture is to be either Blum or Hettich.

5.16.3 Benchtops

Benchtops and worksurfaces are to be one of the following:

- Plastic high-pressure laminate (Laminate)
- Plastic compact laminate (Compact)
- 2 Pac polyurethane (spray finished)
- Reconstituted stone
- Stainless steel
- Galvanised steel (workshops only)
- Timber veneer
- Solid timber
- Other surfaces as *approved* by the *Project Manager*

BENCHTOP MATERIALS

Room Type	Finish Type
Corporate Offices and Reception areas (including kitchenette areas visible within the space)	2 Pac polyurethane/ Reconstituted stone/Timber veneer/Solid timber
General offices	Laminate
General Reception areas	Laminate/Timber veneer
Commercial food preparation areas	Stainless steel
General kitchen areas (including kitchenettes & tea points)	Laminate
Laboratories (refer to Lab design annexure)	Laminate/Compact/Stainless steel
General wet areas	Laminate
General teaching areas	Laminate
Workshops	Laminate/Galvanised steel/Solid timber
Meeting spaces	Laminate/Timber veneer

Table 8 - Benchtop Materials

Reconstituted stone benchtops shall have a minimum thickness of 30mm

Stainless steel benchtops and shelves are to be minimum 2mm thick, 316 grades folded over substrate with no sharp corners or edges.

Galvanised steel benchtops and shelves are to be minimum 1.95mm thick, folded over substrate with no sharp corners or edges.

Substrates to stainless steel and galvanised steel benchtops and shelves are to be either 25mm waterproof plywood or 16mm compressed fibrous cement sheet. Substrates to all other benchtops and worksurfaces) other than reconstituted stone and solid timber) are to be min. 32mm thick moisture resistant grade MDF or particleboard.

Benchtops are to be fully sealed to walls and provided with minimum 150mm high integral splashbacks in wet areas. Laminate splashbacks are to be fully coved to benchtop surface.

Provide cable access cut outs in benchtops as required for access to audio/visual equipment and/or computers. In corporate areas, power and data outlets are to be installed in flush-mounted, spring-loaded power and data hubs mounted in the benchtop.

Where supported on legs in lieu of cupboards, benchtop legs are to be minimum 40 x 40 stainless steel attached to a fully welded 40 x 40 stainless steel frame supporting the benchtop or shelf along all four edges and across the width at nom. 1200mm centres along the length of the benchtop.

5.16.4 Kitchenettes and Tea Points? These are types of spaces?!

Cupboards and benchtops shall be generally as described above.

All kitchenettes and tea points shall be provided with the following fit out, subject to confirmation by the *Project Manager*:

- A single bowl stainless steel sink with drainer equal to Nu-Petite inset sink with drainer
- Sink size: 825W x 500H, Main bowl size: 380W x 420H x 200D / 30L
- Mixer tap – see section 5.17- Sanitary Fixtures and Fittings
- Billi Quadro 420 XL Levered boiling/chilled water dispenser
- Single stainless steel dish drawer dishwasher equal to Fisher & Paykel model no. DD60SDFX7
- Minimum one stack of drawers with one cutlery inserts
- Space for a refrigerator – size and model to be as nominated by the Project Manager
- Space for a built-in microwave oven – size and model to be as nominated by the Project Manager

Consideration is to be given to providing adequate space in an appropriate location for waste receptacles (refer also section 4.24 - Waste Collection)

Provide adequate power outlets, either built into the joinery units or in walls behind, for the various pieces of equipment noted above as well as allowing for a minimum of two outlets for general use located above benchtops.

5.16.5 Glass Whiteboards and Writable Walls

Glass whiteboards and writable walls shall be provided in teaching spaces and elsewhere as nominated in the functional design brief.

Glass used in whiteboards and writable walls shall be low-iron, toughened glass with the selected colour backing paint. Where provided in offices and meeting rooms, glass whiteboards shall be magnetic.

5.17 Sanitary Fixtures and Fittings

5.17.1 Generally

Sanitary fixtures shall be as follows:

SCHEDULE OF SANITARY FIXTURES

Fixture Type	Selection Required
Water Closet – Standard	Caroma® Urbane Wall Faced close coupled pan with anti-vandal kit 611300W 5 Star WELS
Water Closet – PWD Accessible	Caroma® Care 800 WFCC Suite- Pedigree II Care single flap seat in Majestic grey 901800BMG

	5 Star WELS
Urinal – Wall hung	Caroma® Leda Electronic Urinal 678230W 6 Star WELS
Basin – Standard wall hung	Caroma® Liano Wall basin with 1 tap hole 649315W and exposed chrome medina bottle trap 687290C
Basin – Standard semi-recessed	Caroma® Liano Wall basin with 1 tap hole 649315W and exposed chrome medina bottle trap 687290C
Basin – Standard inset	Caroma® Liano Vanity basin with 1 tap hole 664715W and exposed chrome medina bottle trap 687290C
Basin – PWD wall hung	Caroma® Liano Nexus wall basin with 1 tap hole 665615W and exposed chrome medina bottle trap 687290C
Basin – PWD wall hung (alternative)	Caroma® Cube Extension (RHS or LHS) wall basin with 1 tap hole and exposed chrome medina bottle trap 687290C
Basin – PWD semi-recessed	Caroma® Liano Nexus semi-recessed basin with 1 tap hole 665715W and exposed chrome medina bottle trap 687290C
Cleaner's sink	Caroma® Cleaner's Sink with heavy chrome plated brass hinged grating, rubber rest pad and 1521 Bracket (white powdercoated)
Drinking Fountain – freestanding	Enware Free standing chiller with bubbler and carafe filler - stainless steel. Model No. DFSA121
Combined Drinking Fountain/Bottle filling Station – wall hung	CIVIQ Elkay EZH20 Bottle Filling Station with Integral SwirlFlo Bi-Level Fountain
Flushing Rim Sink	Stoddart Flushing Rim Sink Model No. SPPL-FR-C-WI-R-315 A1 fabricated into S/Steel bench top
Clinical Basin	Caroma® Clinic 600 Wall Basin
Scrub Trough	Britex® Wall Mounted Surgeons Scrub Trough - 2000mm long Model No TST-WM-304-2000 (LH or RH)
Autoclave	A Tomy Model SX-700E Autoclave
RO Unit	Millipore Bench mounted RO Unit Model No. Milli-Q® Direct 16

Table 9 - Schedule of Sanitary Fixtures

SCHEDULE OF TAPWARE

Fixture Type	Selection
Mixer Tap – Sink (standard)	Caroma® Nordic Sink mixer (240mm) 90946C4A with disabled lever extension 90921C 6 Star WELS
Mixer Tap – Sink (Hot/Cold/Chilled/Boiling)	Billi® Quadra Plus 5- XL Levered Tap (Standard) with paddle lever mixer. Boiling & Chilled plus Hot & Cold under bench drinking water unit, including hot water service & disabled compliant dispenser with safety switch- Water-cooled 904025LPCH 120 Boiling / 175 Chilled cups per hour 40 L Hot water per hour (sink mixer) Bright Chrome 340mm h x 315mm w x 465mm d 10 Amp
Mixer Tap – Basin (standard)	Caroma® Liano Basin Mixer 96142C5A 6 Star WELS
Mixer Tap – Basin (PWD)	Caroma® Nordic Care Basin Mixer 90965C5A 6 Star WELS
Mixer Tap – Shower (standard)	Caroma® Nordic Shower Mixer 90948C
Mixer Tap – Shower (PWD)	Caroma® Skandic Shower Mixer Model No. 90952C
Hands-free tapware	Enware Enmatic 5000 Series Wall Mounted Sensor Activated Wave-On/Wave-Off- Mains Powered Model No. ENM5072-205
General sink tapware in workshops and utility areas	Caroma® G Series Concealed Lever Hob Sink Set 150mm Handles (160mm outlet) Model No. G72450C4A
Laboratory sinks	'Broen®', 'Enware LF Series' or 'Galvin Engineering' taps, spouts and gas turrets to suit user requirements with chemical resistant coating. Handles shall be to International Colour Coding except for hot water.
Safety Showers/Eye Wash Note: to be installed and certified in accordance with AS 4775 and Section 12.8 of this document	Broen® Redline Body and eye shower, wall mounted in brass with chemical resistant BROEN® Polycoat with self-draining shower head complete with eye/face shower and bowl. Inlet at top: G 3/4 " female. Inlet at bottom: G 3/4 " female. Model No's. S/SHR- 17 455.009 Eye Wash Bowl- VVS 766002 315. 20mm isolation valve installed directly above shower

Eye Wash Stations Note: To be installed and certified in accordance with AS 4775 and Section 12.8 of this document	Broen® or equal laboratory eye wash station
Shower Head (standard)	Con-Serv Breeze/Grand Arm Shower Rose Model No. OH 001G C. 7.5l/min
Shower Head (PWD)	Con-Serv PWD Independent HOSFAB Kit, with 1000mm Satin S/S grab rail, 1.5m reinforced shower hose, concealed flange covers, 3Star WELS rating, ID 018-03C. 7.5l/min
Cistern Cocks	Enware Mini Cistern Stop. Finish: Chrome.
Urinal	20mm isolation valve in ceiling above urinal
Cleaner's sink tapware	Hot & Cold Enware School Pattern FI Bib Tap (Jumper Valve)
Flushing Rim Sink	Galvin Engineering Flowmatic automatic 24AC concealed sensor Assembly with integrated air gap and stainless steel face plate Model number TZ-FLOWSRIM
Clinical Basin	Caroma® G Series Exposed Lever Wall Sink Set 150mm (160mm outlet) Model No. G53350C4A

Table 10 - Schedule of Tapware

NOTE: The above schedules should be used as a guide only and *Consultants* are welcome to present alternatives where appropriate, however, all alternatives are to be *approved* by the *Project Manager* prior to specification.

5.17.2 Ancillary Washroom and Laboratory Fixtures

Ancillary washroom and lab fixtures are to be as follows:

SCHEDULE OF WASHROOM AND LABORATORY FIXTURES

Fixture Type	Selection	Notes
Hand Dryers – All PWD facilities	Dyson® Airblade V	White
Hand Dryers – Executive Suites	Dyson® Airblade dB	White
Hand Dryers – Elsewhere	Dyson® Airblade V	White
Shelf – where required in PWD amenities	Conserv® stainless steel shelf, AS 1428.1 compliant	
PWD Shower Seat	Britex® Folding shower seat with white compact laminate slatted seat, 960Lx400D, BTX-11-024	

PWD Shower Curtain and Track	Lencare® 1800H weighted shower curtain 4103 with roller hook runners 4120 on 90º angle shower curtain rail 3772	Wall to be reinforced with timber or suitable material for fixing
Grab Rails	Conserv® 32mm Satin Stainless Steel	
Robe Hooks	Caroma® Cosmo Metal Robe Hook. Code: 309128C	Wall to be reinforced with timber or suitable material for fixing
Mirrors	Full length acrylic safety mirror with aluminium angle perimeter frame (Satin / Brushed finish). Location and fixing of mirror to be AS 1428.1 Compliant in PWD facilities	
Paper towel dispensers	Supplied by cleaning contractor – builder to install	Locations to be nominated by USC Wall to be reinforced with timber or suitable material for fixing
Soap dispensers	Supplied by cleaning contractor – builder to install	Locations to be nominated by USC Wall to be reinforced with timber or suitable material for fixing
Toilet roll holders	Supplied by cleaning contractor – builder to install	Locations to be nominated by USC Wall to be reinforced with timber or suitable material for fixing
Disinfectant hand wash dispensers	Supplied by cleaning contractor – builder to install	Locations to be nominated by USC Wall to be reinforced with timber or suitable material for fixing

Table 11 - Schedule of Washroom and Laboratory Fixtures

5.18 Building Services

5.18.1 Generally

Refer to subsequent sections as follows:

- Audio Visual Services

Refer also to the latest version of the USC Audio Visual Systems Standards and Specification

- IT Infrastructure Services

Refer also to the latest version of the USC ICT Infrastructure Specification

- Electrical Services

Refer also to Section 7 – Electrical Services

- Lighting

Refer also to Section 7.3 – Lighting

- Fire Services

Refer also to Section 8 – Dry Fire Services and Section 14 – Wet Fire Services

- Security Services

Refer also to Section 9 – Electronic Security and Access Control Systems

- Mechanical Services

Refer also to Section 10 – Mechanical Services

- Hydraulic Services

Refer also to Section 12 – Hydraulic Services

5.18.2 Floor Boxes

The use of floor boxes shall be avoided wherever possible.

Where no alternative is available, floor boxes shall be heavy duty, stainless steel, equal to CMS Titan FT4TP-SC, with soft-close stainless-steel lid and matching screed box. Unless otherwise approved by the University, all floor boxes in floors with resilient finishes or carpet shall include matching inserts.

5.18.3 Fire Penetrations

All Fire Penetrations used by trades will be of the same brand as approved by USC.

The fire penetration register format to match USC standard and shall be managed including all coordination and QA by the head contractor. Every fire penetration label shall be a red and white engraved traffolyte label of minimum, dimensions 80mm x160mm with all required details.

A sample shall be provided to USC for approval. The labels shall be mechanically fixed to the adjacent surface. NO PAPER LABELS.

6 LANDSCAPING

Also refer to Section 3 – Sustainability

6.1 General Requirements

6.1.1 Generally

Landscaping shall be in accordance with the campus master plan if relevant for that location and the identified zone or precinct within each location. This designation will dictate standards, plant species selections, presentation, and materials options. Master plans can be cross referenced with available plant species lists to ensure each location retains its unique identity and sense of place.

Where master plan and design principles lack detail, it will be necessary to ensure that reference is made to relevant documents, precedents, and legislation of local government authorities for best practice.

New landscaping projects will generally require reference documents, as built plans, soil tests, contract documents, materials lists and maintenance manuals as the minimum. Appropriate programs for maintenance and refurbishments will be based off these initial documents.

Materials and workmanship shall be in accordance with relevant Australian Standards.

6.1.2 Landscape Design

Designs for all landscaped areas on all University Campuses and Study Nodes shall embody the following design principles:

- Resilience – designs can adapt and change with changes in climate and user expectations
- Placemaking – designs that integrate and enhance local conditions including topography, trees, vegetation, hydrology, fauna, landmarks, views, and cultural attributes
- Connectivity – designs that acknowledge and enhance connections to and through spaces
- Environmental sensitivity – designs that maximise retention of endemic trees and vegetation, enhance biodiversity and rehabilitate degraded areas
- Wellbeing – designs that are welcoming, accessible, and comfortable, encouraging social interaction and wellbeing. Designs are to provide opportunities for both active and passive recreation, including elements such as appropriate furniture, fittings, shelter, and shade.

All designs shall be coordinated with the architectural and relevant engineering designs to ensure minimum clearances over in-ground services are maintained, and that drains, pits etc. are appropriately located to prevent trip hazards and other undesirable outcomes. Ensure also that trees or other vegetation with large root systems are not located directly over or adjacent to inground services.

6.1.3 Habitat

Habitat is to be conserved or enhanced over the course of a project and any impact on the landscape properly rehabilitated.

Habitat enhancement can be achieved by the following initiatives:

- Selecting appropriate native plant species and creating habitat furniture (For example, rock and hollow 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.

6.1.4 Edible Landscapes

Wherever appropriate, indigenous perennial edible species should be considered in the landscape.

Edible species should be identified through appropriate signage, and visible from common egress areas such that many people are given the opportunity to interact with the plants.

6.2 Landscape Earthworks and Drainage

6.2.1 Tree Protection

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 arboriculture 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.

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

6.2.2 Earthworks

Earthworks need to comply with reference to relevant civil engineering documents, sediment and erosion control requirements, existing services protection, existing vegetation protection measures, excavation, compaction for fill and subgrade, site topsoil requirements, etc.

6.2.3 Surface Drainage

All surface water shall be collected in lakes, detention basins or sumps. These shall incorporate a silt trap and be of sufficient capacity to drain the subject area under all possible conditions. WSUD elements need to be reference to relevant engineering documents and Australian Standards to ensure correct type, size, and capacity.

6.2.4 Subsoil Drainage

Slotted subsoil drain is to be used under poorly draining gardens/lawns as required. All drains shall be enclosed in a geofabric sock and laid in a trench in the subsoil with a gravel surround.

Where drainage is installed under paved areas, rigid PVC shall be used. The outfall of drainage from courtyards is to discharge into stabilised landscapes to prevent erosion and sedimentation of water courses, drainage lines and water bodies.

6.2.5 Stormwater

Implement biological pollution treatment systems 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 Department of Environment and Science and Local Council requirements, and the following pollution reduction targets:

STORMWATER POLLUTANT 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%

Table 12 - Stormwater Pollutant Reduction Targets

6.2.6 Retaining Wall and External Planter Box Drainage

All planter boxes and planter beds within paved areas shall be properly drained, using gravel and synthetic filter fabric.

Where boxes are to be planted with trees, root barriers shall be utilised to prevent root damage to surrounding infrastructure.

Slotted subsoil drain is to be used behind all retaining walls and within planter boxes. All drains shall be enclosed in a geofabric sock and laid in a trench in the subsoil with a gravel surround, drained to discharge into the stormwater system or as otherwise directed by the Project Manager.

6.3 Topsoil and Planting Soil

6.3.1 Material

All soil for grassing and planting shall comply with AS 4419 and 4454 and generally be an approved friable sandy loam. All soil shall be free from stones, weeds, sticks and rubbish. The pH shall be 6.0 to 7.0.

6.3.2 Placing

Soil shall be spread on the prepared subsoil, with any required fertiliser and ameliorants pre-mixed, to achieve required depths.

6.3.3 Existing Topsoil

Existing topsoil is to remain and reused on University grounds unless directed otherwise by the Project Manager.

All topsoil removed during the construction process is to be 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.

Existing topsoils shall be tested in accordance with AS 4419 and were found to be unsuitable, ameliorated by the addition of soil conditioners in accordance with AS 4454 before re-use.

6.3.4 Subsurface Preparation

In garden areas, cultivate the sub grade prior to placement of soil by ripping to a minimum depth of 400mm to loosen the compacted ground. Do not disturb services or existing tree roots. If necessary, cultivate these areas by hand. Elsewhere, prepare the sub-grade by deep ripping to minimum 150mm, cultivating and removing unwanted materials.

6.3.5 Soil Depth for Gardens and Turfed Areas

A minimum depth of 300mm of topsoil is required for garden beds. In turfed or seeded areas, a minimum depth of 100mm topsoil is required.

6.3.6 Soil Depth for Planter Boxes and Beds within Paved Areas

A minimum depth of 500mm of topsoil is required for planter boxes and beds.

6.4 Turf

Turf shall be of an approved species of good quality and free from weeds. Preference is given to disease resistant varieties including broad-leaved buffalo and zoysia grasses. Sports fields will typically require couch varieties and suitable drainage to be provided.

The area to receive turf shall be lightly compacted after sub grade preparation to avoid settlement and be prepared with the appropriate gradients so that grass finishes level with adjoining surfaces. Turf shall be laid along the contours with the joints staggered. The turfed surface shall be lightly and evenly top dressed in sandy loam or sand to fill any depressions. Turf shall be well and regularly watered after laying. All turfed areas are to be irrigated with a system designed for efficient watering using recycled water wherever possible.

6.5 Planting

A Plant Species List for all campuses is detailed in the USC Sunshine C Campus Master Plan. Preference shall be given to the use of local endemic native plants which do not require regular watering.

Plants shall be locally sourced sun-hardened nursery stock, grown in soil, and free from weeds. Advanced trees will be Natspec certified and compliant with AS2303.

Partly fill holes with soil, conditioners, and slow-release fertiliser well mixed into manufacturer's recommendation and covered with 25-50mm of fertiliser-free soil.

Water all plants before and immediately after planting.

6.5.1 Tree Selection

Tree selection is to consider proximity to buildings and infrastructure. Clear access zones at least 4m wide are to be maintained around buildings for maintenance, with specific requirements assessed according to tree species selections.

6.6 Garden Mulch

Mulch shall be free from soil, weed growth and green material or other foreign matter.

Mulch may be of the following types:

- Chipped Green Waste - Derived from trees and vegetation removed from the site during site maintenance operations and stockpiled on the campus.
- Cypress Pine Mulch - Medium grade with minimum bark size of 20mm square and maximum of 75mm square
- Riverstone Mulch - Smooth, washed river stones in sizes varying from 100mm to 40mm to a minimum depth of 150mm.

Generally, mulch is to be placed to a minimum depth of 75mm unless noted otherwise and in all cases, shall finish flush with adjacent surfaces where appropriate.

6.7 Landscape Timber

All timber shall be treated to AS 1604 – 1993. Materials can be hard or softwood. All exposed timber faces are to receive 2 no. coats of clear water-repellent timber preservative after cutting, arising etc. and prior to assembly. All fixings to be hot dipped galvanised.

6.8 Retaining and Planter Box Walls

Retaining walls to changes in site levels within the landscaped areas may be as follows.

- Rock Walls - Rock retaining walls are to be constructed of weathered sandstone or an approved alternative stone. Walls are to be constructed to an angle of repose of approximately 60 degrees maximum, with all rocks set horizontally into wall face. Install Geotextile filter fabric to rear of rocks.
- Concrete Block Interlocking Walls - Caps shall be adhered to tops of all walls, and where walls have stepped tops, the caps are to be cut to suit. Installation of walls is to conform to manufacturers' instructions. Backfill behind wall to depth of 300mm with topsoil.

Planter box walls shall generally be constructed in concrete or reinforced concrete masonry. The finish to retaining and planter box walls shall be selected to minimise maintenance.
Tops of retaining and planter box walls shall be designed to eliminate damage from skateboards, roller blades and bicycles

6.9 Paving and Footpaths

6.9.1 Generally

In all cases, the finished paving level shall be not less than 200mm below internal floor level or 100mm below damp proof course level, except at entries where paths shall be ramped to doorways to conform to AS 1428.1.

Design pavements and locate them in such a manner as to reduce stormwater velocity. The surface of paving should be finished to falls and cross-falls to allow drainage to gardens or grassed areas where possible.

Gratings to sumps in courtyards and feature paving shall be stainless steel of a type that is compatible with wheelchair traffic.

6.9.2 Concrete

Footpaths and general paving may be either lightly exposed aggregate or broom finished and set out with jointing or patterning. The concrete colour should generally be to match any adjoining paving however the use of coloured concrete is desirable.

6.9.3 Paving Units Generally

All paving units shall comply with AS 4455, AS 4456 and AS 3661.

Paving in all areas shall be no less than 20mm for any given material.
Where stone paving is subject to heavy vehicular traffic, the thickness shall be increased to 30mm.

All paving units shall be laid on a reinforced concrete base slab. The thickness of base slabs shall be 100mm minimum for pedestrian traffic and 150mm minimum for vehicular traffic areas.

Set pavers on a nominal 10mm thickness of mortar bedding, fill joints with matching sand and cement/colour agent and install 10mm thick 'Ableflex' to expansion joints in new paving and where new paving abuts existing paths or structures.

Provide a concrete haunch along any unsupported edge to paving.

Where existing unit paved areas are to be extended or modified, paving units shall be to match existing. If no matching paving units are available, consideration shall be given to removing all existing paving units and replacing with an alternative approved by the superintendent.

6.10 Irrigation Systems

6.10.1 Generally

Garden beds and turfed areas shall not be irrigated unless instructed by the Project Manager. All water for irrigation on the Sippy Downs campus shall be taken from the University Lakes, no potable water to be used for irrigation. At other University locations, alternatives to town water supply are to be considered in the design stage of new landscape areas and approved by the Project Manager.

If irrigation is required, the Contractor shall supply an irrigation plan before the commencement of the landscaping.

The landscape contract must include for the supply, installation, testing and commissioning of all the equipment necessary for the completion of the works described or inferred in the tender specification and drawings.

The irrigation system shall be controlled from a central controller unit and connected
to by the Campus Building Management System, with a manual override control box provided at a suitable accessible ground level location for Landscape staff use. System interface.

All necessary approvals must be obtained from the local authorities, Department of Environment and Science and other regulatory authorities.

The system installer must undertake the commissioning of the irrigation system in the presence of the Coordinator, University Grounds.

6.10.2 Irrigation System Materials and Equipment

The irrigation system shall be installed using the following equipment and materials.

6.10.2.1 Water Supply Equipment

Measurable quantities of water at the optimum supply pressure must be provided at the Point of Connection using the following equipment. The equipment must all be flanged drill table D&E.

- Filter - 'Amiad' or equivalent with 80 mesh filter and a pressure 'Binda' cock.
- Backflow Prevention – 'RMC' or equivalent testable backflow prevention device (on site) to Australian Standards
- Control Valves - 'Irritroll' either 'Century' or 'Toro 250' or equivalent.
- Solenoid Cable - Solenoid cable must consist of polythene insulated multi-strand, multi-core copper wire in a sheath suitable for direct burial. HTE cable to AS 3147/1988. Cables must run continuously, without joints from controller to converters, valves and switches.
- Cable Connectors - Cable joints must be made waterproof and corrosion proof using solder and 'TYFLO' Heat shrink, or '3 DBY' or equivalent.

6.10.2.2 Pipework

All pipework shall be uPVC minimum Class 12 pipe for all main lines, laterals, and sub-laterals with solvent welded joints. Class 10 may be used where laterals are downstream from solenoid valves. Sizes 80mm and upward must be rubber ring jointed to AS 1477. MDPE pipe PN 12.5 Class 12 polythene may be substituted for uPVC. Fused joints, or compression fittings must be used, and must have matching pressure ratings.

6.10.2.3 Sprinkler

Spray heads must be Toro, Hardie or approved equivalent. Use 12" Pop-up for shrubs and 6" Pop-up for ground covers. Sprinkler heads shall be as follows.

- Small Rotor Heads - 'Toro 300' series.
- Small Spray Heads – 'Toro 570' series
- Large Rotor Heads – 'Toro 640' series.
- Pop-up Sprinklers – 'Spears' on articulated risers sized to match the sprinkler inlet size.

6.10.2.4 Valves

Valves shall be as follows

- Air Valves – 'Bermad' 25 and 50mm double purpose air release model 4415 or equivalent.
- Valve Boxes - Must be made of structural foam and must be fitted with locking lids. Valve boxes for control valves must be Carson 910 or equal. Other boxes must be large enough to house, and allow service of, their valves.

6.10.3 Irrigation System Installation

6.10.3.1 Controller

The controller must be hard wired to a dedicated circuit breaker and must be identified at fuse box as being 'Irrigation Only'.

6.10.3.2 Water Meter and Pressure Regulating Valve

This shall be installed as a single assembly, comprising filter, water meter, pressure regulating valve and backflow device in accordance with current AS 3500 and associated codes. The assembly connections are to be dezincified brass with inlet/outlet isolation ball valves. The assembly must be contained within a lockable, purpose made, galvanized box.

6.10.3.3 Sprinklers

Sprinkler positions must be set out by a certified irrigation designer with a minimum of head-to-head spacings.

Shrub sprinklers must be installed on risers.
Pop-up sprinkler risers must be installed allow free movement of the sprinkler before backfilling, and sprinklers shall be set to grade.

Control valves with flow control must all be adjusted to provide optimum sprinkler performance without misting or overthrow.

6.10.3.4 Drip Lines

Installation must commence at the control valve where the 20mm, 200 mesh filter and air vent are fitted. The 40mm MDPE sub main is to be connected to a pressure regulating valve with 68 kPa discharge pressure, and at each group of two or three lines. The pressure reducing valve is connected to the line by 19mm Polythene pipe. The drip line must be buried 75mm below ground level and must be laid in row spacings of 600mm.

6.10.3.5 Control Valves

Control valves must be identified by permanent engraved labels securely fastened to the valve flow stem.
Valve boxes must be set to grade with the base supported on bricks to ensure there can be no contact with irrigation pipe works.

Cabling from main controller and between valve boxes must be installed in comms conduit to facilitate future replacement without trenching. Direct buried irrigation cabling is not permitted.

6.10.3.6 Excavation and Backfilling

The system installer must not excavate by machine within 1 metre of existing underground services. All surfaces (turf, concrete, bitumen etc) and any existing underground services damaged or cut because of excavations by the installer must be restored to their original condition.

Trench widths must be equivalent to 3 nominal pipe diameters to provide working room and to ensure ample sand bedding all-round the pipes.

Trench depths must be sufficient to allow 75mm of sand underlay under the pipe, + the pipe diameter of pipe + 150mm sand + 150mm of topsoil. The trench bottom must be level, free of rocks and sharp objects and must support the whole length of the pipe.

Backfilling to trenches for all pipes, and cables and conduits shall be screened bedding sand. The minimum underlay shall be 75mm and the minimum overlay 150mm.

Install pipe marker tape over sand before backfilling with topsoil.

Suitable spoil from the trench excavation, free from rocks, clay, rubbish and building debris may be used to top up the trench if necessary.

Where separate trenching is needed for the power or communication cable, the minimum depth must be 450mm and minimum width 100mm.

6.10.3.7 Pipelaying

PVC pipe must be installed to conform with the current AS 2032.
MDPE pipe must be installed to current AS 2033 and AS 1460 parts 1 & 2. Care must be taken not to kink pipe.

6.10.3.8 Flushing of New Pipework

After pressure testing has been carried out the new pipework must be flushed thoroughly with the available water pressure before the sprinklers are attached to the risers.

6.10.3.9 Hydraulic Testing

The whole of the system must be tested at 1000 kPa. The tests must be carried out by the installer at his own risk and expense.

All work shall withstand the test pressure for a period of two hours.

6.10.3.10 Restoration of Existing Surfaces

All existing surfaces, concrete, turf, or bitumen where disturbed by the system installation shall be restored by the installer unless otherwise advised by the Superintendent.

6.10.3.11 Warranty

The Contractor must provide a warranty on workmanship for a period of twelve (12) months after the date of Practical Completion to USC.

6.10.3.12 As Constructed Drawings

As constructed drawings of the irrigation system shall be submitted to the Superintendent.

All piping, wiring and major components must be shown using triangulation from at least two fixed ground permanent points. Each irrigation zone is to be clearly identified on plans and shaded diagrams provided (soft and A3 laminated hard copies) for operator use at the manual override control box location.

Provide a list of components and show typical layouts and fittings.

6.11 Landscape Furniture and Structures

6.11.1 Landscape Furniture

Landscape furniture shall include (but not limited to) the following:

- Seats
- Tables
- Bins
- Bollards
- Lighting
- Fencing
- Signage

Samples of all proposed furniture selections shall be provided to the *University* for approval prior to specification and installation.

Interpretive signage with QR codes shall be incorporated in all landscaped areas containing features or specimens of significant cultural or natural value.

Lighting shall be in accordance with Section 7.3 – Emergency Power and Lighting.

Lighting shall be designed to comply with Crime Prevention Through Environmental Design (CPTED) (see section 2.6 - Design for Personal Safety and Crime Prevention) strategies and recommendations.

6.11.2 Landscape Bollards

Bollards shall be either fixed or removable as nominated in the functional design brief.

Where vehicle intrusion and personal safety is identified as a risk by the University, vehicle mitigation and anti-ramming solutions shall be provided by the Consultant for review and approval by the Project Manager.

6.11.3 Landscape Structures

Landscape structures shall include (but not limited to) the following:

- Shade sails
- Arbors
- Pergolas
- Water features

The design of all landscape structures shall be complimentary to adjacent buildings using, where possible, elements that are evocative of the natural landscape.

6.12 The Landscape Maintenance Period

The landscape maintenance period shall commence from the date of Practical Completion of the Works and shall extend for a minimum period of twelve (12) months. Maintenance of landscape works to include watering, mowing, pruning, weeding, fertilising, pest and disease control, replacement of dead or missing plants and the like for grassed and garden areas.

Any replacement plants shall be of a size and maturity which matches those in the landscaping at the time of replacement.

6.13 Signage and Wayfinding

All signage at USC is to be designed and/or approved by the USC Marketing & External Engagement department and conform to their specific requirements.

Consultants shall engage with the USC Marketing & External Engagement department team early in the design process to ensure signage and wayfinding opportunities are identified and designs prepared, costed, and included in the project tender documentation wherever possible. USC Marketing & External Engagement is to be consulted throughout the purchasing phase of the process to ensure design requirements are correctly adhered to in production.

All signage is to be durable and fit for purpose, with interchangeable name plates when identifying room occupants.

7 ELECTRICAL SERVICES

Refer also to the latest version of the USC ICT Infrastructure Specification.

7.1 Electrical Services Design and Equipment Requirements

7.1.1 Equipment Quality and Support

All equipment and components shall be a reputable brand and be of high quality and reliability, readily available, with a Queensland based agent for service / spare parts, with sufficient stock of spares to support USC's operation.

Critical Spares requirements shall be listed in Operating and Maintenance Manuals.

7.1.2 Independent Testing

Testing shall include all mandatory tests as per Australian legislation, standards, and codes, including but not limited to insulation resistance, fault loop impedance and earth resistance.
Calibration and maintenance of all instruments shall be in accordance with NATA standard. Where required by the project or specification, instruments shall be NATA certified and calibrated.

All testing to be carried out in accordance with legislative requirements and all test results are to be submitted and included in the Operation & Maintenance Manuals.

All new work to comply with relevant legislative requirements.

7.2 Low Voltage Electrical Services

7.2.1 Maximum Demand Calculations

Maximum demand calculations shall be undertaken for all new buildings and submitted for design review. Calculations shall be in accordance with AS3000.

7.2.2 Low Voltage Supply

All incoming mains or consumers mains for each building shall be sized for the maximum demand plus 30%. Submains shall generally be XLPE/PVC, insulated and installed from the low voltage point of supply. All underground cabling shall be nylon sheathed to protect against termite damage.

7.2.3 Main Switchboard

The Main Switchboard shall be designed for ease of maintenance and future upgrades or modifications. Main switchboards shall be construction of 2mm zinc anneal steel IP54 for indoor use. Main switchboards in external environments shall be constructed in marine grade stainless steel (316L) and be IP56 rated.

The (main) switch-room shall be designed to allow sufficient access and clearance for a safe working environment. There shall be a minimum of 1.2m clearance around a main switchboard unless located in a cupboard where the clearance will be 1.2m to the front of the main switchboard.

At least 30% spare space and capacity in the main switchboard and busbar shall be provided as a minimum. Spare spaces shall be distributed across each section of the main switchboard and each section shall contain at least two off spare spaces. Cubicles shall not exceed 900mm in width. No equipment is to be mounted less than 300mm above the floor.

The main switchboard shall be floor mounted on a heavy duty hot dipped galvanised steel plinth, free standing cubicle style construction with top or bottom entry and top or bottom exits (for external switchboards only bottom entry is permitted). All external switchboards to be 316 stainless steel or marine grade aluminium construction. Fault level withstand shall be appropriate for each application and to suit the prospective fault at the main switchboard incoming terminals. All sections on the main switchboard shall be modular type to allow ease of upgrade. Provision shall be made to extend the busbars in either direction.

Each cubicle shall have a hinged escutcheon secured via slotted quarter turn locks. Escutcheons shall be painted white and the external finish for the main switchboard shall be electric orange. Escutcheons are to be able to be opened without the necessity to turn off the associated switch(s) or circuit breaker(s) or in lieu the switches and circuit breakers are to be fitted with defeat mechanisms. Door handles shall flush swing chrome type and fitted with L&F 92268 locks.

Non-fading A1 size laminated prints of the 'As Constructed' line diagram schematic drawings of the main switchboard and the building electrical reticulation shall be installed on a wall within the Main Switch room showing as a minimum all outgoing cables and the rating, model and manufacture of all switchgear installed in the switchboard.

Control sections shall be located within its own compartment with a separate escutcheon and door.

Thermo-scans shall be undertaken under load on all main switchboards at completion, at six months into the defect's liability period and no less than 4 weeks prior to completion of the defect's liability period.

7.2.4 Distribution Board

Distribution boards shall be strategically located to address issues such as voltage drop, fault loop impedance and flexibility.

Minimum fault rating: 10kA

All lighting and power circuits are to be loaded to less than 75% of their rated capacity. All distribution boards shall be sized large enough to cater for all incoming submains and outgoing cables. Positioning of terminal blocks, contactors, time clocks and other accessories shall be done in a neat and tidy manner. A separate controls section that is segregated from the main section shall be provided. All cables supplying circuit breakers shall be via ducting complete with easily removable lids.

All distribution boards are to have essential and non-essential section, with the non-essential controlled by a load shed contractor.

The minimum depth of the distribution board shall be 150mm and minimum clearance between circuit breakers and the edge of the distribution board shall be 115mm.

Internal distribution boards are to be IP54 rated and external boards IP56 rated, all finished in electric orange. Escutcheons are to be hinged via lift off pintle hinges and fitted with slotted quarter turn locks. Escutcheons are to be able to be opened without the necessity to turn off the associated switch(s) or circuit breaker(s) or in lieu the switches and circuit breakers are to be fitted with defeat mechanisms.

Fault current limiting is to be provided for each circuit according to its rating. A full mounting chassis is to be provided for circuit breakers.

Distribution boards shall have a minimum of 30% spare current carrying capacity and 30% spare pole space. Acceptable distribution board makes, or manufacturers are NHP, Schneider-MG, Heinemann or Eaton Cutler-Hammer or approved equal.

All sub-circuits shall be installed with Residual Current Device (RCD) protection which includes all power sub-circuits supplying socket outlets and lighting circuits, and in accordance with AS 3000. Each circuit shall be individually protected.

Separate dedicated essential services circuits are to be provided for server rooms. Refer also to USC ICT Infrastructure Specification

Circuit schedule cards are to be provided in each distribution board and as a soft editable (word, excel, etc) copy in the manual – provide information as a minimum:

- Distribution Board- Fault Rating, Prospective Fault Level (Without Upstream Cascade protection taken into account), - on Switch Board Block Plan;
- Submains, Size, Length of Run, Origin (where fed from), Upstream Protection (rating and settings to achieve “enhanced selectivity”)- on Switch Board Block Plan;
- Final Sub-circuits, Designation, Circuit Protection, Cable Size, Neutral Number, Earth Number – on card

Where electrical junction boxes are used, they shall be accessible and labelled on the front to indicate the switchboard served by the box and origin of supply.

7.2.5 Switchgear

7.2.5.1 Circuit Breakers

Miniature circuit breakers (MCBs) shall comply to AS3111.

Residual current devices (RCDs) shall be Type II with a maximum tripping current of 30mA complying with AS 61009.1 and AS 3190. Residual current devices shall be incorporated to provide earth leakage protection of nominated circuits and equipment for general use. The residual current protection shall be integral with Miniature Circuit Breakers. RCD/MCBs shall occupy the same number of pole spaces as per standard MCBs within an MCB chassis.

Duplex type circuit breakers shall not be used under any circumstance. Any existing duplex circuit breakers are to be replaced with any new works.

7.2.5.2 Contractors

Contactors shall comply with AS3947.4 and be of the compact, block type with auxiliary contacts as required by control circuitry. Contactors shall be rated for enclosed uninterrupted duty with a utilisation category of AC3.

Selection of contactors shall be such that co-ordination with protective devices is type 'C'.

Provide Man/Off/Auto switches on the escutcheon for all controlled circuits.

7.2.6 Electrical Riser Cupboard

A dedicated electrical services riser shall be provided for the reticulation of electrical services throughout the building. The minimum size of the electrical riser shall be 2100mm height and 500mm wide. Each electrical riser shall have lighting and a double 10A switched socket outlet per floor.

Ensure that the fire rating between floors is maintaining and that all cable penetrations are fire stopped in an approved manner – fire pillows are not acceptable.

7.2.7 Cable Supports

Any cable support systems (For example, conduits, trays, cable pits, ducting etc) shall be provided with a minimum 50% space for future expansions. Cable supports in corrosive areas or areas with a high salt contamination in the atmosphere shall be manufactured of 316L stainless steel.

All cable support systems are to be designed and co-ordinated between disciplines to ensure each discipline has adequate space to install and maintain their respective service and provide absolute minimum mandatory segregation requirements. It is expected that a minimum segregation of 300mm be used a starting point for example with common types of cables that require mandatory segregation distances – segregation is horizontal and vertical and at crossovers.

- Low voltage cabling and Fire Detector Cabling 300mm
- Low voltage cabling and Fire BOWS/EWS Cabling 300mm
- Low voltage cabling and extra-low voltage cabling 300mm
- Low voltage cabling and Telecommunications cabling 300mm
- Low voltage cabling and Security cabling 300mm
- Low voltage cabling and BMS cabling 300mm
- Low voltage and other specialist cabling 300mm

Cable pits shall be *Polycrete* and installed in 100mm steel reinforced concrete or cast in situ concrete type with galvanised steel lids. The pits shall be drained to the nearest stormwater connection where possible.

7.2.8 Underground Low Voltage Electrical Services

All underground electrical services shall be installed in conduit and in accordance with the requirements of AS 3000 and shall be laid in sand with depth of (min) 75mm below and 150mm above and to sides (min 50mm sand between conduits side by side) and shall be identified by laying an approved continuous PVC marker tape 300mm min above the conduits.

At least two spare conduits of equal or greater size are required with the design of the underground main service route conduits/services or conduits located under hard pavement. All spare underground conduits are to be fitted with nylon polypropylene cable as a draw wire. Only selected backfill shall be used and shall be compacted in layers not exceeding 200mm to a density of 90%. The minimum cover shall be in accordance with AS3000.

Minimum size of underground conduit shall be 32mm. Underground cable shall be double insulated cable, not less than 2.5mm². All underground submains shall have nylon sheaths to prevent termite damage.
Underground cable joints shall not be permitted.

Maximum distance between pits on underground cable runs shall be 60m.

All underground pits shall have their lids marked with a brass/aluminium/stainless steel plate indicating the service installed the route from the pit and shall be adequately drained. Brass marker plates shall be installed at kerbs and road crossing and any changes in direction. The lettering shall be minimum 15mm high engraved with black infill. All pits and pipes are to be identified on as-built plans in pdf and dwg formats, including survey coordinates.

Combined services trenches can be utilised if suitable for a particular application.

7.2.9 Motors and Variable Speed Drivers

Refer to Section 10 Mechanical Services for minimum requirements.

7.2.10 Sub-Circuit Wiring

7.2.10.1 Generally

Total voltage drop shall not be calculated in accordance with Australian Standards.
Single insulated cables shall not be used unless approved by the Project Manager. All cables shall be thermoplastic-sheathed cable (TPS) or XLPE/PVC type and voltage drop shall not exceed 2% for final sub-circuits.

Cabling serving each level of occupied space remains within that occupied space, (for example, power cabling is not to reticulate via the ceiling space below). Horizontal main runs of cabling shall generally be reticulated via accessible ceiling spaces on trays (when grouped), minor runs are to be via catenaries with vertical runs routed via wall cavities and discretely positioned vertical runs of perimeter cable duct.

Careful design co-ordination to ensure that sub-circuit cabling is not run in the vicinity of extraneous conductive materials which cannot be effectively earthed such as conductive building papers – foil insulation. Where this applies the sub-circuit cabling must be installed in PVC conduit.

Local distribution to GPOs (in low concentrations) shall be via wall and stud-partition cavities, and for heavier concentrations or where flexibility is required, via multi-compartment perimeter skirting duct.

Cabling made redundant by a refurbishment must be removed in their entirety.

Cables must not be supported on the T Bar ceiling grid, tiles, or supports.

7.2.10.2 Power and Lighting Cables

Minimum sub-circuit power cabling shall not be less than 2.5mm stranded copper conductors (TPS). Lighting and field control wiring shall be not less than 1.5mm² stranded copper. Loop in and loop out principles shall be used for sub-circuit cabling.

7.2.10.3 Entries

Entries to switchboards or equipment via gland plates or through panels shall be made using circular, orange-sheathed, cable and suitable compression glands. Double insulated flat cable may be used if entering through ducts or conduits. Non-metallic gland plates shall be used when the cable rating exceeds 125A.

7.2.1.4 Fault Loop Impedance

All circuits are to be designed with maximum circuit lengths to meet the Fault Loop Impedance requirements of AS 3000.

7.2.13 Power Factor Correction

A PFC cubicle is to be provided which is connected at one end of the main switchboard. This PFC installation shall ensure a unity power factor applicable to the completed building.

7.2.14 Lighting and Surge Protection

Lightning protection shall be provided to buildings if recommended, using the risk assessment criteria as specified by AS 1768. Undertake a lightning protection risk assessment as per AS1768 and submit the risk index and a recommendation for approval to the Project Manager.

Surge diverters are to be provided on all main switchboards and distribution boards. Surge diverters are to be shunt type and based on MOV technology by a manufacturer approved by the Project Manager. Surge diverters shall be installed on the line side of incoming functional units and upstream of RCDs

A Perspex panel shall be provided such that the indicators (showing device status and life) are visible from the external/through the escutcheon. Where possible, surge diverter status is to be monitored via the BMS.

7.2.15 General Purpose Outlines

The number of General-purpose outlets shall be in accordance with room data sheets or the brief.

All general-purpose outlets (GPOs) shall be AS 1428.1 compliant, 230V type, RCD protected. GPOs shall also generally be 10A unless otherwise noted in the room data sheets. GPOs shall be Clipsal Classic 2000 system (or equivalent dual outlet as approved by the Project Manager) with an ID window. Typed circuit identification numbers must be located on each power outlet (Circuit number and distribution board origin e.g., DB2A-15) with matching number system at each sub-board.

ID window labels shall be typed NOT handwritten. Labelling of all outlets are also to be undertaken on the inside with an indelible pen.

Power outlet faceplates shall be as follows:

- RED - Generator
- GREEN - Filtered Power (marked as computer only)
- DARK BLUE – Uninterruptible Power Supply
- WHITE - Normal Power
- BEIGE - Cleaning power

A minimum allowance of three double general-purpose outlets shall be provided for each office and workstation - two double general-purpose outlets below bench and one double general-purpose outlet above bench with inbuilt USB socket.

General-purpose outlets are to be flush mounted. Cleaning outlets shall be single 10A general-purpose outlet and mounted at 300mm AFL. A cleaner's outlet shall be allocated every 20m.

Power for audio -visual equipment- A separate power circuit must be provided for all audio-visual equipment in all projects. Where possible projectors and audio-visual equipment shall be on the same circuit.

'Soft-wiring' for power is permissible provided the quantities of outlets comply with the above criteria. Ducted skirting (min size 150x50mm 3 channel aluminium type with covers that positively clip in place - ECD or Moduline) at floor level shall be provided for all perimeter walls.

7.2.16 Laboratories – Specific Occupancy Requirements

7.2.16.1 General

Dedicated lab panels or lab switchboards shall be in each laboratory, complete with local emergency shutdown facility, as per AS/NZS 2982:2010 and AS/NZS 2243 series. The switchboard shall be used only for the supply of power sub-circuits within the lab.

The shutdown button shall isolate all reticulated services including power and gasses only. Power shut off shall not affect the operation of fume cupboards, critical refrigeration, or bio-safety cabinets.

All exit points from the laboratory area shall have an emergency shutdown button. This shall be a red mushroom head button mounted on a stainless-steel panel engraved with the list of services shutdowns, the reset

procedure, and a map of the area to be shut down. The power shut off button shall be shrouded to prevent accidental operation. Operation of an emergency shutdown push button shall require manual resetting of both the electricity and gas and associated services. Gas services shall not be automatically reconnected in the event of temporary loss of electrical supply due to a blackout etc

All duress alarms, purge buttons, and emergency shut down systems are to be monitored on BMS and Gallagher.

7.2.16.2 PC3 Laboratory

The design of all PC3 laboratories shall comply with AS/NZS 2982, AS/NZS 2243.3 and associated regulatory requirements. PC3 laboratories also seeking Quarantine status shall comply with all relevant DAWR Biosecurity regulations and provisions.

An electronic access control system shall be used to control the access into the facility. Airlock doors shall be interlocked. A communication system and a backup system shall be provided inside the facility.

The electrical services i.e., luminaires, shall be constructed to enable decontamination to occur easily and quickly, including fumigation of all spaces in the facility.

Where GPOs are required as part of the fumigation process these should be controlled by remote switches. If a dedicated building management system (BMS) control panel is employed to manage the fumigation zones, then the fumigation power outlets shall be controlled by the BMS.

All cable penetrations into the PC3 facility are to be sealed to prevent the ingress of air and water. The penetration shall be tested during commissioning of the facility and any defects shall be rectified.

All contact points between services and surfaces shall be sealed to prevent dust traps.

Emergency stop buttons shall be used as Services Isolation Points to isolate all reticulated services into the facility except supplies to lighting, fridges, freezers, fume cupboards and bio-safety cabinets where isolation of these services could lead to further risks.

Specific services shall be provided to suit the use of the facility.

7.3 Emergency Power and Lighting

7.3.1 Generator Supply

Where required, an auto start emergency diesel generator with sufficient capacity to service items nominated in the brief is to be provided. The generator shall have sufficient capacity/fuel to run at full load for 12 hours as a minimum. Generators are to be sized for operation between a minimum of 60% and a maximum of 80% of design load.

Additionally, generator power is to be provided for all fire safety equipment and services, uninterruptible power supplies, data racks/telecommunications equipment, Building Management System, lighting and power outlets in plantroom, security panels, cold rooms, refrigerators, and freezers in

laboratories as well as all standalone cold rooms and freezers and HVAC fan coil units, air handling units and fans in critical area, such as PC labs.

Generators shall be the encapsulated, weatherproof acoustic rated stainless-steel enclosure (canopy style) with acoustic louvres (sound pressure level to be agreed at early design stage) with base mounted self-bunded day fuel tank. Generally, the units will be skid mounted and installed on a slab adjacent to the new buildings within a roofed compound, while maintaining separation to allow free air flow and not be roofed. The required acoustic rating will be determined on a project-by-project basis.

For testing purposes and peak load curtailment, all generators are to be fitted with synchronisation controls to enable seamless connection to mains power.

Refer below for bulk fuel tank requirements.

The set shall start automatically and only connect to load after running up to speed and frequency. The load shall be connected automatically through a closed transition automatic transfer switch on the building main switchboard. The generator set shall be capable of accepting full load within ten (10) seconds of receiving a start signal. The set is to also have a “Manual” mode.

The Generator shall have electronic controlled governing.

Upon restoration of normal supply, the set shall have a predetermined shut down procedure.

Provide a separate float/trickle battery charger for all batteries (Starting/Cranking and Control System) to maintain battery life and state of charge – Battery Charger(s) to be connected to essential supply on a separate circuit from the site main switchboard.

The generator control panel shall be complete with all necessary controls for start-up and shutdown as well as monitoring and interface with logic controls on the Building main switchboard. The control systems and circuitry shall interface with the main switchboard manufacturer to ensure proper operation of the system.

The diesel generator shall be “prime” rated for tropical and humid conditions applicable to the location of the installation, minimum ambient rating is 50 degrees Celsius. A load bank shall also be provided for the testing and on load tests of the generator (for new buildings). Minimum Site testing is: (note this is to be one continuous test)

- 100% of for 4 hours
- 110% for 1 hour
- Stepped Cool-down for 1 hour as per manufacturers requirements

All relevant engine parameters to be monitored and recorded for the above test at 15 min intervals:

- Generator kW and kVAr output.
- Generator output voltage.
- Generator output current.
- Generator output frequency.
- Power factor.
- Oil pressure and water temperature.
- Electrical power requirements of continuously running electric motor driven ancillaries.
- Each battery charger current and voltage readings.

- Noise level.

Distribution boards that are supplied with generator supply shall have 2 x chassis- non-essential and essential (generator) supply to allow for load shedding when the generator is operating.

Generators shall be connected to the building management system to via a high-level BACnet or Modbus interface to provide remote monitoring and alarms. All generators are to be fit with dual phase-failure relays, wired in parallel, and phase failures are to be monitored by the building management system.

7.3.1.1 Bulk Fuel Tank

Where required, a bulk fuel tank is to have the following minimum requirements:

- Comply to all relevant Australian Standards and EPA requirements
- Be self-bunded type minimum 110%
- Concrete Plinth Mounted/Skid type with a system of rag bolt cage mounted bollards
- Have a roof over the entire extent of the bunded area
- Tank to be supplied with in-built water drain off point
- To have Interstitial space monitoring and venting
- Mechanicals overfill protection and overfill alarm
- Suction line to have anti-syphon valve
- Full under-tank visibility to facilitate airflow an eliminate corrosion of the floor of the tank
- Front bunded pump bay with full frontal access – tank size permitting
- Weatherproof heavy-duty roller door – only applicable to tanks with a pump bay.
- Be protected with a paint/coating system not inferior to Inorganic zinc silicate to AS/NZS 3750.15, followed by polyurethane to AS/NZS 3750.6.
- High Level Interface with BMS for monitoring and alarms

Dipsticks: Form from brass section or anodised aluminium extrusion, with the bottom 100 mm coated with nylon or equivalent non-conducting coating. Stamp or engrave calibrations at intervals of not more than 5% of nominal tank capacity.

7.3.1.2 Fuel Distribution System

Provide a duty/standby fuel distribution from the bulk fuel storage tank to the base mounted day tank of the generator. Provide manual bypass valves and a panel to control the pumps.

Type: Self priming positive displacement internal gear type pumps with mechanical seal and direct driven by totally enclosed motor.

Bypass: Provide an automatic built-in overpressure bypass with adjustable spring relief.

Mounting: Mount the motor and pump on a common base plate.

Material- Casing and rotor: Cast iron or cast steel.

Material- Shaft: Hardened steel.

Drip tray: Provide a 50mm deep drip tray under each pump to be minimum 1.6 mm thick copper with brazed joints with rolled edges.

7.3.2 Uninterruptible Power Supply (UPS)

A UPS is to be provided where specified on room data sheets or brief but are generally provided on all data and AV racks. In small distribution data rooms, the battery cabinet may be housed in the same enclosure or data rack. In the case of a Data Centre, which houses servers, the battery cabinet must be in a separate air-conditioned room from the data and server racks. A static bypass is to be provided for each UPS. The UPS shall have a minimum backup of 30 min and where required by the BCA, shall be in a dedicated fire rated room.

All UPS shall be connected to BMS with High Level Interface for monitoring and alarms.

All UPSs are to be fitted with a Simple Network Management Protocol (SNMP) communications card connected to the information technology network for remote monitoring.

All UPSs shall be true online, double conversion type. Data centres shall be fitted with modular parallel redundance (N+1) style UPS's and modular battery systems with hot swappable components to ensure sufficient redundancy.

7.3.3 Emergency Lighting

Emergency and exit evacuation lighting shall be supplied and installed, conforming to AS 2293.1 for computerised monitored type. The fittings shall be RF model, compatible with the existing manufacturer on campus which is Stanilite Nexus models.

In addition to being computer monitored and connected to the site-wide emergency lighting monitoring system, separate manual test facilities to be provided in each distribution board supplying circuits with emergency lighting connected.

Luminaires shall be self-contained, maintained, or non-maintained fittings surface and recessed type. The installation shall be arranged in accordance with AS 2293 with luminaires automatically connected to their emergency power source upon failure of the electrical supply to the normal lighting in the designated area.

In buildings supplied with essential power and subject to the Project Manager's approval the sensing for an emergency or emergency exit light may not actually be from the un- switched active of the adjacent light fitting if that luminaire is not connected to essential power (this is to prevent the emergency or emergency light fitting running down on battery and not charging when the generator is running)

All emergency and exit lights shall be LED type.

On completion, provide certification of installation compliance with relevant codes (i.e., BCA/NCC and AS 2293.1). As part of commissioning, contractors will be required to complete the Nexus electronic network records with all information. The "As Constructed" drawings, all individual light fitting addresses, and locations, as well as all router addresses, and locations must be clearly shown. A completed logbook (to AS 2293-2/1995) will also be required on handover.

During the defect's maintenance period, tests shall be recorded in a hard-bound logbook and handed over at the end of the maintenance period. Maintenance procedures including full discharge tests shall be carried out at six (6) monthly intervals to AS 2293.2.

Circuit breakers controlling emergency and exit lighting circuits shall be labelled: "WARNING- Interrupting supply will discharge emergency lighting batteries"

All batteries shall be high temperature Li-ON type.

ILON 600 communications interface devices shall be provided to connect to the campus data network as required along with any required power supply. Connect and commission the card(s) to the existing communications network and existing University exit/emergency light computer system.

In addition to Australian Standards requirements, provide an emergency light in each toilet area, conference room and electrical switch room.

Stanilite (ABB) should be engaged as the commissioning agents for each system installation and the commissioning report should be submitted as part of the Operation & Maintenance Manuals.

As-built plans are to be provided clearly showing the following for each emergency light:

- Light location
- ID number; and
- MAC address

Training, including face-to-face training, Training Manuals, and online access to the Nexus system, are to be provided with the installation, along with 6 monthly and 12 monthly testing.

7.4 Lighting Design

7.4.1 General Requirements

Refer also to section 2.4 - Whole of Life Design Considerations, section 2.12 - Natural Light and Solar Control, section 2.21 - 'Smart Campus' Technologies and USC AV Systems Standards and Specification

Only energy efficient LED lamps shall be used for all applications. Mercury vapour, incandescent, fluorescent, Metal Halide and HPS (SON) shall not be user.

All luminaires shall carry a minimum 5-year warranty and ensure it is in the Universities name.

All lighting shall be design by a specialist lighting consultant in accordance with Australian Standard 1680.

Lighting levels for all major projects are to be nominated by the Consultant for approval by the USC Project Manager before construction.

Indirect lighting is preferred for internal lighting where possible; however, where ceiling mounted fitting are user to achieve the required lighting intensity and/or meet budgetary outcomes, recessed luminaires are to be used where practical. All luminaires shall be adequately ventilated, with all serviceable components of luminaires easily accessible without dismantling or removing the luminaire.

Proposed lighting fixtures are to be submitted to the Project Manager for approval during the design development stage.

All light fittings are to be located / positioned to allow maintenance by a 3-meter step ladder max, EWP, or scissor lift. Luminaires shall not be mounted above stairs and ramps or where access to the luminaires for maintenance cannot be achieved in a safe manner without the need for scaffolding. Where this is not practical then a maintenance strategy is to be provided by the electrical engineer or designer.

Re-use of existing luminaires will only be allowed with the approval of the Project Manager and only where it can be demonstrated that the existing fittings can be cost-effectively refurbished to meet current standards where necessary.

All dimmable lighting shall be DALI, IEC 62386 control system compliant.

All luminaires are to have an IP rating appropriate for the location and are to be sealed against the ingress of insects and vermin.

All luminaires shall be provided with a 3-pin plug and 1500mm of flexible lead to connect luminaires to a lighting (socket) outlet securely fixed in the ceiling space (concrete ceiling, structural supports catenary wires and the like). Lighting Socket Outlets shall be clearly circuit numbered and marked with permanent marker the Sub Board No. and Circuit Breaker No.

Layout of luminaries should be preferably in rows parallel to the longest window wall and should provide an even illuminance.

7.4.1.1 Lighting Power Density (shouldn't be down a level)

In general, maximum power density for lighting shall be < 2W/m² per 100 lux

7.4.1.2 LED Fittings (Shouldn't be down a level)

LEDs are to satisfy the following minimum requirements:

- LED Luminaires shall be an *approved*, commercial quality fitting.

- Have specially designed heat dissipation to ensure the junction temperature of any LED does not exceed the manufacturer's recommended maximum operating temperature. Heat dissipation shall be designed for the installation conditions and wattage of the unit.
- Be purpose-built LED fittings designed for use with an integral LED module unless a retrofit style lamp is specified
- Be photometered by a NATA *approved* laboratory as a complete luminaire including the driver and all attachments, at operating temperatures consistent with its intended installation with resultant photometric data available.
- LED modules shall be manufactured by an *approved* manufacturer.

IP56 weatherproof LED luminaires shall be used in external applications and in plant decks.

7.4.1.3 Task Lighting

Task lighting is to be used wherever high localised levels of illuminance are required. The background lighting shall provide ambient lighting and the task lighting shall provide the lighting levels over the working plane as per recommendations of AS 1680.

Task lighting is to be on a separate circuit (from the background lighting).

7.4.1.4 Spares

Where unique fittings are specified, 10% as spares shall be specified.

7.4.1.5 Switching

Light switches shall be suitable for controlling LED lighting and be rated at 10A. Clipsal Classic 2000 series outlets with ID (Circuit identification label) windows shall be used. Switches in PWD facilities are to be in accordance with AS 1428.1

Circuit details shall be printed and be inserted in the ID window. In addition, circuit details shall be written on the lighting plate with permanent marker pen in a position where it is not visible when surround is replaced. As a minimum, circuit details shall include distribution board reference, circuit number and circuit breaker number.

Each row of luminaires next to windows shall be separately switched or controlled. Additionally, in teaching spaces the row of lighting fittings parallel to the white board or projection wall/screen shall also be independently switched.

All lighting switches shall be at centre line 1050mm above finished floor level.

Where four or less switches are grouped in the one location, they shall be mounted behind the one face plate. Where more than four switches are grouped in the one location, they shall be mounted behind a satin finished stainless steel face plate which shall be engraved to indicate the area controlled by each switch.

7.4.1.5 Wiring

Lighting circuits shall be wired in not less than 1.5mm² stranded copper cables. The circuits shall be designed to no more than 70% of capacity and shall be protected by 16A RCD circuit breaker. Also refer to “Fault Loop Impedance”.

7.4.2 Internal Lighting

7.4.2.1 Generally

Consideration is to be given to the type, size, and location of the luminaire, its integration with surrounding materials and finished, and coordination with other fixtures. Lamp output colours should be kept uniform within individual spaces, maximum 4000K.

All luminaries shall be plug-in style

7.4.2.2 General Teaching Spaces

These spaces or the like shall be provided with illumination complying with AS 1680.2.3 and AS 1428.1

In addition to the requirements of this Standard, adequate focussed lighting, without excess shadows, shall be provided on both the face of the presenter for lip reading and on the interpreter for sign language interpretation. Spotlights must be specified, positioned, and controlled to avoid adversely impacting on the vision of the presenter at the front of the theatre. The proposed lighting solution must be approved by USC IT.

Lecture Theatre lighting shall be mounted on a lowerable ‘lighting beam’ system with local key lockable controls for raising and lowering, or otherwise accessible with the approval of the Project Manager, for maintenance and refocussing.

7.4.2.3 Laboratories and Workshops

Luminaires in laboratories and workshops shall be carefully selected meet any special requirements which may apply to the space e.g., PC rating or hazardous zoning.

In laboratories with a PC rating of 2 or above, luminaire diffusers shall have perimeter seals at the junction with the ceiling suspension system to avoid contaminants being transferred into the ceiling space. Luminaires in laboratories or other spaces where the use of volatile materials has been identified as creating hazardous zones, must be certified as not providing an ignition source when required by a hazardous zones report.

Lighting in workshops shall be sealed against the ingress of insects and dust.

7.4.2.4 Videoconferencing Rooms

The illumination to these spaces shall comply with the recommendations of AS 1680.2.3 – 1994 clause 10.15. The minimum horizontal illumination level in the room shall be 360 lux, dimmable.

Luminaires within such rooms shall employ linear 4000K LED lamps. The lighting design shall achieve uniform and diffuse lighting in the vertical plane to eliminate facial shadows.

Advanced lighting control shall only be specified where interface to an Audio-Visual system is required.

7.4.2.5 Stairs and Ramps

Within stairwells, luminaires shall be mounted on the walls or to the soffit of the landings at no more than 3 meters above finished floor level.

Lighting in stairwells is to be individually sensor activated with five minutes on time.

Luminaires shall not be mounted above stairs and ramps or where access to the luminaires for maintenance cannot be achieved in a safe manner without the need to use scaffolding.

Aisle stairs and ramps within rooms that have dimmable lighting, e.g., auditoriums, lecture theatres and the like, shall have low voltage 'Hawko LED cinema' aisle lights mounted on the end of the seating rows or fixed writing benches. Light fittings shall have natural white colour LEDs and shall have Number inserts. If self-illuminating nosing(s) are used, lighting is still required to ensure that the nosing luminance remains charged for the duration of the space use.

In non-enclosed stairs, or stairs where natural light is sufficient for daytime use, stair lighting shall be switched or controlled by the external lighting program of the building management system.

7.4.3 Lecture Theatre Lighting (Incl. Auditorium Performance Spaces) – Additional Requirement

Designers should discuss requirements with the *University's* Information Technology team at early design stage.

Refer to section 2.21 – 'Smart Campus' Technologies and the latest version of the USC Audio Visual Systems Standards and Specification

7.4.3.1 Generally

Lighting in lecture theatres is to be designed to create the optimal visual environment for large-screen presentations and will be tailored to meet the specific requirements of different lecture theatre spaces.

All lighting is to be integrated into the AV control system via the Crestron control panel as specified in the USC Audio Visual Systems Standards and Specification.

7.4.3.2 Detail Design

Lecture theatre lighting is to be designed such that the relative brightness of the projected image is sufficient for clarity and legibility, whilst providing sufficient lighting levels in the body of the theatre to allow for the reading and taking of notes.

General-purpose house lighting must be even, multi-directional to minimise shadows and sufficiently bright for reading and writing. The target lighting level is 320 lux measured across the seating area.

Lighting for projection applications must be 'vertical', with as little horizontal component as possible. Lighting must be zoned from front to rear to allow differential lighting or 'profiling'.

Lighting is to be arranged in zones from front to back with lighting levels controlled with multi-channel dimmers. The number of zones required is to be determined by the size of the theatre, with a general rule of one zone for every 100-seat audience area or part thereof, generally as follows:

- In larger theatres (over 15 metres front to rear) lights shall be arranged in a minimum of three zones- front, middle and rear.
- In smaller theatres (under 15 metres front to rear) lights shall be arranged in two zones- front and rear.
- The front zone(s) of lights shall not spill onto the screens.

Transitions between different lighting configurations and levels must be as smooth as possible to minimise 'visual jarring' (e.g., sudden, large changes in brightness).

All theatre lighting (except exit lights) must be remotely controllable (automated) from the theatre control systems specified by the USC IT Department. This is achieved with contractor switching of lighting circuits and DALI digitally controlled dimmers.

Lighting systems must not cause interference to any other audio-visual equipment in the theatre. This includes infra-red (IR) acoustic and electrical interference.

House lighting shall be DALI controlled.

7.4.3.3 House Lighting and Lighting for Projection

Light fittings shall direct light vertically with a minimum of horizontal lighting component. Recessed down-lights are preferred. Care shall be taken to minimise glare.

Lights shall be spaced so there is significant overlap of beam patterns (so a lamp failure does not create an unusable dark zone).

Lighting levels shall be fully and continuously controllable from 100% light output to less than 2%. Control function (i.e., control input versus light output) shall be approximately linear.

Lighting zones shall be controlled by individual dimmer channels, which are controlled by the theatre control system specified by the USC IT Department (dimmers are specified below).

7.4.3.4 Additional Lighting

Emergency Exit lights shall be of low brightness type using green graphic on a black background to conform to AS 2293.1.

Bio-box lighting shall include LED work lighting and manually dimmable LED down-lights over working areas.

Writing board lighting shall provide approximate 300 lux of light on the vertical plane of the board surface, without creating glare for the viewers and without creating reflections that could obscure the information thereon.

Illuminated 'Lecture in Progress' signs shall be fitted on the outside of each entry door and switched via a contactor which in turn is controlled by the theatre control system.

7.4.3.5 Stage and Aisle Lighting

Directional lighting shall be installed over the lectern area. This shall comprise at least two narrow-beam adjustable lights (LED downlights or spotlights) controlled from a separate dimmer channel. There shall be no spill onto the projection screens, and care shall be taken to avoid reflections off the lectern surfaces.

Where installed, aisle lighting shall be low-intensity and shall be configured for minimum spill onto projection screens (e.g., directed downwards).

- Aisle lights shall be controlled by a contactor and dimmer, which is controlled by the theatre lighting control system.
- Optionally, aisle lights may be controlled from a separate dimmer channel.

7.4.3.6 Dimmers

Dimmers should be specified to ensure software compatibility. It is essential that local theatre control be achieved in conjunction with the automated control system.

Dimmers shall be controlled by a serial data link from the Theatre Control System. There shall be separate control panels along with separate lighting control for all dimming circuits.

Where practical, the dimmer(s) shall be installed in or near the bio-box to facilitate control wiring and adjustment. The dimmers shall not generate electrical interference to audio-visual equipment or generate audible noise.

Combined dimming and switching units are not recommended.

7.4.4 External Lighting

External lighting is to be considered integral to the building design. Consideration is to be given to Crime Prevention Through Environmental Design (CPTED) principles, ensuring adequate lighting levels in all external pedestrian and sitting areas, as well as roadways and carparks.

The type and location of external light fittings are to be such that glare is minimised and light spill onto adjoining properties is avoided as far as possible, whilst ensuring there is sufficient lighting for safety. Ensure sufficient lighting levels for security CCTV camera capture. Sensor controls are to be used in locations where night-time usage is intermittent and/or areas posing heightened security or safety risks.

External lighting around buildings and under-croft areas shall generally be provided by means of soffit or wall-mounted luminaires. Lighting of paths, roadways and open areas shall generally be provided by way of pole-mounted luminaires. Alternatives will be allowed only with the approval of the USC Project Manager. Lighting bollards are not permitted.

All external lighting including parking spaces, aisles, roadways, and pathways shall be designed to comply with AS 1158 Lighting for roads and public spaces. The actual category applicable is to be determined at early design stage with inclusion of the University.

External lighting fittings shall use 5000K LED lamps controlled by the Campus BMS external lighting control. Lighting levels are to be designed and calculated for each individual application with the applicable design criteria.

All pole top mounted LED fittings must have a 'quick release' feature to allow ease of maintenance. Fittings which must be dismantled to replace the LEDs or control gear must not be used.

Fittings selected shall be fitted with a surge diverter internally and have a minimum 5-year warranty.

The University do not allow the use of low height Bollard type luminaires refer section 7.4.3- Lighting Pole.

7.4.5 Signage

Illumination of signs and general displays shall be provided with a maintenance illuminance in the order of 200 – 300 lux either by back-lighting or front lit. Lighting shall be placed so that unwanted reflections shall not occur on the sign.

Any light fittings and associated equipment such as transformers installed within signs for illumination, must be easily accessible for maintenance or replacement, and have a suitable IP (International Protection) rating.

7.4.6 Lighting Poles

Lighting poles shall be hot dip galvanised steel complete with rag bolt mounting. All poles shall have an inspection plate located 600mm above ground level. All wiring shall be loop in loop out of the base of the pole and all lighting poles shall have terminals and RCD/circuit breaker located in the base.

Where the design requires "tee offs" these are only permitted to be completed in small above ground pillars not via underground cable pits.

Generally, pole heights shall be 8m for car parks and roadways and 4.5m for walkways. Hinged poles are to be used where the pole height exceeds 2 metres above the adjacent ground level and mechanical lifter access is not possible or where the adjacent surface is not level.

The final design of the pole and the footing arrangement shall be subject to site investigation and wind loading and engineering certification by a qualified geo-technical engineer is required.

7.4.7 Lighting Controls

Dali Lighting control systems shall be used in all buildings and integrated with Building Management System for scheduling.

The contractor is required to supply USC with any required licenses, equipment, software, and software upgrades for DALI lighting control system. Training will be provided for 2 USC staff by a suitably qualified person on light programming, hard copies of training material is to be provided in electronic and physical format.

Crestron lighting control systems shall be used in all teaching spaces, meeting rooms and auditorium.

All other lighting is to be connected to the University's building management system, which will have dual PE cell inputs (averaged) and each circuit will also have the option to be scheduled. A manual/off/auto control switch will be provided at each building's main switchboard for maintenance purposes.

The installation of Crestron systems at the University must only be carried out by accredited Crestron installers. A copy of all relevant programming documentation, software files, drawings and wiring diagrams must be supplied to the University upon completion of the installation. A copy of the data files MUST be supplied upon hand over of the site.

7.4.7.1 General Area

One light fitting outside lifts and escape stairs shall be on '24 hours' for security. Light fittings in stairwells shall be on 24 hours, sensor controlled with five-minutes on time. The 24-hour lights shall be LED only.

7.4.7.2 Office/Corridors/Storerooms

The lighting will be switched on via a wall switch that will activate the luminaries and the PIR occupancy sensors.

7.4.7.3 Teaching Spaces

Multiple circuit four programmable scene setting control panels to control the lighting environment. The control panels shall be Crestron. The control system shall provide single or combination control of rooms with removable / sliding partitions.

Panels shall incorporate six buttons i.e. OFF, 25% on, 50% on 100% on, raise and lower controls. The dimming control panel shall have an interface for connection to an AV system.

7.4.7.4 Auditorium and Lecture Theatre Lighting

Lighting within the Auditorium or Lecture Theatre will be controlled via dimming control panels utilising a Crestron network that will have an interface to the AV system.

7.4.7.5 Occupancy Detection Sensors

Lighting control occupancy detection sensors shall be equal to B.E.G. KNX PIR detection type and programmable. The detectors shall be capable of detecting finger movement within the space installed.

A one-off remote-control IR-PD device is to be provided for remote setting of detectors. This is to be passed to the USC Project Manager when commissioning is complete.

The contractor shall demonstrate the correct operation of the system for University approval.

7.4.7.6 External Lighting

External lighting shall be controlled via the campus wide building management system. Connected to PE Cell for light activation and manual/off/auto switch in designated switch board for maintenance testing.

8 DRY FIRE SERVICES

Refer also to the latest version of the USC ICT Infrastructure Specification

8.1 General Requirements

Mandatory

In addition to the requirements of the BCA or any other statutory requirements, all buildings shall have an automatic smoke detection system when nominated in the function design brief. The system shall be an electronic addressable automatic fire detection system comprising of building Fire Indication Panel (FIP), Sub FIP's (project specific), detectors, manual call points and Building Occupant Warning System (BOWS)/ Emergency Warning and Intercommunication System (EWIS) as required.

Any structure or building used for student or staff sleeping accommodation shall be provided with fire services complying with the requirements of a Class 3 structure or building, regardless of the building classification.

8.2 Fire Indication Panel(s)

The building fire indication panel shall be in a weather protected location, preferably inside the building close to the main entry. If located externally, the fire indication panel shall be housed in a stainless steel IP65 cabinet and located out of direct sunlight. All panel keys are to be standard pattern 003 keys already in use at the University.

To be compatible with the USC Fire System, the fire indication panel shall be a Notifier 3030 series panel with 6AT annunciation device. The system shall connect to the campus main fire indicator panel via a network card installed in the new building fire indication panel and dual optical fibre links. There are to be two dedicated optical fibre links from two different locations (for redundancy in the event one fibre path is damaged) in accordance with USC IT guidelines.

Once connected to the existing campus (main) fire alarm panel the system will automatically indicate an alarm to the local fire authority upon detection of a fire by a thermal or smoke detector or any other fire detection device or manually operated alarm. Ensure that connection to, programming and labelling of the master panel is included in the design.

Any new building fire indication panel shall incorporate all alarm zone facilities, ancillary control facilities, master alarm facilities, auto testing facilities, and indicators and isolators grouped in logical order. Clearly labelled manually operated switches to isolate door holders, bells, and relays (for maintenance), air-conditioning shutdown, and interface with the University security system are to be included. Allow for 30% spare capacity for future expansions. All panel keys are to be to the standard pattern 003 key already in use at the University.

8.3 Fire Graphics and Digital Voice Command Systems

The University ONYX fire graphics and DVC systems are to be updated with the new layout details including license and software upgrades required.

8.4 Fire Detectors

All detectors shall be specified in accordance with AS 1670. Detectors shall be fully addressable and be compatible for use with the Notifier FIP.

Locate all detectors in accordance with AS 1670. Remote detectors shall be provided with mounting bracket to allow for ease of testing and maintenance. Access to all detectors for maintenance is essential.

Thermals shall be provided in showers and kitchens to minimise false alarms. In accommodation buildings, multi-criteria detectors shall be used. Thermal detectors shall also be used in external areas and public access areas around buildings. Thermal detectors are preferred over smoke detectors for use in concealed spaces such as ceiling and roof spaces.

Provide Duct Probe Detectors for all dedicated Return Air Ducts. Provide insect ingress protection to all external detectors.

8.5 Occupant Warning Systems

The Building Occupant Warning System and Emergency Warning and Intercommunication System shall be Notifier and integrated with the Fire Indication Panel. Speakers shall be 100mm diameter recessed type when installed in accessible ceilings or surface mounted type when installed on concrete soffits.

Horn speakers are to be used in plantrooms and other services equipment rooms. The amplifier shall be sized to suit all devices.

Provide separately addressable, IP65 horn speakers to all building external areas.

8.6 Gas Suppression Systems

8.6.1 Generally

Gas suppression systems shall be considered for the protection of critical data centres only following an exhaustive analysis of all other options by the Consultant. The Consultant shall prepare a risk analysis and submit it to the University prior to approval being granted for the use of such systems.

8.6.2 Design

Gas suppression systems shall be designed strictly in accordance with Australian Standards and the University's WHS requirements. Consultants shall engage with, and have the design approved by, the University's WHS team during design development.

The design of rooms with gas suppression systems shall take the following into consideration:

- The provision of clear and unobstructed escape paths from the data centre with escape routes clearly line-marked on the floor;
- The provision of clear viewing panels between the data centre and adjoining spaces to allow for observation of all parts of the data centre from outside the room (IT rack design must allow for clear views of the total space);

- The provision of both audible and visible low oxygen alarms activated when the oxygen level falls below 20.9%;
- The provision of both audible and visible alarms if the system is in activation mode and about to disperse gasses;
- The provision of oxygen level monitors both inside and immediately outside the data centre adjacent to entry doors connected to the *University's* BMS with BMS alarm activation when the oxygen level falls below 20.9%;
- The provision of signs on entry doors warning users that they are about to enter a fire suppression-controlled area;
- Warning signs showing manual gas release points. Manual gas release points and override switches are to be located both inside and outside of data rooms;
- Safe storage of gas bottles. Gas bottles are to be installed independent of the data centre in an appropriate plant room or space that is not normally occupied and is naturally ventilated;
- Provision of pressure relief venting to compensate for both negative and positive pressures during a gas discharge;

8.6.3 Operations Manual

Provide schematic drawings of the system.

Provide user manuals and warranties (as per OMTrak requirements), including maintenance schedules for the life of the system, as well as gas replacement details.

8.6.4 Procedures Manual

Consultants are to engage with the University's WHS team to prepare a set of safe work procedures for any rooms with gas suppression systems installed.

8.7 Evacuation Diagrams

Evacuation diagrams are to be provided in laminated and framed hard and soft copies in accordance with Australian Standards and statutory requirements and approved by the Queensland Fire and Emergency Services. Evacuation diagrams must also include locations of first aid kids and defibrillators.

9 ELECTRONIC SECURITY AND ACCESS CONTROL SYSTEMS

Mandatory

Refer also to the Latest version of the USC ICT Infrastructure Specification

9.1 General Requirements

This document outlines the minimum standards required for the supply, installation, commissioning, and ongoing maintenance of all electronic security systems for the University at all its campuses and other associated sites.

Security in campus environments has traditionally been considered in terms of electronic systems and scrutiny. This often has resulted in environments which are intimidating, or which feel patently unsafe.

USC recognises and addresses its security issues and assets protection risks and the responsibilities of the University.

This Security Volume proposes fundamental design principles which will inform well-designed environments to facilitate safety and security of users.

It describes principles of planning, location, vision, and physical form to aid a sense of safety in public space, as well as defining USCs requirements for electronic security.

USC requires that security elements are incorporated in design but must not override all the primary activities in public spaces.

USC does not wish to turn its campuses fortresses for protection. Neither does it wish to destroy, through security measures, the vibrant communities the University has created. Yet a sense of safety is important to the enjoyment of public space.

These requirements are entirely consistent with the sustainable urban design priorities described in other Volumes of the Design Standards.

The security design concept needs to be established during the early stages of a project and SafeUSC are required to be included in project meetings and be able to contribute to the Design Team effort, and work with representatives from Property Services Project Team and stakeholder consultants, to develop a security system design relevant to the project.

The design and construction must consider the existence of security personnel and security technology capabilities.

9.1.1 Risk Management

Understanding of security needs, conditions, threats, and vulnerabilities.

USC requires that security elements are incorporated in design but must not override all the primary activities in public spaces.

USC does not wish to turn its campuses fortresses for protection. Neither does it wish to destroy, through security measures, the vibrant communities the University has created. Yet a sense of safety is important to the enjoyment of public space.

These requirements are entirely consistent with the sustainable urban design priorities described in other Volumes of the Design Standards.

The security design concept needs to be established during the early stages of a project and SafeUSC are required to be included in project meetings and be able to contribute to the Design Team effort, and work with representatives from Property Services Project Team and stakeholder consultants, to develop a security system design relevant to the project.

The design and construction must consider the existence of security personnel and security technology capabilities.

The importance of the perceptions of personal safety, as well as actual safety, have long been recognised as influencing how place and space is used.

9.1.2 Urban planning and design policies

Practices that include Safer Design or Crime Prevention. Through Environmental Design (CPTED) in State and local government guidelines will facilitate appropriate design of buildings and public spaces.

Walkable neighbourhoods – attract people in order to populate spaces.

Natural surveillance – visibility of entrances.

Security “barriers”.

Design streets to increase the presence of people, with adjoining buildings designed so that people have a good view of public space.

Gathering spaces located in areas where there is natural surveillance from surrounding buildings and public space.

9.1.3 Certified Security System Contractor Requirements

USC currently has a preferred supplier system for the installation and maintenance of all electronic security systems. Only these suppliers are to be engaged to provide these services for any USC facility. Each proposed contractor must have the following in place prior to bidding for or carrying out for any installation or maintenance works either directly to USC or via a USC appointed project builder.

Note that all electronic security contractors must submit their security system credentials to the USC Project Manager for approval prior to beginning any works. Failure to have all documentation in place will forfeit any rights of the contractor at carry out work at USC sites.

The electronic security contractor must be a Gallagher certified installer with at least 5 years’ experience.

The electronic security contractor must have a dedicated Gallagher IT person that is trained in all aspects of the Gallagher system including High Level interfaces to other USC electronic security systems.

All personal employed by the electronic security contractor and any subcontract personal must be trained and Gallagher certified in the tasks they will be performing.

The electronic security contractor must be an Avigilon partner so as to be able to obtain technical support for any issues that arise.

The electronic security contractor must have a dedicated Avigilon IT person that is trained in all aspects of the Avigilon system including High Level interfaces to other USC electronic security systems.

All personal employed by the electronic security contractor and any subcontract personal must be trained and Avigilon certified in the tasks they will be performing. Training is to be undertaken either online or in person by an Avigilon representative.

The electronic security contractor must be a Jacques partner so as to be able to obtain technical support for any issues that arise.

The electronic security contractor must have a dedicated Jacques IT person that is trained in all aspects of the Jacques systems used on any USC sites including High Level interfaces to other USC electronic security systems.

All personal employed by the electronic security contractor and any subcontract personal must be proficient in the Jacques systems used on site. Either trained online or in person by a Jacques representative.

9.1.4 Certifies Contractor Installation and Maintenance Standards

All electronic security contractors must submit their government mandated security certificates to a USC representative to approve prior to beginning any works. Failure to have all documentation in place will forfeit any rights of the contractor at carry out work at USC sites. These include the following:

The contractor's company security provider licence.

Each contractor employee's and any sub-contractor's individual security provider licence.

Each contractor employee's and any sub-contractor's individual ACA open cabling licence.

Any other licences such as structured cabling, fibre optics or electrical works.

9.1.5 Cabling Standards

All contractors, their employees and sub-contractors are to adhere to the Australian Communications and Media Authority (ACMA) cabling rules – Telecommunications Cabling Provide Rules 2014.

All data infrastructure cabling is to be carried out in accordance with the latest version of the USC ICT Infrastructure Specification.

Note the following:

Any electrical works is to be carried out by a USC approved contractor with the appropriate licences and certificates.

Any fire system works is to be carried out by a USC approved contractor with the appropriate licences and certificates.

Any lift works is to be carried out by a USC approved contractor with the appropriate licences and certificates.

All ancillary devices, door locks, strikes, reed switches etc. are to be cabled with industry standard security cabling. Provide a sample/colour specification sheet of proposed cables for use on the project at early design stage for approval by USC Project Manager

9.2 Design Overview

The USC Security and Access Control Systems (SACS) design principal is to provide all reasonable and authorised access to sites, buildings, and offices while maintaining electronic data records through electronic access control and/or CCTV systems. As such, the issue of and use of hard keys for access control will be reduced to the minimum possible.

In general, all access points will be fitted with access control; the type and features dependent on the assessed risk.

Office Doors: Fitted with Aperio wireless access control as per the specifications below and no lock cylinder. (The Aperio door furniture allows for a lock cylinder and this must be fitted with a block plate).

Internal Doors (multiple use low risk areas): Fitted with Aperio wireless access control with Master key override.

All other doors (Computer Labs, Data Rooms, External door): Fitted with Gallagher hardwired access control and a Master key override.

9.2.1 Locking and Keying

The University's approved lock and key providers and maintainers of the key databases are as follows:

The University of the Sunshine Coast Campus Name – Key Provider

USC Moreton Bay, USC South Bank – John Barnes & Co, Salisbury

USC Sunshine Coast, USC Gympie, Thompson Institute – Lockmaster Locksmiths, Maroochydore

USC Fraser Coast, Fraser Island Research and Learning Centre (Dilli Village) – Allstrong Locksmiths & Security, Hervey Bay

These Companies shall be consulted for specification of the master keying profile, provision and installation of locks and cylinders.

The University's approved lock and key providers, and maintainers of the key databases are:

Petrie and Southbank- John Barnes & Co, Locksmiths

Sippy Downs, Thompson Institute, Gympie- Lockmaster Locksmiths, Maroochydore

Fraser Coast, Dilli Village- Allstrong Locksmiths, Hervey Bay.

These companies will be consulted for specification of the master keying profile, provisions and installation of locks and cylinders.

9.2.2 Duress Buttons

Duress buttons are normally installed in public reception areas, cash transaction centres, and counselling rooms. Other areas are considered based on the assessed risks.

Consultants are to confer with the University's security team to assess and approve locations of Duress Buttons on a project-by-project basis.

9.2.3 Emergency Call Points

Emergency Call Points will be installed in public areas and along pedestrian, walking, and cycling routes.

Consultants are to confer with the University's security team to assess and approve locations of ECPs on a project-by-project basis.

9.2.4 Closed Circuit Television

All cameras shall be at minimum 2MP (Megapixels) internal and 5MB and (Megapixels) external with analytics.

CCTV Cameras shall meet the requirements of the current system and be consistent with the requirements of USC.

Cameras shall be:

- Of vandal proof design where tampering or malicious damage can occur.
- Installed at a height that is safely accessible for maintenance purposes.
- Not to be fixed to heritage buildings without appropriate Heritage approvals.

CCTV Camera Placement- Placement of all new CCTV cameras will be subject to the requirements of the project in consultation with USC Security Services.

Cameras must be located and selected according to the following:

Internal cameras at building entrance:

- Cameras shall monitor pedestrian traffic entering or departing through a building entrance.
- Recording angle must be set to view face/head of building entrants.

External cameras at building entry and exit points:

- Cameras shall monitor pedestrian traffic entering or going past building entry points.
- Recording angle must be set to view face/head of building entrants.
- Reception areas and premises where monetary transactions take place:

- Cameras shall monitor activity at University reception areas and areas where monetary transactions take place and/or where there are interactions with members of the public.

Areas of critical infrastructure or where livestock or dangerous chemicals are housed:

Cameras shall monitor activity in areas containing animals, equipment, information technologies or communication networks which, if rendered inoperable for an extended period, would significantly impact on the functioning of the University.

Areas containing objects of high value or desirability

Cameras shall monitor activity in high-risk areas containing objects of high value or desirability and include computer labs, specialist classrooms, teaching spaces or storage areas

Designated safer walkways and zones:

- Cameras shall monitor traffic along designated safer walkways, light corridors, heavy traffic routes and corridors outside toilets.
- Areas subject to petty theft, vandalism, or graffiti:
- Cameras shall monitor activity in areas where there is a history of criminal damage or where temporary installations may pose a risk; such areas may include library spaces and other student study areas, 24-hour computer labs and high-profile buildings.

Car park entrances and exits:

- Cameras shall capture vehicle number plates, facial identification of pedestrian traffic, remote monitoring of traffic flows (vehicle and pedestrian) and assist remote management of vehicle access. Licence Plate Recognition (LPR) cameras shall be used.

All CCTV recording equipment shall meet the following below requirements:

- The CCTV system shall have fail over capability to ensure that recording is maintained in the event of any failure of equipment in high and/or medium risk areas. The method of fail over shall meet the requirements of the current system and be consistent with the requirements of USC.
- Equipment is to have a storage capacity of 30 days minimum; new installs using existing equipment shall ensure the 30-day storage is retained.
- Cameras shall be set to record 24/7.
- Cameras shall be connected to USC-ITS network and must meet ITS cabling standards.
- Cameras shall be set for Motion detection recording, allowing 30 seconds of pre-recording and 30 seconds of post recording.
- Camera shall be set for Alarm/Event recording, allowing 30 seconds of pre-recording and post recording.

Requirement for approved hardware supply

All Network Video Recorders (NVR's) shall meet the requirements of the current system and be consistent with the requirements of USC

9.3 Approved Equipment

9.3.1 Gallagher Access Control Equipment

All University campuses and Sites are controlled by Gallagher security equipment. No alternative system will be allowed to be installed.

APPROVED GALLAGHER EQUIPMENT

Brand	Model	Comment
Gallagher	6000	Used for all new installations, upgrades, and maintenance.
Gallagher	8H and 4H Relay Boards	
Gallagher	8R and 4R Relay Boards	Used for maintenance only.
Gallagher	2 Door HBUS	Used only for system upgrades or maintenance only. (New install by approval only)
Gallagher	2 Door GBUS	Used for maintenance only.
Gallagher	GBUS Input / Output PCB 16IN/16OUT 8IN/4OUT	Used for maintenance only.
Gallagher	HBUS Input / Output PCB 16IN/16OUT 8IN/4OUT	Used for all new installations, upgrades, and maintenance.
Gallagher	Card Reader / Keypads T20 /T15	Used for all new installations, upgrades, and maintenance.
Gallagher	Card Reader: T10	Used for maintenance only.
Gallagher	Cabinet with 8Amp Power Supply	Used for all new installations, upgrades, and maintenance. (Must have 4 batteries installed)
Gallagher	PSTN Dialler Plus an Inner Range T4000	Used for sending alarms to an outside monitoring company
Gallagher	Cabling	All cabling used to connect to the Gallagher equipment will need to meet the Gallagher minimum requirements.

Table 13 - Gallagher Access Control Equipment

9.3.2 Aperio Access Control Equipment

All new and upgrades for the Aperio lock will need to be installed with a Lockwood 3772 mechanical lock to take advantage of the stronger springs and tongue retraction. Aperio control equipment must be Bluetooth enabled

All new timber and aluminium doors installed will need to be able to accommodate the Lockwood 3772 mechanical lock. This allows for easy and consistent installation throughout all campuses.

If a narrow style mechanical lock is requested to be installed, then the door frame will need to be able to accommodate a lock with a 3782, 30mm back set.

Note – approval will need to be obtained from an approved USC representative to install narrow style locks.

APPROVED APERIO EQUIPMENT

Brand	Model	Comment
Aperio	E100 V3 Multi Read Escutcheon, with key over-ride option.	These locks are to match existing Aperio locks. They are to be installed on all internal doors as advised. Examples- offices, cleaners' cupboards, or storerooms. When installing with the key over-ride not being used the key barrel hole will need to be blanked with an approved device.
Aperio	AH-30 1:8 Communication HUB	Communication HUB's need to be installed either on the ceiling or wall mounted. Approval will need to be gained if the area has a special finish. Communication Hubs cannot be installed ***in*** the ceiling.
Aperio	Cabling	All cabling used to connect to the Aperio equipment and connect to the Gallagher equipment will need to meet the Aperio and Gallagher minimum requirements.

Table 14 - Aperio Access Control Equipment

9.3.3 Electric Locking Equipment

APPROVED LOCKING EQUIPMENT		
Brand	Model	Comments
Lockwood	3570 Electric Monitored mortise locks	All locks will be set to fail secure unless they are in a fire escape path. Fire escape locks will be released via a slave relay that will be located inside the security system control panels. This slave relay will be activated via the fire system in the event of a fire situation.
Lockwood	3582 Electric Monitored mortise locks	All locks will be purchased as fail secure unless they are in a fire escape path. Fire escape locks will be released via a slave relay that will be located inside the security system control panels. This slave relay will be activated via the fire system in the event of a fire situation.
FSH	Electromagnetic Locking Devises	To be installed as per manufactures recommendations. Not to be used on external entry doors unless prior approval is obtained from a USC approved representative.
FSH or Lockwood	Electric Strikes	**Not to be used on any doors unless prior approval is obtained from a USC approved representative.**
FSH or Lockwood	V-Locks/ Shear Locks	**Not to be used on any doors unless prior approval is obtained from a USC approved representative.**
FSH and Lockwood	Cabling	All cabling used to connect to the locking equipment will need to meet the minimum requirements of both the control equipment and the locking device manufacture.

Table 15 - Approved Locking Equipment

9.3.4 Access Control Accessories

APPROVED CONTROL ACCESSORIES

Brand	Model	Comment
Smart Innovations	SMART4342G	Green mushroom press to exit button.
Trojan	EXIT1000 EM-REX Break Glass	To be installed on all fire exit paths that require a Press to Exit button to get out. **Note – all break glasses must be monitored.**
Non-Branded	SOUN9050 DOTL Buzzer	To be installed on all hard-wired access control doors. The buzzer is to be installed on the inside of the room. Install in the ceiling space if it can be accessible for maintenance purposes. Otherwise install on the ceiling just inside the door.
ASSA Abloy	Lead Covers cable transfers AB8810	Use on all electric mortise lock doors. Note – no external cable transfer devices to be used unless prior approval from a USC approved representative.

Table 16 - Approved Control Accessories

9.3.5 Intruder Alarm Accessories

APPROVED ALARM ACCESSORIES

Brand	Model	Comment
Non-Branded	20mm Flush Mount Reed Switch	To be used on all specified doors to be monitored that are not hard-wired access control. To be wired for 4 state monitoring.
Bosch	PIR Corner Mount Ceiling 360 Degree	To be used for any specified intruder monitoring. Must have separate alarm and tamper contacts. To be wired for 4 state monitoring.
Smart Innovations	SEN3045	Used for all under desk or wall mounted duress applications. No LED required.

Table 17 - Approved Intruder Alarm Accessories

9.3.6 Closed Circuit Television Equipment

APPROVED CCTV EQUIPMENT

Brand	Model	Comment
Avigilon	Recording Servers Recording Appliances	All recording devices will be an Avigilon supply devise. Each recording device will be fit for the situation in which it will be installed. All recording devises are to be purchased with Enterprise licencing, so they are compatible with the current Avigilon systems. NVRs to be installed with Avigilon analytical software
Avigilon (Cameras)	Bullet (Analytic) Dome (Analytic) 1,2- or 3-Way Dome Analytical PTZ light catcher	All cameras purchased and installed will be fit for that location. All camera models and locations will be specified or approved with the USC representative.
Avigilon	Camera Licencing	All camera licences are to be purchased with Enterprise licencing, so they are compatible with the current Avigilon systems.
Avigilon (Software)	Virtual Matrix Mobile Client	All software to be compatible with the current version of Avigilon server and client.
Avigilon	Cabling	All cabling used to connect to the CCTV equipment will need to meet the minimum requirements of equipment manufacture. Note – all data cabling must adhere to the USC Structured Cabling Standards.

Table 18 - Approved Closed Circuit Television Equipment

9.3.7 Emergency Call Points and Intercom Control Equipment

APPROVED ECP AND INTERCOM CONTROL EQUIPMENT		
Brand	Model	Comment
Jacques (Server)	IP Based System	The server is currently installed. Any changes, upgrades or additions will need to be compatible with the working system.
Jacques (Field Devices (IP Based)	HPU Jem² Units (ECP) Video & Audio Units	All new and upgraded devises are to be IP based and compatible with the current IP Jacques system.
Jacques (Lift Phones - IP Based)	JIB-3B1	To be used as the lift phone for all lift installs and upgrades.
Jacques (Car Park Intercoms still on PABX System)	VDL-441	Currently used for entry to the car parks as there are not data cables to these locations. Must be maintained until upgrades occur.
Jacques	Cabling	All cabling used to connect to the Jacques equipment will need to meet the minimum requirements of the equipment manufacture. **Note – all data cabling must adhere to the USC structured cabling standards.**

Table 19 - Approved Emergency Call Point and Intercom Control Equipment

The control system panels are to be placed between 1500 – 2000mm above finished floor level to allow safe access without having to utilise a ladder. The battery controller box/panel must always be placed either underneath the main controller box/panel or beside it. This will avoid batteries leaking acid over the main controller box/panels.

Card readers shall be provided for all external doors and egress paths doors, afterhours access, communications, computer labs, 24-hour access rooms, particular amenities (for example, kitchenette adjacent to conference room) and other doors as nominated in the project room data sheets. Push button to exit shall be provided for all doors that do not have free handle to exit. All external doors are also to be provided with reed switches linked to the EACS.

9.4 Freezer Alarms

Notwithstanding the requirements of other sections, all cold rooms, and freezer rooms are to be monitored by Gallagher and the BMS via low level interface and by the Frigbot system connected directly to the digital controller. Upright fridges and refrigerator and freezer temperatures and alarms must be monitored by the Gallagher security system and BMS via low level interface.

9.5 Interconnection with other Building Systems

In all bookable spaces, the access control system and the building management system are to be interfaced with the room booking system to actuate services such as lighting, HVAC, and hot/chilled drinking water units etc. within the space automatically. Programming of the services will be determined on a project-by-project basis in consultation with the University.

10 MECHANICAL SERVICES

10.1 Certification

Mandatory

All designs done or and on behalf of USC require RPEQ Certification (Registered Professional Engineer Queensland), unless approved by the *University.*

Form 15 Design Certification is to be obtained.

10.2 Mechanical Services Design Requirements

10.2.1 Mechanical Design for Sub-Tropical Area

In addition to the requirements outlined above in section 2.9 – Design for Sub-tropical area, the design must specifically deter the growth of mould.

For this reason, the internal humidity levels within the building shall not exceed 70% under any circumstance with upper limit control of 65% Relative Humidity (RH) whilst air conditioning systems are operational.

Ensure that duct leakage is minimised, and that exhausts from conditioned or cold spaces traversing through ambient air are insulated as necessary to prevent condensation.

Care is to be taken in the design to ensure that non-conditioned outside air is not drawn across chilled water piped, Fan Coil Units and duct work. Chilled water pipes fan coil units and ductwork are not to be in ambient air spaces except for plant rooms.

10.2.2 Passive Energy Efficiency

Design should take advantage of local climate / weather profiles. Consideration should be given to the reduced use of air conditioning, ventilation etc. by making advantageous use of shading, prevailing breezes, and the like.

Where practical, atrium's etc. can be naturally vented with passive and active elements to enhance air movement and comfort.

Air movement should be enhanced (for example, through large commercial ceiling fans etc.) to minimise the reliance on air conditioning or to enhance the environment.

10.2.3 Heat Recovery and Energy Efficiency

USC is committed to both minimising life costs of ownership and being environmentally responsible.

Areas with high fresh air requirements (due to occupancy, operation, etc.) should be provided with enthalpy recovery from relief air. Similarly, in areas requiring large exhaust of conditioned air, energy recovery from such exhaust is desirable. The control of outdoor air ventilation rates can be utilised in conjunction with energy reduction strategies if room pressurisation is a key driver. CO^2-e control of outdoor air ventilation rates can be utilised in conjunction with energy reduction strategies.

Under all ventilation demand strategies, the building shall remain under a positive pressure.

Systems shall be designed so that fans, pumps etc. are operating against modest pressures, whilst maintaining economy of installation (for example, pipes are not excessively oversized etc.)

10.2.4 Equipment Quality and Support

All equipment and components shall have a proven track record of operation in Queensland and be of high quality and reliability, readily available, with a Queensland based agent for service / spare parts, with sufficient stock of spares to support USC's operation.

Critical spares requirements shall be listed in Operating and Maintenance Manuals.

10.2.5 Locating Existing Services

All existing services for the project shall be identified and confirmed onsite in accordance with the requirements identified through USC's permit to work system

10.2.6 Diversity of Systems

Generally central systems, plant, and infrastructure (chilled water pumps, pipes, central air handlers etc) shall be designed without diversity of load or spaces. They shall be capable of serving the full concurrent design loads.

10.2.7 Specific Design Requirements (should be first)

The design standards are provided with the intent that the default energy rating would be in the order of 4.5-star NABERs rating and previous maintenance or performance issues experienced with existing HVAC installations onsite are not repeated.

Where existing buildings are being substantially refurbished, existing HVAC systems are to be upgraded or replaced to reflect this requirement.

10.2.8 Campus District Cooling

USC Sunshine Coast Campus has a campus district cooling (CDC) reticulation system and uses a central energy plan (CEP) to generate chilled water for distribution to campus buildings through the chilled water piping reticulation. The Director, Facilities Management approves new connections onto the CDC.

To maximise the benefits of the CEP system, these provisions must comply with:

- All air conditioning systems used in the building shall be chilled water type. Direct expansion systems shall not be used for any application unless specifically approved by the Director, Facilities Management during Schematic Design.
- Chilled water-cooling coil selections shall be based on the parameters scheduled below.
- Individual building chilled water energy (kWh) metering shall be provided using magnetic flow meters and flow and return chilled water temperature monitoring. At each temperature sensor thermometer pocket (well), provide an adjacent binder fitting for testing and calibration purposes. A second set of thermometer pockets shall be provided for interface with the campus BMS.
- USC chilled water energy metering will indicate kWh thermal This meter measures chilled water mass flow rate plus flow and return water temperatures and has dual outputs, 4-20mA to the campus BMS
- Provide dedicated electrical power consumption metering (kWh electrical) of the mechanical services switchboard to capture only air conditioning air handling units serving each building or group of buildings. Separate metering of miscellaneous ventilation systems etc. shall be at the discretion of the USC brief and/or Director, Facilities Management and shall be additional to that mentioned above.
- Two-way chilled water control valves shall be used throughout. Three-way valves or fixed or motorised flow/return bypass connections shall not be used under any circumstances.
- Coil control systems employing constant coil air off temperature (AOCT) control or similar control strategies which can result in fully open control valves at part load conditions shall not be used. AOCT control shall only be used in combination with set-point reset strategies to ensure that chilled water control valves respond to building load.

10.2.8.1 Internal with Reticulation System

The building shall be connected to the central energy plant site reticulation network at valved connection points located in a pit in a location approved by the USC Project Manager during Schematic Design. All connections to the building shall have wafer butterfly valves which can isolate the building.

Designers shall analyse part load and after-hours system flow requirements for the building and determine appropriate pumping configuration. In some applications a low load pump may be required.

For critical applications, systems are to be arranged to accommodate the temporary connection of the university's mobile chiller, by provision of accessible branch valves and connections.

10.2.8.2 Design Parameters Central Energy Plan

The following design parameters apply to the Central Energy Plan (CEP) interface and shall be used for purposes of selecting pumps, pipework, and fittings.

CENTRAL ENERGY PLAN PARAMETERS	
Parameter	**Design Criteria**
Available Flow / Return Differential Pressure	0 kPa

Available Flow Rate	As nominated by the mechanical designer
Delivery Temperature	7.0 degrees Celsius
Static Pressure	300 kPa

Table 20 - CEP Interface Design Parameters

10.2.8.3 Selection of Cooling Towers

Is it important to maintain high building chilled water ΔTs (Delta-T) during full and part load conditions to reduce pumping power. Designers shall recognise this requirement to avoid any unnecessary system elements which compromise building ΔT (Delta-T). Control systems shall be arranged to ensure that control valve positions respond to building load. Flow and return bypasses shall be avoided.

Cooling coils shall be specified to achieve high ΔTs (Delta-T and designers should scrutinise manufacturer's technical data for cooling coils prior to accepting tenders.

10.2.8.4 Coil Selection Criteria – Design Parameters

Select all cooling coils using the following criteria:

COIL SELECTION CRITERIA

Parameter	Design Criteria
Chilled Water Entering / Leaving Temperatures	7.0 degrees C / 17.0 degrees C
Maximum Coil Face Velocity	1.8 m/s
Max Coil Air Pressure Drop	80 Pa
Max Coil Water Pressure Drop	40 kPa

Table 21 - Coil Selection Criteria

Use the following coil construction:

COIL CONSTRUCTION CRITERIA

Component	Construction Material
General Air Handling Units	Copper tube aluminium fin
Outside Air Pre-Conditioners	Copper tube and copper fins electroplated in brass frames

Table 22 - Coil Construction

Cooling coils shall be fitted with drip trays. Drip trays shall be stainless steel and shall extend a minimum of 450mm beyond pre-cooling coils and chilled water coils on the downstream side of the coil. Drip trays and have sides and underside insulated with 12mm closed cell rubber.

Install coils with sufficient space under for cleaning and fully flash around to prevent by-pass. Coils shall have bleed and drain connections.

10.2.8.5 Approval Request for Campus District Cooling Connection

A single request for approval to connect to the campus cooling district is to be sent to the Director, Facilities Management, at least 3 working days before the connection is required. This document shall contain the following information.

From the RPEQ certified design engineer:

- Building Peak Load Chilled Water Flow Demand (l/s);
- Building Peak Load Chilled Water Design ΔT (oC);
- 24 hr Systems Peak Load Chilled Water Flow (l/s);
- 24 hr Systems Peak Load Chilled Design ΔT (oC);
- As built drawing of surveyed chilled water in ground pipework, pit, and connection point; and
- Certificate of Design Compliance.

From the commission team:

- Mechanical Services Commissioning Plan
- Certificate of Installation Compliance
- Water quality test result (pre-connection clean and passivation)
- Water pressure test results
- System commissioning test results

10.2.9 Low Load Conditions

The campus district cooling system (CDC) provides designers the ability to address both low loads and peak loads.

Consider the low load operating conditions and ensure that pump sets, controls etc., and the system design can accommodate low loads and small stand-alone loads (etc.). In some cases, the CDC may provide sufficient low load flow without building pump operation.

Identify the requirements and strategy carefully and obtain approval from the USC Project Manager.

10.2.10 Carbon Dioxide Control

Areas with high fresh air proportions shall include assessment of energy reduction strategies such as CO^2-e control and CO^2-e modulation. Provide design feedback to the USC Project Manager of the cost and return benefits of the system on a case-by-case bases.

10.2.11 Ambient Design Conditions

Determine outside winter and summer dry-bulb design temperatures and other ambient conditions in accordance with AIRAH 4 published data included in DA9 Design Manual or CAMEL weather data.

Confirm with the USC Project Manager that the design is to be based on comfort or critical weather data.

Typically use *comfort weather data* for all general comfort air conditioning applications. *Critical weather data* shall be used for all process cooling, controlled environment spaces, data centres and particularly spaces with high fresh air loads.

The ambient air design condition for condensers (where permitted to be used) should be adjusted to account for local effects such as roof heating, partial recirculation etc.

10.2.12 Heating, Ventilation and Air Conditioning Zoning

Heaters shall not be incorporated in VAV boxes unless approved by the USC Project Manager. Where heaters are installed, service panels must be provided in a suitable location for testing and visual inspection of heaters in operation.

Air conditioning zones shall be carefully arranged to permit accurate control of conditions and to avoid reheat, excessive zone throttling and such. Zoning shall permit functionally separate systems to be turned off individually.

- Generally thermal / control zones on air handlers shall not exceed 150 m^2 for internal zones and 100 m^2 for perimeter zones (Guide). The zoning is acknowledged to have flexibility based on the RPEQ design engineer's advice.
- Zones displaying different usage patterns, solar aspects or load profiles must be served separately if a temperature swing of 10Cdb outside of normal temperature proportional control range is likely.
- Zones with different operating times must be served by separate plant
- Specific zones requiring specialised humidity controls vs comfort conditioning must be by served separate plant
- Lecture theatres and intermittently loaded spaces must be served by separate plant.
- Areas with constant or 24/7 loads must be served by separate plant
- Laboratories requiring separate plant etc.

10.2.13 Internal Design Parameters

Refer to USC Thermal Comfort Guidelines.

For special process areas, laboratories, physical activity areas, design conditions are to be in accordance with the Function Design Brief and approved by the USC Project Manager.

10.2.14 Humidity Control and Requirements

The University of the Sunshine Coast's campuses are generally located in Sub-Tropical environments, in addition to which, teaching and laboratory environments often include large fresh requirements. General comfort design required to produce approximately 55% Relative Humidity (RH) at 23 degrees internal temperature and external design conditions. Systems shall be designed to inherently limit space Relative Humidity (RH) to below 65% under all conditions. The schematic design and design development reports shall specifically cover how space Relative Humidity (RH) will be controlled.

10.2.14.1 Humidification

Humidification is not required on most projects.

When humidification is required for a specific project, ensure that the method is energy efficient, suitable for sustained operation, and suitable for the water supply available.

10.2.14.2 Humidity Controlled Spaces

For specific areas close humidity control may be required. For example, library spaces, laboratory space, etc.

Designers are required to produce energy efficient designs with inherently "improved" dehumidification over commercial norms. The use of additional energy to perform reheat dehumidification is to be avoided, and generally direct electric reheat will not be permitted for comfort dehumidification.

Dehumidification plant design shall accommodate part load conditions. Calculations should be verified by plotted psychometric charts (included in schematic design and design development reports.

10.2.15 Heat Load Calculations

Formal heat load calculations are to be undertaken for all air-conditioned spaces. The heat load must be calculated using software recognised by the National Construction Code (NCC).

Occupancy rates are to be taken, in the first instance, from the functional design brief were provided otherwise from the occupancy information provided in the following table extracted from the Tertiary Education Facilities Management Association (TEFMA) Guidelines Edition 3

POPULATION DENSITY GUIDELINES

SPACE	INDICATIVE OCCUPANCY
Administration spaces – General	12 sqm / person
Administration spaces – Heads of School / Departments	16 sqm / person
Administration spaces – Senior Executive	28 sqm / person
Postgraduate spaces – office	2 – 4 sqm / person in shared room
Post graduate spaces – labs	6 sqm / person
Conference / Meeting Rooms	2 sqm / person
Tutorial Rooms	2 sqm / person
Lecture Theatres	2 sqm / person
Computer Teaching Laboratories	3.5 sqm / person
Science Teaching Laboratories	5 – 6 sqm / person

Table 23 - Population Density Guidelines

Where no other guidance is provided, the occupancy information provided in the NCC shall be used.

All room occupancies and loads are to be confirmed in writing with the room sheets to the USC Project Manager before design development.

Activity levels used for heat loads shall match the usage of the space.

Initial calculations may be based on the allowances for lighting, equipment etc. provided in the brief or in this guide. Calculations shall be checked and amended before final design using information relevant to the specific project (e.g., specialist lighting etc.).

A modest safety factor should be applied (typically 5-15% at the discretion of the designer), however particular care must be exercised not to significantly oversize plant. Safety factors should be advised in the schematic design and design development reports.

10.2.16 Ventilation of Area

10.2.16.1 Shower Area

Shower areas shall always be mechanically vented.

10.2.16.2 Amenities and Ablution Areas

Wherever practical these shall be naturally vented. Natural ventilation openings etc. shall be a minimum of 200% of legislated requirements, otherwise mechanical ventilation should be applied.

10.2.17 Plantroom and Plant Locations and Platforms

All air handling plantrooms shall be fully enclosed and included within the building vapour barrier and insulation systems. Plantrooms shall be designed to limit internal temperature to under 26˚C, and this may require air conditioning of the plantroom space.

Plantrooms and the like shall not be located immediately bordering noise sensitive spaces (e.g., plant room backing on conference rooms and the like). Wherever possible, plantrooms shall be stacked above one another in multistorey buildings.

Air Handling Units are to be a minimum of 600mm from the walls to allow for maintenance. The plantrooms shall be painted, and floors finished with two-part epoxy paint.

Plantrooms shall be carefully planned to facilitate all service and maintenance activities. For example, motor changes, drive changes, filter access, coil and AHU cleaning, fan changes, etc.

Safe permanent access is paramount.

Where plant is located on external decks at height, permanent stairs, handrails etc. should be provided. Where ladders are used, these should only be for minor service items and must be less than 2.5m in height.

Plantrooms should be tanked / bunded and provided with drainage to address any free water (e.g., roof leakage, tray overflow etc.) Provide access panels to ducts immediately below roof penetrations to allow inspection for water ingress.

10.2.18 Noise and Vibration Control

Prior to finalising the design, provide an overall strategy for vibration isolation to all equipment with moving parts to the USC Project Manager for review and approval.

Pipework shall not be rigidly mounted to building structure. Ensure that hangers are arranged to accommodate thermal expansion, transient loads and conditions whilst maintaining isolation.

10.2.19 Design Sound Levels for Spaces

Noise level limits from Mechanical Services plant etc. shall be:

MECHANICAL SERVICES SOUND LEVELS	
SPACE	**SOUND POWER IN dBA**

Offices (enclosed)	37
Open Plan Offices, Administration Spaces, etc., Post Graduate areas	37
Tutorial / teaching rooms	37
Lecture Theatre / Auditoriums	32
Library	40
Laboratories	40
Video Conferencing Areas	32
Corridors, Lobbies, Foyers	45
Outside	5 dB above ambient at 10 metres

Table 24 - Mechanical Services Sound Levels

Take particular care to avoid tonal components, whistles, rattles etc. Avoid intrusive noises such as machinery start and stop characteristics. Generally, allow VSD or soft starting.

10.2.19.1 Duct Design

Duct systems must be designed with velocity and pressure drop characteristics that permit full design flow to all points, do not create excess noise, do not contribute to noise bridges between areas and do not adversely affect comfort (e.g., draughts, stagnant areas etc.)

DUCT DESIGN PARAMETERS

TYPE	VELOCITY [M/S] (MAX)	PRESSURE [Pa/m] (MAX)
Supply Air Duct	8	0.8
Return Air Duct	5	0.8
Exhaust Ducts	7.5	0.8
Flexible Duct	2.5	
Exposed Duct	4.0	0.8

Table 25 - Duct Design Parameters

Supply air duct risers may run at higher velocities than set out above.

10.2.19.2 Return Air Transfer Systems

Door grilles shall not be used without the approval of the USC Project Manager. Typically, air-conditioned rooms and toilets shall be provided with acoustic return air transfer systems sized to limit pressure drop to 10 Pa. Cascaded return air transfer systems shall not be used.

10.2.20 Ductwork

All air handling ductwork design and construction methods shall comply with AS 4254 / SMACNA and shall be minimum 500pa pressure rating Class B, generally with external insulation as per section 10.3.10 Pipe Insulation

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, externally insulated.

10.2.20.1 Ductwork Materials

- Within concealed and plant spaces: Galvanised sheet metal
- Externally to buildings: stainless steel (including all fixings etc.)
- Exposed within spaces: fabric duct, spiral wound circular, or oval duct, coloured to architect and *University* direction
- For fume exhaust or in corrosive environments: Stainless steel / POLY VINYL CHLORIDE UN-PLASTICISED (UPVC) / PVC
- Fibreglass duct is not permitted
- All duct materials, sealants etc. shall meet the requirements of AS 1530

10.2.20.2 Ductwork Arrangements

- Ducts shall traverse with a minimum of bends, offsets, obstructions
- Penetrations through building elements shall match fire and acoustic properties of the wall.
- Prevent entry to the building through ducts / louvers and the like.
- Where external to buildings be constructed to be weatherproof and prevent ponding of water etc.
- Avoid multiple obstructions of changes of directions particularly near each other.
- Volume dampers shall be located away from terminal devices to avoid noise.
- Duct connections to fresh air louvers etc. shall be provided with a drain section which drains any carried-in water back through the face of the building to the exterior.

10.3 Mechanical Services Equipment Requirements

10.3.1 Identification of Equipment and Services

Confirm the plant numbering sequence with the USC Project Manager prior to commencement of drawings. Prefix equipment with building number.

All items of equipment must be suitably identified with Traffolyte labels.

Generally, all plant is to be numbered as follows:

- Chilled water entering building temperature sensor “T-1”

- Chilled water leaving building temperature sensor “T-2”
- Primary chilled water pumps “PCHWP-1”
- Secondary chilled water pumps “SCHWP-1”
- Fan coil unit ground floor “FCU 0-01”, “FCU 0-02”
- Fan coil unit 1st floor “FCU 1-01”, “FCU 1-02”
- Fan coil unit 2nd floor “FCU 2-01”, “FCU 2-02”
- Air handling unit ground floor “AHU 0-01”, “AHU 0-02”
- Air handling unit 1st floor “AHU 1-01”, “AHU 1-02”
- Air handling unit 2nd floor “AHU 2-01”, “AHU 2-02”
- Multi-level AHU for VAV “AHU-1”, “AHU-2”
- VAV; AHU number plus VAV number “1-01”
- Preconditioner “PCU-1”
- Exhaust fan “EF-1”
- Toilet exhaust fan “TEF-1”

Services shall be identified by laying continuous PVC marker tape on the sand bed 300mm above the pipe. The marker tape shall be colour coded, magnetic and be printed with the identification of the contents of the pipe and/or conduits and direction of flow. Provide brass engraved markers cast into any hard landscaping or cast into concrete markers, as approved by the USC Project Manager.

10.3.2 Air Handlers

10.3.2.1 Principles

All air handling equipment should be floor or plantroom mounted ducted equipment, readily serviceable without use of special platforms, lifting equipment etc.

All air handling equipment shall be non-cold tracking TB2 thermal rating. In ceiling air handling equipment will not be allowed.

10.3.2.2 Arrangement and Type

AHU equipment shall be built up sandwich panel or proprietary equipment manufactured. Drain trays in all instances shall be stainless steel and full width, depth condensate trays.

10.3.2.3 Cooling Coil Arrangements

Air handling equipment shall be designed to inherently provide enhanced dehumidification at low loads. Refer to section – 10.3.2.5 Coils and Condensate Trays for coil requirements.

Provide isolation switches on power supply for air handing unit chilled water valve actuators.

All AHU's serving animal facilities, PC2 / PC3 laboratories, teaching labs, lecture theatres and preconditioner plant shall be fitted with UV lamps for coil sterilization e.g., Sterile Aire.

10.3.2.4 Casings and Insulation

Air handlers and fan coil units shall be sandwich panel construction complying (at minimum) with NCC Section J Insulation and leakage requirements, displaying no cold tracking at supply air temperature of 12 degrees with ambient wet bulb of 28 degrees.

Cabinets shall be of sheet steel (external sheet minimum thickness 1.6mm, internal sheet minimum thickness 1.2mm), reinforced to prevent drumming. Casings shall be either powder coated, or factory finished internally and externally.

Where necessary for corrosion resistance or other requirements, casings may be Aluminium or stainless steel.

10.3.2.5 Coils and Condensate Trays

Fin spacing shall not exceed 472 fins per meter. Water carryover from the cooling coil is not permitted.

In general, coils are to be aluminium fin, copper tube, mechanically bonded construction. Where additional corrosion resistance is required or for applications, coils maybe copper/copper or stainless steel.

Condensate drainage is to be gravity driven. The use of condensate pumps is not permitted without written acceptance from the USC Project Manager.

10.3.3 Fans

Ventilation fans shall be of an approved manufacturer and shall be carefully selected to match the system requirements.

- Fans handling moisture laden air or exposed to weather must be minimum IP55.
- Significant fans (generally fans above 1.1kW or where required for critical applications or control) are to be provided as three-phase with VSD, however smaller fans may be three phase VSD if necessary.
- Fans are generally to be located within plantrooms etc. Avoid the installation of fans in ceiling spaces or rooftop, etc. unless specifically approved by the USC Project Manager.

10.3.4 Motors

Motors are to be high efficiency three-phase units, IP56 minimum, tropic proof. Motors shall be non-overloading and selected to match full speed operation on full size impellor. Where VSD drives are used, motors shall be suitable for operation at low speed without overheating and shall include an insulated bearing on the non-drive end.

10.3.5 Variable Speed Drives

Fan motors of 750Watts and below may be single phase direct drive with manual speed controllers (unless required to be variable speed or three-phase to suit other requirements). Larger fans are to be multiple belt drives with adjustable pulleys or Variable Speed Drive. VSD's are to be connected to the BMS via High Level Interface (HLI)

Where air handlers serve systems with variable air flows, provide Variable Speed drive.

10.3.6 Filters

Plantrooms shall be provided with filters at the fresh air entry point. High efficiency filters minimum rating F5 shall protect all air handling equipment. These filters in turn shall be protected by pre-filters rated G4.

HEPA filters shall be carefully specified for the requirements of the space. For these systems ensure sufficient fan capacity and control. Fan assisted HEPA units may be used. As installed DOP testing and certification must be provided with each HEPA / NEPA install.

Provide Magnehelic gauges to all filters.

Where filters are of a critical nature to the operation or safety of a space (e.g., PC3 etc), provide filter differential pressure switches or air flow measurement and provide alarm function to alert users at the BMS front end and occupants within the building.

10.3.7 Refrigeration

All refrigeration systems shall utilise non-ozone depleting refrigerants.

All cool rooms and freezer rooms shall have Tecumseh, Acpac or Compac Condensing units with semi-hermetic or hermetic compressors. Scroll compressors are not permitted.

All cool rooms and freezer rooms shall be fitted with Cabero evaporators and Carel EVD Ice electronic expansion valves. All medium and low temp pipework insulation is to be a minimum of 19mm thermo break foil backed insulation. All freezer rooms and cool rooms shall have heated floors and door frames.

All cool rooms and freezer room duress alarms must sound a local alarm, connected to the building management system, connected to Gallagher and strobe light fitted at the area. A red mushroom head style button shrouded to prevent accidental operation mounted on a colour coded traggolyte panel including identification and reset procedure.

Cool rooms shall have Dixel XR20 controllers and Freezer rooms shall have Dixel XR60 controllers. The Dixel controllers shall be connected to Frigbot monitoring system. The BMS shall also monitor room temperature and alarms shall be enabled. All controller enclosures shall be stainless steel or aluminium and not plastic.

Provision for alarm cabling to all Lab self-contained refrigeration, such as –80 freezers, to connect to the Gallagher system controller shall be provided.

Unless integral to the self-contained refrigeration unit, all condensing units will be in plant rooms and designed with adequate condenser air flow and each unit is to be on individual electrical supply circuits. All condensing units are to be located so they are easily accessible for maintenance.

10.3.8 Fire Dampers

Fire Dampers shall be fully compliant to NCC, Australian Standards (AS 1668.1) and the like in all aspects. Fire dampers shall be inspected and certified prior to practical completion.

Ensure that fire dampers are arranged to permit maintenance and inspection, including removal and replacement without specialist height equipment and unimpeded access.

Fire dampers shall be carefully selected so that they do not adversely affect system air flows, pressure drops or noise levels. Avoid bends hard onto fire dampers.

Duct sections connected to fire dampers must be carefully constructed to be “drop away” as required by AS 1668. Hangers, services etc. must not interfere with the dropping away of duct from the fire damper connection

10.3.8.1 Identification and Records

Provide permanent traffolyte labels for identification to all fire dampers. Where fire dampers are concealed, provide visible labelling to indicate their location. Ensure all installation, test and inspection records are provided to USC Project Manager within one week of testing.

10.3.9 Water Treatment

Pre-cleaning must be provided on all pipe systems, and only after successful pressure testing which has been signed off by the Project Manager. Circulate non-foaming alkaline detergent solution for minimum 2 hours before removing this solution and flushing the system twice with fresh water. Immediately apply protective chemicals into the system.

Ensure all chemical treatments are suitable for use with those chemicals used in the campus district cooling system loop and have no detrimental effect on systems. Recommendations are to be submitted to the Director, Management for approval, during design development.

The corrosion inhibitor dosage shall limit the corrosion to less than 3 mils per year (0.0762 mm) for steel and 1 mil per year (0.0254 mm) for copper.

10.3.10 Chilled Water Pipework

10.3.10.1 Dissimilar Metals

Provide full galvanic separation between dissimilar metals.

10.3.10.2 Headers

Where headers are provided, provide at least one spare pair of take-offs for future use complete with isolation valves. Provide valves bypass line to avoid “dead-legs

10.3.10.3 Pipe Materials – Above Ground

Chilled water pipework above ground and/or within buildings shall be AS 1432 Type B Copper shall be phosphorus de-oxidised non-arsenical copper.

Larger diameter pipe may be stainless steel, spiral butt welded from minimum 2mm thick, grade 316 stainless steel sheet. Provide TIG full butt weld joints. Passivate weld areas following welding. Stainless steel pipe.

10.3.10.4 Pipe Materials – Below Ground

Chilled water pipework below ground shall be insulated HDPE or MDPE PE100 PN10 and buried at 1200 fill and embedded in sand.

10.3.10.5 Pipe Pits

Underground pipe transitions from one material to another, connections to campus district cooling system etc. shall be made within formed concrete pits with Gatic® pit lids. Pits shall be drained and arranged to be fully accessible for service work on valves etc.

All bolts, washers and fittings in pits shall be stainless steel. Thrust or mounting brackets shall be stainless steel or fully hot dip galvanised

10.3.10.6 Balancing Valves

Option 1: Control valves for air handlers are generally pressure independent flow regulating self-balancing valves. Provide double regulating valves at each major branch take-off or take-off to each floor, building etc., to allow balancing and measurement of respective branches.

Option 2: Each AHU shall have double regulating valves. If this option is adopted, the building campus district cooling pipe connection shall have a pressure independent flow regulating device to ensure the building does not receive more flow than the design value at any time of the year.

10.3.10.7 Isolation Valves

Provide isolation valves to all air handling plant to enable service work / replacement of control valves, coils and the like.

Provide isolation valves at each major branch take-off, or take-off to each floor etc. Provide isolation valves at each duty/standby piece of equipment to allow servicing etc.

Provide isolation valves at the campus district cooling connection point.

Provide blanked isolation valves (150mm diameter) at suitable location adjacent the building chilled water connection point to allow connection of USC's portable chiller.

Up to 50mm: Ball valve, Screwed BSP Bronze body, Stainless steel ball and stem.

Over 50mm: Butterfly Valve (Gear type over 80mm), Lugged body to table E.

10.3.10.8 Check Valves

Check valves: Dual flap type, fully sealing, spring assisted.

10.3.10.9 Binder Point

Provide binder test/measurement points across all operating elements of plant, including but not limited to:

- Each air handler cooling coil
- Every pump
- Any strainers or filters in the system
- Flow meters
- Adjacent any BMS sensing point (Pressure, temperature, sensing etc) to allow calibration and verification
- Campus district cooling connection point; and
- Temporary chiller connection point.

10.3.10.10 Sensor Wells – Energy Calculator Wells

Energy calculator wells may be fitted in the vertical position.

10.3.10.11 Air Venting

Provide an automatic air bleed at the top of each vertical riser and at all high points within the system. The automatic air bleed shall be fitted with an isolation valve and a permanent connection to a drain point complete with a section of clear hose.

10.3.10.12 Identification (should be further up)

Provide identification of all pipes in accordance with AS 1345 for the Identification of the contents of piping, conduits, and ducts and AS 1319, Safety signs for the occupational environment.

"Safetyman" adhesive labels are an acceptable method. Provide flow direction arrows to all pipework at regular intervals (not exceeding 5m and at all connections)

All externally exposed pipework shall be fully painted. Colour standards shall be in accordance with AS 2700

10.3.11 Pipe Insulation

10.3.11.1 Insulation Material and Method

At hangers provide insulation blocks of high-density polyurethane foam, except for pipes up to 25mm diameter where zinc annealed saddles may be used. For pipes larger than 25mm two rolled half sections of 1.2mm zinc anneal shall be installed at the hanger to avoid damage to the phenol foam block. Where necessary to prevent crushing, provide extended saddle sections to support the pipe.

Compartmentalise insulation every 5m or at insulation blocks and adjacent to fittings and take-offs to prevent longitudinal moisture transfer along the pipe. Insulation shall be sealed to the pipes at these points.

Pipework from floor level to 2100mm above floor in plantrooms shall be metal sheathed, with Colourbond or painted steel sheathing.

Where exposed to view, and where exposed to weather or the possibility of physical damage, all pipes shall be sheathed.

10.3.11.1 Chilled Water Valve Trains (if this is regarding Chilled Water Pipework why is it in a new number?!)

Valves and strainers adjacent to fan coil units, air handlers, pumps are not be insulated but provided with drained insulated stainless-steel safety tray. The condensate tray shall be insulated with minimum 25mmThermobreak applied to the base and sides.

Arrange for all such valves to be installed in the horizontal.

Insulation for other valves, flanges and fittings shall be arranged for easy removal for maintenance purposes and shall have hinged and clipped (not screw fixed) casings. Pack penetrations for valve spindles etc. with white petroleum grease to provide a continuous vapour barrier.

10.3.12 Condensate Pipe Work

Provide insulated PVC condensate drains to all air handling equipment, pumps etc. The minimum pipe diameter is to be 32mm. Insulation shall be minimum R-value of 0.75 Thermobreak, or thicker as required to prevent condensation forming.

The insulation shall be carried vapour tight to within the air handler casing.

Provide a removable section of clear PVC pipe to inspect and service the drain.

Safe trays are to be separately drained.

Condensate is to discharge to an approved tundish. Provide sufficient height to the unit to ensure satisfactory operation of the serviceable trap. Traps shall be sized to a height to accommodate the air side pressure differences of the air handler.

10.3.13 Duct Insulation (combine the Acoustic and Thermal into one heading each)

10.3.13.1 Ductwork Insulation Thermal Material and Method

All Duct insulation shall be continuous and fully vapour sealed. Where required for thermal insulation, the minimum R value of the insulation shall be the greater of:

- As required by the version of NCC applicable to the project
- For refurbishments etc., as required by NCC
- As required instances to prevent condensation etc.

External insulation shall be Thermobreak, securely glued to the clean external surface of the duct. Where necessary apply multiple layers. Each layer shall be vapour taped and sealed fully.

Only where permitted by the Project Manager, external Bradford duct blanket may be used in lieu of Thermobreak. The duct-blanket shall meet or exceed all thermal property requirements, installed strictly to the Manufacturer's requirement.

10.3.13.2 Ductwork Insulation Acoustic Material and Method

Where required for acoustic purposes, insulation shall be evaluated for the required performance. The mechanical engineer is required to undertake simple acoustic selection, however where an acoustic engineer is appointed, refer to the acoustic engineer for guidance.

Internal insulation should generally only be applied:

- Within the plantroom
- For plant located within spaces, the first 5-8m of duct and first two bends.
- Return air duct adjacent to plantrooms

Internal insulation applied for acoustic purposes shall also meet or exceed the thermal insulation requirements. Insulation shall generally be SuperTel, UltraTel, or equal, installed strictly to manufacturer's guidelines, and finished with durable, easily cleaned acoustic facing material that will not allow moisture retention within the insulation. Perforated Metal lining to internal insulation

Where insulation is accessible, provide perforated galvanised steel lining and protection to the insulation.

Where required for acoustic purposes, insulation shall be evaluated for the required performance.

10.3.13 Exhaust System

10.3.13.1 General

Ventilation systems must be suitable for the duty required. Exhausts likely to handle contaminated air, moist air etc. must be specifically suitable. For moisture laden air or where condensation may occur within the duct, duct should be fully waterproof and appropriately drained. Install removable drain to allow service and inspection.

10.3.13.2 Exhaust Stacks and Flues

Where permitted, exhaust stacks shall be fully drained with removable section to facilitate cleaning etc.

Exhausts shall be arranged to avoid adverse effects on intakes, other buildings, surfaces etc. For example, ensure kitchen exhausts are arranged so as not to cause excessive deposits of grease etc. on roofs.

Exhaust ductwork, fans and the like shall be concealed from view as practically possible. Specialist exhaust systems (i.e., fume cupboards) shall be in a separated ventilated plantroom and not on the roof. Plantroom shall have a roof and walls with adequate access for servicing.

10.3.13.3 Kitchen Exhaust

Kitchen exhaust shall be fully compliant to codes and regulations. Ensure kitchen exhaust systems more than 1000l/s are provided with user VSD control to NCC section J.

Kitchen exhaust hoods shall be 316 stainless steel.

Honeycomb (like Email GW) filters shall be provided with a full set of spares to allow cyclic cleaning.

High efficiency, low air volume hoods of self-cleaning type shall be Stoddart or similar.

Provide easily accessible access panels to AS 1668 for full cleaning access and drains to adequately cater for cleaning solutions. Where discharges can admit water / weather, ensure that waterproof duct construction with accessible drain is provided.

10.3.13.4 Laboratory General Exhaust Systems

An independent laboratory exhaust is typically to be provided with intakes in each laboratory, independent of the building / laboratory room ventilation. Generally, this system shall be 100mm PVC minimum diameter, terminated in PVC ball valves and stubs at accessible locations.

10.3.14 Fume Cupboards and Systems

10.3.14.1 General

Fume cupboards shall be of an approved manufacturer. Fume cupboards, biological safety cabinets, laminar flow cupboards, gloveboxes etc. are to be treated with particular care. Ensure all legislative requirements are

met. Ensure a detailed briefing and confirmation with the Project Manager of exact requirements, to be signed off by the laboratory manager.

Ensure that makeup air is correctly provided. Generally, fume cupboards may place high fresh air loads on air conditioning plant. Ensure that correct sizing is undertaken, including any requirement for humidity control, and that services are closely co-ordinated.

Recirculating fume cupboards are not the preferred solution and can only be used with the approval of the Project Manager.

Fume cupboards shall conform to the requirements of the latest version of AS 2243.8, and AS 2982. Fume cupboards shall be variable air flow type.

The fume cupboards shall be either constructed from unplasticized poly vinyl chloride (UPVC) or corrosion resistant Fibreglass (GRP) to AS 1530 Part 3, depending on the client requirements. Provide infill panels above each fume cupboard to the ceiling line and cove the floor up the base to a minimum of 25mm.

Where the discharges from a fume cupboard or a group of fume cupboards could impact on intakes to buildings, undertake an analysis of the air discharge flow to determine the impact of the fumes. This should be undertaken prior to final review of the design and shall be presented as a brief report to the Project Manager.

Energy saving models shall be used for all University fume cupboards.

10.3.14.2 Sign off and Specifications of Services

Use the *Fume Cupboard Checklist* provided in Appendix F.1 to obtain signoff from the Director, Facilities Management as to exact services required for each fume cupboard.

10.3.15 Flammable Materials Storage Cabinets

Class 3 dangerous goods cabinets shall be in accordance with AS 1940 and shall be provided with a ducted mechanical exhaust system.

10.3.16 Materials Storage Cabinets

Class specific goods cabinets shall be fitted with ducted mechanical exhaust systems and be in accordance with codes and requirements.

10.4 Laboratory & Piped Services

10.4.1 Gases Stores

Gases shall be supplied from bottles located within a lockable visually screened and ventilated storage space located external to the building which is easily accessible by the service road. Segregate gases as per AS 4332, paying particular attention to oxidizing and flammable gases, as well as segregation required between gases and other items (e.g., oxygen segregation from ductwork etc).

Cylinders shall be manifolded with non-return valves in such a way that any cylinder can be removed and still allow the effective operation of the pressure manifold. Identify whether manifolds are auto or manual changeover and provide alarms as necessary.

Gas services shall not be automatically reconnected in the event of temporary loss of electrical supply due to a blackout etc.

Bottle / Manifold regulators shall be provided to reticulate gas at required flow rate at the required pressure accounting for any line loses etc.

Where necessary, user point metering or pressure regulation shall be provided. Regulators shall be reliable and accurate.

All gas stores shall be fitted with a duress alarm, push button activation type with anti-vandal surround, clearly identified with Traffolyte labelling, monitored on Gallagher system and BMS.

All gas stores shall be fitted with emergency stop buttons with anti-vandal surround,
clearly identified with traffolyte labelling, monitored on Gallagher system and BMS. The quantity of emergency stops will be determined by number of gas systems installed.

10.4.2 High Purity Installations

High purity and Ultra-high purity installations should be orbitally welded stainless or constructed with appropriately clean materials and constructed in a manner to ensure the cleanliness is maintained. General welding or brazing in these systems is not permitted.

10.4.3 Liquified Petroleum Gas

Refer to Section 12 - Hydraulic Services

10.4.4 Compressed Air

Where possible utilise existing compressed air systems (e.g., in adjacent buildings) or link new installations with existing to provide backup.

Compressed air shall be reticulated in pressure grade appropriate copper pipe, terminated in SwageLok ½ inch or 12mm quick-connect, push-on barb or other to match requirements.

Air filters shall be provided and shall be substantially mounted. Unless otherwise specified, compressed air shall be reticulated at 700kPa and regulated at each laboratory with isolation values.

Confirm type (e.g., reciprocating / rotary vane) of compressor required for the project.

Confirm the Oil / Water / Particulate aspects required for the project and ensure full compliance for compressor / distribution network to suite.

Receivers shall be provided to limit the number of starts per hour to manufacturer’s recommendations. Receiver mounted compressors are acceptable in smaller sizes.

Compressors shall be silenced as necessary to meet the acoustic requirements of the project / guidelines. All air compressors shall be located within plant rooms accessible by lift or adequate safe access. All compressors shall be monitored on the building management systems for status, faults, and alarms.

10.4.5 Vacuum Pumps and Plant

Where vacuum is required confirm the full requirements (e.g., general suction, nature of contaminants, medical suction etc.) for the project.

Similarly, to compressed air services, where possible utilise existing plant in adjacent buildings, or link new plant to adjacent buildings to provide backup.

Ensure vacuum plant can perform the duty under all operating conditions. Provide line filters etc to contain particulate items etc. Where biological material is present, provide Bacteria filters etc.

Vacuum pumps shall be capable of passing fluids from the system without damage to the pump (which shall be bronze impellor with bronze end plates.)

Pumps shall be mounted together with motor on integral base and shall be isolated from building services and structure.

Provide water seals with safety interlocks to each pump, with piping to the seals as recommended by the pump manufacturer.

Control systems shall be checked and commissioned by the pump manufacturer.

10.4.6 Vacuum Tanks

Vacuum tanks shall be provided to limit the number of starts per hour to manufacturer's recommendations. Provide gauges, safety valves and pressure regulation valves as required.

10.4.7 Vacuum Pipe

Vacuum services shall be reticulated in high pressure PVC or other to suit the application. All pipework shall rise in the direction of flow.

10.4.8 Distilled Water and Demineralized Reverse Osmosis Water.

Special water systems (such as deionised, demineralised, reverse osmosis or purified) where required should be accurately defined in terms of demand and water quality.

Laboratories may provide their own water treatment/purification systems which may require pre-treated water, UV sterilisation, carbon filtration, storage tanks/vessels, recirculation pumps, special piping and avoidance of dead legs, and special metal-free tap ware.

Systems may be either stand-alone or recirculating depending on quality and quantity.

Systems shall be verified, commissioned, and tested by the system manufacturer.

10.4.9 Isolation of Piped Services

Isolation shall be provided at:

- all infrastructure connection points (e.g., main lines, main branches, plant),
- at the bottom (or top for top fed) of risers
- each floor take-off
- each major branch junction (example > 10 connected points)

10.4.10 Special Applications – Laboratories

Special applications and laboratories should be treated with particular care. Where air flow directionality is required (e.g., PC2), USC prefers active control (e.g., pressure sensing or VSD control) over relying on fixed air balance.

Laboratories should always be designed with appropriate control, safety and management measures addressed.

Laboratory design should always be undertaken by experienced specialists due to the diversity of requirements.

Exhausts must be located so that contamination of fresh air, intake to buildings is avoided.

10.4.11 Physical Containment Level 2 and Specific-Pathogen Free Laboratories

Physical Containment Level 2 Laboratories (PC2) are significantly controlled spaces. Ensure strict compliance with all Codes, Certifying bodies, and regulators.

PC2 laboratory areas must be provided with active pressure control to achieve the airflow requirements. Return air treatment must comply strictly with Code requirements and any specific requirements of the project.

PC2 Animal houses, Insect facilities etc. must be provided with Stainless steel access mesh to Code. Generally, all instances of control mesh must be backed up by removable filters to allow removal of the mesh without concern for release of contaminants.

Take particular care with low level exhausts to ensure that inlets are filtered, easily removable for access and service and robust to suit the cleaning, maintenance and use of the facility.

For Specific-Pathogen Free (SPF) facilities, pressure above surrounding spaces is to be actively controlled. The design must be conducive to the elimination of pathogens transgressing the SPF boundary.

All ventilation fans, air handler fans etc. should be provided with VSDs to enable rebalancing of systems, ensuring airflow regimes are met.

10.4.12 Physical Containment Level 3 Laboratories (acronym)

Physical Containment Level 3 Laboratories (PC3) are significantly controlled spaces and as such, a specialist consultant is to be employed to undertake all design work relating to these spaces. All work undertaken in relation to PC3 laboratories is to be designed and carried out in strict compliance with all Codes, certifying bodies, regulators etc. and close communication is to be maintained from the instigation of the project to fully understand the operative requirements.

All secure duct and valves shall be strictly specified. Ensure careful co-ordination of gauge panels and alarm panels, fumigation ports etc. Ensure careful co-ordination throughout and especially for fumigation requirements.

Ensure that Pass-through access areas are fully compliant and fully serviceable for the intended use.

All ventilation fans, air handler fans etc. should be provided with VSDs to enable rebalancing of systems, ensuring airflow regimes are met.

Design must only be undertaken by parties well experienced in these spaces.

11 BUILDING MANAGEMENT SYSTEMS

Mandatory

11.1 Building Management System Design General

New or refurbished buildings at USC are controlled and monitored by two building management and control systems (BMS) using direct digital control. The two systems used at USC are TraneVeolia – TracerES and Austec – Reliable Controls. Wherever BMS is referred to within this document, it refers to TraneVeolia – TracerES or Austec – Reliable Controls. Where an existing installation is being refurbished or expanded, all new controls must be readily compatible with existing controls at that Campus and graphics updated.

All field devices in plant rooms shall be labelled, including chilled water sensors and chilled water valves. Chilled water supply temp to building is to be labelled (T1). Chilled water return temp from building is to be labelled (T2).

Where duty /standby plant is installed, automatic changeover shall occur during the morning, at staggered times and days for different plant. Automatic changeover after hours shall be avoided so that there is someone on hand to attend to any issues that may occur during changeover.

The BMS contractor shall provide training to staff nominated by the Project Manager.

11.2 Design for Project and Future – additional requirements

Additional controller space shall be provided to all BMS enclosures, being the greater of:

- For general academic and non-critical process buildings, the controllers shall be determined on known future requirements plus one additional controller over, or
- For critical process buildings (PC2/PC3 Laboratories, Data Centres, and Plant that is the single point of failure for business disruption) shall have a planned reliability strategy. The controllers shall be paired with one controller per control group so if the controller fails, it does not affect other plant operation, or
- Additional 10% of the BMS panel space, or
- one full additional controller and ancillaries

These impacts are to be clearly articulated in the design documentation.

11.3 Equipment Quality and Support

All equipment and components shall have a proven track record of operation in Queensland and be of high quality and reliability, readily available, with a Queensland based agent for service / spare parts, with sufficient stock of spares to support USC's operation.

Critical Spares requirements shall be listed in Operating and Maintenance Manuals.

11.4 Design for Maintenance

Ongoing service and maintenance must be facilitated in the installation. Measures at least will provide minimum service access spaces, easily workable arrangements, clear unencumbered walkways of minimum width 1200mm.

In all cases mandatory clear access for electrical switchboards and the like is to be provided.

11.5 Controller Location

All BMS controllers must be installed in lockable, dustproof BMS specific cabinets in plant rooms. Where mechanical services switchboards are provided, the BMS equipment may be located therein, in a separate segregated cubicle. Locks shall be keyed to an S-1-1 (Plant and Electrical Key).

Provisions are to be made for heat dissipation, particularly for external panels, and panels containing high heat generating equipment such as SCR / SSR controls and similar.

11.5 Wiring Requirements

All controller digital output I/O to use extra-low voltage (24V) slave relays with LED indicator lights.

All controls emanating from controllers to external devices must be 24VDC or 24VAC originating from a 240V/24V transformer mounted within the controller cabinet or in external switchboards and switched by internal relays within the controller panel

All BMS controllers must be supplied with access to the USC BMS network via an adjacent data outlet. The outlet shall be mounted in the BMS section of the board and include one (1) per controller.

11.6 Uninterrupted Power Supply to Building Management System Controller

Building management system (BMS) controllers that are associated with or monitoring essential services (e.g., Generators, Laboratory equipment.) shall be connected to the essential power supply and supported by an Uninterrupted Power Supply (UPS).

The UPS shall be on the essential services network and include an SNMP communications card connected to the University Information technology network for UPS monitoring purposes

11.7 Fire Mode Variable Air Volume Box Settings

In fire mode, all VAV dampers shall modulate closed to ensure smoke is not spread between rooms and reinstated to automatic (open) position once the fire alarm signal is disabled.

11.8 Technicians

All technicians that work on the USC Building Management System (BMS) (Trane, TracerES, Austec Reliable Controls) shall be known to the Director, Facilities Management. Retain required licence for the works carried out and shall have a minimum of five years' experience in programming

11.9 Control Methodologies

11.9.1 Air Pre-Conditioned Units

11.9.1.1 Chilled Water Valve Control

A temperature and humidity sensor must be installed in the supply air duct of the pre-conditioner after any cooling coil and heat exchanger. Dew point is calculated by the BMS. The chilled water valve is controlled to maintain a constant leaving air dew point of 13°C (Initial Setting).

The BMS calculates the room dew point Td from the formula:

Td = T-[(100-RH)/5]

Where: Td: Dew point temperature °C, T: Supply Air temperature °C, RH: Supply Air Relative Humidity (%).

The BMS will use proportional control to maintain the dew point setpoint Td SP of 13°C.

The supply air temperature set point for the PCU is derived using a low signal select from its associated AHUs chilled water valve positions to maintain a minimum chilled water valve position of 10%. As the lowest valve position deviates from 10% to 100%, the supply air temperature set point will be reset from 12.0°C to 24.0°C.

Control of the chilled water valve will be in response to the lowest signal select between the Dew Point Control signal and the S/A Temp Control signal.

11.9.1.2 Static Pressure Control

The variable speed drive on the supply fan is controlled by a pressure transducer located in the supply air duct. The fan VSD is controlled via proportional plus integral control loop with a user adjustable set point of initially 5 Pa via the pre-conditioner graphic.

11.9.1.3 Plant monitoring

Monitored, recorded, and displayed information on the BMS graphic is to include but not restricted to;-

- fan status
- fire alarm
- supply air temperature
- supply air humidity
- supply air dewpoint
- supply air static pressure
- chilled water valve signal

Each zone serviced by air handling units is to be clearly identified by way of colour shading or the like, as approved by USC Project Manager.

11.9.2 Constant Volume Air Handling Units

11.9.2.1 Fan Start

- Each unit is to be time scheduled, adjustable from the AHU graphics page, initially set to 0730-1800hrs (global site timeclock schedule to be used).
- On receipt of fan status, via a duct mounted air-pressure switch, control is enabled. On loss of status, all controls are disabled.
- After-hours air conditioning is to be activated by an after-hours button, which enables two hours run time. A green indicator lamp is to show that the AHU is activated. A second press of the after-hours button will terminate after hours mode. If the after-hours mode is left to run its two-hour run time.

11.9.2.2 Temperature Control

- A wall mounted temperature sensor reads room temperature with the Building management system calculating the supply air temperature
- The chilled water valve is to be modulated to maintain conditions in the space via proportional plus integral control algorithm to the user adjustable set-point from the air handling unit's graphic page
- For air handling units with multiple temperature sensors the building management system is to calculate the supply air temperature from the highest or average space temperature. These control modes are to be selectable from the air handling unit's graphic page.
- For air handling units connected to pre-conditioners, an unoccupied temperature set back of 25°c is to be used.
- For all office areas and conference room areas, a wall mounted temperature controller with 1.5 deg either side of building management system setpoint is to be provided.

11.9.2.3 Plant monitoring

Monitored, recorded, and displayed information on the BMS graphic is to include but not restricted to:

- zone temperatures
- return air temperature
- CO^2-e level, if used
- fresh air make-up variable air volume quantity
- air handling unit fault
- fan status
- fire alarm
- supply air temperature
- chilled water valve signal

11.9.3 Variable Air Volume Air Handling Units

11.9.3.1 Fan Start

- Each unit is time scheduled, adjustable via the AHU graphic, initially set to 0730-1800hrs (global site timeclock schedule to be used).
- On receipt of fan status (via a duct mounted air-pressure switch) control is enabled. On loss of fan status all controls are disabled.
- When the supply air fan is called for, by either the schedule or after-hours button, the variable speed drive is given a start signal and initially ramp to its programmed minimum output frequency. On receipt of a fan status, control is enabled. If fan status is lost all controls are disabled.
- Each VAV zone has an after-hours button, which enables two hours run time. A green indicator lamp is to show that the AHU is activated. A second press of the after-hours button will terminate after hours mode.
- If one zone is called for after-hours use, only that zone shall operate in normal mode. The remaining boxes shall remain at their minimum air quantity and not have authority over the high select routine.

11.9.3.2 Temperature Control

- The AHU chilled water valve is controlled by a supply air temperature sensor via proportional plus integral control. This set-point is calculated using an algorithm to maintain space conditions depending on the VAV mode selected on the graphics. The modes available are:
- Highest- Select;- the highest cooling call of the VAV's served from this AHU
- Average- Select;- the average cooling call of the VAV's served from this AHU excluding any VAV's with a cooling call of zero. If the maximum cooling demand is 0%, the supply air set-point is 21°C. If the maximum cooling demand is 100%, the supply air set-point is 12°C. This must be in accordance with the USC Thermal Comfort Guidelines.
- For AHUs connected to pre-conditioners, an unoccupied temperature set back of 25°c is to be used.
- For all office areas and conference room areas, a wall mounted temperature controller with 1.5 deg either side of BMS setpoint is to be provided.

11.9.3.3 Static Pressure Control

The VSD output is modulated via proportional plus integral control algorithm based on the input of a duct-mounted pressure transducer to maintain a predetermined static duct pressure set-point. The duct pressure set point is user adjustable via the AHU graphic.

11.9.3.4 Variable Air Volume Control

- VAVs are to modulates through proportional control to maintain a user adjustable set-point via the VAV graphic by calculating a required airflow measured in litres per second to obtain the required space conditions.

- The airflow set point is calculated within the limits set for each VAV box minimum and maximum flows and is adjustable via the VAV graphic.
- VAVs are to be controllable via their graphics page for the following:
  - Automatic
  - minimum airflow
  - maximum airflow
  - force open
  - force closed.

11.9.3.5 Plant Monitoring

Monitored, recorded, and displayed information on the BMS graphic is to include but not restricted to:-

- zone temperatures
- zone VAV air quantity
- return air temperature
- supply air pressure
- CO^2-e level, if used
- outside air VAV quantity
- AHU fault
- fan status
- fire alarm
- supply air temperature; and
- Chilled water valve signal.

All VAV locations shall be displayed and identified on the building management system graphics.

11.9.4 Carbon Dioxide Control

A duct mounted CO^2-e sensor is in the AHU return air duct. If the CO^2-e level rises above set-point, initially 800ppm, the outside air quantity is modulated from minimum outside air quantity to maximum air quantity when the CO^2-e level is 200ppm above set-point.

11.10 Equipment Monitoring

The BMS is required to monitor as a minimum, status, alarm, fault and levels of critical equipment such as:

- Generators
- UPS
- Diesel fuel tanks
- Battery systems
- Pumps and variable speed drives
- All emergency stops
- Purge

- Duress alarms
- Refrigeration, such as fridges, freezers, cool rooms, freezer rooms
- Back up cooling systems, such as data room back up air conditioning units
- All fans
- Fume Cupboards
- Fire Indication Panels
- Lifts and Lift pones
- Main switch boards, Mechanical services switch board
- Air compressor
- HVAC units such as, computer room air conditioning (CRACR) units, Direct expansion units (DX units)
- All as shut down solenoids

The University shall add items based on equipment installed by Contactor

12 HYDRAULIC SERVICES

12.1 General Design Requirements

All exposed pipe work in washroom/shower/toilet facilities, kitchens and general work/student areas is to be chrome plated. All hydraulic penetrations in building fabric to be finished with chrome wall or floor flanges and the penetration shall achieve the required fire rating for that part of the building. Water and gas services in buildings located below slab are to be designed to be fully retrievable.

12.2 Noise & Vibration Control

Hydraulic systems are to be designed to eliminate transmission of noise and vibration from hydraulic equipment to the building structure, spares, and users. Reciprocating or rotating equipment shall be isolated from structure and other systems by vibration isolators. Where necessary, seismic type restraint shall be used.

Pipework shall not be rigidly mounted to building structure. Ensure that handers are arranged to accommodate thermal expansion, transient loads, and conditions while maintaining isolation. Penetrations shall incorporate sealing methods (whether they are acoustically rated, fire rated, weather rated etc) that do not provide a vibration bridge from services to structure.

12.2.1 Design Sound Levels

Review the arrangement of the hydraulic plant and equipment and advise at the design development stage of any areas where noise will exceed the levels shown in . In addition, noise generated by hydraulic services and equipment shall not raise external sound levels by more than 5dBA above ambient levels at 10m from the source.

All pipework shall be isolated from spring-mounted equipment by flexible pipework with a flexibility to match the deflection of the equipment spring mountings. Expansion and vibration in pipework shall be taken up by appropriately designed and approved changes of direction or expansion loops.

Take particular care to avoid tonal components, whistles, rattles etc. Avoid intrusive noises such as machinery start and stop characteristics. Generally, allow VSD or soft starting.

12.3 Interfaces with Building Management System

Allow for in the design all required interfaces from hydraulic equipment & control panels to the University's building management system. This includes:

- All Water Meters
- Pumps – signals for pump run/stop, pump fail & high/low level alarms
- Hot Water Installations
- Gas – signals from gas control panels for gas on/off & emergency shut down

12.4 Design for Project and Future – Additional Requirements

Generally, all hydraulic infrastructure systems (drainage, water, gas etc) should have a minimum of 25% spare capacity to facilitate the natural progression of University buildings.

Include in future capacity requirements additional space required for plant/storage enclosures (e.g., gas bottles)

12.5 Arrangement of Services

Take particular care with arrangement of services and ensure full co-ordination of the project.

Specific requirements are as follows :

- The separation of pipes and location of pipes in relation to electrical services shall be such that the risk of damage from the contents of the plumbing, or from condensation etc associate therewith, shall not be a possibility.
- Water or drainage shall not be installed above electrical equipment, communications and data racks, computer equipment and the like.
- Water or drainage shall not be installed within switch rooms or electrical risers.

12.6 Locating Existing Services

All existing services for the project shall be identified and confirmed onsite using a hydro vacuum system only.

12.7 Interfacing to Existing Water and Sewer Infrastructure

The design shall provide for the connection to existing drinking, non-drinking water and sewer infrastructure within the site. Co-ordination with civil, electrical, communications, wet fire and mechanical services will be required to ensure possible common trenching of services is achieved.

12.8 Laboratory Hydraulic Services

Laboratories should contain stainless steel laboratory sinks, emergency deluge showers, emergency eye washes and separate hand washing basins. The hand wash basins will require drinking cold and warm water and be located near the entry/exit points of the Laboratory.

The emergency deluge showers, emergency eye washes will require drinking water connections and be within 10 seconds reach for any individual. The emergency deluge showers shall be connected to a minimum 32mm drinking water service and shall be provided with a means of either collecting or draining the wastewater away.

Emergency deluge shower flows to be test and verified that they are in accordance with Australian Standards. A register of emergency showers is to be provided and each shower identified by labelling.

316 stainless-steel laboratory sinks may be 40 litre single bowls or double bowl laboratory sinks with integral draining boards and 300mm high integral stainless-steel splashbacks.

70 litre pot sinks. Laboratory sinks may be required in some applications.

Heigh adjustable laboratory sinks may be required to provide access. Height adjustable laboratory sinks will require watermarked approved flexible connections long enough tot suit the joiner movement. In some instance where corrosive chemical exposure is likely, the use of porcelain bowl sinks may be necessary,

Special water systems (such as deionised, demineralised, reverse osmosis or purified) when required should be accurately defined in terms of demand and water quality. Laboratories may provide their own water treatment or purification systems that may require the below:

- UV sterilisation
- Carbon filtration
- Storage tanks or vessels
- Recirculation pumps
- Special piping and avoidance of dead legs
- Special metal-free tap ware

System may be either stand-alone or recirculating depending on quality and quantity. Enquire of the nature of liquid wastes to be produced in the laboratory and determine in consultation with the local authority whether dilution, neutralisation or holding may be required of the application.

12.9 Sanitary Drainage

The design shall allow for all drainage to be fed to the existing infrastructure to a point of connection provided by the civil engineer via gravity at normal grades and in accordance with the local authority's requirements.

Reduced grade drains are to be always avoided.

If reduced grades are required, then permission must be sought from the Project Manager at the Schematic Design stage and confirmed at each milestone.

Sewer lifting stations are to be always avoided.

If a lifting station is required, then permission must be sought from the Project Manager at the Schematic Design stage and confirmed at each milestone. Sewer pump stations shall be connected to the University's building management system to provide pump status and alarms.

12.9.1 Materials

Materials shall be poly vinyl chloride un-plasticised (poly vinyl chloride un-plasticised (uPVC)) pipes and fittings with solvent welded joints or welded high density polyethylene (HDPE).

12.9.2 Inspection Chambers

Inspection chambers shall be installed in accordance with Local Authority requirements with Gatic®® gas tight bolt down chamber covers stamped 'SAN'. Gatic®® light duty covers shall be generally specified except in roadways where medium duty covers shall be specified. All chambers over 1200mm in depth shall have hot dipped galvanised step irons or ladder specified.

Sanitary risers will have a test gate and expansion joint at the base on each floor in an accessible position. Access panels are to be nominated on the hydraulic plans and coordinated with the Architect.

12.10 Trade Waste Drainage

The design shall allow for all trade waste drainage to be feed via gravity to the house drain after being treated to the local authority's requirements through proprietary pre-treatment device.

Reduced grade drains are to always be avoided. If reduced grades are required, permission must be sought from the Project Manager at the schematic design stage and confirmed at each milestone.

Trade Waste lifting stations are to always be avoided. If a lifting station is required, permission must be sought from the Project Manager at the schematic design stage and confirmed at each milestone.

12.10.1 Materials

Materials shall be electrofusion welded high density polyethylene (HDPE) pipes and fittings. The longest run of greasy waste at normal falls shall be 12 meters. Heat tracing trade waste lines are to always be avoided. If heat trace cannot be avoided, permission must be sought from the Project Manager at the schematic design stage and confirmed at each milestone.

Trade waste risers will have a test gate and expansion joint at the base on each floor in an accessible position. Access panels are to be nominated on the hydraulic plans and coordinated with the architectural design.

12.11 Gully Traps

All gully traps are to have a non-mechanical permanent method of charging and priming.

12.11.1 Priming

Gullies unable to be charged by a fixture shall have their water seal protected by a priming device e.g. The priming drain connection shall connect to the nearest WC flush pipe and run under slab in 6mm copper tube to connect to the FWG above the water seal. The copper tube is to be encased in Denso®®-tape wrapping.

Floor waste gullies shall have chrome plated brass or stainless-steel screwed grates set flush with the floor finish surface. All floor wastes in concrete floor slabs shall have puddle flanges. All floor wastes shall be regularly charged via a sink, basin, condensate drain or a non-mechanical priming system – a hose tap will not suffice.

12.12 Trade Water Pre-Treatment

The requirements of the local authority shall be sought and communicated to the Project Manager at the schematic design stage and confirmed at each milestone.

Grease traps will be required for all greasy waste lines. Grease traps shall be a minimum 550 litres with class D bolt down Gatic® lids and positioned in an accessible location for cleaning with a vacuum truck but shall not be in front of house or high-profile areas.

All above ground trade waste pre-treatment devices shall be made of marine grade stainless steel and preferably under cover or inside plant rooms. 20mm anti-vandal hose taps with the required backflow will be positioned within 6m of trade waste devices for cleaning purposes.

12.12.1 Grease Interceptor Traps Sizing

Grease interceptor traps (GIT) shall be a minimum of 550 litres but in all case sized to twice the total flow of fixtures it services. Sizing shall comply with local authorities sizing table with sizing tables displayed on hydraulic plans.

12.12.2 Grease Interceptor Traps Protection

Grease interceptor traps (GIT) installed above ground shall be installed on a minimum of 100mm concrete plinth designed by a structural engineer. Bollards are to be provided if required to protect from vehicular traffic or mechanical damage.

12.12.3 Oil and Water Separators

Oil and water separators are to above ground type manufactured from stainless steel and install under cover within a bunded area.

12.12.4 Treatment

Other than treatment to comply with trade waster requirements, wastewater shall not be treated, including grey water.

12.13 Wastewater Treatment and Re-use

The treatment of any wastewater for re-use is not permitted.

12.14 Roof and Roof Access

A safe permanent means of access to the roof shall be provided and shall fall under the architectural design. This would include safety guide wires for use during maintenance of the roof and roof drainage systems. The preferred pitch of the roof is 5-7 degrees. If any of these items have not been addressed in the architectural design the hydraulic engineer shall bring this to the attention of the Project Manager at the schematic design and confirmed at each milestone.

12.15 Roof Drainage

Box gutters and concealed eaves gutters are not permitted. All roof drainage systems are to be made from marine grade stainless steel including gutters and downpipes.

12.15.1 General Requirements

Eaves gutters shall be sized to a 1:100-year Average Return Interval (ARI)

The sole of eaves gutters is to be a minimum 200mm wide and must allow ease of access into the gutter for cleaning. The back and stop ends of the eaves gutter is to be a minimum 30mm higher than the front of the eaves gutter.

The minimum size of a downpipe shall be 150mm. The roof drainage system is to be designed to withstand cyclonic conditions and add a 10% safety margin to the final calculations for sizing.

Down pipes within building elements will have a test gate and expansion joint at the base in an accessible position and will be hydrostatically tested. Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

12.16 Rainwater Tanks

If required, the rainwater tanks will be connected to non-trafficable roof tops, be insect and vermin proof, and be sized relative to the catchment area and rainfall data for the area where they will be installed. Provide rainwater tank sizing calculations in the schematic design and design development reports.

If supplied by a wet system of drainage, an in-ground first flush device is to be fitted to allow the system to drain so that insects can't breed in the system. The tank outlet/s will have a larger cross sectional area then the inlets i.e., if there are two 100mm downpipes discharging to a tank then there would need to be two 100mm outlets.

A permanent means to exclude leaf litter and debris from entering the tank will be required. This could in the form of leaf excluding rain heads or sieves on the inlet to the tanks and be in such a way that they can be easily maintained.

Underground tanks shall be avoided but if required by the University, shall be designed by a structural engineer, have reflux valves fitted to the outlets, have bolt down Gatic® access lids positioned over the inlets and outlets of the tank, and be positioned so that a vacuum truck can access it to clean the bottom of the tank.

12.17 Storm Water Drainage

Down pipes are to discharge over storm water inlet pits where not connected to a rainwater harvesting tank. If connected to a rainwater tank the downpipe shall be hard connected into the storm water drainage system with adequate provision beside the base of the downpipe for clearing.

Downpipes are to discharge over minimum 450v450 inlet pits with the minimum depth of four times the diameter of the downpipe discharging over it. Specify stainless steel or hot dipped galvanised heel guard lock down grates on all storm water inlet pits. The outlet of the downpipe is to be a minimum 150mm above the grate, for ease of clearing, and be angled so that the discharge, no matter how minor, discharges over the grate of the put.

Co-ordinator with the civil drainage and landscape architect will need to be demonstrated during all stages of the design.

Downpipes connected to rainwater tanks shall be designed to be hard connected to the storm water system with a chrome plated brass clear out to surface installed beside where the down pipe enters the ground. If the downpipe is in soft landscaped areas provide a concrete surround 100mm above surrounding surface.

12.17.1 Sizes

All stormwater drainage shall be a minimum 150mm internal diameter.

12.18 Clear Outs

Clear outs will be provided as per the standards and provided every 30m and at changes of direction of all drainage systems. Clear outs will be chrome plated brass and will have concrete surrounds in soft landscaped areas and will be 100mm above the surrounding surface.

Clear outs will be provided adjacent to every water closet on ground floor in an accessible position to enable clear access to drainage system with an electric eel drain clearing machine.

12.19 Drainage in other than Stable Group

All drainage in unstable ground is to be protected from excessive soil movement and will be required to be designed & certified by a suitably qualified registered engineer. The hydraulic engineer is to document in the schematic details and design development reports the results and recommendations from the geotechnical engineer on the soil conditions.

12.20 Portable Water

Back-flow prevention devices shall be fitted to all buildings and to supply lines to laboratories.

Water metering, connected to the BMS, shall be provided for all new buildings, or when carrying out alterations and/or extensions to buildings without metering.

Drinking water will be connected to a minimum 50mm connection point at the boundary of the project and sized to meet the maximum demand of the building. The water will pass through an above ground digital full flow meter assembly connected to the University's BMS. The meter assembly will include an appropriate backflow device, have a full flow bypass under the meter assembly and a means of disconnection to service and replace the meter, strainer & backflow valve as required.

The water pressure will be limited as per the standards and to individual equipment as per the manufacturer's instructions. The reticulated pipework design is to be such that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is in an accessible position not more than 1500mm above Finished Floor Level (FFL). This will enable maintenance to be carried out and new branch lines to be installed without having to shut the water down to entire buildings.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the architectural design.

12.20.1 Pipework

Inground Cold water services shall be Class B copper tubing up to 100mm, above 100mm shall be minimum class 18 poly vinyl chloride un-plasticised (uPVC) blue brute. All inground copper water piping shall be protected with Denso® wrapping or equivalent.

All above ground water services to be installed in Class B copper tube. All exposed pipework shall be chrome plated.

Each fixture is to have its own isolation valve for maintenance.

12.21 Non-Portable Water

Non-drinking water will be connected to a minimum 50mm connection point at the boundary of the project and sized to meet the maximum demand of the building. The water will pass through an above ground digital full flow meter assembly connected to the University's BMS. The meter signals shall be readable via the University's building management system. The meter assembly will include an appropriate backflow device, have a full flow bypass under the meter assembly and a means of disconnection to service/replace the meter, strainer & backflow valve as required.

The non-drinking water pressure will be limited as per the standards (limited to 500 kpa to an individual building) and to individual equipment as per the manufacturer's instructions.

The non-drinking water reticulated pipework design is to be such that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is in an accessible position not more than 1500mm above finished floor level. This will enable maintenance to be carried out and new branch lines to be installed without having to shut the non-drinking water down to entire buildings. Provide details of the required signage at the point of discharge of non-drinking water points.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the architect design.

Each fixture is to have its own isolation valve for maintenance, quarter turn valves are not permitted.

12.21.1 Pipework

Inground cold water services shall be Class B copper tubing up to 100mm. Above 100mm shall be minimum class 18 poly vinyl chloride un-plasticised (uPVC) blue brute. All inground copper water piping shall be protected with Denso® wrapping or equivalent.

All above ground water services to be installed in Class B copper tube. All exposed pipework shall be chrome plated.

Provide non-potable water to all irrigation systems toilet cisterns and science laboratories.

12.22 Portable and Non-Portable Hot Water

12.22.1 General Requirements

The preferred method of generating hot water is with solar or heat pump. Harvesting of other heat sources to provide supply air to heat pumps is encouraged along with directing the heat pump cool air to areas requiring cooling, such as A/C fresh air intakes or plant rooms.

Hot water plant to be from approved suppliers- Rheem® or Dux®. If an alternative hot water system is being proposed, then permission must be sought from the Project Manager at the schematic design stage and confirmed at each milestone. Alternative proposals are to be submitted with full data sheets for approval before proceeding.

Where multiple hot water systems are required, they shall be designed to the standards and manufacturers requirements. The consultant's drawings shall include details of how the hot water systems are to be manifolded together and balanced.

In instances of wait times for hot water of more than 15 seconds, a balanced flow and return system is to be designed for the building.

Instantaneous hot water units can be utilised in instances of a fixture requiring hot water that is remote from the building's hot water systems and to eliminate the need for excessive runs.

All hot water storage tanks inside a building are to be provided with a drained copper safe tray and the hot water system placed on a non-corrosive spacer within the safe tray.

All hot water pipes, valves and equipment is to be insulated as per the Australian Standards. Insulation on flow and return systems to be thickness and type to achieve total heat emission of 5°C or less.

Allow for sufficient space around the unit for removal of elements and above the unit for the withdrawal of anodes. Electrical isolators to be positioned for easy maintenance access.

12.22.2 Design

The hot water design is to be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is in an accessible position not more than 1500mm above finished floor level. This will enable maintenance to be carried out and new branch lines to be installed without having to shut the non-drinking potable water down to entire buildings.

Each fixture is to have its own isolation valve for maintenance, quarter turn or gate valves are not permitted. Access panels are to be nominated on the hydraulic plans and co-ordinated with the architectural design.

Install a backflow device with the required level of protection to the hot water service to fixtures requiring non-drinking potable hot water. Provide details of the required signage at the point of discharge.

Heat pump systems may be provided by single or multiple units. The location of the evaporators must be located where adequate ambient or heated air flow is available and if possible, external unless if a plant room where the waste cool air can be utilised by HVAC fresh air intake. The design must address recirculated air issues, which will reduce overall performance and energy efficiency.

Gas fired hot water units shall be mains pressure storage units in single or multiple installations.

Quick recovery or boiling water units to single isolated applications such as tea preparation stations, may be provided using a under sink mounted quick recovery unit.

12.23 Metering

Water metering will be provided to all new buildings or to buildings undergoing refurbishment or extensions. The meters shall be an electric digital full flow meter and be connected to the University's building management system.

Sub-meters will be provided for the following:

- All individual buildings
- All tenancies
- Inlet supply and discharge of cooling towers
- Irrigation systems
- Rainwater pump outlets connected to fixtures
- Inlet supply and outlet supplies to water polishing plant i.e., Reverse Osmosis

12.24 Backflow Prevention

Back flow prevention devices shall be fitted to all buildings and to supply lines connected to fixtures and fittings requiring back flow prevention e.g., non-drinking water to a Laboratory, supply to a hose tap adjacent a grease trap.

The back-flow device shall be rated according to the relevant hazard level it is protecting the water supply from. Barrel unions are to be fitted either side of the back-flow device to facilitate the ease of maintenance or replacement. The minimum size of a drain or tundish for a back-flow valve shall be 100mm.

Back flow devices shall not be fitted anywhere on a building where it may cause damage to the building, a slip hazard or become a nuisance. As a minimum, back flow device located outside buildings are to be installed in

lockable galvanised steel boxes with a drain hole. The discharge from drain hole is to be easily visible from buildings, pathways, or roads adjacent the installation.

Backflow prevention devices shall be Tyco, Watts or equally approved by the Project Manager. All ported backflow prevention devices shall be provided with a Tundish sized to Australian Standard 3500 but in no case smaller than 100mm.

All backflow prevention valves located externally shall be in lockable galvanised boxes. All backflow devises are to be listed on a register to be provided to the Project Manager.

12.25 Pumps

Pumps shall be Grundfos electronic variable speed type, with both local and building management system alarms. Pumps are to be designed as a minimum of two identical pump sets manifolded together with details of valve trains, pressure vessels and rated to supply flows complying with relevant Australian Standard for the installation.

Pumps are to be installed on a minimum of 100mm plinths with antivibration mounts the connections are to be class D flanges, flexible and anti-vibration.

Pumps are to be in weatherproof ventilated structures and are to be designed with allowance for access, maintenance, and replacement. Generally, the pumps duty will be Duty Call- Duty, Standby – Duty, Duty – Duty Stop and have 12-hour automatic change over. Pumps are to be clearly marked with manufacturer and duty pressure and flows.

12.26 Hot Water Pumps

Hot water circulating pumps shall be provided in hot water flow and return loops to minimise dead legs. The hot water circulating pump shall be installed on the return hot water loop.

Pumps shall be of the Grundfos “in line” model with isolation valves either side of the pump to facilitate replacement or maintenance. Pump casings shall be bronze with bronze impellers and mechanical seals. Where hot water pumps are timer controlled, they shall be connected to the building management system time scheduled and indicate operating status and water temperature.

Visually accessible temperature devices are to be provided on the upstream and downstream sides of the circulation pump to enable monitoring of the systems operational temperature, also to allow the correct adjustment to the circulation pump. Where the system is required to provide larger volumes of circulated hot water an intelligent logic controller is to be specified.

12.27 Filtered Water

In general, filtered water is to be delivered through USC's Water Refill Campus initiative and as a result, no further water filtration system will be required. Where specifically requested, additional water filter options are to be discussed with the Project Manager and confirmed in writing.

12.28 Liquefied Petroleum Gas and Natural Gas Services

Gas services shall be natural gas or liquefied petroleum (LP) gas.

The gas services engineer shall provide the pipe sizing calculations in the design development report and allow for future expansion of the reticulated gas system by a minimum of 25%.

All joints in the reticulated gas system shall be silver soldered with a minimum 15% silver solder and pipe work is to be concealed from view. Where the pipe work is visible it shall be protected from mechanical damage and be chromed plated.

Provide in the design a room gas control keypad panel adjacent to the normal entry and exit door so that the gas cut-out emergency button may be activated when exiting in an emergency. The control panel is to be connected to suitable gas sniffers, located in accordance with the requirements for the gas being used within the room, which will shut down the gas in the event of a leak.

The system shall be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gas ball valve which is in an accessible position not more than 1500mm above finished floor level. This will enable maintenance to be carried out and new branch lines to be installed without having to shut the gas down to entire buildings.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the architectural design.

Where LP gas cylinders are to be installed allow for following as a minimum:

- Double cylinder installation connected in parallel
- Provide a visually screening secure mesh or vented enclosure to cylinders with lockable gates
- Locate as close as possible to high usage rooms and near service road for ease of access for bottle replacement or in situ filling
- Locate on a concrete plinth at a level above adjacent garden beds
- Provide hard paving access to the LP gas cylinders
- Provide hazardous material signage

12.29 Valves

12.29.1 Generally

All valves are to be DR Brass, Stainless steel equal approved by Project Manager.

All valves are to display either their water mark or Australian Standard approval. Control valves shall be provided on all hot and cold supply to all individual fixtures. All valves 25 mm and greater to be install with barrel unions with class D flanges.

Inspection chambers shall be installed in accordance with Local Authority requirements with Gatic® gas tight bolt down chamber covers. Gatic® light duty covers shall be generally specified except in roadways where medium duty covers shall be specified. All chambers over 1200mm in depth shall have hot dipped galvanised step irons or ladder specified.

12.29.2 Thermostatic Mixing Vales

Thermostatic mixing valve (TMV) shall be FM Mattson or equal approved by Project Manager. Set to maximum of 45degrees for disable fixtures and 50degrees for all ablution fixtures.

12.29.3 Control Valves

Control valves are to be tested gate vales, brass or stainless steel and installed a minimum of 1500mm above finished floor level. Control valve shall be provided to isolate fixtures, groups of fixtures and individual floors of buildings.

12.29.4 Pressure Limiting Valves

Pressure limiting valves shall be provided to ensure individual fixtures have a maximum pressure of 500Kpa or a lesser pressure if required to comply with manufacturer's instructions.

12.29.5 Mini Cistern Cocks

Mini cistern cocks are to be jumper valve type and not quarter turn type valves.

12.30 Host Taps

Hose taps to be 'DR Brass Vandal Proof' with jumper valve and key type displaying water mark or Australian Standards marking. Hose taps must be in all cleans stores, amenities, every 40m externally to building, each roof structure, event/activation areas and outside retail premises.

12.31 Labelling

Labelling shall be provided to all items to give clear indication of direction of flow and service purpose. Labels shall be colour coded to comply with Australian Standard 1318.

Equipment Labels shall be 3 layer laminated plastic coloured to Australian Standards fixed by stainless steel screws (approved adhesive fixings may be used to plastic accessories).

Labels shall be sized to suite the importance and application and must be uniform for similar items. Minimum letter size is to be 3mm and 0.3mm line thickness.

Above ground pipework identification shall be in accordance with AS 1345 to identify piping, conduit, and ducts.

Underground pipe work shall have traceable warning tape place 75mm above the pipework. Warning tape is to be manufactured from polypropylene with 316 stainless steel trace wire imbedded to enable location detection complying with Australian Standard 2648. The width of the marking tap shall be equal to the diameter of pipe it is protecting up to 400mm.

12.32 Tundishes

Tundishes may be PVC, sized to comply with Australian Standard 3500 and shall be trapped where required. When exposed internally, chrome plated, or stainless steel shall be used. Tundishes receiving condensate shall be lagged and insulated unless underground or encased in concrete.

12.33 Insulation

In all cases pipe insulation is to comply with the requirements of the BCA latest edition Section J for thermal properties for the relevant climate zone.

13 VERTICAL TRANSPORTATION

13.1 Vertical Transportation General Requirements

All work specified for the vertical transportation services is to be designed in accordance with the requirements of AS 1735.1 Lifts, Escalators and Moving Walks Part 1: General Requirements.

Lifts are to be only of high commercial quality, durable and reliable, with ease of use, smooth ride in operation and landing. All lifts shall have microprocessor-based control systems.

Specify only lifts manufactured by tier 1 firms, such as KONE, Schindler, Thyssenkrupp, Otis, that stock readily available equipment and are supported locally with technical assistance and sufficient levels of stock for ongoing maintenance.

Hydraulic or domestic type lifts are not to be used without the approval of the Project Manager and only in specialised situations.

All lifts are to be provided with audio, visual and tactile information in accordance with AS 1428.

All lift cars are to include at least one mirror finished wall and handrails in accordance with AS 1428.

All internal finishes are to be hardwearing, low maintenance and easy to clean.

13.2 Transport Calculations

The Consultant shall provide a report recommending lift type, size, speed, capacity, number off etc to the University for approval.

13.3 Performance Criteria

The performance of lifts shall meet the following as a minimum:

- Door opening time 2.5 to 3s
- Door closing time 3 to 3.5s
- Levelling accuracy ±6mm
- Lifts shall have a minimum speed of 1m/s for up to 4 stores and 1.5m/s for up to 8 storeys
- The lift shall have the capacity of 120 minimum starts per hour.

13.4 Equipment Types

13.4.1 Buildings Under Four Levels

Buildings of 2-4 levels should be designed with MRL (machine room less) traction lifts.

13.4.2 Buildings Four Levels and Over

Buildings 4 levels or more should be provided with MRL gearless traction lifts with AC-VVVF drive including regeneration.

13.4.3 Hydraulic Lifts

Hydraulic lifts are not to be used except for specialist lifting applications (loading docks etc). Hydraulic lifts are not to be used for general passenger applications.

13.5 Lift Loading

Unless briefed otherwise, or required by traffic studies or building use, lifts should be designed for a minimum duty of 1600 kg/21-person capacity.

13.6 Life Car Size

Lift car size shall be in accordance with AS 1428.2 to allow sufficient circulation space for a 180° wheelchair turn, with a minimum internal dimension of 1600mm wide x 2100mm deep.

Lifts that service three or more floors (or as required by the Building Certifier) shall be deemed an emergency lift and have horizontal stretcher provision.

Car size of goods lifts are to be sized according to largest transportable good as identified in space data for the building, but generally as a minimum size suitable for a standard pallet including lifter.

Car sizes of refurbished or retrofitted lifts are to be considered on case-by-case basis.

13.7 Electrical Supply

All power supplies etc shall comply with AS 3000.

Submains shall be designed to not more than 3% voltage drop at full load operating condition in UP direction, or 5% transient voltage drop on start of upwards travel.

Power for lift shaft and lift ventilation and/or air conditioning must be included in the design.

13.8 Location

Lifts shall be located adjacent stairs etc to facilitate emergency evacuations and encourage the use of stairs.

Consider the location lift shafts and motor rooms in relation to the building and surrounds with consideration given to access for maintenance and noise intrusion into adjoining spaces.

Any lighting visible to outside (e.g., exposed lifts, glass walled shaft s etc) shall be arranged so as not to attract insects.

Lifts located in potentially explosive locations shall be certified for use in those conditions.

13.9 Lift Security

All lifts are to be provided with the facility to have them locked off or "shutdown" by security or maintenance staff. Where required, lift operation should also be designed to allow the car to travel without occupants when transporting hazardous substances.

Lifts shall be designed as “Emergency Lifts” only if required by code.

All lifts to be integrated with Gallagher system and swipe card access located inside each lift car and at every floor level. All lift cars and lift foyers on each floor must have a CCTV camera installed.

13.10 Hazardous Goods

All lifts that are required for the transportation of hazardous goods are to have a fully documented safe operation mode designed specifically for hazardous goods requirements.

13.11 Lift Car Interiors

Lift car interiors shall be of a professional commercial 316 grade, diamond pattern stainless steel on all sides, front and rear, with a full width mirror finish stainless steel (above handrail) on the rear wall.

Where lifts are required to operate as goods lifts outside of normal passenger lift operation, supply removable, padded protective drapes with hanging studs and flanged eyelets.

The car operating panel shall be hairline stainless steel. Stainless steel rubbing rails shall be provided on the sides and rear wall and shall be removable type. Stainless steel handrails are to be provided in all lifts and shall be in accordance with AS 1735.12 at a minimum.

Lift floors in goods lifts and lifts that open to an external space or carpark, shall be rubber studded floor tiles. Elsewhere, lift floors shall be carpet finished.

13.12 Car Ceilings and Lighting

The University prefers the ceiling to be drop ceiling type with perimeter recessed LED lighting. Suspended metal and acrylic grid ceiling diffusers shall only be used when the height is below 2300mm.

Provide a lockable access hatch for external recovery purposes built into ceiling of the lift.

13.13 Car Ventilation

Each lift shall have a quiet exhaust fan to supplement natural ventilation, providing a minimum of 30 air changes per hour, and preferably by three phase motors. External lifts shall be air conditioned.

13.14 Landing Doors

The University prefers finished stainless-steel landing doors, centre opening, manufactured from 316 Stainless Steel finish Alternatives will be considered and must be approved in writing by the University.

Doors shall be 1200mm wide x 2100mm high.

13.15 Fire Precaution

All lift shafts shall be fire protected in accordance with BCA requirements.

13.16 Lift Safety

All lift should be provided with a lift overload indicator both auditory and visual. Additionally, the lift door safety shall be provided with 3D photoelectric sensors.

The lift may be fitted with a delayed closing function with low speed, low torque delayed closing function with audible alarm operating when the door is held open not less than than 10 seconds (Negated by pressing the open-door button)

13.16.1 Delayed Closing

Where the closing of doors is delayed for a period of not less than 10 s through the operation of the passenger-protection device, the doors may power close with the passenger-protection device ineffective, provided that the kinetic energy then does not exceed 3.4 J and an audible warning is sounded in the car. The timing device used for this purpose shall be fully reset after the car leaves each landing.

13.16.2 Circuit Failure

In the event of an open-circuit failure of the passenger-protection device, or the wiring thereto, the door shall not continue to close at normal operating speed but may continue to close at a lower speed provided that its kinetic energy does not exceed 3.4 J and an audible warning is sounded in the car.

13.17 Lift Controls

Lift controls shall be accessible for all users and shall include Braille and signage as well as spoken announcement (with volume control). A tone alert shall be provided at each landing.

For lift access doors located outside of access-controlled zones, after hours control shall be by swipe card linked to the University's access control system. Flush mounted key switches should be provided for operative and manual control and keyed to the University's key system.

All lift controls shall be programmable and not subject to any software locks or require the use of proprietary access or programming tools. Car indicator panels shall include every floor that is served by the lift and a door open/close. The emergency call button and override key switch shall be located with the indicator panel.

Level and direction indicators shall be provided inside the lift car.

All lifts shall be provided with a single, 10A GPO fitted on the lift car control panel for use by cleaners.

13.18 Hall Indicators

Hall indicators shall be hairline stainless steel panels. Hall indicators shall show the direction of travel and the current location of the lift. Hall indicator panels shall be provided on every floor served by the lift, accessible for all users and shall include Braille and signage.

The ground floor level is to be denoted as level '0' – zero, or 'GROUND'. Subsequent levels are to be sequentially numbered starting at 'Level 1'.

13.19 Emergency Phone

An emergency phone shall be provided in the lift car to allow emergency communication or calls from passengers in the lift.

For remote sites without security presence 24 hours – 7 days a week, lifts are to be provided with a dual GSM emergency phone service.

On sites that are monitored with security presence 24 hours – 7 days a week, lifts are to be fitted with an intercom system that is compatible with the University's ECP system and monitored by BMS.

The system shall have hands free automatic dialling upon activation of the call button. Identification label to be clearly provided in lift car and is to include the USC security services emergency contact number

13.20 Lift Alarms

All lift fault alarms shall be connected to the University's BMS system via a High-Level Interface and connected to Gallagher system.

13.21 Lift Pits and Wells

All lift pits shall be founded to solid earth in accordance with AS 1735, always kept dry, with a 300mm square sump to a depth of 300mm minimum. Provide a float controlled stainless steel sump pump to pump out the lift pit to an approved waste point. Provide float switches to supply high-level water alarms, relayed to the University's BMS.

13.22 Return to Floor and Power Failure

All lifts are to be enabled to return to ground floor and doors open automatically in the event of power failure via either a battery power supply, UPS or through connection to an emergency generator supply if available within the building.

13.23 Lift Motor Room

All lifts shall be the type that does not require a machine room above the lift shaft – MRL type.

13.24 Registration of Lift

Prior to putting the lift into operation, the Contractor shall prepare and submit all required

documentation to the University to enable registration in accordance with statutory requirements.

14 WET FIRE SERVICES

14.1 General

Fire service designs shall ensure a full town or site campus water mains flow and pressure test specific to the project site is obtained prior to the design of any wet fire service. Flow and pressure testing results should be verified by the installing contractor prior to the commencement of works.

The fire system performance is to be tested in accordance with the commissioning requirements of AS 2419 in the presence of the consulting engineer and relevant University staff. Provide all testing results to the Project Manager prior to inspection and approval by the QFES.

QFES requirements for all wet fire services over and above the requirements of the relevant Australian Standards must be adhered to following consultation with the relevant QFES building assessment officer and included in the design development report.

Following the completion of the performance testing the QFES Community Safety Inspection Officers will conduct their proving tests as a process in the final certification of the systems.

Fire Services contractors shall provide evidence to the Project Manager that they are duly registered with the Fire Protection Contractors Registration Board of Queensland, and have such licences as required by State legislation.

All fire service designs shall specify that fire services are to be certified and tagged by a certified fire services equipment installer.

The consultant shall specify that the fire service key required for all door locks and key switches shall be keyed to the 003-fire service key only.

Fire services designs shall specify that the installing contractor is to provide maintenance manuals with all technical information, maintenance and testing programs, all warranties, and hardcopies of drawings in accordance with the Project Compliance Handover Checklist.

A reference copy of the Project compliance handover checklist can be found at appendix C of this document for information purposes. An original template of the Project Compliance Handover Checklist will be supplied by the USC Project Manager.

14.2 Fire Hydrant Services

14.2.1 General Requirements

Fire hydrant service design must be in accordance with the requirements of the National Construction Code (NCC) Volume 1, Part E1.3, AS 2419.1 and Queensland Fire and Emergency Services (QFES)

Unless otherwise specified by the University, hydrant systems shall be ‘wet pipe’ systems.

14.2.2 Design

The water supply design for fire hydrant services shall be provided via a dedicated water service to the building isolated by double check valves located in an accessible approved position.

Hyena hydraulic calculations shall be included in the schematic design and design development reports and reviewed by the University prior to systems installation.

The system design shall allow for the protection of any 'Open Yard' in accordance with the requirements of AS 2419.1

Designs shall include anti-tamper/vandal proof device e fitted to all hydrant's standpipe and landing valves hydrants accessible to the public to prevent unwanted operation of the service.

All standpipes and any inground steel services are to be lagged with double wrapped denzo tape to a minimum 150mm above the surrounding finished surface level to stop any potential corrosion and be protected from vehicles and machinery by bollards.

Where designs include fire hydrant enclosures, they must be clearly identified.

Provide block plans in accordance with Australian Standards.

Where designs include internal hydrants, allowance must be made for a safe discharge point (Fire Test Drain) for the testing of the two most disadvantaged fire hydrants. All discharge points shall be fitted with the required number of 65mm round thread 'Type 6' QFES compliant female couplings and shall be designed to discharge to the sewer drainage system.

Where available, fire hydrant services shall be designed such that all routine test and maintenance 'waste' water is recycled within the service or captured with the possibility of re-use by other permissible services.

Wet fire services shall be designed such that preventative maintenance can be carried out in accordance with AS 1851.

14.2.3 Technical Requirements

All above-ground hydrant valves shall be designed as Galvin, Dixon Fire or Tyco.

Any in-ground spring type hydrants shall be of the A.W.E. (Associated Water Equipment) 'Maxi Flow' nylon coated type.

The fire hydrant design shall include only 'POTTER' pressure switches.

14.3 Fire Hose Reel Services

14.3.1 General Requirements

Fire hose reel performance must be in accordance with the requirements of The National Construction Code (NCC) Volume 1 Part E1.4 & AS 2441.

14.3.2 Design

Fire Hose Reels are to be 36 metres in length and the system designed to provide full coverage in accordance with Specification E1.5 of the BCA and AS 2441.

All hose reels are to be designed with a tested ball valve fitted to allow the removal of the fire hose reel for servicing and or replacement.

Extended swivel arms shall be allowed for with the design where hose reels are installed inside recessed areas, inside cupboards or cabinets.

Where fire hose reels are to be exposed to direct sunlight and weather and not otherwise housed in a suitable enclosure, a purpose-built cabinet/cupboard is to be provided. Floor mounting brackets shall be utilized only where other forms of mounting/support are not available.

All fire hose reel cabinets and enclosures shall be designed to include visible signage in accordance with the requirements of AS 2441.

Only brass screw nozzles shall be specified.

14.3.3 Technical Requirements

Only 'Quell' Selector type, Wormald Model 92-482P or Fire Master (Tyco) 'Exelgard' fire hose reels shall be specified.

14.4 Fire Sprinkler Services

14.4.1 General Requirements

All fire sprinkler services shall be designed in accordance with the National Construction Code (NCC) Volume 1, Part E1.5, Specification E1.5 and all applicable parts of AS 2118.

Unless otherwise specified by the University, fire sprinkler systems shall be 'wet pipe' systems.

14.4.2 Design

The configuration of the various services shall be in accordance with:

- Residential Buildings – AS 2118.4
- All other areas – AS 2118.1
- Combined hydrant and sprinkler services – AS 2118.6

Hyena Hydraulic calculations shall be included in the schematic design and design development reports and reviewed by the University prior to systems installation.

All fire sprinkler services design shall include provisions to allow for routine testing in accordance with the requirements of AS 1851.

Fire sprinkler services shall be designed such that all routine test and maintenance 'waste' water is recycled within the service or discharged into the sewer drainage system. Consideration shall be given to the availability of system consumables, replacement pipe, fittings, valves, and any other item required.

Fire sprinkler control valve assemblies are to be located within a secure enclosure and fitted with anti-tamper devices to prevent unwanted system activation. Fire sprinkler control valve assemblies shall be in an AS 2118.1 compliant location readily accessible to the attending authority, approved by the building certifier and the QFES prior to design finalisation.

Block plans must be provided in accordance with Australian Standards.

The required system duties shall be nominated as a basis for the system performance testing in accordance with the requirements of AS 1851.1.

Fire sprinkler systems shall be designed and installed such that system activation is relayed to the QFES or designated third party monitoring service.

14.4.3 Technical Requirements

The fire sprinkler service design shall include only 'POTTER' pressure switches.

14.5 Fire Pump and Pump Room Design

14.5.1 Access

Pumps rooms and contained plant and equipment must be designed such that access for both operation and maintenance are available without obstruction.

14.5.2 Location

The location and design of fire pump room installations shall be approved by the Project Manager, Building Certifier and the QFES prior to design finalisation.

14.5.3 Duty

Pump duties shall be designed such that the available flow and pressure of the pump is at least 20% greater than the system duty flow and pressure requirements to allow for pump redundancy.

14.5.4 Maintenance and Testing

Provision must be made within the design of the fire pump rooms for ongoing testing & maintenance with consideration being given to available power sources, lighting, and drainage.

14.5.5 Equipment

All large ticket fire pumps shall be designed as compression ignition type 'Kelair', 'Prime Pumps' or 'Southern Cross'. Installation of other equipment of equal or superior standard shall only be used after the approval of the Project Manager has been obtained.

Pressures relief valves shall be included within the design for all pumps and system pipework. All pump systems shall be designed with mechanical seals only.

All pressure gauge inclusions shall be designed with an isolation valve to enable service or replacement of the gauge.

14.5.6 Notification

The consultant shall design all fire pump installations fitted with a 'Pump-Run' and 'Pump-Fail' audible and visual notification installed external to the fire pumproom in a visible location. The notification signals shall interface with both the building BMS and security services.

14.6 Booster Assemblies Design

Where required, hydrant booster designs shall meet the requirements of AS 2419.1/2/3.

14.6.1 Location

The wet fire services design shall include the location, colour, and design of fire booster installations, which shall be approved by the Building Certifier and the QFES prior to design finalisation.

14.6.2 Construction

Masonry construction is preferred to metal cabinets. Should a metal cabinet be utilised, it shall be power-coated 316 stainless steel or powder-coated marine grade aluminium construction.

14.7 Water Supply Design

Where required water storage tanks design shall meet the requirements of AS 2419.1 & AS 2118.1 respectively.

14.7.1 Location

The location, colour and construction of water storage tanks shall be to the satisfaction of the University and approved by the Building Certifier and the QFES prior to design finalisation.

14.7.2 Capacity

Where on-site water storage is required the design shall ensure that the 'effective' capacity of the storage guarantees the total system/s demand for the required system/s duration.

14.7.3 Configuration

Water storage tank configuration design shall be such that during maintenance at least 50% capacity is always available for use

APPENDIX A

A.1 As Constructed Documentation

A.1.1 Generally

Work as executed drawings, correcting tender drawings as altered consequent upon directions given during the construction of the Works shall be provided as a precondition of Practical Completion on all projects.

For all building projects $2m and over in contract value, the University requires the Contractor use the OMTrack document management system to provide all as constructed documentation, including drawings, specifications, schedules, and reports. The Contractor shall provide 1 copy of all services drawings in A1 size paper in a suitably sized plan horse. Details of the requirement can be found in the OMTrak Information Sheet which can be found at Appendix B.

For all other building projects, the University required the contractor to provide all as constructed documentation including drawings, specifications schedules, reports etc to the Project Manager for noting in the Project Compliance Handover Checklist, which can be found in Appendix C for information only.

A.1.2 Submissions

Computer generated tender drawings developed as workshop drawings to as-executed status shall be provided in AutoCAD dwg. format and pdf. All drawings shall indicate room numbering as agreed with the University.

Show the “as installed” locations of building elements, plant, and equipment. Show coordinating dimensions where applicable.

Show dimensions, types and location of equipment, cables, piping, and ductwork in relation to permanent site features and other underground services. Include relationship to building structure and other services, and changes made during commissioning and the maintenance period. Include diagrammatic drawings of each system showing piping and wiring, and principal items of equipment. All underground services and pit locations are also to have geographical coordinates provided to be added to USC SAM plans.

Incorporate all modifications made during the progress of the work and testing period. Show any provisions for the future.

Use the same borders and title block as the contract drawings. All record drawings are to be signed and dated by the Consultant or Contractor.

A.1.3 Zone Diagrams

Zone diagrams shall be colour coded, plastic, back engraved and show all relevant information and update existing diagrams when alterations take place. These diagrams shall be provided as a practical completion requirement.

In addition to the general requirements for record drawings the fire services as-built drawings (to be provided in both .pdf & in dwg. format) are to show all zones, detector and manual call points locations with addresses, cable routes.

A.1.4 Format

All As-Constructed drawings must be provided in both AutoCAD dwg and pdf format as follows:

- 1 x electronic copy provided by email or a suitable file internet file transfer method.
- 2 x electronic copies provided on 2 separate USB drives.

A completed transmittal sheet is to accompany each set of drawings issued. In addition to electronic format the contractor is required to supply the University 1 set of Services "as Built" drawings, A1 size paper and in a suitably sized plan horse.

The following work-as-executed drawings are required as a minimum, as applicable to the project: (Refer also to Services Specifications for any additional requirements)

1. Architectural

1.1 Floor plans all levels
1.2 Roof Plans
1.3 Elevations
1.4 Sections

2. Mechanical

2.1 Ductwork – all levels
2.2 Pipework (other than hydraulics relevant to mechanical services) – all levels
2.3 Plant room layouts
2.4 Air conditioning plant
2.5 Fans
2.6 Fire dampers

3. Electrical

3.1 Switchboards
3.2 Submains
3.3 Light fittings, general and emergency
3.4 GPOs
3.5 Air condition and permanently connected equipment
3.6 Fans and heaters
3.7 Hot water units
3.8 Three phase power outlets
3.9 Logbook sand data entry sheet for emergency and exit lighting
3.10 Route of underground services
3.11 Thermal and smoke detectors showing wiring and EOL
3.12 EQIS spearers, if applicable

4. Communications

4.1 Phone, data outlets and head end equipment

5. Hydraulics

5.1 Plumbing and drainage site plan
5.2 Plumbing and drainage all levels
5.3 Plumbing isometrics
5.4 Hot water units
5.5 Location of any isolating valves

6. Fire Protection Services

6.1 Fire Boards
6.2 Main Wiring runs
6.3 Thermal and smoke detectors showing wiring
6.4 EWIS speakers (if applicable)
6.5 Connections to other systems such as HVAC, Auto doors, lifts, smoke exhaust fans etc.

7. Equipment/Installation Registers (all as required by Australian Standards and appropriate regulation)

7.1 Fire stopping
7.2 Fire Doors
7.3 Fire hydrants
7.4 Fire hose reels
7.5 Portable fire extinguishers
7.6 Fire blankets
7.7 Fire dampers
7.8 Smoke extraction fans
7.9 Fire rated access panels
7.10 Emergency and exit lights

A.2 Operation and Maintenance Manuals

A.2.1 Generally

Practical Completion will not be granted on any project until the completed operating and maintenance manuals in the specified format have been provided.

For all building projects $2m and over in contract value, the *University* requires the Contractors use of OMTrak document management system to provide all Operation and Maintenance Manuals as well as capital asset maintenance and operations data.

Details of the requirements can be found in Appendix B.

For all other building projects, the *University* required the *Contractor* to provide all Operation and Maintenance manuals to the USC Project Manager for noting in the Project Compliance Handover Checklist.

Refer to Appendix C of this document for a copy of the Checklist for information purposes only.

Operating and maintenance manuals for all plant and equipment and lists of 'prescribed equipment' must be provided and shall include comprehensive maintenance schedules.

During the *Defect Liability period* for new building works, all scheduled maintenance is to be undertaken by the contractor and logged in a maintenance register to be provided to the University at the completion of the DLP prior to release of any Security held.

A.2.2 Format

Manuals must be provided in both Microsoft Word and pdf format as follows:

- 1 x electronic copy provided by email or a suitable file internet file transfer method.
- 2 x electronic copies provided on 2 separate USB drives.

A completed transmittal sheet is to accompany each manual.

A.2.3 Manual Contents

The required "typical" format of manuals is detailed below. The actual range and content of manuals provided will be dependent on the range and complexity of elements incorporated in the project.

Section	Content
Introduction	Index; list of Contractors and Subcontractors; list of Guarantees provided with copies; list of Certificates of Approval with copies, copy of Site and Building Survey; list of As-Constructed drawings supplied, list of Specifications supplied
Architectural	Hardware Complete schedule and description; Manufacturer's literature for all hardware items; keying schedule; keying diagram (tree); maintenance advice Finishes Schedule and description; manufacturer's literature; maintenance advice on external wall treatments, doors, internal wall treatments and floor finishes. Colour scheme Description; manufacturer and colour name for all walls including paint, pre-finished materials, tiles and other external features.
Landscaping	As-constructed drawings; schedule of all planting; external furniture and maintenance schedule; irrigation system with manufacturer's operating instructions; maintenance advice on lawns, vines, ground covers, shrubs, trees and landscape lighting.
Hydraulics drainage	As-constructed drawings with locations of all control valves; description of system; manufacturer's literature for all proprietary items including fire hose reels and fire hydrants; advice on maintenance; plumbing; approved drawings; list of replacement fittings; water services and any other items as listed in Hydraulics Specification.
Structural	As-constructed drawings to include cable tension locations to underside of floors, and floor loadings.

Mechanical services	Description of operation; operating and maintenance advice; servicing advice; manufacturers' literature and as-constructed drawings for lifts, pumps, fans and emergency power plant. Other items as listed in Mechanical Specification.
Electrical services	Light and power Description and circuity diagrams; details of switchboard; schedule of light fittings and manufacturers' literature; as-constructed drawings; single line diagrams. Data reticulation Description of system; location of drawings; manufacturers' literature; installation diagrams. Fire alarm systems Approved drawings (i.e. approved from QFRS); description of operation; location diagrams; maintenance instruction; emergency procedure. Electrical equipment Description of operation; maintenance instructions; manufacturers' literature (e.g. hair dryers, etc.) Security and access systems Description of system; location diagrams and installation drawings; operating instructions, manufacturers' literature. Other items as listed in Electrical Specification.
IT services	Detailed descriptions, operating and maintenance instructions for all AV equipment, switches, PCs, WiFi equipment and IT systems installed as part of the project. As-constructed drawings showing the locations of all specialist AV and WiFi equipment.
Equipment lists	Equipment lists will be requested as required for the updating of USC Maintenance Management System and Asset Register.
Plans	Each manual is to include a set of relevant A1 and A3 size folded-up plans.
Fire services	Approved/certified drawings marked with "approved" from the relevant authority; shop drawing; description of operation; locations diagrams; maintenance instructions; emergency procedures.
Building management system	Approved drawings; shop drawings; points list; controllers list; hardware list; functional description of operation; locations diagrams; maintenance instructions; emergency procedures.

A.3 Building Compliance Handover Checklist

At the completion of all projects, the Project Compliance Handover Checklist is to be completed by the Project Manager and submitted to the Director, Facilities Management along with copies of all Operation and Maintenance Manuals, As-Constructed Drawings and Specifications, and Certificates (except were uploaded via OMTrak).

A reference copy of the Project Compliance Handover Checklist can be found at Appendix C of this document for information only.

A.4 Building Occupant Guide and Education

At the completion of all projects, the Consultant must provide a Building Occupant Guide, which describes features of the building that the occupants will or could interact with. The guide shall be produced in a digital, online format and shall be in accordance with the requirements outlined below.

The building occupant guide must be able to be easily and clearly understood by the occupants and shall include the following information:

A.4.1.1 Building Services

A 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 systems
- Cooling systems
- Electrical systems
- Lighting
- Domestic Hot Water

A.4.1.2 Transport Facilities

Car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use.

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. Update existing information with each new project.

A.4.1.3 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 collection and storage areas are located
- Schedules for waste and recycling removal

A.5 Asset Register

At the completed of all projects, the *University* requires the *Contractor* to provide details of all new assets as well as all existing assets disposed of whilst carrying out the works. The USC Asset Matrix Schedule can be found in Appendix D, this document will assist Contractors is capturing required assets.

For all building projects $2m and over in contract value, the *University* requires the *Contractor* user the OMTrak document management system to register these assets. Details of the requirements can be found in the OMTrak Information Sheet which can be found at Appendix B.

For all other projects, the university will provide the Contractor with an Asset Register template that Stipulated the information required to be collected. A reference copy of the Asset Register Template can be found at Appendix D for information only.

APPENDIX B

B.1 Operations and Maintenance Manuals

B.1.1 OMTrak System Operations and Maintenance Manuals

Note that the following Operations and Maintenance O&M Manuals details is for information purposes only and have been supplied by the WebFM Vendor and contact outlined in section (a).

In section *(c) Capture Of Asset, barcoding, Maintenance And Operations Data,* the Appendix 1 schedule mentioned, refers to the Appendix D Asset Matrix in this USC Design Standards and Guidelines document.

Operations and Maintenance O&M Manuals

1.1 OMTRAK system Operations and Maintenance Manuals

The Contractor shall provide completed Operation and Maintenance Manuals to the Principals Project Manager and to the satisfaction of the Project Manager using the OMTRAK System, prior to Completion or the date nominated in the approved Commissioning and Handover Plan.

This is a condition precedent to payment for any Completion Amounts due under the Contract and Date of Practical Completion notice.

(a) Use of OMTRAK Proprietary System:

The Contractor at its cost shall procure THE OMTRAK System for the purpose of producing Electronic O&M Manuals.

ryan.chappell@webfm.net

www.omtrak.com

Contact: Ryan Chappell Mob: 0473 001 523

The Contractor shall procure the OMTRAK system within 30 days of commencement of the Contract or at a time approved by the Project Manager. The cost of the use of the OMTRAK system shall be to the contractors account for the sum, initially treated as a Provisional Sum in the Contract.

(b) Objectives

The objectives of the Operations and Maintenance Manuals are:

(i) to be of sufficient detail to enable the Principal to take over any maintenance, operation or use of the works and to do so in a safe, effective and efficient manner;

(ii) to enable progressive and timely development and checking of the Manuals in advance of any completion milestones;

(iii) to be fully completed and finalised prior to the Principals occupation, use or acceptance of the works;

(iv) to be developed in standardised and fully electronic data format suitable for upload to the Principals Asset and Data Management Systems;

(v) to enable complete financial reconciliation of the assets and works showing element and asset costs, life expectancy costs and the like.

(c) Capture Of Asset, barcoding, Maintenance And Operations Data

Contractors shall progressively capture and input all relevant data into the OMTRAK operations and maintenance manuals system in a timely manner during the contract term and obtain progressive feedback from the relevant consultants on the acceptability of the data entered, and prior to any handover of the works. Contractors and project Consultants are required to check and correct the data progressively.

Contractors shall provision to capture and barcode all assets as per the Appendix 1 schedule. Barcodes will be provided by relevant University of the Sunshine Coast team.

(d) Staged Completions

Where the works are to be completed and handed over to the Principal in stages or separable portions the operations and maintenance manuals are to be completed to sufficient detail and content to enable the Principal to assume its responsibilities for the ongoing operation and maintenance as well as Essential Services Compliance reporting of the completed works.

(e) Access By The Principal

The Contractor shall make available the Operations and Maintenance Manuals in electronic format via OMTRAK internet access for review by the Principal the Project Manager and the Project Consultants at the Contractors cost.

(f) Access By Others

The contractor shall provide access to the on-line OMTRAK System for other relevant parties including but not limited to:

(i) Sub-contractors

(ii) Design Consultants

(iii) Independent Certifiers

(iv) Other Parties with responsibilities in regard to development, checking and finalizing Operations and Maintenance Manuals;

(v) All parties with access to the system shall record any errors or omissions and to update the status on any actions taken.

(g) OMTRAK Setup

The Contractor is to provide a suitable venue and to co-ordinate attendance of relevant participants to the initial Set-up workshop conducted by OMTRAK. The Set-up session is to

(i) ensure the correct base facility and or asset data is used in the system,

(ii) to establish the number of manuals and there scope relative to the completed works

(iii) to agree the respective roles and responsibilities of the parties in development of Operations and Maintenance Manuals

(iv) to advise the various parties using the system of any special requirements to be addressed in the Operations and Maintenance Manuals;

The Set-Up workshop is to be conducted early in the project term to allow all Parties sufficient time to enable progressive data input prior to completion of any stage or separable portion of the works.

(h) Training

The Contractor is to ensure all relevant staff, consultants and sub-contractors are suitably trained in the proper operation of the OMTRAK system.

The Contractor is also to provide at its cost training of nominated Principals representatives, Project Manager or agents in operation of the OMTRAK System. The number of trainees nominated shall be a reasonable number in consideration of the size and complexity of the works.

(i) Standard O&M Headings

Operations and Maintenance Manuals shall follow the standard headings shown below to ensure consistency for all elements of the works:

(i) **Introduction & Scope** – description of the systems, the approach taken and other relevant information to ensure the Facilities Staff have an understanding of the equipment and its intended purpose

(ii) **Assets** - detailed schedule of all financial assets data, maintainable assets data, items and locations

(iii) **Maintenance** - detailed instructions and frequency to ensure proper function of the assets. Prepopulated lists are available or option to create custom routines

(iv) **Operations Data** - detailed instructions for safe and efficient operation of the assets, including general cleaning, proper use and function of the assets/systems and relevant suppliers documentation

(v) **Spare Parts** - listed items or components required to complete maintenance or operation tasks or for replacements

(vi) **Warranty and Certificates** - descriptions of all warranties and (both contracted and procured through suppliers) for the assets and descriptions of any certificates issued as part of the works including uploaded copies of all relevant documents

(vii) **Help and Contact** - Details of any relevant contractors, suppliers and the like who may be used by the Principal / building owner to support the longer term operation and maintenance of the assets

(viii) **Drawings and Reference** - lists of all final as built drawings, specifications and other relevant documents forming the final contract scope and other relevant attachments - including product manuals, specifications and the like relevant to the proper operation and maintenance of the works.

Where a particular section is not relevant it may be left blank

(j) Site Works

The Contractor shall:

(i) Utilise the online defect / snag module of the OmTrak system during commissioning, handover and throughout the Defects Liability Period.
(ii) Ensure the OmTrak system is used by all Subcontractors engaged by the Contractor on the project, including subsequent legal successors in title.
(iii) Progressively update, complete and close out the defects / snags for each category of works throughout the Time for Completion and until the end of Defect Liability Period.
(iv) Check, validate and report upon the accuracy and completeness of the defects/snags list.
(v) The system procured shall be available for use by all the Contractor, Subcontractors, consultants and Employer.

(k) Handover Of Asset, Maintenance And Operations Data

The Contractor is to advise the Project Manager and project Consultants Principal and or the Authorised Person when the Operations and Maintenance data is complete and accurately reflects the Works.

The Contractor is to complete the draft Operations and Maintenance Manuals 28 days in advance of Handover of the Works or parts thereof or in accord with the approved Commissioning and Handover Plan whichever is the earlier date.

When the Project Manager and Principal or the Authorised Persons identify any errors or omissions in the submitted data then within the time period stated in the approved Commissioning and Handover Plan or the issued Defect Notice the Contractor is required to rectify any items and to pay all such costs that may be incurred to update the final data.

(l) Document Completion

The Contractor shall integrate the collection of asset data documents, and their subsequent production and submission in accord with the timing set out in the approved Commissioning and Handover Plan (including Inspection and Test Plans and Staged works handover), with progressive development of documents in electronic form.

The number of electronic copies of O&M Manuals shall be as stated in the approved Commissioning and Handover Plan or in the absence of a stated number 1 copy for each defined recipient in the approved Commissioning and Handover Plan. In the absence of any defined recipients a minimum of 4CD Copies are to be supplied.

Sub-contractors are to advise the Contractor who is responsible for verification of O&M Manuals, when Manuals are at draft stage and ready for review and then inform the Project Manager and the project Consultants and Principal or another Authorised Party.

Nominated project Consultants personnel, the Principal, and or Responsible Party in accord with the approved Commissioning and Handover Plan shall access the on-line O&M Manuals and provide comments or directions for any corrections as needed.

The Contractor and his sub-contractors shall update the O&M Manual data in accord with the directions issued and the stated timetable and notify the Project Manager, Principal or Responsible Party of satisfactory completion.

When notified by the Principal or Responsible Party of the completion of all O&M Manuals the Contractor is to direct OMTRAK to close on-line access (to prevent further alteration to the approved data) and transfer all O&M Data to DVD versions for Handover.

(m) Compliance With Laws, Standards And Specifications

The Contractor shall check and verify that all data and attached files and documents that form the completed O&M Manuals comply with the relevant Laws, Standards, Codes and Specifications applicable to the works to enable the proper operation and maintenance by the Principal and or its appointed agents of the completed works.

(n) Hard Copy Format

The Contractor is to provide Hard Copy versions of O&M Manuals only if specified in the Contract Specification or approved Commissioning and Handover Plan or other contract document.

Where any conflict occurs with any other part of the contract and or specifications in reference to provision of Hard Copy O&M Manuals the Principal in the interests of compliance with Green Building Policy shall accept the same number of electronic copies of O&M Manuals in lieu of the number of Hard Copy Manuals nominated.

(o) Electronic Copy Format

The Contractor is to provide to the Principal the specified number of copies of the OMTRAK electronic O&M Manuals in CD or DVD disks containing all O&M Manual data, attached files and documents transferred from the on-line web site. Disk Media are to be packaged in a suitably bound Disk Case. Disks and Case are to be fully labelled with the following:

(i) Project Name (Front Case cover and Spine, All Disk Media);

(ii) Contractor Name and contact details (logo may be inserted);

(iii) Compiled date (date when O&M Manuals data transferred to Disk Media);

(iv) Contents List (include list of all trade manuals in order);

(v) Installation instructions (inside front Case Cover).

All O&M Manuals are to be supplied in database and PDF formats as single electronic systems with suitable hyperlinks to all associated files, photographs and documents for easy retrieval and use by the Principal.

The number of electronic copies of OMTRAK O&M Manuals shall be as stated in the approved Commissioning and Handover Plan or in the absence of a stated number 1 copy for each defined recipient in the approved Commissioning and Handover Plan. A minimum of 2 CD Copies are to be supplied.

APPENDIX C

C.1 Project Compliance Handover Checklist

Reference copy for information only

The project compliance handover checklist will be provided by the USC Project Manager in excel format.

FM Project Compliance Handover Checklist

USC

Document Control Details		Revision History			
Document Title	FM Project Compliance Handover Checklist	Version	Date	Edited by	Comments/Summary of changes
Document Revision Number	0.2	0.02	2/06/2021		Draft
Document Prepared By	Facilities Management, University of the Sunshine Coast				
Document Author					
Contact Phone	07 5456 5427				
Document Owner	Director, Facilities Management				
Contact Phone	07 5456 5778				

Document Approval			
Name	Position	Signature	Date

Project Details			
Building/Project Name		Practical Completion Date	
Building/Project Location		Value at PC	
Head Consultant's Name		Date of Hand-over	
Head Consultant's Contact Detail		C&C Project Manager	
Head Contractor's Name		C&C contact details	
Head Contractor's Contact details		FM handover person	
FM Project Manager/Project Offi		FM contact details	

Defects	Yes/No		When?	Additional Notes:
Defect notification completed?				
If no, what defects are still to be remedied and what is the expected date of completion? (Attach if				
Contact for DLP after hand-over				
Defect Liability Period? (DLP) End date?				
Bank Guarantee/Retention	**Yes/No**		**Type?**	
Bank Guarantee/Retention on DLP works?				
Value of Guarantee/Retention $				
Contact for DLP after hand-over				
Certification	**Yes/No**		**File Location**	
Statutory certification certificates supplied to USC?				
Form 11 Certificate of Classification completed and displayed?				
Electrical Compliance certificate issued?				
Plumbing Compliance certificates issued?				
Fire services certified and tagged by a certified fire services equipment installer?				
Termite Management System certificates issued and				
Maintenance Schedules completed?				
Contractors Engaged for Maintenance schedules as below?				

Operations Manauls provided (NOTE: to be provided via OMTrak where contract value ≥ $2m)	Yes/No		File Location
Product and Equipment (include warranty certificates, list all equip)			
Electrical			
Mechanical			
Hydraulic			
Lifts			
Fire			
Security			
Service Manuals provided (NOTE: to be provided via OMTrak where contract value ≥ $2m)	**Yes/No**		**File Location**
Electrical			
Mechanical			
Hydraulic			
Lifts			
Fire			
Security			
Other (please specify)			

USC HSW Site Risk Assessment	
Completed Yes /No	
File Location	
Site approved for occupanc	

Chain of Responsibility Certification

Any unusual or innovative building materials/components used in the construction must be supported by "Evidence of Suitability". Copies of the "chain of responsibility" certification must be allowed for here.

As-Constructed Documentation provided (NOTE: to be provided via OMTrak where contract value ≥ $2m)		Yes/No		File Location	Description of Innovative or new materials
Architectural	Drawings				
	Specifications				
Structural	Drawings				
	Specifications				
Fire	Drawings				
	Specifications				
Security	Drawings				
	Specifications				
Civil	Drawings				
	Specifications				Location of Evidence of Suitability
Landscape	Drawings				
	Specifications				
Electrical	Drawings				
	Specifications				
Mechanical	Drawings				
	Specifications				
Hydraulic	Drawings				
	Specifications				
Lifts	Drawings				
	Specifications				
Other (please specify)	Drawings				
	Specifications				

Consultant List	Name	Contact Details
Architect		
Structural Engineer		
Fire Engineer		

Security		
Civil Engineer		
Landscape Architect/Designer		
Electrical Engineer		
Mechanical Engineer		
Hydraulic Engineer		
Lifts		
Other (please specify)		

Head Contractor and sub-contractor List	Name	Contact Details
Head Contractor		
Structural Steelwork		
Concretor		
Termite Management		
Waterproofer		
Wet Fire		
Dry Fire		
Security		
Civil Works		
Landscape		
Electrical		
Comms		
Mechanical		
Plumber		
Drainer		
Lifts		
Roofer		
Carpet/Vinyl layer		
Timber Floors		
Tile layer		
Ceiling Fixer		
Joiner		

Painter		
AV installer		
Signage		
Other (please specify)		

Warranties provided (NOTE: to be provided via OMTrak where contract value ≥ $2m)	Yes/No		File Location	Warranty Period
Adhesives, sealants & fasteners				
Fire stopping				
Metalwork Prefinishes				
Termite Management				
Timber finishes and treatments				
Roof access safety systems				
Concrete finishes				
Brick and block construction				
Steel - protective paint coatings				
Roofing				
Cladding (pre-finished)				
Cladding (site applied finish)				
Windows and glazed doors				
Doors and access panels				
Overhead doors				
Door hardware				
External screens				
Glass components				
Partitions - framed and lined				
Partitions - glazed				
Washroom cubicle systems				
Suspended ceilings				
Joinery				
Metalwork - fabricated				
Stainless steel benching				
Miscelaneous furniture				
Signs and displays				
Waterproofing - wet areas				
Ceramic tiling				
Resilient finishes				
Carpets				
Timber floors				
Specialty floors (please specify)				
Painting				

Other (NOTE: to be provided via OMTrak where contract value ≥ $2m)	Yes/No		File Location
Product and Equipment (include warranty certificates,			
Consultancy Reports included			
Asbestos Clearance Report on Works			
Workcover Incident Reports			
Critical Emails to project			
Schedules of Internal Finishes			
Schedules of External Finishes			
FF&E Schedule			
Sanitary Fixtures and Fittings Schedule			
Door Hardware Schedule			

APPENDIX D - ARCHIBUS ASSET INFORMATION

D.1 ARCHIBUS Asset Matrix

Reference copy only

The Archibus Asset Matrix is an outline of the asset capture requirements within the Asset Template and in the OMTrak Asset Capturing tool.

A complete list of assets to capture can be provided by the USC Project Manager in an excel format.

	The space level needs to be included in the asset submission				
	Site Level	**Building Level**	**Floor Level**	**Room Level**	***If located on Campus Grounds, provide a description of the location, and note to closest building***
Appliances and White Goods					
Dishwasher	x	x	x	x	
Fridge/Freezer	x	x	x	x	
Kitchen / Commercial Kitchen	x	x	x	x	
Laundry	x	x	x	x	
BMS					
Reliable Controls/Tracer	x	x			
Electrical Meter	x	x	x	x	x
Water Meters	x	x	x	x	x
Cabinetry					
Fixed Benchtops/Cupboards	x	x	x	x	
Mirrors	x	x	x	x	
Toilet Partitioning	x	x	x	x	
Splashback	x	x	x	x	
External Fabric (Roof)					
Guttering and Downpipes	x	x			
Roofing	x	x			
Cladding	x	x			
External Windows and Doors					
Awnings/Sunhoods	x	x			
Windows	x	x			
Electrical and Lighting (in spaces)					
Power Points and Data Points	x	x	x	x	
Internal Lighting (LED, etc)	x	x	x	x	
Hand Dryer	x	x	x	x	
Electrical switch boards and risers;					
Data Cabling	x	x			
Switch Boards (Main, Dist., Mech.)	x	x	x	x	
Electrical Control Boards	x	x	x	x	
UPS	x	x	x	x	
Fence/Balustrade					
Ground Fencing	x	x			
Bollards	x	x			

Handrails/Balustrade	x	x	x	x	
FF&E					
Fixed Furniture - Grounds	x	x			x
Fixed Furniture - Internal	x	x	x	x	
Fire Safety					
Fire Detection System	x	x			
Fire Graphics	x	x			
Sound and Intercom System	x	x			
Special Hazard System	x	x			
Automatic Fire Sprinkler System	x	x			
Fire Blanket/Extinguisher	x	x	x	x	
Fire Hose Reel	x	x	x	x	
Fire Pump Set	x	x	x	x	
Floor Coverings					
By Type/Fabric	x	x	x	x	
Grounds Lighting					
Carpark/Road Lighting	x	x			
Footpath Lighting	x	x			
HVAC					
Air Handling Units/Fan Coil Units	x	x	x	x	
Cassette	x	x	x	x	
Dust Extraction System	x	x	x	x	
Ceiling Fan	x	x	x	x	
HVAC Room Vent	x	x	x	x	
Hydraulic Equipment					
Sewage Pump/Sump Pumps	x	x	x	x	
Boiling/Chilled Hot Water Unit	x	x	x	x	
Floor Waste/Drain	x	x	x	x	
Hot Water System	x	x	x	x	
Internal Windows and Doors					
Doors and Roller Doors	x	x	x	x	
Automatic Doors	x	x	x	x	
Fire Door	x	x	x	x	
Window Glass/Gazed	x	x	x	x	
Internal Ceilings					
By Type/Fabric	x	x	x	x	
Internal Walls					
By Type/Fabric	x	x	x	x	
Irrigation					
Irrigation	x	x			
Irrigation Control	x	x			
Sprinkler System	x	x			
Large Building Components					
Decking	x	x			
Shade Sails/Fabric Sail	x	x	x	x	Can be either to a building level or a room level
Boom Gate/Cantilever Gate	x	x			
Lifts					

Lift Car Structure	x	x	x	x	
Life Door	x	x	x	x	
Mechanical Other					
Single Overhead Gantry	x	x	x	x	
Emergency Generator	x	x	x	x	
Pool Equipment (Chlorine Dosing)	x	x	x	x	
Paths and Roads					
Surrounding Building Pavers	x	x			
Grounds Surface (by type)	x	x			
Security					
CCTV Camera	x	x			
Swipe Access Readers	x	x	x	x	
Gallagher Controller	x	x	x	x	
Door Release Button	x	x	x	x	
Access Control and Alarm System	x	x			
Specialised Equipment					
Refrigeration Equipment	x	x	x	x	
Emergency Eye Wash Station	x	x	x	x	
Emergency Shower Station	x	x	x	x	
Operable Walls	x	x	x	x	With Operable Walls – Allocate to the lower room number
Super Structure					
Foundation (by Type)	x	x			
Super Structure (By Type)	x	x			
Carport Streel Structure	x	x			
Tapware Fixtures					
Washroom Sink and Tapware	x	x	x	x	
Hand Basin	x	x	x	x	
Shower Screen	x	x	x	x	
Kitchen Sink and Tapware	x	x	x	x	
Toilet and Urinal	x	x	x	x	
Window Coverings					
Roller blinds (Block out or Sheer)	x	x	x	x	
Curtains	x	x	x	x	
Window Frosting/Tinting	x	x	x	x	

Appendix Table 1 - Archibus Asset Matrix

D.2 ARCHIBUS Asset Template Details

The Archibus Asset Register template will be provided by the USC Project Manager in an excel format.

The below table outlines the formatting and character limits required in each field to ensure a full asset profile can be created.

Column	Description	Format	Character Limit	Example
Asset List *Completed by*	This is a mandatory and unique identifier that should completed **last**. This	Building/ Room Level Asset: Site-Building-#####	32 Characters	SD-C-00001 BT-TI-00345 SD-00001

USC	number is specific to the individual asset and will include the site, building and unique number.	Site Level Asset: Site-#####		
Asset Standard *Refer to Equipment Standards*	A descriptive standard that is required for all assets.	Text.	Validated Field	RM-FLR-CRP MEC-HVAC-MSSB
Site Name	Official Site Code	Site Code	Validated Field	SD, FC, MB
Building Code	Official Building Code	Building Code	Validated Field	Q, FCA, A
Floor Code	Floor Code of asset location	Floor Code	Validated Field	1,2,3, G
Room Code	Room Code of asset location	Room Code	Validated Field	G.17,1.45, 2.12
Asset Name	Name of asset name. Examples are provided on Template.	Free Text	25 Character Limit	Floor Covering MSSB
Description	Description of the asset	Free Text	40 Character Limit	Carpet Tiles Services: G.03
Manufacturer	Asset Manufacturer Name	Free Text	Company name	Sinko
Serial Number	Assets Serial Number	Free Text	Serial Number	SRC-1000HW
Purchase Price	Price the asset was purchased	Numerical	No Limit	6500.00 100.00
AMS Responsibility	Is this piece of equipment AMS Responsibility to maintain? Majority Yes.	Yes or No	Validated Field	Yes No
Installation Date	Date of installation of asset	Numerical Format dd-mm-yyyy	Date Format	2019-01-01 1994-06-01
In-Service Date	Date equipment is in service	Numerical Format dd-mm-yyyy	Date Format	2019-01-01 1994-06-01
Equipment status	Identifies if the asset is In Service or Out of Service	Set options to use In Service = in Out of Service = out	Validated Field	in out
Condition	Condition rating of the equipment. Scale of 1 – 5	The exact wording: 5- Failed 4 – Poor 3 – Fair 2 – Good 1 – Very Good	Validated Field	5- Failed 4 – Poor 3 – Fair 2 – Good 1 – Very Good

				0 – Null Value
Condition Description	If there is a certain reason for the condition rating given, please explain here.	Free Text	50 Characters	Free Text
Criticality	Criticality rating describes how critical this asset is to the university. Scale of 1- 5	Use the below scale 5 – Very High 4 – High 3 – Moderate 2 – Low 1 – Very Low	Validated Field	5 4 3 2 1 0
USC Likelihood of Failure	What is the likelihood of this asset failing within the year. Scale of 1- 5	The exact wording: 5 – Almost Certain 4 – Likely 3 – Possible 2 – Unlikely 1 – Rare	Validated Field	5 – Almost Certain 4 – Likely 3 – Possible 2 – Unlikely 1 – Rare 0 – Null Value
Consequence of Failure	If the asset does fail, what is the Consequence. Scale of 1 – 5	The Exact Wording: 5 – Significant 4 – Extensive 3 – Moderate 2 – Negligible 1 – Insignificant	Validated Field	5 – Significant 4 – Extensive 3 – Moderate 2 – Negligible 1 – Insignificant 0 – Null Value
End of Economic Life	Year Life expectancy of this asset	Numeric	yyyy	2032
Additional Comments	Any additional comments	Free text		

Appendix Table 2 - Asset Template Details

D.3 ARCHIBUS Asset Template

Reference copy only

The Archibus Asset Register template will be provided by the USC Project Manager in an excel format.

An example of the fields and asset capture for a Boiling/Chilled Water Unit in space SD-Q-G-G.11.

Asset Lis	Asset Standar	Site Code	Building Code	Floor Code	Room Code	Asset Nam	Description	Manufacture	Serial Number	Model Number	AMS Responsibility
SD-Q-00001	RM-PLMB-BOIL	SD	Q	G	G.11	Boiling/ Chilled	Billi Quadra 42	Billi	Q025468	Quadra 420 XL	Yes

Figure 1 - Asset Template Example Part 1

AMS Responsibility	Purchase Pric	Purchase Dat	Install Date	In-Service Dat	Equip. Status	Condition Rating	Asset Criticalit	Likelihood Of Failure	Consequence Of Failure	End of Economic Life	Additional Comments
Yes	$4,550.00	1/01/2021	10/03/2021	10/03/2021	In Service	2 - Good	2	2 - Unlikely	2 - Negligible	2029	null

Figure 2 - Asset Template Example Part 2

APPENDIX E - USC CAD STANDARDS

E.1 Requirements – Overview

All consultants and contactors will be required to meet the CAD standards prescribed within this document, as part of their condition of engagement. Any changes from these standards are to be approved in writing in advance by the Director, Facilities Management prior to the commencement of any work. Where it is deemed that the conditions of the CAD standards have not been adhered to, consultants will be required to rectify the CAD data before full payment of consultancy fees is approved.

Any enquiries should be directed to the following USC Staff members:

Manager, Capital Projects: Peter Knuth – email: pknuth@usc.edu.au

Manager, Projects and Communication: Kathryn Robertson – email: Krobert1@usc.edu.au

E.2 Submissions

The consultant and contractor are responsible for archiving the electronic data until final written acceptance from the University has been issued. Electronic data deliverables are required with all major submittals past schematic design unless otherwise directed in the Contract Agreement.

Data submitted for review during a project may be exchanged via email or an agreed internet file transfer method.

All final electronic data deliverable packages shall be in accordance with the requirements outlined in the Project Compliance Handover Checklist which can be found HERE.

A reference copy of the FM Project Compliance Handover Checklist can be found at Appendix C of the USC Design Standards and Guidelines for information only.

Consultants are solely responsible for the production and appearance of their hard copy submittals. All drawings are to appear as intended when printed at the nominated drawing scale.

E.3 Data Requirements

E.3.1 File Types

Both text and CAD type files will be included in the electronic data deliverables and shall include the following:

- Site Survey drawings and Geo-technical reports.
- The DA (Development Application) drawings and the approved Construction Certificate drawings
- Tender documentation
- Construction documentation
- As Built drawings

- All word-processed documents (Specifications, Schedules, Charts etc,) required to complete the project

All drawing files are to be accompanied by associated plot configuration files, font files, shape files and externally referenced files.

E.3.2 Drawing Files

There shall be only one drawing in each drawing file, drawn at 1:1 scale. All floor plans, elevations and sections must be in coordination with the same geometric set out point. All floor plans in the drawing set, including those of sub-consultants, must be drawn in the same orientation on the drawing sheets.

Should work be conducted to only a section of an existing building, the current floor plan in its entirety must be included within the file, including the amended areas

E.3.3 Text Files

Text files are to be saved in Microsoft Word document format.

E.3.4 File Information

All information included in hard copy submittals is to be included in electronic data deliverables.

Blocks, families, and cells used in the documents are to be consistent throughout.

All graphic images in the drawing files are to be vectorized images. No raster images will be acceptable.

E.3.5 File Format

All submittals shall incorporate good drafting practices and organise information clearly and systematically.

Graphic elements representing a physical component of the project (i.e., lines indicating a wall, or a block indicating a light fixture) shall be shown only one time in the submittals. If additional references to the object are needed in additional drawing files they shall be shown via an external reference of the original file.

E.3.6 File Size and Organisation

It is the responsibility of the consultant to organise drawing information coherently and maintain reasonable file sizes.

E.3.7 Reference Files

Drawings using reference files (Xref) are to list referenced files on the title block layer. This list will give an account of dependent files for the complete document. In all submittals reference files shall be located in the same directory as the dependent files.

Each Xref is to be brought in on a separate layer with the layer name being their filename and must be bound before submission.

The drawing file should contain only the consultant's extent of works on file. Any reference to base architectural or co-ordination will be via "X-referencing" and should not be imported as any other drawing file.

E.3.8 Drawing Reference Point

The co-ordination point for the drawing file is to be inserted on the building set out reference point, which is identified as the co-ordinates for the project.

E.3.9 Document File Format

One drawing file corresponding to each hard copy submittal sheet is to be saved in a plot-ready format. Document files shall be formatted utilising paper space. Plotting shall be set to plot a view named "plot" with a plot scale of 1:1 formatted to match the hard copy submittals.

E.3.10 Revision Handling

All changes to tender and working drawing files must have revisions recorded on each drawing.

The plot file must display a history of changes in the revision's column and a cloud with a revision symbol highlighting the last changes made. The revisions in a plot file are recorded in an issue/revision number format A1, A2, A3,..B1, B2, B3 etc where the letter refers to the issue and the number refers to the revisions made since the last issue. It is essential that a copy of the last issue has been archived in CAD file format before any further revisions are made.

E.4 Format Requirements

E.4.1 Drawing Formats

Sheet border, title block, consultant's stamp, logos, and all other components of the master drawing sheet shall be in paper space.

All graphic representations of the project or facility and all related notes, dimensions, symbols, etc, shall be constructed in model space.

All graphic entities shall be comprised of representational and geometrically accurate entities, e.g., a circle shall be represented by circle entity and NOT a visually equivalent collection of line segments. Items shown in a dashed line type shall be created with the LINETYPE feature and NOT by individual line elements.

E.4.2 Standard Sheet Sizes and Formats

All sheet sizes are to be limited to five standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:

- A4 Sized Plot 21cm x 29.7cm
- A3 Sized Plot 29.7cm x 42cm
- A2 Sized Plot 42cm x 59.4cm
- A1 Sized Plot 59.4cm x 84cm
- A0 Sized Plot 84cm x 118.9cm
- B sized sheets will only be allowed under special circumstances.

E.4.3 Text and Font Format

Always use Arial type for both text and dimensions.

Text should always be 1.8mm, 2.5mm, 3.5mm, 5mm, 7mm or10mm at final plot scale

E.4.4 Special Entity Requirements

Common symbols, doors, WC's, windows, equipment, etc, shall be blocks. Consultants shall use predefined blocks when provided by the University. All blocks shall be created in layer 0. Blocks must not contain any embedded layers. Block insertion point must be 0,0. All colour to be "By Layer". All Linetype to be "By Layer"

Entities to be shown as blocks:

- All Plumbing & Fixtures eg water closets, urinals, lavatories, tubs, grab bars, accessories, mirrors
- All Electrical Devices & Hardware eg lighting fixtures, switches, outlets, panels
- Mechanical Equipment eg supply diffusers, return grilles, thermostats, air handlers
- Doors (insert with scale set to door size)
- Windows (insert with scale to window size)
- Equipment, type II * II
- Furniture
- Drawing Symbols
- Door and window marks, room # indicators, scale indicators, north arrows

E.4.5 Dimensioning

All dimensions shown in the project submittals shall be fully associative and must not be exploded. Dimension definition points should be located with an appropriate Object Snap (End Point, Mid-Point, etc) or otherwise located precisely on the project geometry. Manual input of dimension text or otherwise overriding the actual dimensions is NOT acceptable in submittals to the University.

The dimension style is "Ticks" with a variation called "Arrows" for Leaders with thicker arrowheads.

All buildings are to be set out 3 dimensionally from at least two known reference points. Small scale set-out drawings are to be dimensioned to structural elements, not finished faces of linings, unless alignment of finished faces with existing surfaces is required.

E.4.6 Lifecyle, Fill and Hatch Patterns

All hatching and linetypes must be metric [acadiso.lin, acadiso.pat] imperial linetypes are not to be used in any circumstances.

All hatching is to be associative and must not be exploded.

No rasterized images will be acceptable for either text or drawing files. Vectorized fill patterns are acceptable. Limit excessive use of hatch patterns to avoid unnecessarily large files. All consultants are responsible for keeping file sizes within manageable limits. Refer to section 2.6 for copy and compression formats.

E.4.7 Line Weights and Pen Assignments

All Submittals to the University shall have colours set by layer, not by entity, and a plot style file to assign line weights for each colour is to be created

Consultants should Submit a Plot style file (*.Ctb) with the dada deliverable package.

E.4.8 Prototype Drawing Files

The University shall provide Prototype drawing files and symbols when required by the consultant. These may include, but not be limited to: typical title sheets, formatted drawing files with layering standards, drawing symbology and other blocks.

E.5 Layering

The following USC layer naming convention must be used for all AutoCAD files.

The colour and line type assignments for the layers are provided to support University of the Sunshine Coast personnel in producing consistent hard copy output from the electronic submittals. Consultants are solely responsible for the production and appearance of their hard copy submittals.

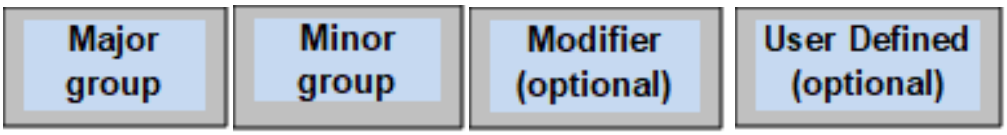
All layering names and information within shall coincide with the following guidelines. Only applicable layers are to be used. Blank layers are not to be included in the electronic data deliverables. If reference files are used, refer to section 2.7 for additional direction.

Where the nature of a project or drawing requires it, consultants may propose expansions of the layering guidelines. The proposed expansion shall be submitted in writing to the Manager, Capital Projects and is subject to revision or rejection at the discretion of the University.

Accepted expansions of the layer name guidelines may be included in future revisions of the University of the Sunshine Coast Competitor Aided Design Guidelines at the discretion of the University.

Layer names are subdivided into 4 sections including:

Major, **Minor**, **Modifier** and **User Defined** as shown below:



X-XXXX-XXXX-XXXX

E.5.1 Major group

Major group headings shall define the layer's discipline as follows:

Code	Discipline
A	Architectural
C	Civil
E	Electrical
F	Fire Protection
H	Hydraulic
L	Landscape
M	Mechanical
P	Plumbing
Q	Communications
S	Structural
Z	Space management

Appendix Table 3 - Major Group Label

E.5.2 Minor group

Minor group headings shall define assemblies or construction systems such as walls, doors, ceilings. Below are listed examples of minor group layers. For list all abbreviations refer to section E.6 Abbreviations.

ARCHITECTURAL LAYERS (A-XXXX)

Code	Description	Colour	Linetype
CLNG	Ceiling Elements, Soffits, and Bulkheads	9, Light grey	Hidden
COLS	Structural Columns	6, Magenta	Continuous
DOOR	Doors	4, Cyan	Continuous
DUCT	Ductwork	7, White	Continuous
EQPM	Equipment	8, Dark grey	Continuous
FLOR	Floor Information	7, White	Continuous
FURN	Furniture	8, Dark grey	Continuous
GLAZ	Window, Glass partitions	4, Cyan	Continuous
GRID	Grids	5, Blue	Center
LIFT	Lift Cars	8, Dark grey	Continuous
ROOF	Roof Information	7, White	Continuous
STRS	Stair risers, treads, ramps, arrows	7, White	Continuous

WALL	Wall	1, Red	Continuous
...	...	...	...

Appendix Table 4 - Minor Group Architectural Layers

CIVIL LAYERS LAYERS(C-XXXX)

Code	Description	Colour	Linetype
BLDG	Building	6, Magenta	Continuous
PAVE	Paving, Footpaths, Courts etc	7, White	Continuous
PKNG	Parking Layouts indicators, arrows	9, Light grey	Continuous
PROP	Property Lines and Benchmarks	1, Red	Hidden
ROAD	Roads	7, White	Continuous
SETB	Easements, Setbacks ...	5, Blue	Hidden
TOPO	Topographic info, contours, levels...	8, Dark grey	Continuous
VEGE	Vegetation, soft landscaping	3, Green	Continuous
WATR	Site Water Features, Rivers, Streams	4, Cyan	Continuous
...	...	...	...

Appendix Table 5 - Minor Group Civil Layers

ELECTRICAL LAYERS (E-XXXX)

Also refer to section E.6 Abbreviations

FIRE PROTECTION LAYERS (F-XXXX)

Also refer to section E.6 Abbreviations

HYDRAULIC LAYERS (H-XXXX)

Also refer to section E.6 Abbreviations

LANDSCAPE LAYERS (L-XXXX)

Also refer to section E.6 Abbreviations

MECHANICAL LAYERS (M-XXXX)

Code	Description	Colour	Linetype
HOTW	Hot water		
NGAS	Natural Gas		
...	...	...	...

Appendix Table 6 - Minor Group Mechanical Layers

PLUMBING LAYERS (P-XXXX)

Code	Description	Colour	Linetype
DOMW	Domestic Water System		
GSWR	Grey Water System		
SSWR	Sanitary Sewer System		
STRM	Storm Drain System		
...	...	...	...

Appendix Table 7 - Minor Group Plumbing Layers

COMMUNICATIONS LAYERS (Q-XXXX)

Code	Description	Colour	Linetype
COMM	Communication System		
...	...	...	...

Appendix Table 8 - Minor Group Communications Layers

STRUCTURE LAYERS (S-XXXX)

Code	Description	Colour	Linetype
BEAM	Structural Beams		
FRAM	Framing		
JOIS	Joists		
PURL	Purlins		
RFTR	Rafters		
...	...	...	...

Appendix Table 9 - Minor Group Structure Layers

SPACE MANAGEMENT LAYERS (Z-XXXX)

Code	Description	Colour	Linetype
NOTE	Notes, Call Outs, Keynotes, Leaders	9, Light grey	
PATT	Patterns, hatches indicating occupants (schools, divisions)	Varies	Solid hatches
PBLD	Polylines for Building footprint	5, Blue	Hidden
PGRS	Polylines for Gross floor areas	5, Blue	Hidden
PNET	Polylines for Net areas	5, Blue	Hidden
PUCA	Polylines for Unenclosed covered areas	5, Blue	Hidden
RNAM	Room names, functions	7, White	
RNUM	Room numbers	7, White	
ROCC	Room occupants (schools, divisions, people's names...)	7, White	
TEXT	General Notes & Specifications	7, White	
…	…	…	…

Appendix Table 10 - Minor Group Space Management Layers

All levels of a building are to have a Space Management drawing to define the areas outlined in the Area Definitions table below. These drawings will contain closed polylines of the relevant areas overlaying the Architectural Base plan for that level. This information is subsequently linked to the FMS Space and Asset Management Systems to allow reporting on the data.

AREA DEFINITIONS

Area Name	Definition
Building Footprint Area	Areas measured from the nominal outside face of exterior walls including any minor projections such as columns and the like which project from the normal outside face of exterior walls.
Gross Floor Area	Areas measured from the nominal inside face of exterior walls including any minor projections such as columns and the like which project from the normal inside face of exterior walls.
Net Area	Areas measured from the nominal inside face of internal walls including any minor projections such as columns and the like which project from the normal inside face of internal walls. Net areas include rooms, corridors, voids, stairs, lift-wells, and services risers.

Unenclosed Covered Area	Areas measured between the outside face of exterior walls and external balustrade or columns. When the covering element (roof or upper floor) is supported by columns, cantilevered, or suspended, or any combination of these, the measurements shall be taken to the edge of the paving or to the edge of the cover, whichever is the lesser. UCA includes roofed balconies, open verandas, porches, and porticos, attached open covered ways alongside buildings, under crofts and useable space under buildings, unenclosed access galleries (including ground floor) and any other trafficable covered areas of the building which are not totally enclosed by full height walls. UCA shall not include eaves overhangs, sun shading, awnings connecting or isolated covered ways and the like where these do not relate to clearly defined trafficable covered areas.

Appendix Table 11 - Area Definitions

Consultants are required to produce and/or amend the abovementioned closed polylines on all spaces within each building they are working on. These polylines are to be placed on the appropriate layer according to the table above and the FMS layering standards.

E.5.3 Modifier group

Modifier headings shall further define the minor group headings such as:

GENERIC INFORMATION (X-XXXX-XXXX)

Code	Description	Colour	Linetype
DEMO	Items to be Demolished		
DIMS	Dimensions		
ELEV	Elevation linework		
EXST	Existing elements to Remain		
FIXD	Fixed items		
IDEN	Identification numbers, codes etc		
LEVL	Levels, RL's etc		
MBND	Materials Beyond cut in Section		
MOVE	Movable items		
NEWW	New Work in existing Buildings		
NOTE	Notes, Call Outs, Keynotes, Leaders		
NPLT	Non plotting Information		
OTLN	Outlines, rooms floors, roofs, buildings etc		
OVER	Items over the work plane		
PATT	Hatches, Patterns, Tones		

SCHD	Schedules, lists etc		
SECT	Section linework		
SYMB	Detail symbols, north points, section lines	11	
TEXT	General Notes & Specifications		
TTBK	Titleblock info (fixed information)		
TTLS	Title info (variable)date, dwg number, etc		
UNDR	Items under the work plane	UNDR	
VPRT	AutoCAD Viewports	VPRT	Autocad Viewports

Appendix Table 12 - Modifier Group Generic Information

Modifier headings shall further define the minor group headings such as:

MATERIAL INFORMATION (X-XXXX-XXXX)

Code	Description	Colour	Linetype
BLOK	Blockwork		
BRIK	Brickwork		
CONC	Concrete		
METL	Metal Work, Handrails		
STEL	Steelwork, structural		
...	...	...	...

Appendix Table 13 - Modifier Group Material Information

E.5.4 User Defined group

Modifiers and user defined characters are options provided for extended clarification. Most layers on small projects will only require five-character major/minor format. However, user defined characters may be used to add further options such as different plotted colours, linetypes or line thicknesses beneath minor group

E.6 Abbreviations

E.6.1 Minor group

All minor group headings shall comply with the following abbreviation outline:

ABLT - Anchor Bolts
ACID - Acid, Alkaline, And Oil Waste Systems
ALRM - Alarm System
AREA - Area Calculations & Occupancy Info

AUXL - Auxiliary Systems
BELL - Bell System
BLDG - Building Foot Print
BRIN - Brine System
CCTV - Closed Circuit Television
CHIM - Prefabricated Chimneys
CLNG - Ceiling Information
CLOK - Clock System
COMM - Telephone & Communication System
CMPA - Compressed Air System
COLS - Columns
CO2S - Co2 System
CTRL - Control & Instrumentation System
CWTR - Chilled Water System
DATA - Data System
DETL - Details
DICT - Central Dictation System
DOMW - Domestic Hot & Cold Water System
DOOR - Doors
DUST - Dust & Fume Collection System
DIMS - Dimensions
ELEV - Interior & Exterior Elevations
ENER - Energy Management System
EQPM - Equipment
EXHS - Exhaust System
FIRE - Fire Protection or Alarm System
FIXT - Fixtures
FLOR- Floor Information
FNDN - Foundation
FRAM - Framing Plan (Beams & Joists)
FUEL - Fuel System Piping
FURN - Furniture
GLAZ - Windows & Curtain Walls
GRID - Column Grid
GRND - Ground (Elec.) and/or (Planting)
GSWR - Grey Water System
HALN - Halon System
HOTW - Hot Water Heating System
HVAC - HVAC System
INTC - Intercom System
IRRG - Irrigation System

LEGN - Legend of Symbols
LLIN - Single Line Diagram
LTNG - Lighting Protection System
MACH - Machine Shop Equipment
MDGS - Medical System
METL - Miscellaneous Metal
NGAS - Natural Gas & Storage Tanks
NURS - Nurse Call System
NOTE - Notes, Call Outs, & Keynotes
PGNG - Paging System
PKGN - Parking
PLNT - Planting
POWR - Power
PROC - Processing System
PROP - Property Line
PROT - Fire Protection System
REFG - Refrigeration System
RISR - Riser Diagram or Plan
ROAD - Roads
ROOF - Roof
SANR - Sanitary Drainage
SCHD - Scheduled & Title Block Sheets
SECT - Sections
SERT - Security System
SHBD - Sheet Boarder & Title Block Line Work
SITE - Site Improvements
SLAB - Slab
STEM - Steam Systems
STRM - Storm Drain System
SPCL - Special System
SPRN - Fire Protection Sprinkler System
SSWR - Sanitary Sewer
SOUN - Sound or Pa System
STAN - Fire Protection Standpipe System
SYMB - Symbols, Bubbles, And Targets
TEST - Test Equipment
TOPO - Proposed Contour Lines & Elevations
TVAN - Television Antenna System
TREE - Tree
TEXT - General Notes & Specifications
WALK - Walks and Steps

WALL - Walls
WATR - Domestic Water

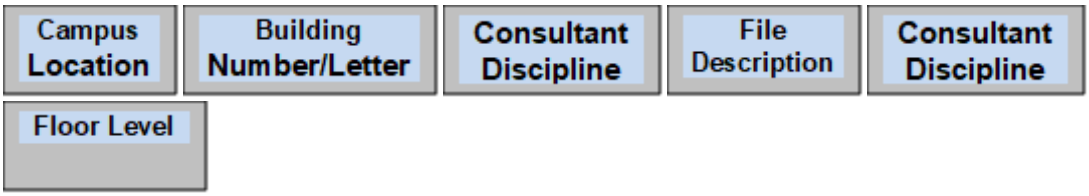
E.6.2 Modifier and User Definitions

ACCS - Access
ALRM- Alarm
APPL - Appliances
BEAM - Beams
BEDS - Landscaping Beds
BORE - Test Borings
BRDG - Bridges
BRNG - Bearings & Distance Labels
BUSW - Busways
CABL- Cable Trays
CARS - Graphic Illustration of Cars
CASE - Casework
CDFF - Hvac Ceiling Diffusers
CEQP - Compressed Air Equipment
CHAR- Chairs & Other Seating
CIRC - Circuits
CNTR - Centerlines
CONP - Steam Systems Condensate Piping
CONS - Construction Controls
COVR - Coverage
CPIP - Compressed Air Piping
CURB - Curbs
CLNG - Ceiling
CTRL - Controls
DECK - Decking or Decks
DEMO- Existing to Be Removed
DEVC - Devices
DIAG - Diagram
DIMS - Dimensions
DRAN - Drainage System or Indication
DUCT - Duct Work
DHED- Door Header
EDGE - Edge of Perimeter
ELEV - Elevation or Elevated Surface
EMER- Emergency
EQPM - Equipment

EQUI - Equipotential System
ESMT - Easements, Right-of-Way & Set Backs
EVTR - Elevator Equipment
EXIT - Exiting
EXST - Existing to Remain
FEED - Feeders
FENC - Fencing
FILE - File Cabinets
FIXD - Fixed
FIXT - Fixtures
FLDR - Floor Drains

E.7 File Naming

All files included in the electronic data deliverable package will conform to the following file naming convention. Alternative file naming conventions may be utilised only with prior written approval of a detailed alternative. Approval of alternate naming conventions is solely at the discretion of the *University*.



XX-XXX-XX-XXXX-XX.DWG/PDF

E.7.1 First, and Second Characters

XX-XXX-XX-XXXX-XX.DWG

First and second characters on all file names will identify the campus or study node where the works are located. The main campuses and study nodes and codes to be used are as follows:

Code	Campus/Study Node
SD	Sippy Downs
FC	Fraser Coast
CA	Caboolture
GY	Gympie
MB	Moreton Bay

NJ	Noosa J
MD	Maroochydore
SB	South Bank
BT	Birtinya
HP	Sunshine Coast University Hospital

Appendix Table 14 - Campus Location Code

Table reference

E.7.2 Third, Fourth and Fifth Characters

XX-**XXX**-XX-XXXX-XX.DWG

Third fourth and fifth characters on all file names will identify the building number or name. For new developments, the building numbers shall be obtained from the USC Facilities Management Department. One- and two-digit building numbers/names shall be preceded by leading 0's to provide three (3) character building numbers.

E.7.3 Sixth Character

XX-XXX-**XX** –XXXX-XX.DWG

Sixth character on all file names will identify the applicable consultant discipline. They are as follows:

Code	Discipline	Code	Discipline	Code	Discipline
AS	Accessibility	**LG**	Legal	**AU**	Authorities
AC	Acoustic	**LT**	Lighting	**BC**	Building Certification
AD	Administration	**LX**	Logistics	**CO**	Contract Administration
AR	Architectural	**ME**	Mechanical	**DC**	Document Control
CV	Civil	**OM**	Operations & Maintenance	**DF**	Dry Fire
CM	Commissioning	**PD**	Plumbing & Drainage	**ES**	Erosion and Sediment
CS	Cost	**PC**	Procurement	**FC**	Facade
EW	Earthworks	PM	Project Management	**GS**	Gas
EL	Electrical	**SG**	Signage	**IF**	Internal Finishes
EN	Environmental	**ST**	Structural	**JO**	Joinery
FN	Finance	**SY**	Surveying	**LD**	Landscape and Urban Design
FE	Fire	**UT**	Utilities	**MT**	Mass Timber
FF	Furniture Fixtures & Equipment	**VT**	Vertical Transport	**PL**	Planning

GT	Geotechnical	**PV**	Pavement	**PU**	Public Utilities
HZ	HAZOP	**RM**	Risk Management	**QY**	Quality Assurance
HS	Health & Safety	**RO**	Roadway	**QS**	Quantity Surveying
HV	HVAC	**TF**	Traffic	**SR**	Sewerage and Waste Management
HY	Hydraulic	**AV**	Audio Visual	**SF**	Signs, Line marking and Road Furniture
SF	Signs, Line marking and Road Furniture	**ESD**	Environmentally Sustainable Design	**TW**	Temporary Works
SW	Stormwater Drainage	**FO**	Fit out	**TM**	Transport Modelling
SS	Streetscape	**IC**	Independent Certification	**WA**	Water
SC	Stakeholder Consultation	**IT**	Information & Communications Technology (ICT)	**WF**	Wet Fire
				WS	Work Health & Safety
				SU	Security

Table 26 - File Description Code

E.7.4 Seventh, eighth, ninth and tenth Characters

All master files will use the last four digits of the drawing name.

XX-XXX-X-**XX**XX.DWG

The first two digits will identify the type of sheet as follows:

Code	Drawing name	Code	Drawing name
GE	General	**RP**	Roof Plan
AX	Axonometric	**SP**	Site Plan
SE	Building Sections	**UI**	Utilities Infrastructure (Campus wide)
RC	Reflected Ceiling Plan	**WS**	Wall Sections
DE	Detail	**DP**	Demolition Plan
EL	Exterior Elevations	**EP**	Existing plan
FP	Floor Plan		
IE	Interior Elevations		

Table 27 - Discipline Code

The last two characters will identify the floor, elevation, section, or detail number:

XX-XXX-X-XX**XX**.DWG

E.7.5 Example

A Level 2 Reflected Ceiling Plan prepared by the consultant Architect for works located in Building B on the Moreton Bay campus would be named as follows:

MB-00B-AR-RC02-00.PDF

APPENDIX F – CHECKLISTS

F.1 Fume Cupboard Checklist

Fume Cupboard Checklist			
Location:			
No.	Feature	Requirement	Comment
1	Construction material		
2	External dimensions (WxHxD)		
3	Sash height		
4	Number of GPO's required	4 per fume cupboard	
5	Number of sinks required	1 per fume cupboard	
6	Sink dimensions (WxHxD)		Preferably small sinks in the fume hoods in the teaching labs with slightly bigger ones in the prep lab
7	Work surface material (Tiles, Stainless Steel, Epoxy, Laminate, Trespa)		No stainless steel
8	Apparatus scaffold required (Y/N)	Yes	
9	Gas services required – type and number	1 per fume cupboard	LPG
10	Gas services required – type and number		
11	Gas services required – type and number		
12	Gas services required – type and number		
13	Compressed air required – number		
14	Vacuum required – number		
15	Scrubber required (Y/N)	1	At least one available in Science teaching workspace for class preparations
16	Processed chilled water required (Y/N)		

17	Under-bench flammable Class 3 cabinet required (Y/N)		
18	Under-bench corrosive Class 8 cabinet required (Y/N)		
19	Solvent recovery system required (Y/N)		
20	High vacuum cupboard and connection required (Y/N)		
21			
22			
23			
24			
25			