

University of Wollongong

Western Building

State Significant Development
Application Report – Electrical
Services Schematic

Rev C | 5 October 2017

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1 Introduction

The new Western Building will be a landmark development for the University of Wollongong (UoW) campus. It will be located adjacent the campus Ring Road at the western end of the campus. The proposed project will accommodate the diverse functions of The Arts English and Media (TAEM) School and the Health and Society (HAS) School and the School of Geography and Sustainable Communities (SGSC) into a collaborative and engaging hub that will support the ambitions of next generation research and learning. Functions accommodated include specialist teaching spaces, academic and professional staff workplace, informal collaboration spaces as well as other support spaces. The proposed building will be circa 11,000sqm gross floor area across four levels plus a plant level.

This report details the proposed electrical services concept design. The key consideration that has driven the electrical design for Western Building has been to meet the requirements of both an educational building as well as meet the design criteria required for a theatre and performance venue open to the public. This has driven the requirement for critical life safety systems as well as specific electrical infrastructure to theatre spaces which are described further later in this report.

1.1 Key Abbreviations

HV	High Voltage (11,000V electrical supply)
LV	Low Voltage (400V electrical supply)
FOBOT	Fibre Optic Break Out Tray

2 Services Overview and Distribution Strategy

2.1 Site Services Overview

The Western building will be located within the University of Wollongong's main campus.

The proposed site is currently adjacent to the Western car park and is proposed to replace the existing buildings numbered 45 - 60. Demolition works required are not described within this report and will be covered under works separate to this contract.



Figure 1 Proposed Western Building Location

2.2 Existing Electrical Services

There is a number of existing services supplying several demountable buildings.

UoW intends to demolish the existing buildings and clear the site for construction. They will also disconnect and isolate the existing services. This will be undertaken under a separate scope of work from this Project.

Redundant infrastructure shall be safely removed and disposed of by an appropriately qualified and licensed demolition contractor.

The scope demarcation line between demolition and construction works is yet to be determined.

2.3 Proposed Electrical Services Distribution

The main electrical services plant serving the Western building will be distributed across multiple levels. Ground floor will house main fire services electrical plant. The main electrical switchboard and communications rooms are proposed at Level 1. Life safety generator will be situated at external roof level, or adjacent to the building.

Primary reticulation of building services will be routed through centrally located risers formed within the main centre structural core. This will consist of a main electrical riser, A security systems riser and an ICT communication riser adjacent to vertically stacked floor distribution structural cores.

2.4 Energy Sub-Metering

Energy sub-metering will be provided to meet University of Wollongong and BCA requirements.

2.5 Building Management & Controls System (BMCS)

Building management and controls system is envisaged to be part of the mechanical services.

2.6 Items requiring further resolution

The current proposed location of the main switch room is at ground floor between the two large CTA spaces and beneath a stair leading to level 1. BCA guide volume one does not allow occupied spaces beneath a fire escape stair shaft. Further confirmation is required from the architect to determine the functionality of this stair routing above the switch room as either fire escape route or general use only stair.

3 Electrical Services

3.1 Overview

The electrical services schematic design has been developed to provide a dedicated electrical supply which will provide sufficient capacity for the forecast power demand of the building.

A standby generator will be provided as a means of backup secondary supply to life safety system loads in the event of mains failure

A generator is required under the BCA due to the proposed Atrium in the building.

3.1.1 Electrical System Topology

- The electrical system will comprise a dedicated new external packaged 1.5 MVA substation. It is understood that the HV network present across the university campus is provided by Endeavour Energy. It has not been confirmed at this time if sufficient capacity is available and is be subject to application with Endeavour Energy for an HV supply.
- The transformer will supply a 2000A rated building main switchboard.
- General final LV distribution equipment will be located within the electrical riser.
- All distribution equipment will be typically accessible from service corridors.
- Dedicated power distribution boards will be provided to each performance theatre. These will serve both technical power and general small power circuits within the spaces in line with NCC BCA requirements.

3.1.2 Communications System Topology

The communications system will form part of the campus-wide communications network.

The point of connection to the existing network will be advised by the University of Wollongong (UoW) ICT team. Existing in-ground conduits and pits will be utilised where possible. Additional conduit and pits will be provided as necessary.

The proposed lead-in services are telephone services, university network connection and a fire loop. It is yet to be determined the nature of these services, i.e. copper vs fibre. UoW is yet to confirm whether the application to Telstra/NBN will be handled by the design team or UoW FMD.

The preferred origin of supply and the existing site infrastructure will determine the preferred point of entry into the building.

Satellite comm's floor distribution rooms will be provided on each level. Fibre backbone will reticulate to each floor distribution room through the ICT comm's riser / or stacked comms rooms. Final voice/data outlets will be served on a level by level basis and via horizontal copper cabling.

Building management controls and fire services will reticulate through the general electrical risers.

Security system cabling will reticulate within the security systems riser.

3.2 Relevant Standards

The design will be undertaken in accordance with the latest edition of appropriate Australian Standards and UoW guidelines including;

- AS/NZS3000: Wiring Rules;
- AS/NZS3008: Electrical installations – Selection of cables;
- AS1680 (all parts): Interior Lighting;
- AS2293: Emergency Lighting to Buildings;
- AS2067: High Voltage Installations;
- AS61439.1 and AS 61439.2: Low Voltage switchgear and control gear assemblies;
- NSW Service & Installation Rules;
- The relevant Service Rules and Network Standards of Ausgrid;
- AS/NZS 3080 - Telecommunications installations – Generic cabling for commercial premises;
- AS/ACIF S008 – Requirements for Customer Cabling Products;
- AS/ACIF S009 – Installation Requirements for Customer Cabling;
- AS 2053 - Conduits and fittings for electrical installations;
- AS/NZS 4836 - Safe working on low-voltage electrical installations;
- AS 1768 - Lightning protection
- AS 2053 - Conduits and fittings for electrical installations
- AS 2243.7 - Safety in Laboratories – Electrical aspects
- National Construction Code (NCC);
- Work Cover;
- University of Wollongong Design Standards and Guidelines including:
 - Electrical Services Design Standard (FMD-MAI-STA-014).
 - AV Standards & Design Guidelines.
 - Electronic Monitoring & Access Control Design Standard
 - CCTV Design Standard (FMD-MAI-STA-012).
 - Installation & Design Specifications for the Implementation of IT Physical Layer Infrastructure

3.3 Design Criteria

3.3.1 Electrical Supply to the Building

The new substation will be 1.5MVA rated and provide a dedicated supply to the building. The substation will have spare capacity to meet the UoW design guidelines.

3.3.2 Maximum Demand Estimation

The electrical loads have been based on typical figures which have been benchmarked against similar projects. The maximum demand for the project is estimated to be 987 kVA (96 VA/m² overall) or 1283 kVA (124 VA/m² overall) including 30% spare capacity as per the UoW design guidelines.

We note that the demand figure will be updated as the design develops, to address inputs to the design assumptions such as developed floor areas, and modifications to address specific user requirements and replace power density rates with actual equipment data.

Typical Space Type	Power (W/m ²)	Lighting (W/m ²)	Mechanical (W/m ²)
Labs & Studios	150	12-15	40
Dressing, rehearsal, gallery	20-30	10-15	60-80
Performance Space	70	10-12	40
Office Areas / Teaching	40-50	10	40
Circulation / Plant / Store	5-10	8-12	8

Typical applied W/m² values

3.4 Electrical System Descriptions

3.4.1 Substation

A Level 3 Accredited Service Provider is required to be engaged by UoW to undertake the design of the substation and HV works. We recommend for UoW to do so immediately, as we understand that Endeavour Energy have an influx of applications and there may be delays to their standard review process.

The site will be supplied from a new 1.5MVA transformer substation, currently proposed to be located as an external kiosk to the building. Application will be made to Endeavour Energy for the supply.

3.4.2 Underground services

LV and Telecommunications/Security/ELV underground shall be provided to UoW and relevant Australian standards.

Indicatively, the following shall apply:

- All underground conduits will be HDPE and a minimum of 50mm.
- All LV power conduits will be orange in colour.
- All communications conduits will be white in colour.
- All conduits shall be Heavy Duty type.
- Coordination of conduits shall be undertaken to achieve EMI requirements.

3.4.3 Main Switchboard(MSB)

A new Main Switchboard (MSB) will be supplied from the new substation. The MSB will be contained within a Main Switch Room (MSR) and designed in accordance with AS/NZS3000. The MSR will be fire rated 120/120/120, have provision for two diverse outward swinging emergency egress doors from the room and will be provided with a suitable system of ventilation.

The MSB will be sized to provide 30% future capacity however due to space limitation there will be no further foot-print available in the main switchroom to enable the MSB to be extended.

The MSB will be floor mounted modular type, type tested to AS61439 requirements.

The MSB will be a rear access, freestanding cubicle type switchboard of Form 4b construction, ingress protection rating IP42 and fitted with Air Circuit Breakers and Moulded Case Circuit Breakers to suit.

The MSB will be constructed to withstand prospective fault currents as advised by the L3 ASP for a minimum of 1 second in accordance with UoW design standards.

The MSB will supply general power and lighting distribution boards on each floor and mechanical services MCCs within the plant rooms. A 'Life Safety' section of the main switchboard will be provided for supplying power to the life safety services such as smoke extract, fire safety equipment and other services which may be declared a life safety service.

A break before make automatic transfer switch will be provided to allow the standby diesel generator supply to feed life safety loads.

The MSB will comprise:

- 1.6mm zinc-coated sheet steel, Z200 construction;
- IP42 metal enclosure;
- Electric orange finish (X15);
- Free standing – supported on a mild steel channel plinth, galvanised to Z600 with toe out profile, nominal 75mm (h) x 40mm (w) x 6mm thick;

- Surge protection at point of entry;
- Prospective short circuit current rating 50kA for 1second;
- Form 4b;
- Bottom entry/top exit;
- Provision for CT metering and wiring;
- Fixed Generator connection and Automatic Transfer Switch (ATS);
- View windows for infra-red thermal imaging
- The MSB will be provided with 30% spare capacity in rating and circuit breaker provisions.
- Complete with normal operating and life safety chassis (segregated to AS/NZS3000 clause 7.2).
- Complete with a standby power source from the standby packaged generator
- The standby power supply will be connected via an Automatic Transfer Switch (ATS) located within the MSB.
- The standby power supply will support Life Safety loads within the building only, including equipment such as fire pumps, evacuation and mechanical life safety services.
- CTs for meters and space to connect power factor correction will be provided within the main switchboard.
- Meters and monitoring will be provided in compliance with the UoW metering guidelines and BCA.



- Typical Building main switchboard

3.4.4 Earthing

A complete MEN electrical earth cabling system for the incoming supply will be provided in accordance with AS3000 requirements.

A dual-purpose communications earthing system (CES) for functional and protective earthing purposes will be designed in accordance with the requirements of AS3000:2007 and S009:2006.

CES earth bars will be provided in each communications room for the connection of ICT cabinets and sensitive equipment

CES earth bars will be provided adjacent to each DB dedicated to supply Audio equipment.

Earthing conductor's insulation will be green/yellow. Earth bars will be located within the communications rooms and will be provided with an earth cable reticulated from the main earth bar located in the main switchroom.

3.4.5 Lightning Protection

A lightning protection risk assessment has been carried out for the building in compliance with AS 1768. It has been determined that there is no requirement for a lightning protection system to be installed at UoW Western Building.

3.4.6 Discrimination

We acknowledge that the UoW design guide require full discrimination between protective devices. However, this may not be necessarily achievable in practice.

We will ensure discrimination in compliance with AS3000 are achieved, and endeavour to improve on the overall discrimination as much as possible.

3.4.7 Final Distribution boards

Split chassis final circuit distribution boards will be provided throughout building on each level within nominated smoke sealed services cupboards / risers and plant rooms.

Distribution boards will supply all lighting and power on the associated level.

Distribution boards will be as follows:

<250A and 10kA: Form 1,

>250A and 10kA: Form 3a.

All distribution boards will be of the dead front type, totally enclosed with insulated busbars. Outgoing circuits will be protected by miniature circuit breakers, with RCBOs provided in accordance with AS/NZS3000.

Final distribution equipment will comprise the following as applicable:

- Split chassis lighting and power distribution boards complete with integral split energy metering;
- Technical power chassis distribution boards complete with integral energy meter;
- Provision for din rail mounted lighting controls (supplied from lighting chassis).
- In line surge filter protection devices will be provided to sensitive final circuits: where advised by the User Groups

- Supplies to security system devices.
- All communication cabinet power circuits;
- All power circuits serving intelligent lighting control equipment and AV power supply circuits;
- Fire detection control and indicating equipment.
- 30% spare capacity (poles and demand);
- Minimum prospective short circuit current (pscc) rating of 20kA for 0.1second – further study to be carried out at later design stage to confirm full system pscc requirements.
- Hinged lockable doors fitted with L & F keys to UoW standard keying system.
- Switchboards will generally be 700mm W x 300mm D x 2000mm H



-
- Typical Final Circuit Distribution boards
-

3.4.7.1 Entertainment Venue Distribution Boards

Technical theatre power distribution boards will be provided to each identified performance theatre. All submains cabling supplying performance theatre distribution boards are required to be supplied by 2-hour fire rated cabling.

Each venue will be supplied via a dedicated submain cable and switchboard in compliance with the requirements of the BCA

3.4.8 LV Power Reticulation

Cabling and cable containment systems will be provided in accordance with AS/NZS3000 and AS/NZS3008. All cables will be copper and reduced sized neutrals will not be used.

Submain LV power reticulation will originate from the MSB.

Life safety services will be served by fire rated cables. The cable containment and associated support system will be fire rated to match the cable installation. WS52 integrity will be provided as a minimum as defined in AS/NZS3013.

Horizontal LV power cabling will reticulate on a cable containment system from the MSB to the main electrical risers as indicated on the layout drawings. The type of containment system

will be determined based upon the cable weight which is to be supported. The maximum kg/m and span distances will be considered in accordance with manufacturer requirements.

- Cable ladder will be used to support all submains cables and life safety services;
- Cable tray and catenary will be used to support all LV final circuits.

On each level, LV power will reticulate to each distribution board via cable containment within at high level via circulation routes.

All submain cables supplying distribution equipment will be complete with cable identification labels at all termination points including:

- General power / life safety annotation;
- Cable size / type / purpose;
- Origin of supply;
- Destination.

Routes for final circuit power supplies is yet to be determined and will be subject to architectural planning and each space type. Final circuit reticulation will be further defined at the next design stage.

Cable containment (ladders, tray, basket, catenary etc) is proposed to be provided with spare capacity.



- Typical Cable containment systems

3.4.9 Voltage Drop

The maximum voltage drop to the final sub-circuit is limited to 7% (rather than 5%). AS/NZS3000 Section 3.6 (Voltage Drop) stipulates that voltage drop may exceed 5% where a substation is dedicated to the premises.

3.4.10 Power Monitoring and Meters

UoW are yet to confirm if Western Building is required to be connected to a site wide metering system.

The metering system will be a BMCS based or stand-alone system. This will be determined in coordination with the mechanical engineer.

The key points of the metering system will be:

- The MSB incomer will be metered allowing overall consumption to be monitored. The functional level will provide energy monitoring and power quality. The proposed meters will be equivalent to EDM1 Mk10E Current Transformed, 3 phase meter.
- The Generator incomer will be metered allowing overall consumption to be monitored. The functional level will provide energy monitoring and power quality. The proposed meters will be equivalent to EDM1 Mk10E Current Transformed, 3 phase meter. Final selection will be by Embedded Network Solutions.
- Each distribution board will be metered. Lighting and power will be metered separately. The functional level will provide energy monitoring (kWh / kVArh / KW).
- Other services such as plant, mechanical, lifts etc. will be provided meters at their incomer, or within the supplying circuit breaker at the MSB. This point will be developed within the detailed design. The functional level will provide energy monitoring to comply with BCA requirements.

3.4.11 Uninterruptable Power Supplies (UPS)

- It is understood that the university do not have a requirement for supplies to UPS systems to any equipment

3.4.12 Power Factor Correction

3.4.12.1 Power Factor Correction System

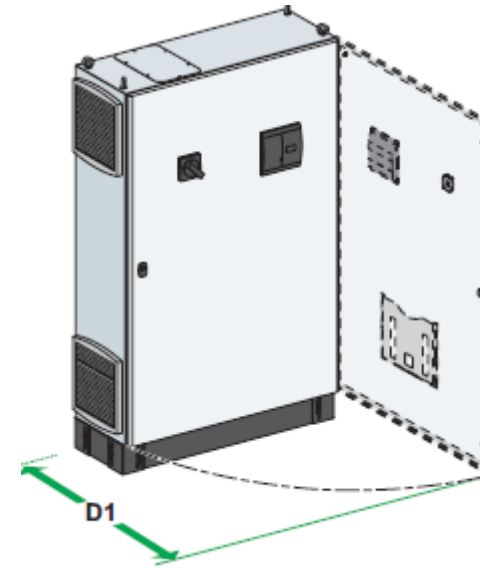
A power factor correction unit will only be provided if required. This will be determined during detailed design.

It is assumed that all motors drivers provided under other disciplines will have internal harmonic filters and power factor correction.

Sufficient space will be provided to accommodate a Power Factor Correction equipment within the main LV switchroom.

A number of factors influence the uncorrected power factor of the building, particularly the nature of load and equipment selections, therefore the power factor unit sizing will be refined as the design is progressed.

Provision within the MSB for PFC CTs, and spatial provision within the main LV switchroom for PFC equipment will be provided.



- Example power factor correction

3.4.13 Generator

3.4.13.1 Generator Rating

A standby generator will be provided to supply power to Life Safety services during a power failure. At this stage it is understood that there is no requirement for any essential or business critical loads by means of backup power supply.

The generator is proposed to support all life safety plant required as identified to us by the fire safety engineer, BCA consultant and mechanical engineer. At this stage the generator has been sized on the following systems identified:

Fire sprinkler

Smoke exhaust

Stair pressurisation

It is our understanding that there are no 'emergency' lifts proposed.

The unit is currently proposed as 150kVA (standby), however this rating will be required to be developed and confirmed as the design progresses and accurate plant loads are determined.



- Typical Packaged Generator set

3.4.13.2 Generator Location

The generator is proposed to be provided as a packaged set and located externally at roof. However, this is subject to review with the Architect.

The generator will be housed in an acoustic enclosure to meet the acoustic requirements defined during the detailed design phase.

3.4.13.3 Generator Switchboard (GSB) & Reticulation

A dedicated GSB is not proposed. The generator will have an enclosed circuit breaker that feeds the Main Switchboard directly.

3.4.13.4 Diesel Generator Load Testing

The diesel generator will be required to be tested to the University's standard maintenance procedures, and to the supplier's requirements. Typically, this would require start up testing monthly, and less frequent (6 month or annual) testing on load.

Planned out of hours' power shut down will be required to facilitate on load testing. The generator/standby power system will be tested using the building life safety loads as this will simulate a supply failure through the entire system.

3.4.13.5 Automatic Transfer Switch (ATS)

Following a power outage, the MSB will lose power. Once the generator is up to speed the ATS will operate and support life safety loads.

When switching back from the generator to the restored mains, there will be a short term power outage.

3.4.13.6 Generator Fuel System

The fuel consumption of the proposed generator is approximately 33 L/hr. An engine-mounted 340L storage tank will provide approximately 12 hours of operation. An overflow / release tank will be mounted below the generator.

A fill point will be provided at ground floor with diesel pipes reticulating directly to the day tank. The pipes shall reticulate in fire-rated riser.

The fill point will have gauges and alarms to assist in minimising risk of over fill or spillage.

The fill point will have a non-return valve with a small compartment for any accidental backflow from the pipes.

3.4.14 Power Distribution

Methods of containment systems for final power circuits within all spaces will be determined at the next design stage once functional use of each space has been investigated. All power circuit containment systems will be designed with sufficient capacity for additional 33% for future installations.

General containment systems may comprise of the following:

- Metallic cable tray – primary distribution from distribution to each space on a floor.
- PVC Dado trunking (compartmental) – cellular office, meeting, studios, labs.
- Floor void / floor screed trunking – class rooms, flexible learning and function rooms.
- Metallic / PVC conduit – Plant rooms, store rooms, circulation, final fixed equipment.



Dado Trunking

3.4.14.1 General Power and Data

Small power outlets will be installed throughout the facility and will be RCD protected as required by AS/NZS3000.

All outlets will be Clipsal, HPM or equal approved.

The following maximum circuit loadings will apply:

5No. 10A GPO's per circuit will be adhered to in non-air-conditioned areas;

8 No. 10A GPO's per circuit will be adhered to in air-conditioned areas;

6 – 8 workstations may be grouped on one circuit

Cabling will be concealed in all instances unless considered not reasonably practicable.

All fixed appliances such as lab equipment, theatre AV equipment such as dimmer racks, hot water systems, mechanical equipment etc. will have the fixed wiring terminating in an isolating switch situated within 1m of the unit in an accessible location. All isolating switches will be engraved to denote duty.

Cleaners outlets will be on dedicated circuits and be placed as deemed necessary.

3.4.14.2 Plant space

All outlets within mechanical plant spaces will be more rugged in nature than general area outlets.

Outlets to electrical and communications rooms will be surface mounted. Outlets will be wired via surface mounted steel conduits.

All outlets will be coordinated with plant and equipment so that they remain accessible and usable.



IP53 plant room GPO

3.4.14.3 External

There will be limited provision for IP56 rated external power outlets, which are to be mounted on the building in nominated locations if required (assumed at roof level for maintenance only at present).

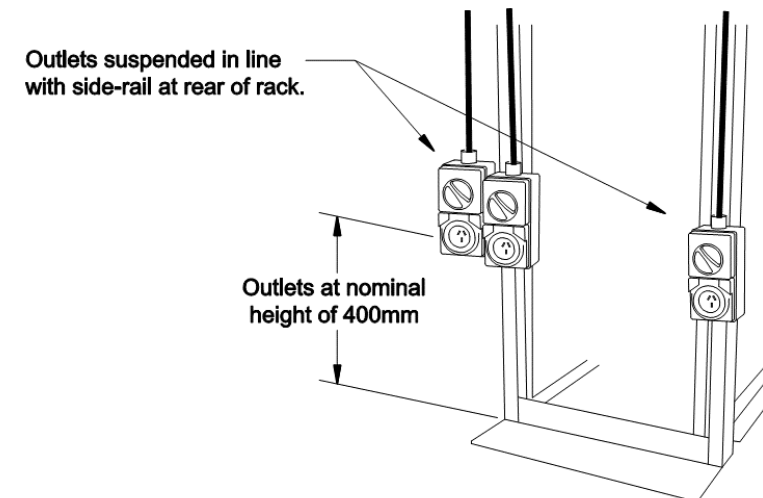


IP56 GPO – External areas

3.4.14.4 Power to ICT cabinets

20A IP56 pendant type GPO's will be provided to each ICT cabinet within the main and floor distributor rooms. The number of outlets will be determined by the equipment to be installed within the racks.

An additional 10A DGPO will be provided for general purpose use / diagnostic equipment.



Suspended power to ICT cabinets

3.4.14.5 Theatre & Rehearsal Space

Full power requirements to performance areas are to be determined at the next design stage through consultation with the theatre consultant.

Rehearsal spaces will require 1 No wall mounted 3-phase 40A power outlet on a dedicated circuit. Final location will be determined with the university, ideally located in corner of room or space.

3.5 General Lighting

3.5.1 General

This section of the report includes proposed lighting strategies for key areas.

All work shall meet all the requirements of national and local authorities and shall be in accordance with the following, and any other relevant standard, in so far as they apply to the work:

- Australian Standards AS1680 Interior and workplace lighting
- National Construction Code (NCC) Section J
- AS1158 Lighting for roads and public spaces
- AS4282 Control of the effects of obtrusive lighting

The power density for the lighting design will comply with Part J6 of the NCC and relevant ESD sustainable targets.

LED technology will be utilised to reduce energy consumption and limit the frequency of maintenance throughout the life of the building.

3.5.1.1 Lighting Character and the Lit Effect

Whilst meeting the brief for the functional spaces, the lit interior will be considered in parallel to the proposed transparency of the building. This is crucial in controlling how the building is perceived from the exterior. The control of brightness adjacent to windows, colour temperature and final luminaire locations are to be carefully considered and developed during the next work stage.

Where required, lighting systems are to complement the different levels of flexibility within the various areas in the selection of luminaires and lighting controls systems.

3.5.1.2 Office Accommodation

Luminaires for office-type spaces will be suspended fittings with both direct and indirect lighting components. Luminaires will be suspended using gripple wire or similar



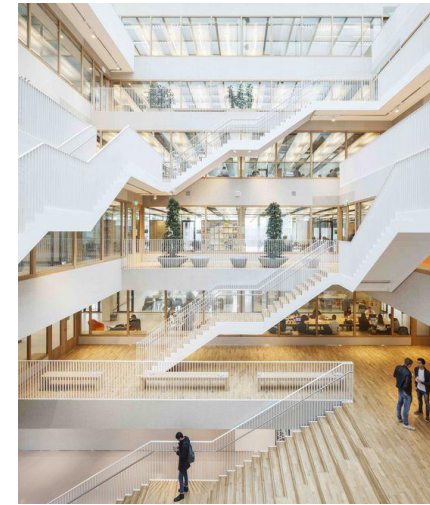
Suspended Direct / indirect luminaires within office areas

3.5.1.3 Entry / Lobby areas

In general, the luminaires are to enhance and compliment the natural daylight that filters through the skylight and the void spaces and the architecture of the building. The lighting within the lobby areas is proposed to be tuneable white light 2700-6000k that reflects the natural variations in daylight.

Lights will be specified to either be recessed or surface mounted depending on the ceiling material. To aid in wayfinding propose to include handrail lighting to the staircase.

The lobby areas also have small informal meeting and furniture areas, these areas will have a variation of lighting typologies to suit the task. Some areas like in booths have the potential to include localised switches.



Filtered light through space



Booth seating and bench seating with localised light

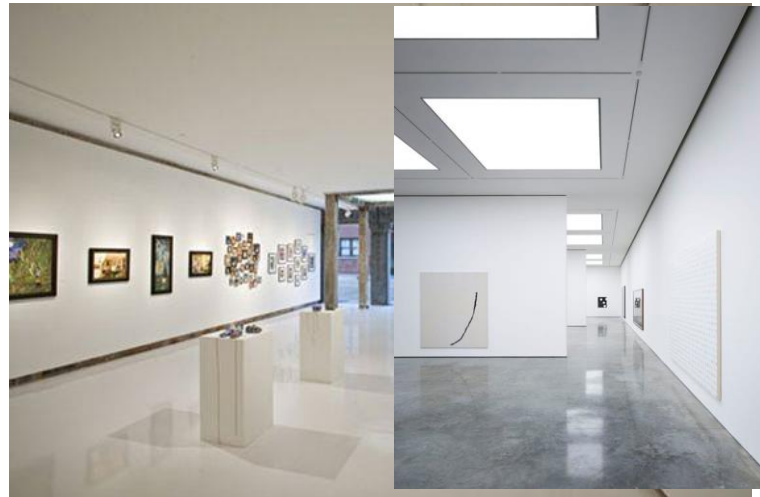


Linear lighting incorporated into ceiling details

3.5.1.4 Gallery and Exhibition space

The Gallery and Exhibition Spaces will require a level of flexibility, for highlighting exhibitions as well as good general light levels.

A suspended track with indirect up lighting and adjustable spot lights is proposed for the perimeter and a general diffused light source for general lighting.



Track and diffused lighting for gallery spaces

3.5.1.5 Large and Small theatre

The Large and small theatre spaces require multiple layers of lighting

Work light – High level lighting 5000k 600lux at

House light – Architectural lighting 3000k with dimming capabilities to 0

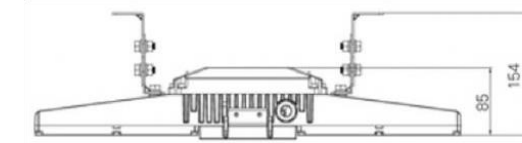
Blue light – low and high level blue LED light for working during performances



House light – underside of catwalk – TBC
Arcsystem Pro One Cell with GDS driver



Blue Light - fixed to side of catwalk or wall TBC



Work Light – in black slim highbay fixed to ceiling

3.5.1.6 LAB and Studio spaces

The lab and studio lighting systems are to complement the different levels of flexibility within the various areas in the selection of luminaires and lighting controls systems.



Nominal dimensions (mm)

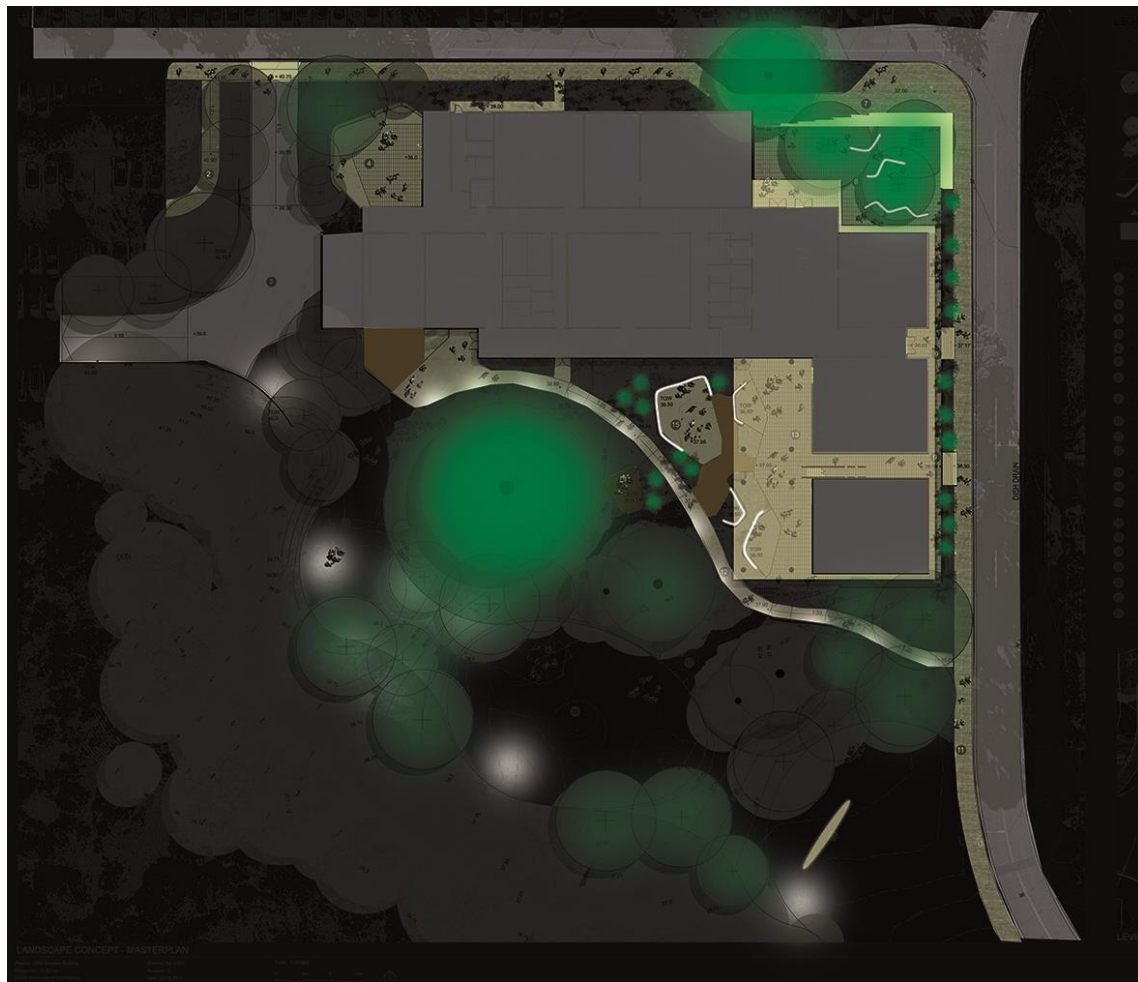
FITTING	FITTING DIMENSIONS				WEIGHT KG.
	A	B	C	D	
ETB 600 x 300	593	293	118	99	4.0
ETB 600 x 600	593	593	142	120	5.1
ETB 1200 x 300	1193	293	118	99	5.8
ETB 1500 x 300	1493	293	118	99	7.5

LED troffer light for Studios and LABs

3.5.1.7 External/Security Lighting

External lighting shall be required to be coordinated with the landscaping and security aspects for the site. For security purposes the external areas shall be required to be illuminated to adequate levels for security, deterrence, CCTV operational purposes, and user amenity. The University have recommended that the superseded Australian Standard 4485.1-1997 shall be used as a reference for required lux levels.

The external lighting details shall be required to be confirmed in the detailed design phase, but shall be selected to meet UoW requirements, including the preference for reputable and warrantied LED type fittings .



External landscape lighting plan to be further developed with Architect and Landscape Architect

3.5.1.8 Exit and Emergency Lighting

Emergency and Exit lighting will be provided in accordance with AS2293.

In general, emergency luminaires will be provided with self-contained 120 minute batteries. With the exception of the theatres, emergency lighting will be dedicated non-maintained LED luminaires. For theatres, a combination of maintained and non-maintained LED luminaires

will be used for house lighting. Maintained LED luminaires will consist of internally illuminated exit signage and lighting within aisles/steps during performance use operation.

The exit and emergency lighting luminaires will be monitored and tested by a Legrand Axiom central system in accordance with UoW standards. Additional software will be provided to carry out the monthly, 6 monthly and annual testing and reporting.

3.5.2 Lighting Control

3.5.2.1 General

Lighting control in the new Western building will be achieved with a combination of standard hard-wire switching and an intelligent, addressable lighting control system. Timers, daylight control and PIR sensors will be used to minimise energy usage. The lighting control system will be interfaced to the Building Management Control System (BMCS), security and AV systems.

The control of all general lighting within the facility will be managed by a Phillips Dynalite system that may incorporate DALI programmable control where required.

Luminaires will be controlled via local switches, passive infrared detectors / light level sensors, time clock scheduling, photocell control, lighting control panels and scene plates.

The lighting control system will provide timing, scheduling and control within all areas of the building and externally as required via time clock and/or photocell.

After hours security lighting will be considered for the public spaces to allow safe movement when the lights are off.

24-hour security lighting will be located at building entry points.

3.5.2.2 Back of House & Amenities

Infrequently accessed spaces will be provided with absence detection to reduce energy consumption, whilst maintaining occupant safety. These systems will be provided with local retractable switches to turn the lights on.

Lighting in amenities will be controlled via absence sensors installed in each amenity. Absence sensors will be set to 30minute time out.

3.5.2.3 External Lighting

External lighting will be time clock and light sensor controlled. A manual override with a BMCS interface will be provided at the external lighting distribution board.

3.5.2.4 Meeting / Seminar Rooms

Scene setting will be achieved through a local lighting control interface/touch screen. Luminaires will be DALI dimmable and addressable to allow for future flexibility and zoning as required by the AV consultant.

3.6 Communications Services

3.6.1 Standards, Codes, Authorities and Guidelines

The communications services design and works will meet all the requirements of all national and local Statutory Authorities and will be in accordance with, but not limited to, the following:

- National Construction Code (NCC);
- Installation & Design Specifications for the Implementation of IT Physical Layer Infrastructure at the University of Wollongong;
- AS/NZS 3080 - Telecommunications installations – Generic cabling for commercial premises;
- AS 3084 - Telecommunications installations – Telecommunications pathways and spaces for commercial buildings;
- AS/ACIF S009:2006 - Installation requirements for customer cabling (wiring rules).

3.6.2 Delineation of Services

The delineation between the base building provisions (designed by the consult) and fitout (designed by the University) for IT and telecommunications services is defined as follows:

Base Building

- Communications room space planning;
- Structured cabling including horizontal and backbone cabling;
- Work area and wireless access point outlets;
- Communication racks and reticulation;
- Communications earthing;
- MDF and IDF frames.

Fit out

- Incoming communications
- File Servers;
- Configuration of the IT network (by the UoW IT department);
- Preferred vendors, approved equipment and configurations;
- User software servers;
- Voice services including headend and handsets;
- Switches, routers and modems;
- Common Wireless Local Area Network;
- Wireless networks including headend;

- Mobile phone coverage systems.

3.6.3 Incoming Services

UoW confirmed that several incoming connections are required.

Telecommunication services will be required, The services provider is yet to be determined. This will be either Telstra or NBN.

Fibre connection from UoW Data Center is required. Details to be confirmed by UoW

Fibre loop connection is required. Details to be confirmed by UoW

3.6.4 Incoming / Main Communication Room (MCR)

One incoming communications room is proposed, housing UoW communications services and MDF. Incoming communications services will be fed into this room and distributed as required to various parts of the building.

The room is proposed to be located at Level 1.

3.6.5 Floor Communications Rooms (FCRs)

To keep the horizontal cabling to less than 90m, FCRs will be provided on each floor where required.

These rooms will house equipment cabinets containing network switches and the patch panels at which vertical and horizontal cabling belonging to the structured cabling system is terminated.

3.6.6 Mobile Phone Coverage

No allowance has been made for carrier mobile phone signal boosting equipment.

3.6.7 Cable routes and risers

Space will be provided for vertical and horizontal cable routes in dedicated spaces throughout the building to facilitate the distribution of backbone and horizontal cables that will be supported on cable basket/tray for the main reticulation routes and supported on catenary wire or in conduit elsewhere.

Communications rooms will be vertically stacked where possible, and a riser will be located within the communications rooms to allow the vertical backbone reticulation throughout the building FDRs. It is understood that no diversely routed redundant backbone cabling to FDR's is required.

Wherever possible, cable routes for backbone and horizontal cabling will be provisioned in back of house areas, areas where public access is limited or corridors. This will allow maintenance works to be carried out away from laboratory areas with minimal impact on the building users.

3.6.8 Communications Rooms Power Supply and UPS

We understand that there are no UPS requirements for this building.

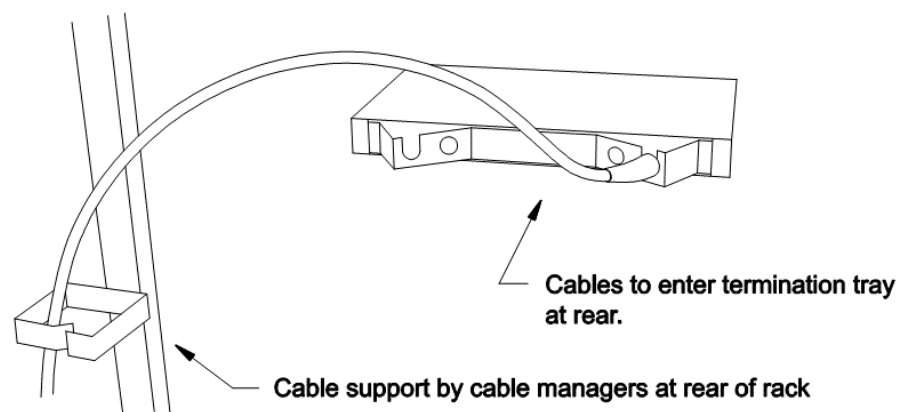
3.6.9 Backbone Cabling

Fibre optic cables will be used as the backbone cables to connect the MCR to each of the FCRs through the riser within each FCR.

No redundant or alternate connections / routes are proposed.

All backbone cabling between communications rooms will be run on cable trays or basket. Where cable trays are not accessible or permitted, wiring will be carried in conduits.

It is proposed to use 12core multi-mode OM4 optical fibre for all backbone cabling. Fibre optic cables will be terminated into 24port FIBOTs with SC connectors.



Fibre termination typical detail

3.6.10 Horizontal Cabling

Unshielded (UTP) Category 6A cabling is proposed for horizontal cabling distribution. The horizontal cables will emanate from the RJ-45 copper patch panels located in FCRs and are terminated at Category 6A RJ-45 socket outlets located at user and equipment locations.

3.6.11 User Data Outlets

In general, data outlets will be provided in accordance with the user group requirements which are yet to be determined. Other systems such as WLAN access points and CCTV cameras will also require telecommunications outlets and will be wired back to the nearest FCR.

3.6.12 Voice Services

Voice services will be done over internet protocol (VoIP)

A small number of traditional copper telephone lines will be provided as required for a number of discrete applications such as lift intercoms, fire alarm panel and back-up to critical systems as required.

3.6.13 Wi-Fi Coverage

Wi-Fi coverage will be provided in locations determined by UoW.

Wireless access points will be surface mounted to false / suspended ceilings. Alternatively, within areas of exposed ceilings, routers will be mounted directly to the soffit or to the underside of electrical ICT comm's containment where suitable.



Cisco Aironet 3800i wi-fi router

All Wi-fi routers will be provided and installed by UoW.

3.6.14 Master Clock System

No allowance has been made for a master clock system.

3.6.15 Public Address System (PA)

No allowance has been made for PA. Refer to Dry Fire section for details of emergency warning systems.

3.7 Security Services

3.7.1 Standards, Codes, Authorities and Guidelines

The security services design and works will meet all the requirements of all national and local Statutory Authorities and will be in accordance with, but not limited to, the following:

- National Construction Code (NCC);
- University of Wollongong Electronic Monitoring and Access Control Design Standards
- University of Wollongong Closed Circuit Television Design Standard (FMD-MAI-STA-012);
- Installation & Design Specifications for the Implementation of IT Physical Layer Infrastructure at the University of Wollongong;
- AS/NZS 3080 - Telecommunications installations – Generic cabling for commercial premises;

- AS 3084 - Telecommunications installations – Telecommunications pathways and spaces for commercial buildings;
- AS/ACIF S009:2006 - Installation requirements for customer cabling (wiring rules).

3.7.2 General

A new Gallagher security system will be installed within the building, linked to the UoW security network.

The system will consist of head end controller, intelligent field processing units (FPU's) and field devices.

The security equipment is to be housed within a dedicated security riser located in the central core rising from ground floor to roof level.

3.7.3 Electronic Monitoring and Access Control

Electronic Monitoring and Access control will be provided at security doors throughout the building. FPU's will be used to communicate with the end units which will consist of:

- Card access readers;
- Break glass points;
- Electronic door locks
- REED Switch
- Reader input / output;
- Lift access equipment;
- Alarm monitoring input / output panels and equipment;
- Remote alarming terminals (key card);
- Alarm response equipment.

All hardware, software and field devices will be Gallagher compliant and approved.

The electronic monitoring and access control system will be time programmable permitting secure periods. The system will be expandable in nature, allowing future sub-systems to be integrated.

The security configuration for the door types throughout the new building, including the lift system, will be designed in accordance with the UoW design standards and user requirements.

The electronic monitoring and access control system will interface with the following systems in accordance with the UoW design standards and user requirements:

Fire (low level);

Lifts (high level);

Automatic doors (low level);

Ventilation (High level)

On designated paths of egress, door locks will be free egress type. Where magnetic locks are used, a local override break glass will be provided so as not to inhibit the egress path in the event of an emergency.

3.7.4 CCTV

The new CCTV system will be IP based and will allow for integration into the UoW CCTV system over the UoW IT network.

The systems will be expandable to allow for future installation of devices as necessary.

The CCTV system is to be designed in accordance with the UoW design standards and user requirements.

The CCTV security system will interface with the electronic monitoring and access control system and the intercom system.

4 Fire Services

4.1 General

As a minimum standard the fire safety systems will be generally designed to University of Wollongong Design Guideline Requirements, BCA deemed to satisfy requirements, and the Fire Engineering

The objectives of the provisions of the Building Code of Australia (BCA) for fire-fighting equipment and services are the following:

- Safeguard occupants from illness or injury while evacuating during a fire;
- Provide facilities for occupants and the fire brigade to undertake fire-fighting operations; and
- Prevent the spread of fire between buildings.

4.2 Regulations, standards and authorities

The fire services systems will be designed in accordance with the following design standards and documents:

- The University of Wollongong - Fire Services Design Standards Version 4 – 2 September 2013
- The University of Wollongong – OH&S Considerations for Design Guidance (WHS Design and Modification Guidelines) OHS064.9
- Building Code of Australia BCA.
- AS 1668 – The Use of Ventilation and Air Conditioning in Buildings.
- AS 1670.1 – Automatic Fire Detection and Alarm Systems.
- AS 1670.4 – Sound System and Intercom System for Emergency Purposes.
- Council requirements.
- Fire Engineering Requirements
- Fire and Rescue NSW.
- Work Cover requirements.
- All Health Authority Requirements.

4.3 Building use and classification

- Building use and classification will be listed in the BCA report.

4.4 Systems

- A fire brigade panel (FBP) will be provided in the main entry to the building. (previously FIP)

The dry fire systems will include:

- Fire detection and alarm system (FDAS); and
- An Emergency warning control and indicating equipment (EWCIE) (previously SSISEP)

4.5 Fire Detection and Alarm System (FDAS)

A fire detection system will be provided within the building as per the requirements of AS1670, the BCA, the fire engineered solution (TBA) and FRNSW.

The automatic smoke and heat detection and alarm system will protect the whole of the building and associated facilities for smoke hazard management control.

Detectors will be spaced and located in accordance with AS1670 or AS1668. Heat detectors will be provided in areas not suitable for smoke detectors.



Figure 2 - Typical smoke and thermal detectors.

The automatic fire and smoke detection system will be monitored and controlled by a fire brigade panel FBP located in the ground floor lobby capable of operating a distributed and or multi loop network of conventional or analogue addressable smoke and heat detectors and other ancillary devices in accordance with University requirements (The University of Wollongong - Fire Services Design Standards Version 4 – 2 September 2013).

The detection system also monitors all devices connected to the fire hydrant; fire sprinkler and fire pump systems as follows:

- Sprinkler flow switches and alarm valves;
- Solenoid test valves;
- Tamper switched on isolation valves;
- Pump status; and
- Pressure switches.

A single graphic display panel will be provided within the entry lobby indicating alarms and faults as they occur.

An aspirated smoke sampling system (Very Early Smoke Detection Alarm - VESDA) will be provided to those rooms where point sampling does not provide adequate levels of protection or where access to point detectors may be limited such as atrium roof. VESDA type smoke detection system will be provided to critical areas onsite only. VESDA systems draw air from the protected spaces and are able to provide fire alarm before smoke is visible.

The smoke hazard management system will interface with essential services equipment via the main FBP fire fan control module or accessible by ground floor access.

Smoke detection will be provided outside each fire stair in all areas and will interface with any required stair pressurisation system(s).



Figure 3 - Typical fire indicator panel and EWCIE panel

4.6 Emergency Warning Control and Indicating Equipment (EWCIE) (previously SSISEP)

An emergency warning control and indicating equipment (EWCIE) (previously SSISEP) will be provided throughout the building with emergency audio message broadcasting through the PA system using the options of pre-recorded messages and live announcements.

The master emergency control panel (MECP) will be provided at reception, adjacent to the FIP for the operation by the brigade in the event of emergency.

The EWCIE will comprise the following but not limited to:

- Master emergency control panel (MECP) will be a microprocessor based integrated EWCIE and will have a minimum 25% of spare capacity of the total devices installed on each loop, warden intercom points (WIPs), visual warning devices, loudspeakers, manual call points, amplifiers, power supplies, batteries and battery chargers, software and hardware, wiring and circuits interface with FBP, interface with BMS/security via FBP, interface with PA system, integrated WIP control;
- Speakers will be provided throughout the building. Horn type speakers or surface mounted speakers will be used in plant rooms. Visual warning devices will be provided in plant rooms with high background ambient noise level as per AS 1670;
- Speakers on floor will be integrated with dropped ceiling modules or be surface fixed;
- Warden intercom points (WIP) and manual call points (MCP) will be provided adjacent to the fire hose reels.
- The EWCIE will be divided into several zones or as determined by the fire engineered solution, each will have its own messages directing occupants to the nearest exit. These zones are to be developed with the fire safety engineer including the use of visual alarms.

The EWCIE will be developed with MLSB FM to ensure interconnections with neighbouring Campus buildings, in accordance with University requirements (The University of Wollongong - Fire Services Design Standards Version 4 – 2 September 2013).

4.7 Distribution Piping and Wiring Systems

The fire services and life safety distribution piping and wiring systems will be coordinated with the architectural design and all other services to follow set services routes to conceal services wherever possible and simplify access for maintenance and servicing.

4.8 Fire Brigade Panel (FBP) (previously FIP)

The FBP will be placed in a position easily accessible to the Fire Brigade from vehicular access on ground level main entry foyer in accordance with the BCA and Fire Engineering Report. The building will have provision for connection to the Campus FBP from which alarm will be transmitted to the Fire Services.

4.9 Passive Fire Protection

New fire services passing through any walls, floors and ceilings required to have a fire resistance level (FRL) rating will be sealed with approved passive fire protection systems to satisfy Section C, Part C3 of the Building Code of Australia, AS1530 and Local Government requirements.

Appendix A

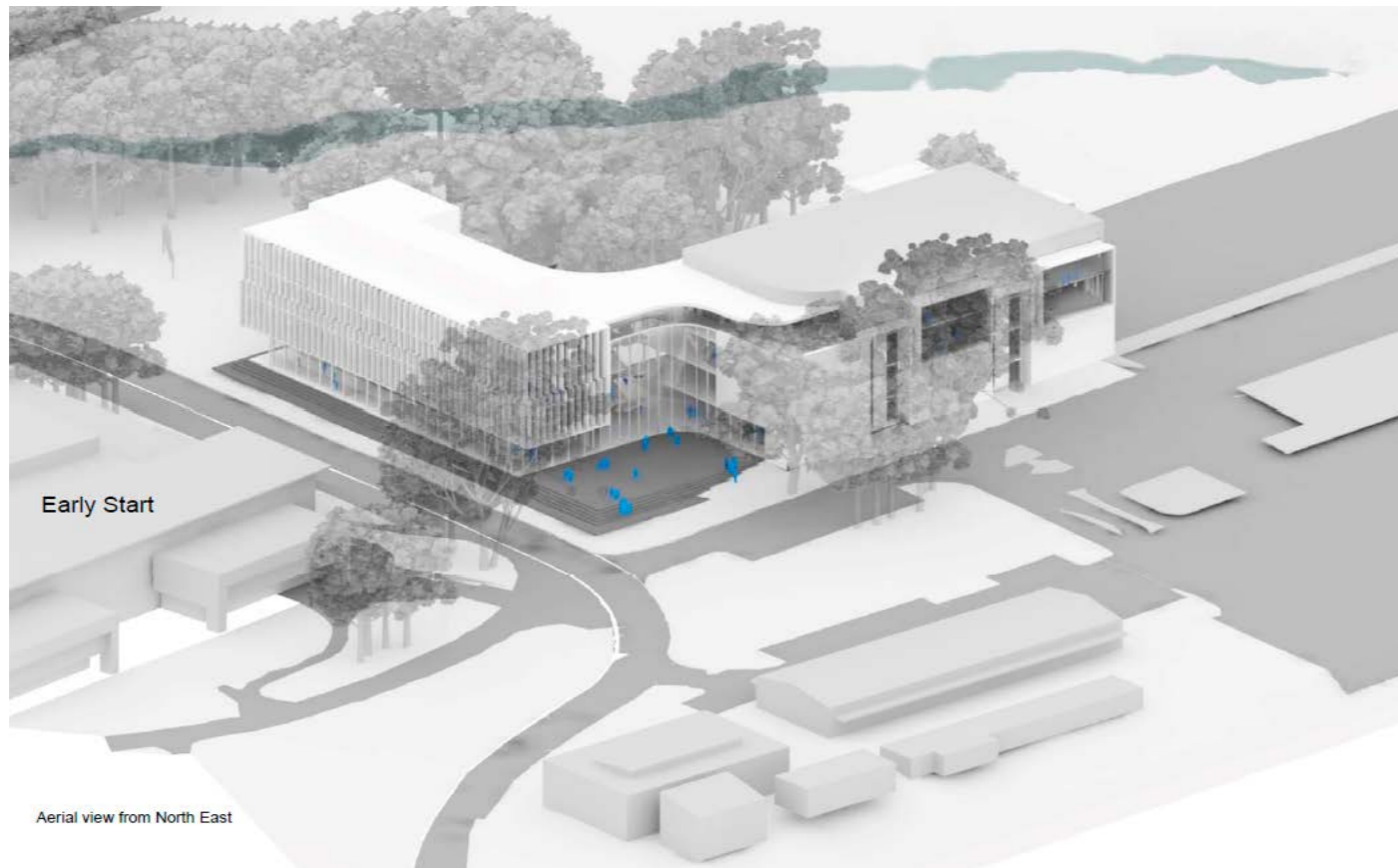
Schematic Drawings

Appendix B

Lighting Report

Appendix C

Consultant Secondary Design Overlay



UoW - Western Building

Schematic Design

Precedent Images



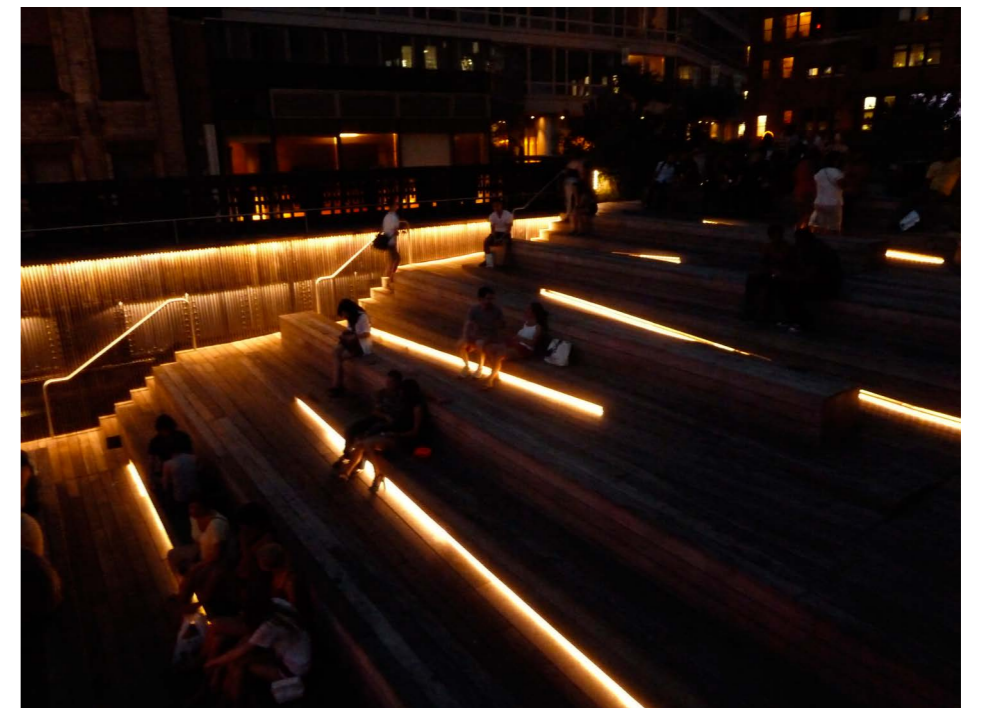
Uplighting to large significant trees in cool white



Illuminating sculpture



Uplighting to large significant trees incorporate RGBW for events



Integrate lighting into steps

Precedent Images



Technical parameters external pathways

This site plan indicates the external design code requirements

The following legislative and design targets are to be met:

- AS1158 Lighting for roads and public spaces
- AS/NZS 4282 Control of the obtrusive effects of outdoor
- External P category lighting
- AS1680 Interior and workplace lighting

*Based upon recommendations from the accessibility consultant.

The tables to the right are used to determine the technical design target and subsequent illuminance level for different types and frequencies of activity. The proposal is to illuminate the precinct using P1 category in mixed traffic areas and P2 category in the mainly pedestrian zones.

AS1158 Outdoor lighting

The categories highlighted have been selected based upon the client briefing, subsequent workshops and project developments. The range has been used to differentiate between the various spaces shown to provide a hierarchy of brightness. These assumptions should be used within the following lighting design stages and clarified through that process.

AS/NZS 1158 Lighting for roads and public spaces

Lighting for roads and public spaces set, helps design, manufacture and install road lighting for the safer use of roads by pedestrians and vehicles

AS/NZS 4282 Control of the obtrusive effects of outdoor lighting

Sets limits to which an exterior lighting installation can reach in regards to the level of potential 'spill light' an installation may create brightness of luminaires and its impact on adjacent residential properties and road users.

TABLE 2.1

LIGHTING CATEGORIES FOR ROAD RESERVES IN LOCAL AREAS

1	2	3	4	5	6
Type of road or pathway		Selection criteria ^{a,b)}			Applicable lighting subcategory ^{c,d)}
General description	Basic operating characteristics	Pedestrian/cycle activity	Risk ^{f)} of crime	Need to enhance prestige	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4
Local roads or streets used primarily for access to abutting properties, including residential properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Medium	Medium	P3
		Low	Low	N/A	P4
Common area, forecourts of cluster housing	Mixed vehicle and pedestrian traffic	N/A	High	N/A	P1
		High	Medium	High	P2
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

AS1158 - External P Category lighting

TABLE 2.2

LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)

1	2	3	4	5	6
Type of pathway		Selection criteria ^{a,b)}			Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/cycle activity	Risk ^{f)} of crime	Need to enhance prestige	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads ^{d)} and arterial roads ^{e)} , walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1 ^{e)}
		High	Medium	High	P2 ^{e)}
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

TABLE 2.3

LIGHTING CATEGORIES FOR PUBLIC ACTIVITY AREAS (EXCLUDING CAR PARKS)

1	2	3	4	5	6
Type of area or activity		Selection criteria ^{a,b)}			Applicable lighting subcategory
General description	Basic operating characteristics	Night time vehicle movements	Risk ^{f)} of crime	Need to enhance prestige	
Areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres	Generally pedestrian movement only	N/A	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8
Transport terminals and interchanges, service areas	Mixed pedestrian and vehicle movement	High	High	High	P6
		Medium	Medium	Medium	P7
		Low	Low	N/A	P8

^{a)} The selection criteria of Columns 3 to 5 should be separately evaluated. The highest level of any of the selection criteria that is deemed appropriate for the area type will determine the applicable lighting subcategory.

^{b)} Refer to Appendix C for guidance on choosing the applicable level of each selection criteria for the environment and purpose of a lighting scheme.

^{c)} The risk levels 'High', 'Medium' and 'Low' correspond to the classifications of the same names in HB 436.

NOTE: See Table 2.5 for lighting categories applicable to outdoor car parks, including roof-top car parks.



Moonlight 0.5 - 1 lux Urban Parks 2 - 10 lux Pathways in City 15 lux + Exterior Bars 30 lux Lounges 40 - 60 lux Lobby 160 - 240 lux Typical Office 320 - 600 lux Overcast Day 5000 - 30,000 lux Daylight 100,000 lux

P1 - P2

P7

Technical parameters internal spaces

This site plan indicates the external design code requirements

Technical Design Parameters

The diagram opposite represents the current lighting targets for a typical floor.

Australian Standards AS1680 Interior and workplace lighting

Interiors

- 320 lux average at working plane height for task areas
- 160 lux average at working plane areas with floor lamps
- Boardroom AV lighting as per AV consultants
- 80 lux for corridor
- 80 lux average at floor storerooms and WCS

National Construction Code (NCC)

- Part J6 Lighting power density
- Office 200 lux or more 9Wm⁻²
- Office less than 200 lux 7Wm⁻²
- Corridors 8Wm⁻²
- Boardroom 10Wm⁻²

Further adjustment factors are available that may increase the overall power limits. As a guidance the lighting design is to aim for a 20% reduction below the NCC maximum.

TABLE 3.1
RECOMMENDED MAINTAINED ILLUMINANCES FOR VARIOUS TYPES OF TASKS, ACTIVITIES OR INTERIORS

Class of task	Recommended maintained illuminance lx	Characteristics of the activity/interior	Representative activities/interiors
Movement and orientation*	40	Interiors rarely visited with visual tasks limited to movement and orientation	Corridors; cable tunnels; indoor storage tanks; walkways.
Rough intermittent*	80	Interiors requiring intermittent use with visual tasks limited to movement, orientation and coarse detail.	Staff change rooms; live storage of bulky materials; dead storage of materials needing care; locker rooms; loading bays.
Normal range of tasks and work places	Simple	Any continuously occupied interior where there are no tasks requiring perception of other than coarse detail. Occasional reading of clearly printed documents for short periods.	Waiting rooms; staff canteens; rough checking of stock; rough bench and machine work; entrance halls; general fabrication of structural steel; casting concrete; automated process monitoring; turbine halls.
	Ordinary or moderately easy	Continuously occupied interiors with moderately easy visual tasks with high contrasts or large detail (>10 min arc).	School chalkboards and charts; medium woodworking; food preparation; counters for transactions.
	Moderately difficult	Areas where visual tasks are moderately difficult with moderate detail (5-10 min arc or tolerances to 125µm) or with low contrasts.	Routine office tasks, e.g. reading, writing, typing, enquiry desks.
	Difficult	Areas where visual tasks are difficult with small detail (3-5 min arc or tolerances to 25µm) or with low contrast.	Inspection of medium work; fine woodworking; car assembly.
	Very difficult	Areas where visual tasks are very difficult with very small detail (2-3 min arc) or with very low contrast.	Drawing boards; most inspection tasks; proofreading; fine machine work; fine painting and finishing; colour matching.
Extremely difficult	1200	Areas where visual tasks are extremely difficult with extremely small detail (1-2 min arc or tolerances below 25µm) or of low contrast. Visual aids may assist.	Fine inspection; paint retouching; fine manufacture; grading of dark materials; colour matching of dyes.
Exceptionally difficult	1600	Areas where visual tasks are exceptionally difficult with exceptionally small detail (<1 min arc) or with very low contrasts. Visual aids will be of advantage.	Graphic arts inspection; hand tailoring; fine die sinking; inspection of dark goods; extra-fine bench work.

* Refer also to AS/NZS 1680.0 for minimum requirements for safe movement.
NOTE: See the Standards in the AS/NZS 1680.2 series for the recommended maintained illuminance for specific tasks and interiors.

TABLE D1
RECOMMENDATIONS FOR CIRCULATION SPACES AND OTHER GENERAL AREAS

1	2	3	4	5	6
Type of interior or activity	Maintained illuminance lx	Lamp colour appearance group	Lamp colour rendering group (minimum)	Maximum glare index	Other recommendations and advice
1 ENTRANCES 1.1 Entrance halls, lobbies, foyers	160	1, 2	2	—	The illuminance applies at floor level. See additional recommendations in Section 3 of this Standard. A lower illuminance may be acceptable at night in hotels, restaurants and similar premises where the prevailing illuminances are low (see Clause 1.2). The lighting of vertical surfaces is important to the appearance of the space. Care should be taken with entrance areas to avoid a pronounced change of illuminance between inside and outside, both by day and by night. In addition, the luminaires used should be of such a type or so located that persons entering or leaving the area will not suffer a significant loss of visibility resulting from glare from the luminaires.
1.2 Waiting rooms	160	1, 2	1B, 2	19	The illuminance applies at floor level. See additional recommendations in Section 3 of this Standard.
1.3 Enquiry desks	320	1, 2	2	19	Local lighting may be appropriate.
1.4 Gatehouses	160	1, 2	2	19	Flexible switching or dimming facilities and low surface reflectances may be desirable for security reasons. Special recommendations apply where visual display terminals are used. Care should be taken to avoid light falling on the glazing from directions which will produce reflections that obscure views through the glazing at night. Appropriate exterior lighting giving good vertical illuminances will be necessary for visibility of persons or vehicles passing through the controlled area.
1.5 Loading bays	80	1, 2	2, 3	—	The provision of adequate vertical illuminances at the loading face is important.

TABLE D1
SPECIFIC RECOMMENDATIONS FOR EDUCATIONAL AND TRAINING FACILITIES

1	2	3	4	5	6
Type of interior or activity	Maintained illuminance lx	Lamp colour appearance group	Lamp colour rendering group (minimum)	Maximum glare index	Other recommendations and advice
1 AUDITORIUMS					See recommendations of Clause 10.15.
1.1 Assembly halls—General use	160	1, 2	1B, 2	19	Include provision for higher illuminance for exhibitions.
1.2 Social activity	80	1, 2	1B, 2	19	Switching and dimming facilities are desirable.
1.3 Examinations	240	1, 2	1B, 2	19	
1.4 Theatre use		(Special application, see Clause 10.15.4)			Aisle lighting may be required.

TABLE D1 (continued)

1	2	3	4	5	6
Type of interior or activity	Maintained illuminance lx	Lamp colour appearance group	Lamp colour rendering group (minimum)	Maximum glare index	Other recommendations and advice
2 CIRCULATION AREAS					Account should be taken of illuminances in adjacent spaces and pronounced differences should be avoided. See advice given under Item 1.1. Vertical illuminances are important for the recognition of people and the detection of obstacles.
2.1 Corridors, passageways, ramps	40	1, 2	2	—	The illuminance applies at floor level. See additional recommendations in Section 3 of this Standard. A lower illuminance may be acceptable at night in hotels, restaurants and similar premises where the prevailing illuminances are low (see Clause 1.2). The type of luminaires and their location within the space should facilitate the visibility of essential information, e.g. directional or location signs. For heavily trafficked areas, the lighting should generally be provided by luminaires mounted at above head-height to minimize possible obstruction of the light. Special requirements may apply for some corridors, e.g. in hospitals.

TABLE E1 (continued)

1	2	3	4	5	6
Type of interior or activity	Maintained illuminance lx	Lamp colour appearance group	Lamp colour rendering group (minimum)	Maximum glare index	Other recommendations and advice
5.3 Conference rooms, boardrooms	240 (160)	1, 2	1B, 2	19	These rooms serve a variety of functions involving meetings, presentations and formal and informal functions. The lighting system or systems should be flexible to suit the variety of needs. The lighting system should be able to perform the functions of Items 5.1 and 5.2 when required. Provision should be made for a reduced level of lighting, corresponding to the lesser of the two recommended illuminances, to suit informal activities. See advice on lighting requirements for video conferencing in AS/NZS 1680.2.3.



Exterior statutory illuminance levels

This plan indicates the statutory lighting targets to be met as minimal requirements.

The adjacent diagram is a sketch view in plan of the precinct that shows the different design targets in each area as per the adjacent tables. These are the minimum statutory requirements that we must meet to comply with

- AS1158 Lighting for roads and public spaces

P Category	Point horizontal illuminance (Eph)	Point vertical illuminance (Epv)	Colour Temp
P1	7 lux	2 lux	4000k
P2	3.5 lux	0.7 lux	4000K
P3	1.75lux	0.3d	
P7	14 lux	4 lux	
P8	7 lux	2 lux	



Internal illumination levels

This plan indicates the statutory lighting targets to be met as minimal requirements.

The adjacent diagram is a sketch view in plan of the UoW building. These are the minimum statutory requirements that we must meet to comply with

- AS1680 Interior and workplace lighting



Ground Floor



Level 1



Level 2



Level 3

Spaces	Functionality	Lux levels
Performing Spaces	Dimming and Switching	80 - 400lux
Formal and informal learning spaces	Dimming and switching	160-400lux
Gallery/ exhibition	Dimming and switching	320lux
Work place	Dimming and switching	320-600lux
Studios	Dimming and switching	320lux
Terrace	Switching PE	3.5lux
Controls	Dimming and switching	400lux

Exterior lighting strategy

This plan indicates the statutory lighting targets to be met as minimal requirements. - This will need to be costed



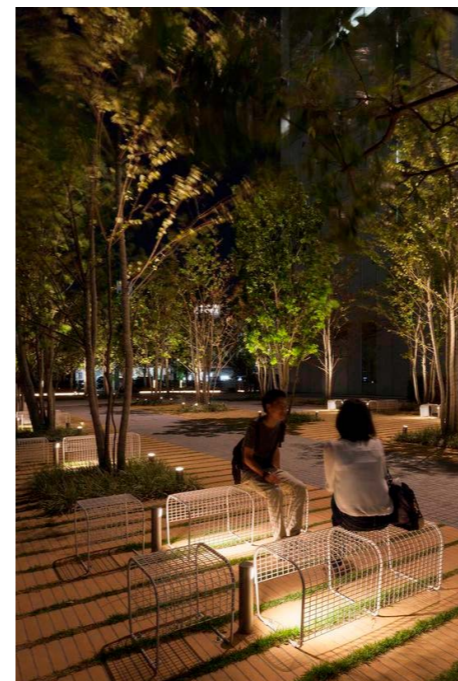
1 Pole with mutiple spots



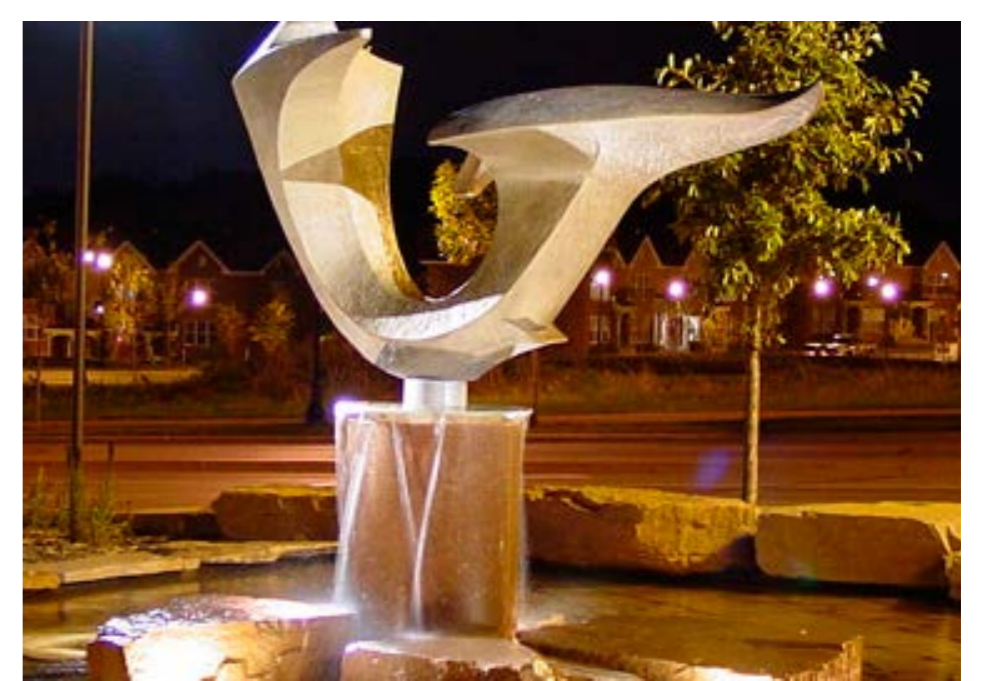
2 Inground uplighting to large trees



3 Integrated lighting into benches



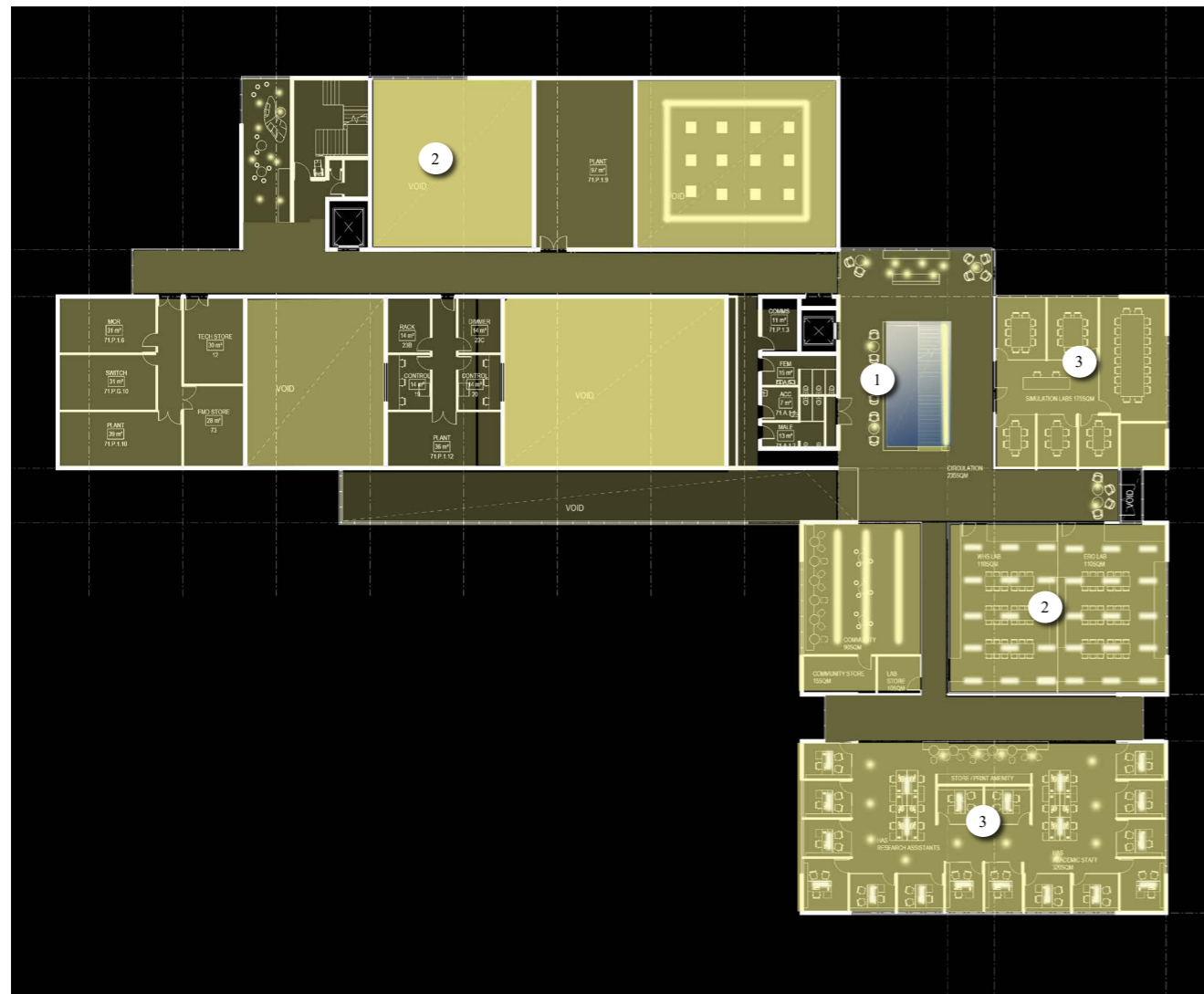
4 Inground uplighting to large trees



5 Lighting existing assest - sculpture

Interior lighting strategy level 1

This plan indicates the statutory lighting targets to be met as minimal requirements.



1 Pendant lighting to seating area



Nominal dimensions (mm)

FITTING	FITTING DIMENSIONS				WEIGHT KG.
	A	B	C	D	
ETB 600 x 300	593	293	118	99	4.0
ETB 600 x 600	593	593	142	120	5.1
ETB 1200 x 300	1193	293	118	99	5.8
ETB 1500 x 300	1493	293	118	99	7.5

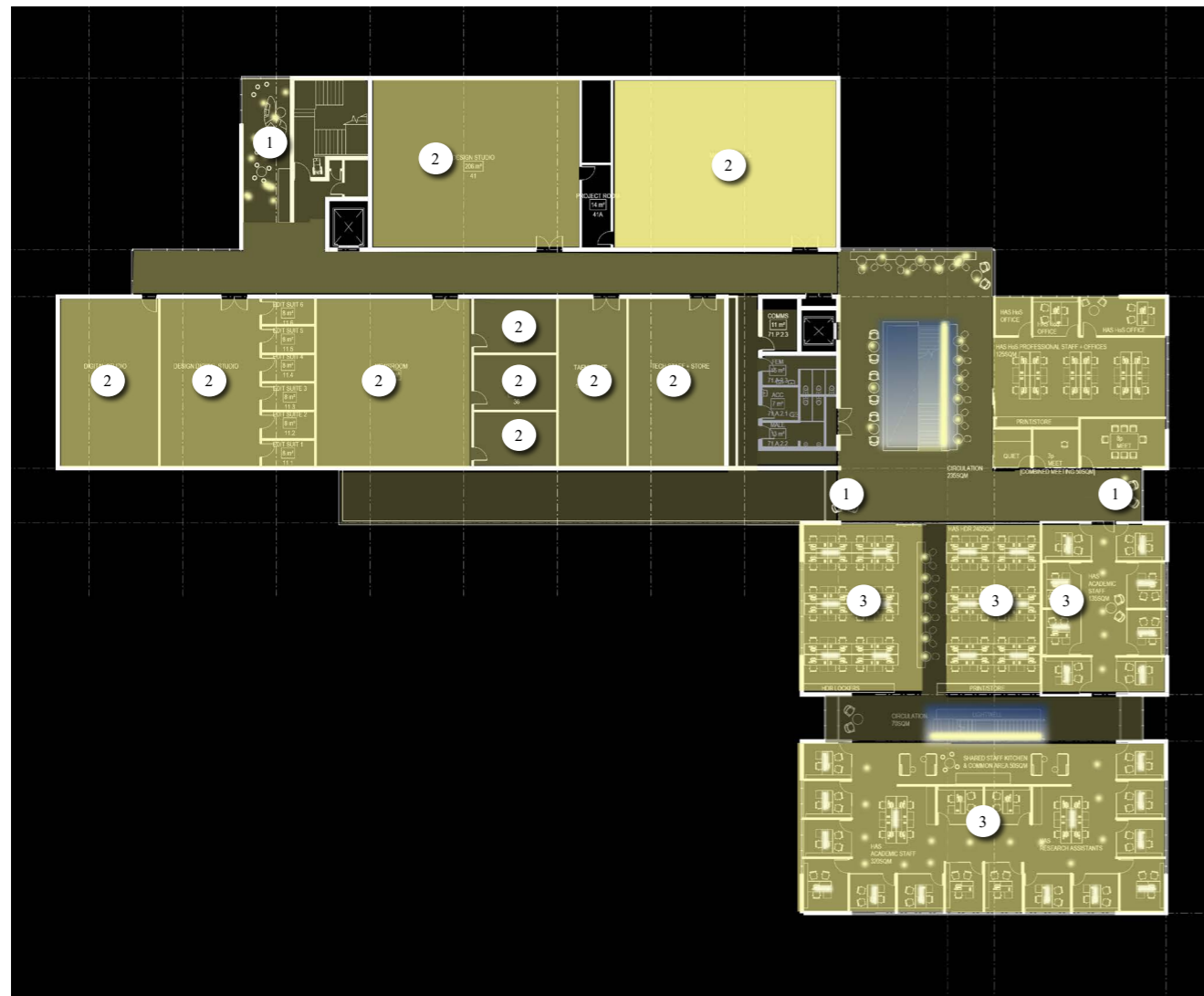
2 Recessed troffer lighting to LAB and Studios



3 Suspended direct / indirect pendants

Interior lighting strategy level 2

This plan indicates the statutory lighting targets to be met as minimal requirements.



1 Recessed lighting to small seating area



Nominal dimensions (mm)

FITTING	FITTING DIMENSIONS				WEIGHT KG.
	A	B	C	D	
ETB 600 x 300	593	293	118	99	4.0
ETB 600 x 600	593	593	142	120	5.1
ETB 1200 x 300	1193	293	118	99	5.8
ETB 1500 x 300	1493	293	118	99	7.5

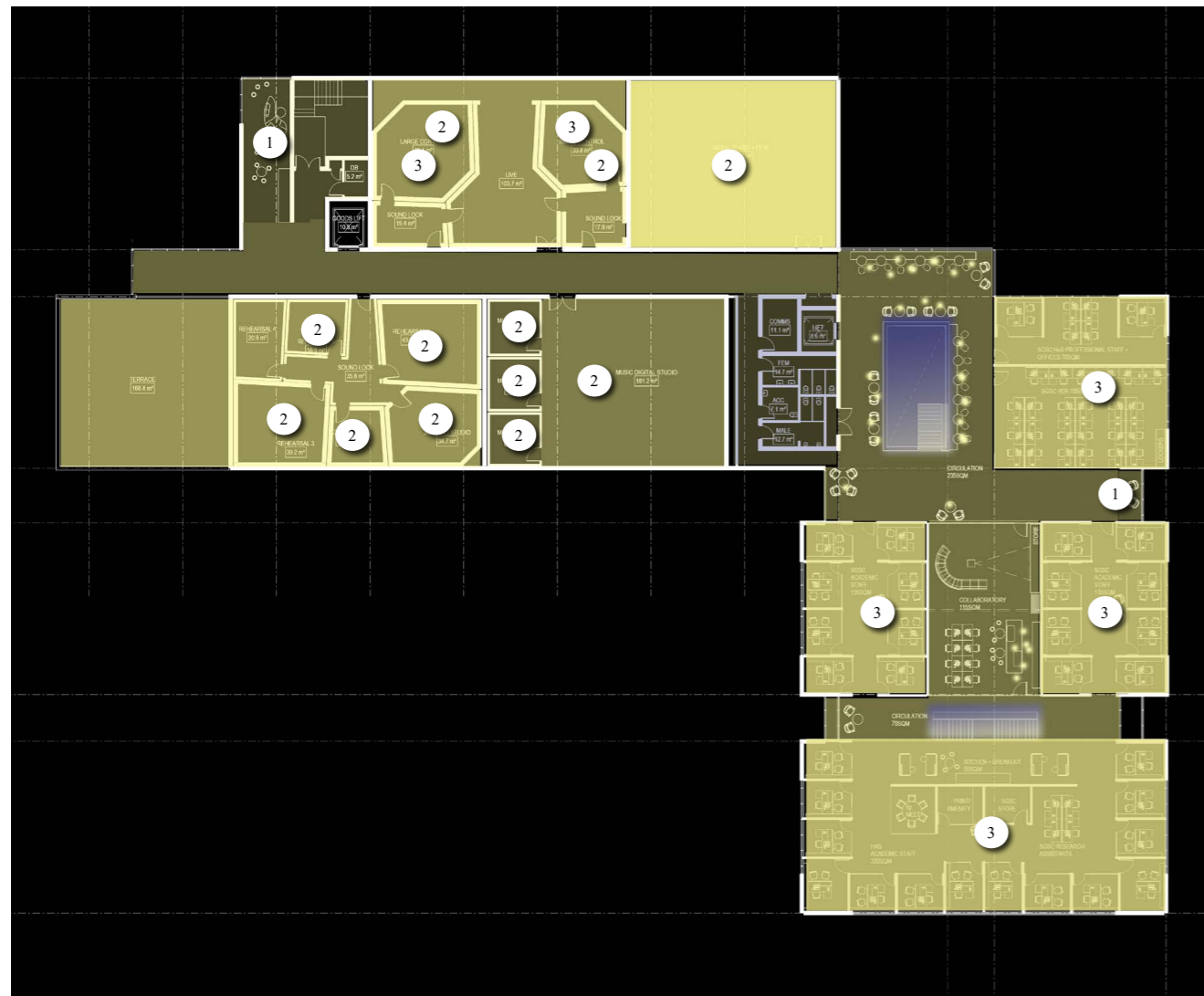
2 Recessed troffer lighting to LAB and Studios



3 Suspended direct / indirect pendants to offices

Interior lighting strategy level 3

This plan indicates the statutory lighting targets to be met as minimal requirements.



1 Pendant lighting to seating area



Nominal dimensions (mm)

FITTING	FITTING DIMENSIONS				WEIGHT KG.
	A	B	C	D	
ETB 600 x 300	593	293	118	99	4.0
ETB 600 x 600	593	593	142	120	5.1
ETB 1200 x 300	1193	293	118	99	5.8
ETB 1500 x 300	1493	293	118	99	7.5

2 Recessed troffer lighting to LAB and Studios

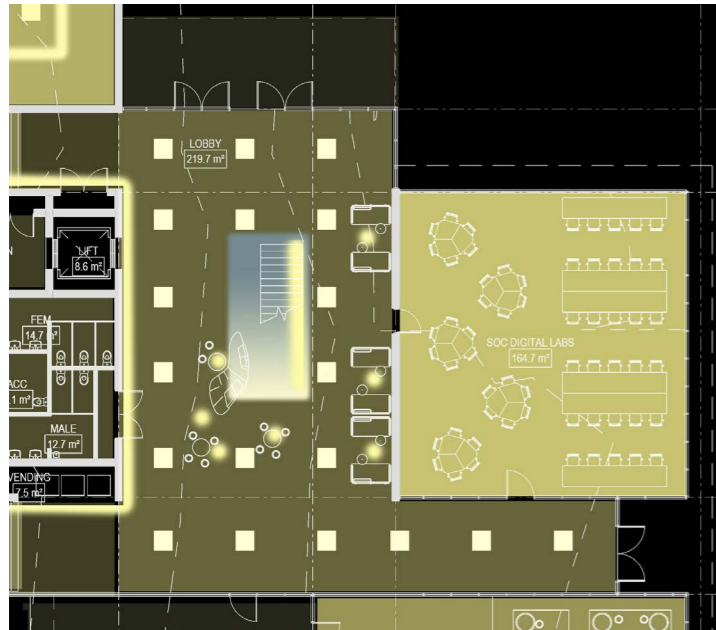
3 Recessed troffer with BLUE LED for control rooms



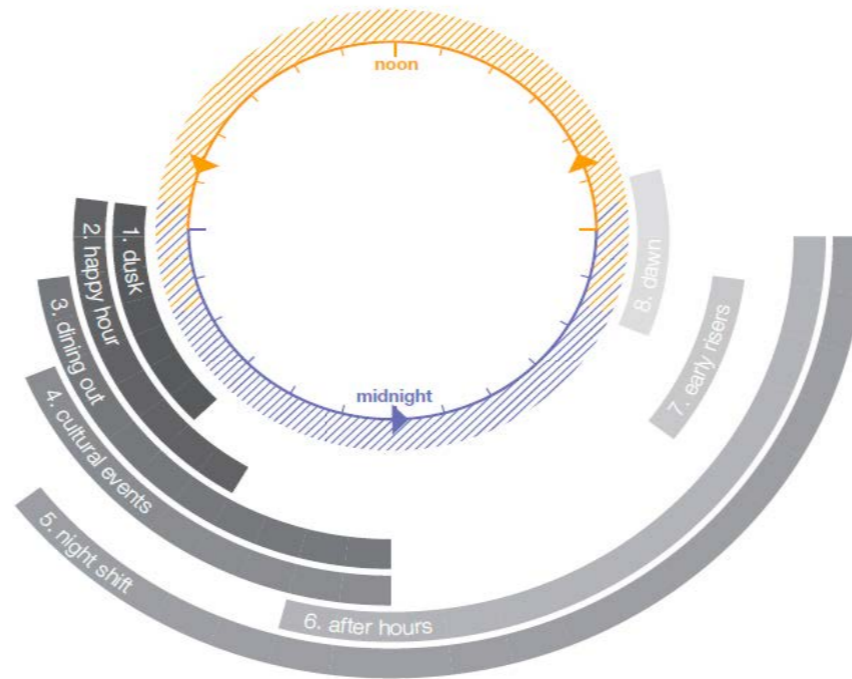
3 Suspended direct / indirect pendants to offices

Dynamic lighting - Lobby spaces

Control and tunability white lighting



For the Lobby areas the electric lighting can be tuneable to provide a subtle variation throughout the day that mimics the natural variations that occur over in the natural environment.



The eight shades above typify an urbanised area in the Western hemisphere such as New York. Cities and their seasonal, cultural and climatic variations will chart their own shades of night dependent on local usage.

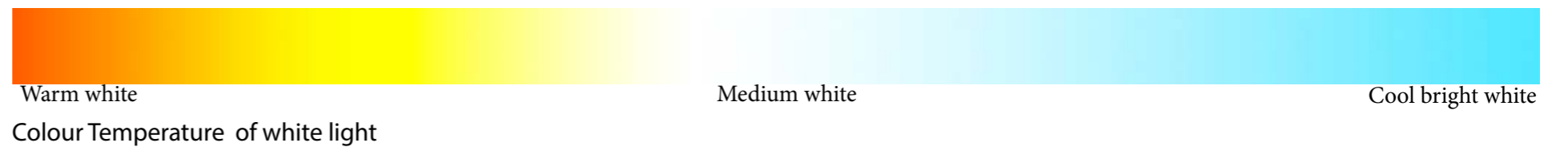
- Dusk:** as the sun sets, depending on season, either the work day extends into the night, or daylight extends into the post work hours
- Happy hour:** the social extension of the work day, decompression time
- Dining out:** the date, the business meeting, the special event, window shopping, strolling, meeting friends
- Cultural events:** going to the movies, theater, the ballet, concert or opera
- Night shift:** factory workers, cleaning crews, around-the-clock services, such as transit, and emergency repairs and services begin
- After hours:** nightclubbing and after-hours clubs
- Early risers:** the first shift arrives, outdoor markets set up, newspapers arrive
- Dawn:** the commuters begin to arrive, school starts

Figure 1: Shades of Night – Public Space during the Darkened Hours is a framework that identifies activity

Cities Alive rethinking the Shades of Night



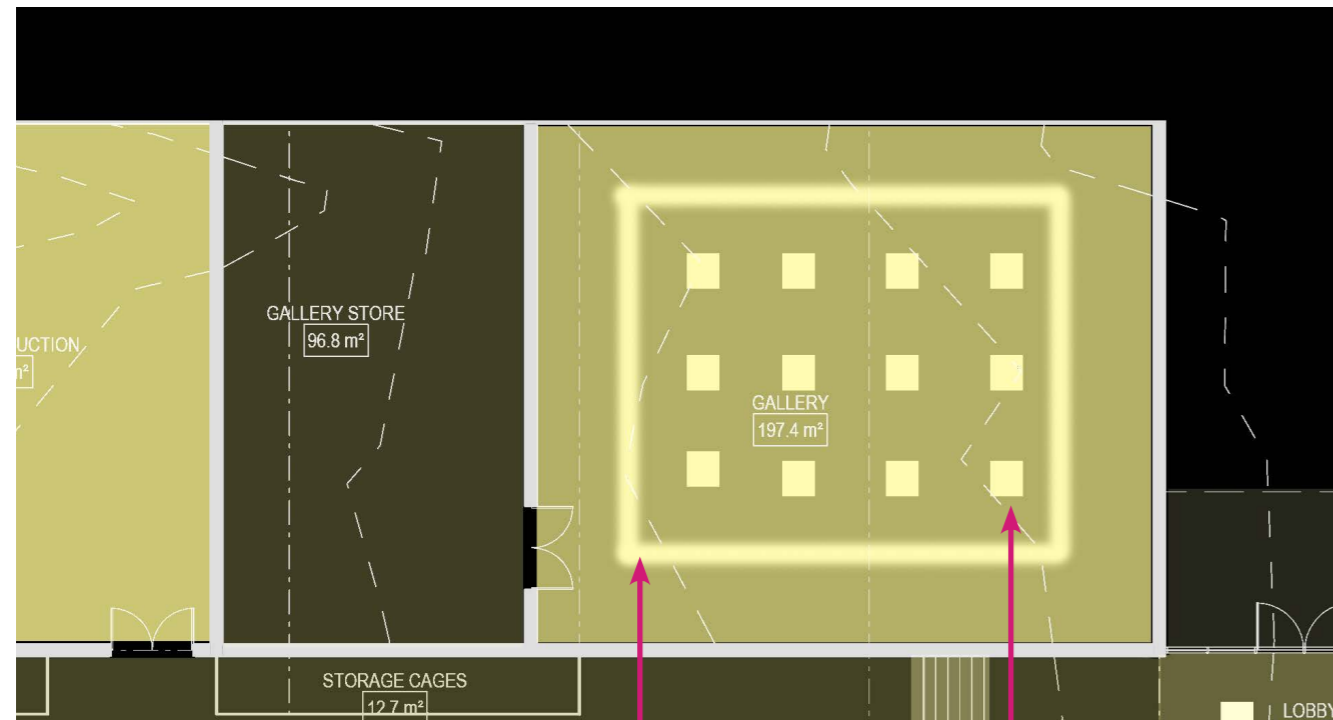
Time-lapse photo showing variation in daylight quality



Gallery + exhibitions spaces

This plan indicates the statutory lighting targets to be met as minimal requirements.

Space	Control / Functionality	Lux levels
Gallery/ exhibition	DALI Dimming and switching	320lux



Indicative layout of lighting

Track lighting to perimeter

Recessed diffused lighting



15° Touch		
m	∅	Lux
1,0	0,3	36093
2,0	0,5	9023
3,0	0,8	4010
4,0	1,1	2256

LED 4500 lm 930



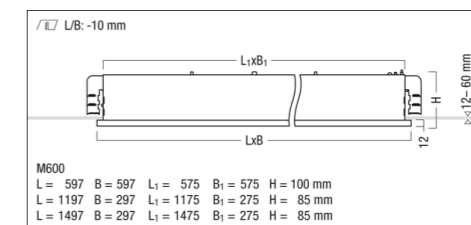
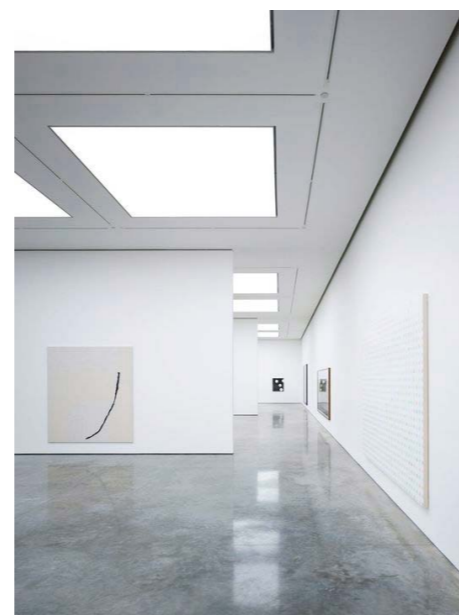
38° Touch		
m	∅	Lux
1,0	0,7	9203
2,0	1,4	2301
3,0	2,1	1023
4,0	2,8	575

LED 4500 lm 930

Direct / Indirect lighting

White 4000k

Type: Adjustable track lighting with linear indirect up light component



Zumtobel

Light fields 600x600

White 4000K

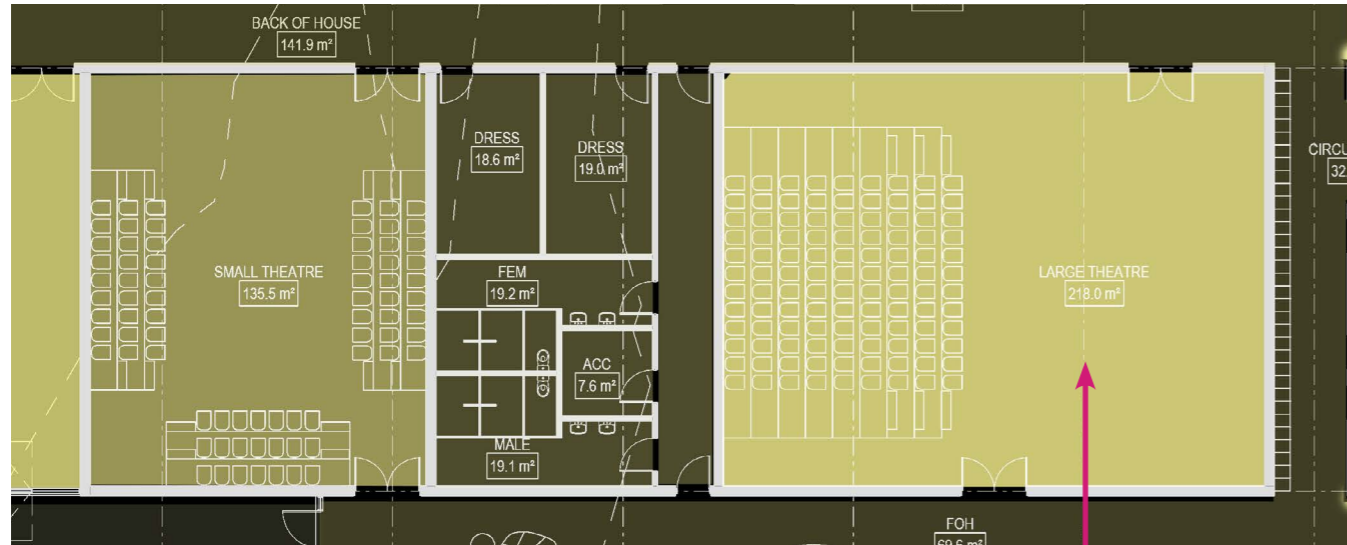
1 Diffused gallery lighting

Theatre + performance spaces ground + L1

The theaters will have a combination of Worklight, Houselight and Blue light

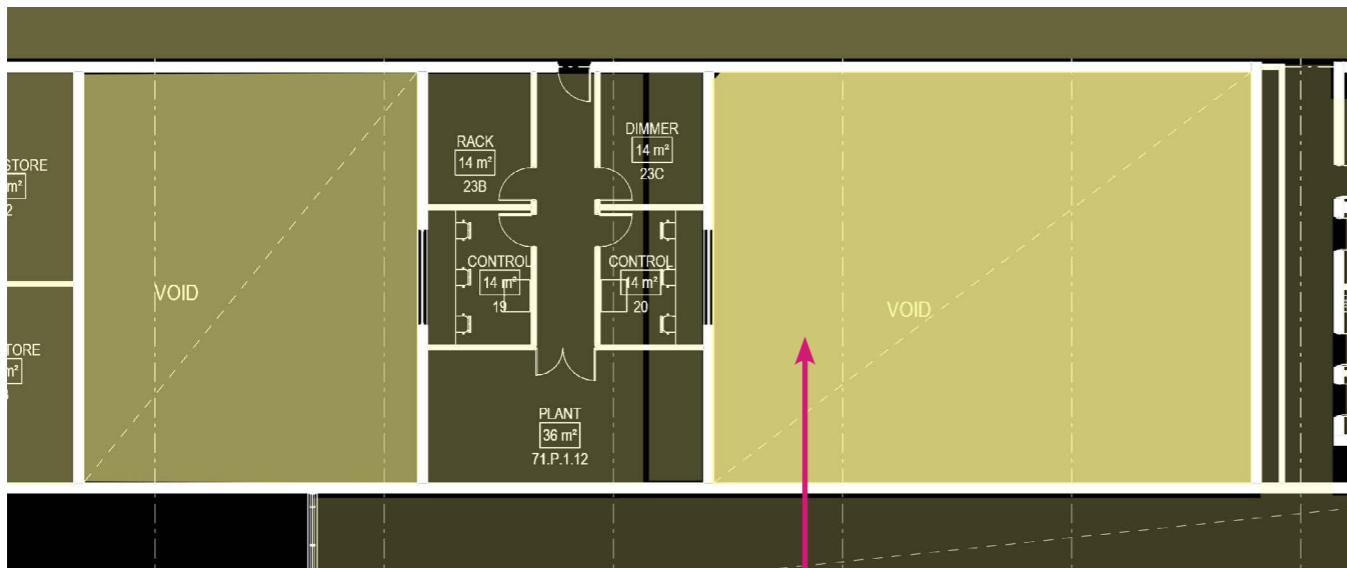
- Work light 4000-5000K - LED battens
- House light - architectural - 3000K
- Blue LED lighting - low level

Space	Control / Functionality	Lux levels
Theater	Specified by theater consultant	varies
	Houselight	0-200 lux
	Worklight	0-500 lux
	Blue light	on / off



Ground Plan

Low level blue LED around perimeter



Level 1 Plan

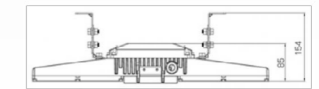
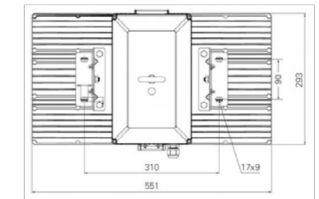
Highbay work light to ceiling



HLX

House light to theatre - 3000K - GDS Arcsystem Pro one cell - 21.W/1661 lm

TBC with theater design



WLX

Work light to theatre - 5000K - GDS Pierlite LEO Highbay



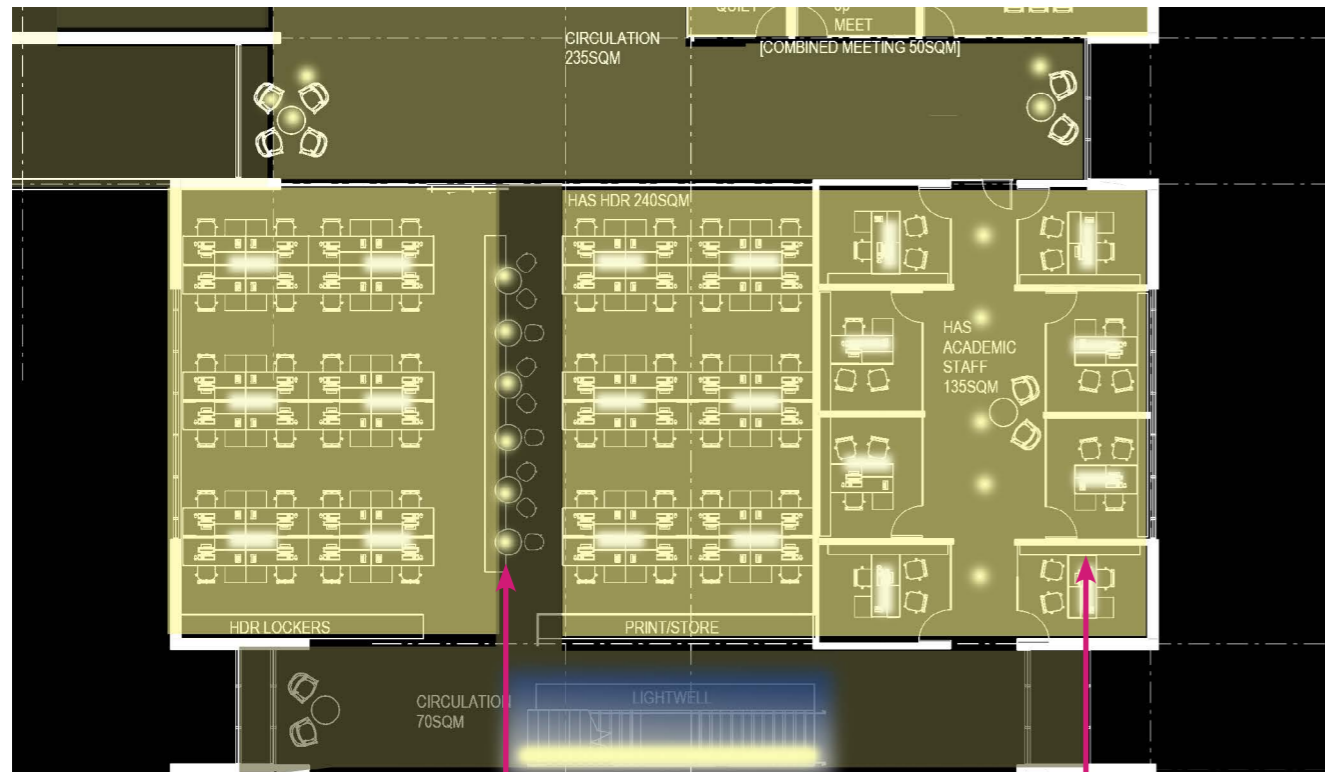
BLX

Blue Light to theatre - GDS BlueDome - 3W

Typical workplace

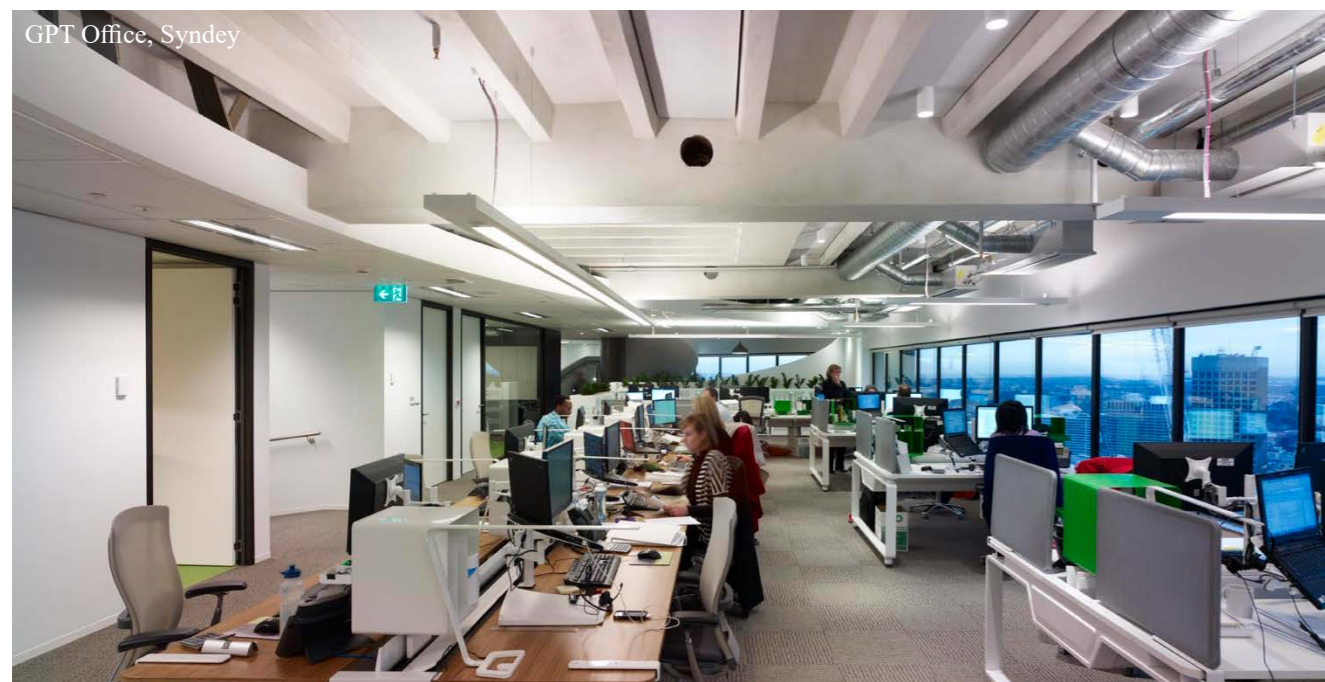
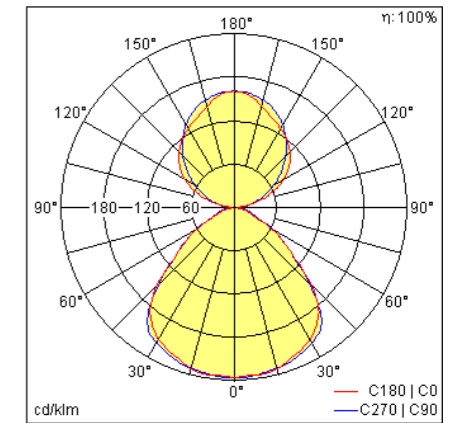
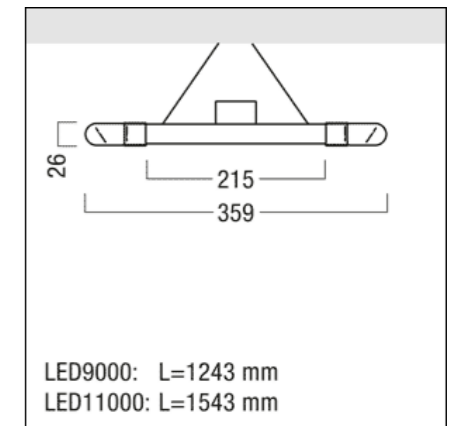
Proposed for the workplace areas is a direct and indirect lighting solution with pools of light to the storage and seating areas to provide a level of variation and interest.

Space	Control / Functionality	Lux levels
Gallery/ exhibition	DALI Dimming and switching	320lux



Downlight to corridors

Suspended indirect / direct pendant



GPT Office, Sydney



Typical open plan office.

Direct / Indirect lighting

Type: Zumtobel Aero Pendant 4000K Unit Cost \$700

Egale Lighting Downlight

G DIMENSIONS	
Height	CUTOUT Ø
130	100
130	100
152	140
152	140

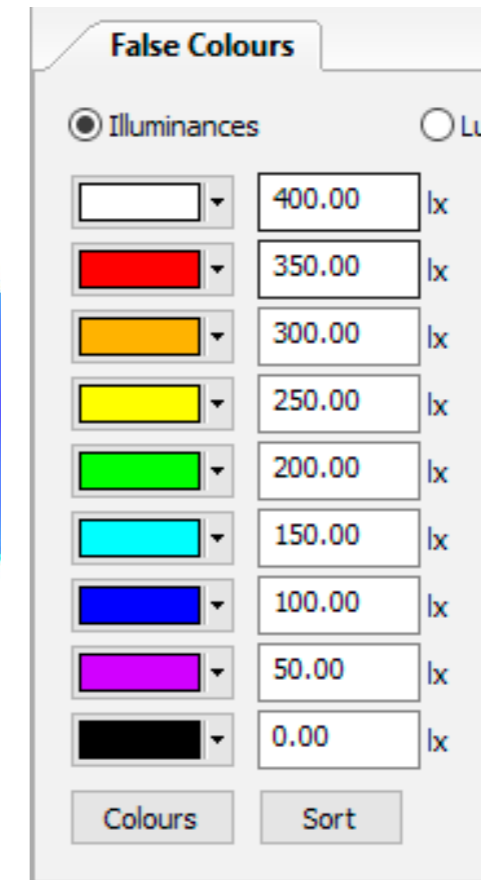
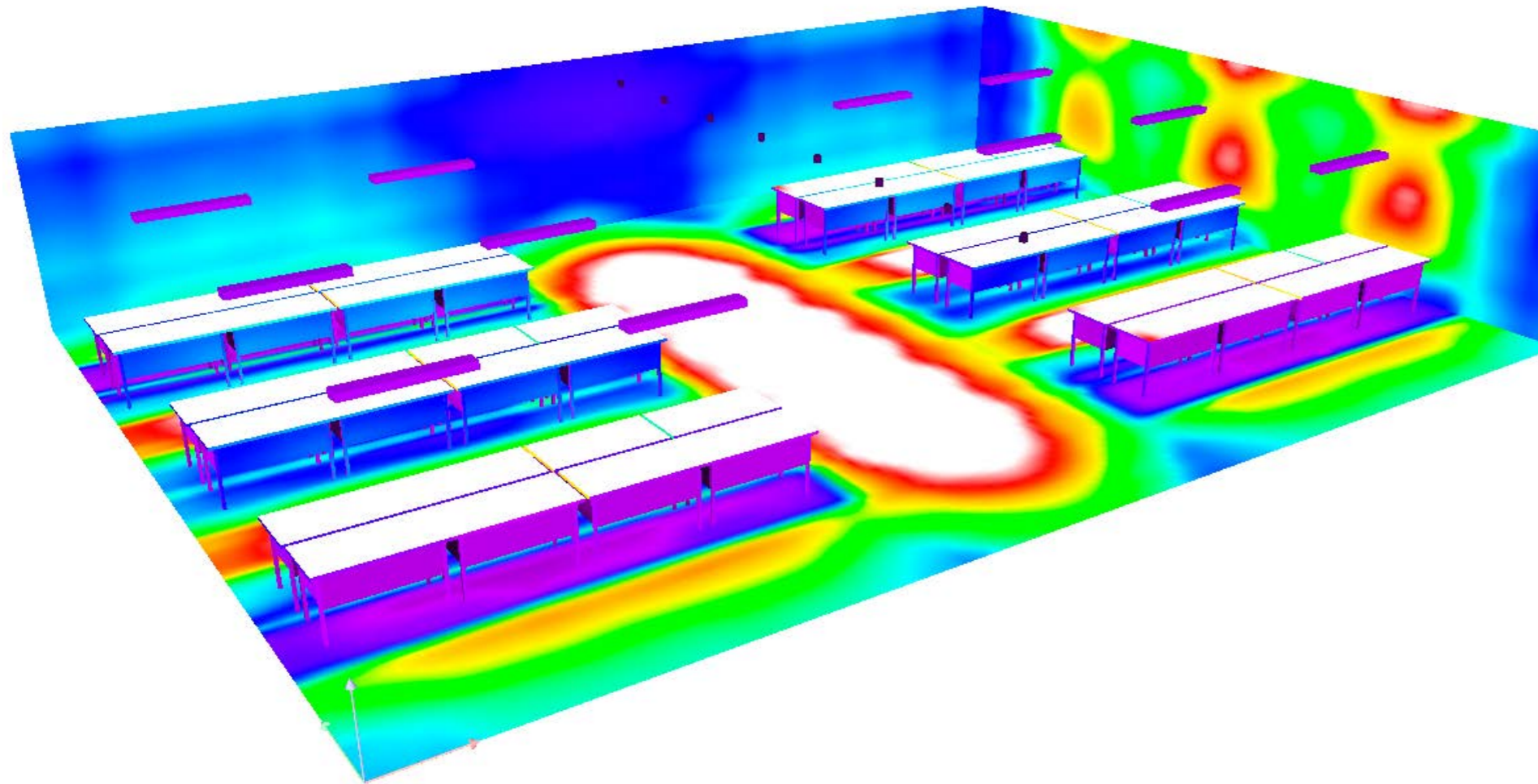
Ø140

152

Ø150

Typical workplace

400lux



Typical open plan office.

Direct / Indirect lighting

Type: Zumtobel Aero Pendant 4000K

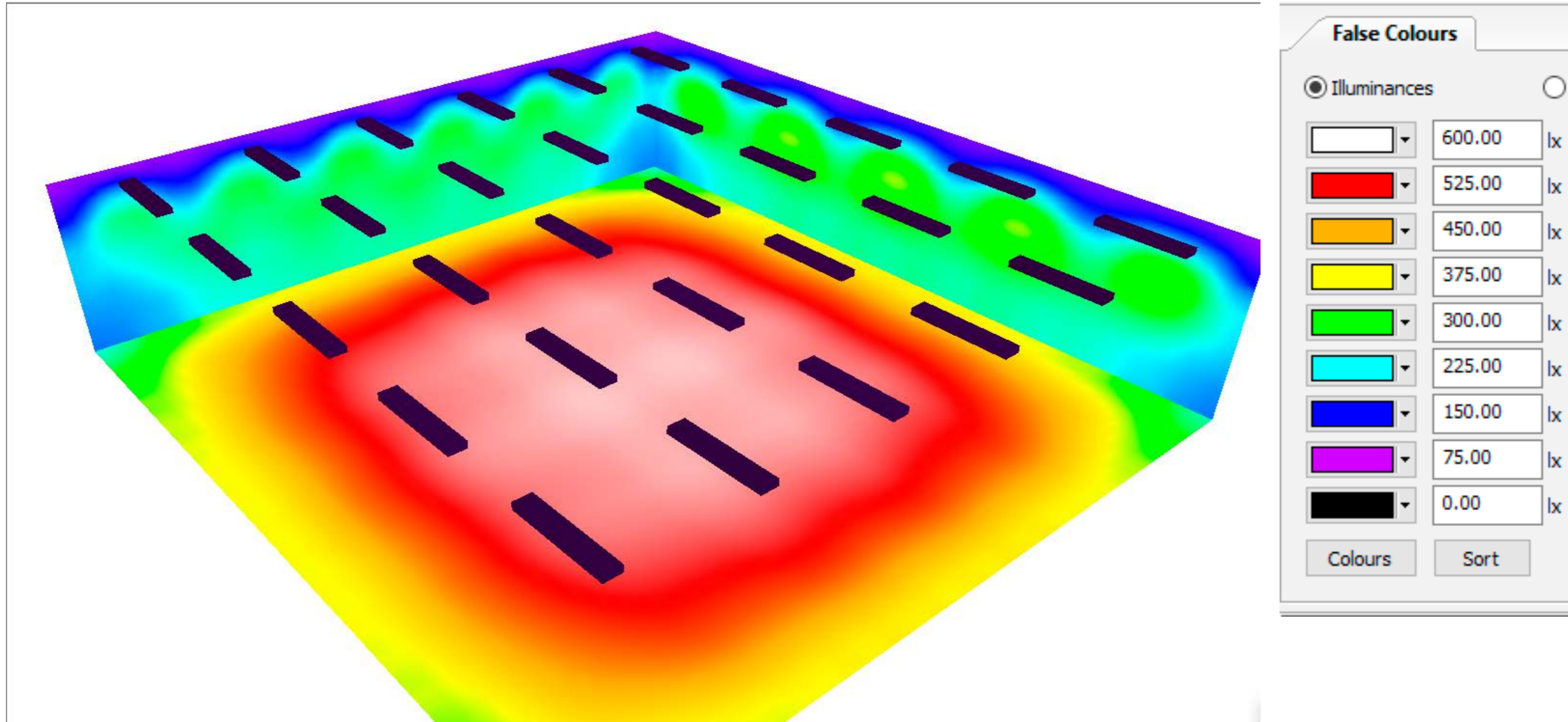
Egale Lighting Downlight

Cost \$18,800 (include 20% marup + installation)

Approx \$80 per sqm

Typical Studio

600lux



Direct

Type: Egale lighting Indigo \$520 each (include 20% marup + istallation)

Total cost \$10,500

Approx \$95 per sqm

Proposed lighting typology



Gallery & exhibition spaces

Direct / Indirect lighting

White 4000k

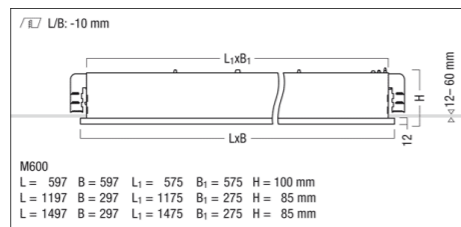
Type: Adjustable track lighting with linear indirect up light component



Zumtobel

Light fields 600x600

White 4000K

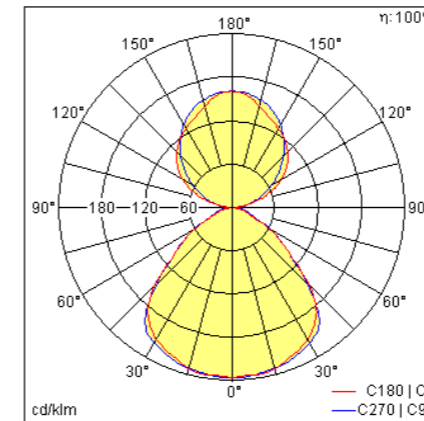
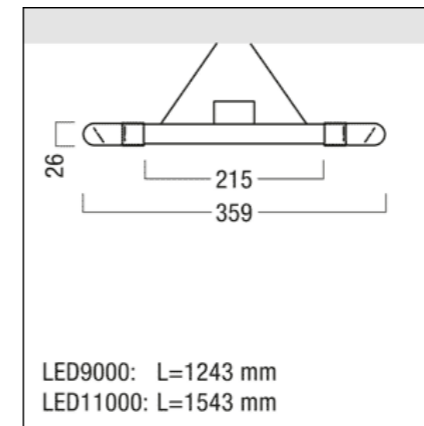


Typical open plan office.

Direct / Indirect lighting

Type: Zumtobel Aero Pendant 4000K Unit Cost \$700

Egale Lighting Downlight



G DIMENSIONS	
Height	CUTOUT \varnothing
130	100
130	100
152	140
152	140

$\varnothing 140$
 152
 $\varnothing 150$



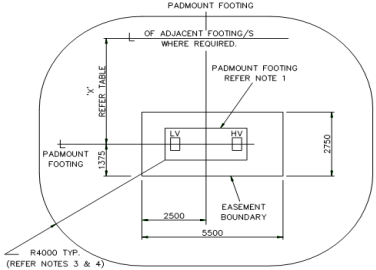

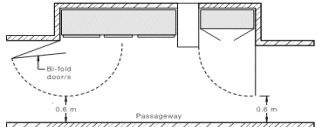

Nominal dimensions (mm)																																							
<table border="1"> <thead> <tr> <th rowspan="2">FITTING</th> <th colspan="4">FITTING DIMENSIONS</th> <th rowspan="2">WEIGHT (KG)</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>ETB 600 x 300</td> <td>593</td> <td>293</td> <td>118</td> <td>99</td> <td>4.0</td> </tr> <tr> <td>ETB 600 x 600</td> <td>593</td> <td>593</td> <td>142</td> <td>120</td> <td>5.1</td> </tr> <tr> <td>ETB 1200 x 300</td> <td>1193</td> <td>293</td> <td>118</td> <td>99</td> <td>5.8</td> </tr> <tr> <td>ETB 1500 x 300</td> <td>1493</td> <td>293</td> <td>118</td> <td>99</td> <td>7.5</td> </tr> </tbody> </table>						FITTING	FITTING DIMENSIONS				WEIGHT (KG)	A	B	C	D	ETB 600 x 300	593	293	118	99	4.0	ETB 600 x 600	593	593	142	120	5.1	ETB 1200 x 300	1193	293	118	99	5.8	ETB 1500 x 300	1493	293	118	99	7.5
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Recessed troffer lighting to LAB and Studios

Project # 255953
 Revision 3
 Date 11-Sep-2017

University of Wollongong - Western Building
 Preliminary Electrical, Comms, Security and Dry Fire Plant Schedule



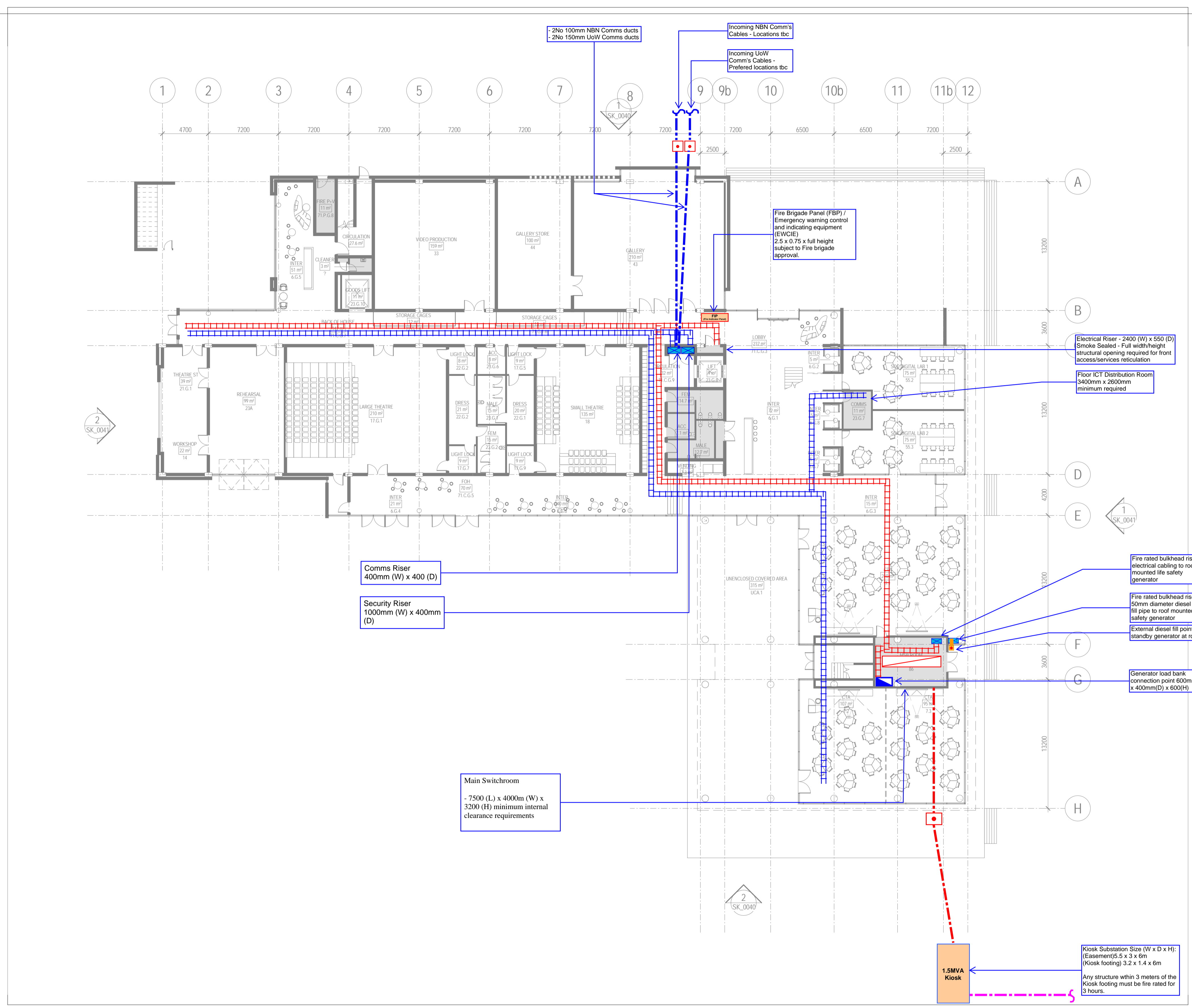
Disc.	Ref.	Item	Description	Possible Locations	Comments	Total Block Size	Total Block Area	Clear Height	Image
						(w x d)	(m ²)	(m)	
Electrical and Security Services	E1	Substation	1 - 1.5 MVA kiosk substation	External pad mount, adjacent to road with heavy vehicle access and non combustable materials around.	No structure above easement. Any structure within 3 meters of the kiosk footing must be fire rated for 3 hours.	5.5 x 3 Easement 3.2 x 1.4 Kiosk Footing	16.5	6	
	E2	Main Switchroom	Main switchboards	Ground floor of building. Incoming LV feed via in ground conduit from substation. Ideally located as close as possible to the substation to minimise cable lengths.	Room to be 2 hour fire rated with dual egress paths. Doors to open outwards. Ventilation to be provided.	7.5 x 4.5	35	3.5	
	E3	DB	Distribution Boards	In a dedicated cupboard in each floor.	Must have minimum clearance of 0.6m in front of cupboard doors in the open position. Not to be located in a path of egress. 600mm clearance is required in front of cupboard or DB doors at all positions, refer image. If within egress route, the cupboard must be smoke-sealed and constructed of non-combustible material. Locked	2.4m x 0.55m	1.2	full height of building	 FIGURE 2.18 ACCESS TO SWITCHBOARDS— SWITCHBOARDS WITH DOORS THAT OPEN INTO ACCESSWAYS OR NARROW PASSAGEWAYS
	E4	Life Safety System Generator	Packaged 150kVA generator Set (external fill point and load bank connection required - pipework and cable route to the roof in fire rated riser. Refer to ESK-001 Option 1 plant massing sketch)	External / Roof	Backup generator required for secondary supply to life safety systems. 1200mm clearance required either side of generator set 8 hour fuel day tank in canopy base of generator Requirement for bulk storage or external fill point tbc	3.5 x 6.5	25		
Communications Services	C1	MCR	Incoming fibre, active equipment, servers, etc.	Ground floor at the perimeter of the building, ideally near the incoming service	Indicative size only - need to determine facility requirements. Room may be required to be fire rated for 2 hours Redundant cooling to be provided	5 x 7	35	3.5	
	C2	FDR	Floor Distributor Room	In a dedicated room. Cable length is limited to 90m, so location of the room must be reviewed against the floorplate size and orientation.	Indicative size only - need to determine facility requirements. If within egress route, the cupboard must be smoke-sealed and constructed of non-combustible material. Room may be required to be fire rated for 2 hours Redundant ventilation to be provided. Assumed no cooling required	3 x 4	12 each	3	

Security	C3	Security Panel Cupboard		Adjacent electrical riser within core at every floor	Dedicated cupboard required for security control panel (one per floor) separate from ICT and LV distribution spaces.	1 x 0.4			
Dry Fire Services	F1	Dry Fire Services riser	Cable reticulation within the building.	Can be shared with other fire services.	To be coordinated with other services	0.5 x 0.25	0.125	floor to floor	
	F2	Fire Control Centre	<p>Fire Brigade attendance enclosure – incorporating FIB (Fire Brigade Panel) previously FIP, EW/CIE - Emergency Warning Control and Indicating Equipment previously SSISEP (EWIS).</p> <p>Please note changes in definitions within new standards AS1670-2015.</p>	<p>Ground level at main entrance.</p> <p>Cupboard located within the main entry to the building or dedicated room. Fire control room is assumed not be required. Location and installation as per ASS1670-2015.</p>	<p>A minimum clearance of 1m in front and 0.5m to each side shall be maintained from FIP/SSISEP enclosures that require operation by emergency service personnel</p>	2.5 x 0.75	1.5	2.1	<p>The diagram illustrates the 'New Requirement' for Fire Control Enclosure (CIE) placement. It shows two enclosures, labeled 'CIE 1' and 'CIE n', positioned side-by-side. Each enclosure is 0.5m wide, and there is a 0.5m clearance on both sides of each enclosure. A 1.0m clear space is required in front of the enclosures. The diagram is labeled 'New Requirement' and 'Clear space in front of CIE'.</p>

Notes

1. All dimensions and areas are indicative at this stage to assist the architects with concept space planning. Further development of brief required with client for example on generator requirements etc.
2. Next step is to mark up areas on architects drawings once concept plans are received - efficiencies may than be acheived by placing plant on roofs, sharing areas, etc
3. All plant rooms and services cupboards must be accessed through non-teaching spaces

- Electrical Legend**
- Riser
 - ▭ Comms cable tray
 - ▭ Power cable tray
 - LV underground conduit
 - Comms underground conduit
 - HV
 - MSB Mechanical services switch board
 - Cable Pit Cable Pit
 - MSB (Main Switchboard) MSB (Main Switchboard)
 - Diesel Pipework

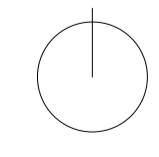
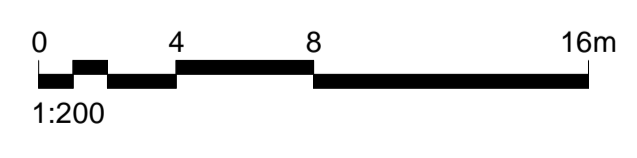


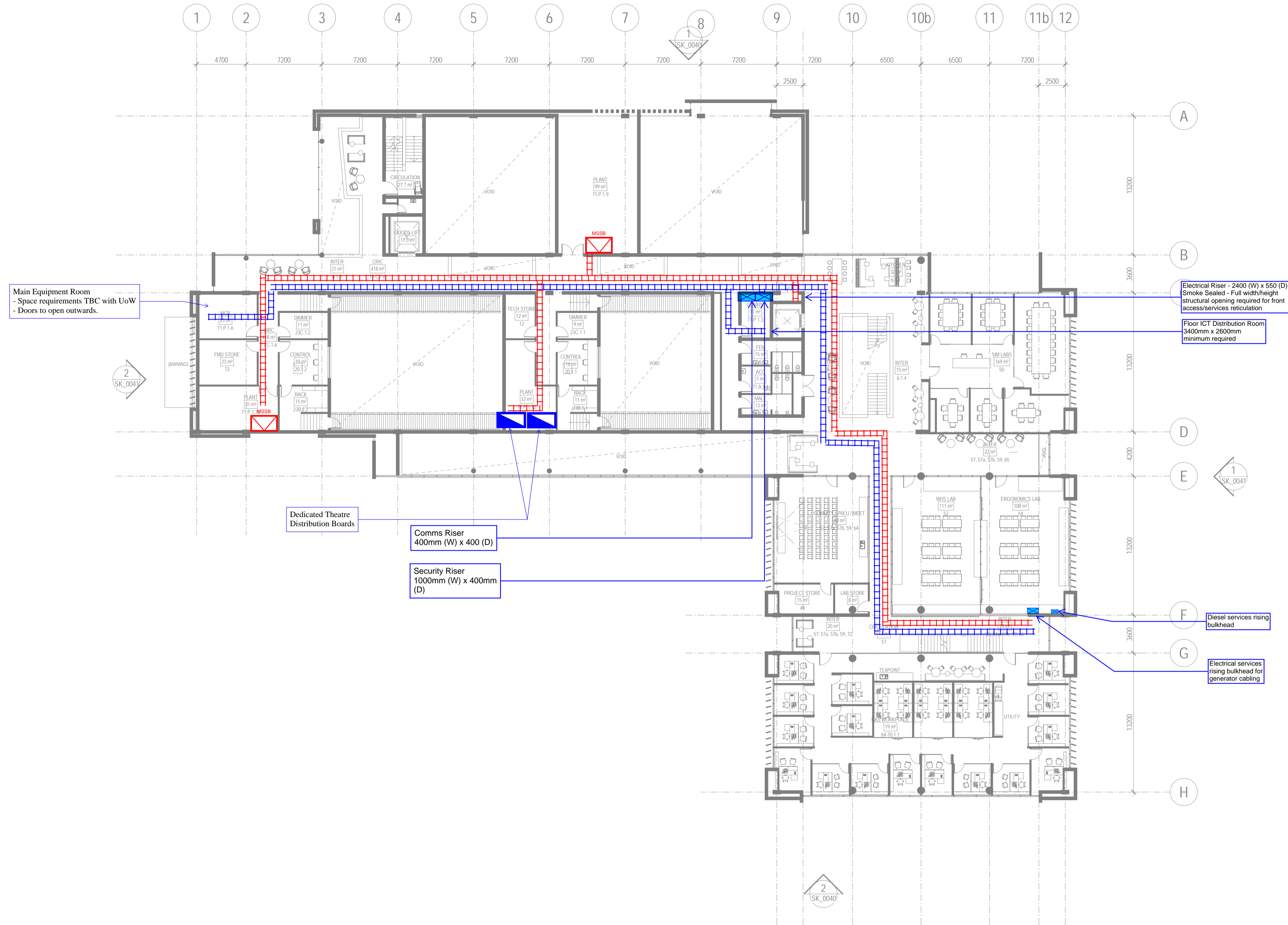
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A SCHEMATIC DESIGN - ISSUED FOR COSTING	24/08/17
B CONSULTANT ISSUE	06/09/17
C ADD ROOM NAMES	07/09/17
D CONSULTANT ISSUE - WORKPLACE ADJUSTED	07/09/17

Scale: 1 : 200 @ A1
 Client: UNIVERSITY OF WOLLONGONG

Project Name: WESTERN BUILDING

Drawing: SK_0033
 SCHEMATIC GROUND LAYOUT

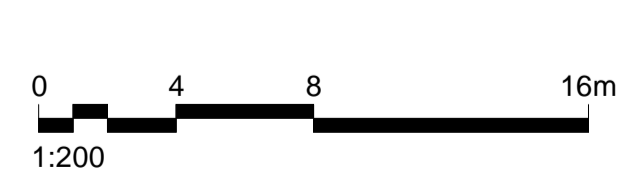




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Client
UNIVERSITY OF WOLLONGONG



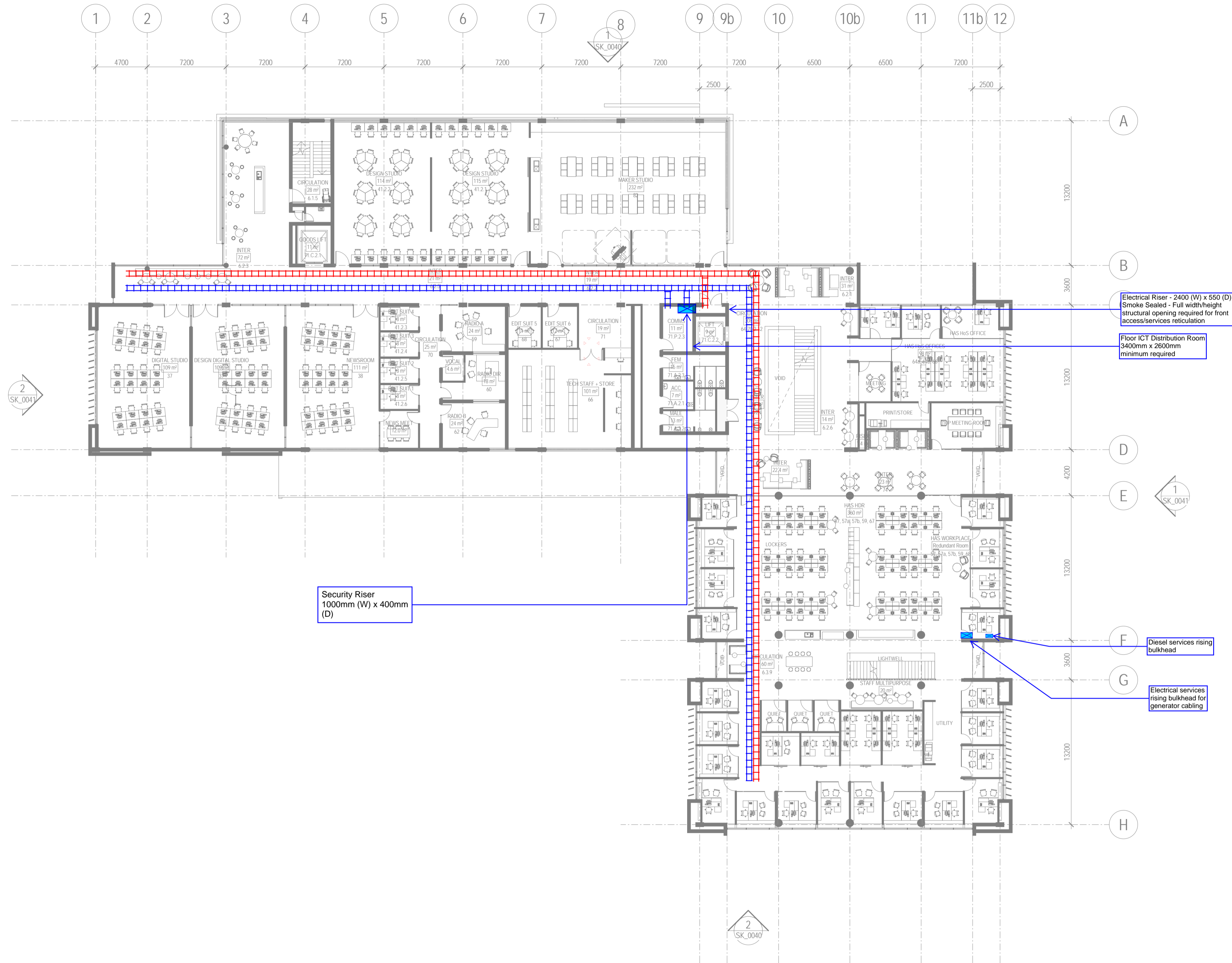
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WESTERN BUILDING



Drawing
SK_0034
SCHEMATIC_LEVEL 1
LAYOUT

HASSELL
ABN 24 007 711 435

NSW Nominated Architects: Tony Grist 5350 Ross de la Motte 7398
INDICATIVE ONLY - NOT FOR CONSTRUCTION



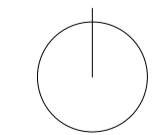
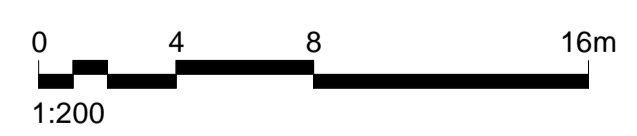
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Scale
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Client
UNIVERSITY OF WOLLONGONG

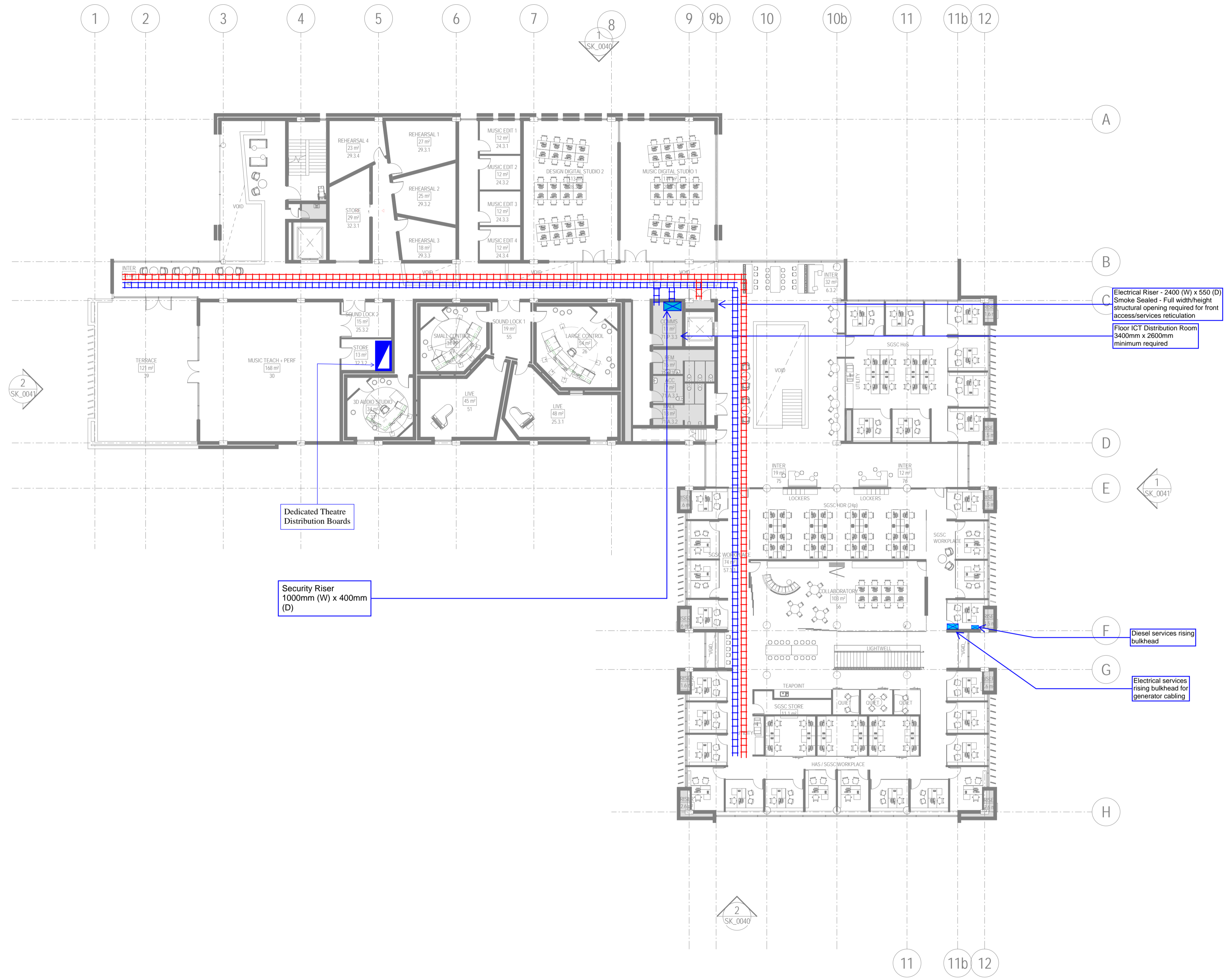
Project Name
WESTERN BUILDING

Drawing
SK_0035
SCHEMATIC_LEVEL 2
LAYOUT



HASSELL
ABN 24 007 711 435

NSW Nominated Architects: Tony Grist 5350 Ross de la Motte 7398
INDICATIVE ONLY - NOT FOR CONSTRUCTION



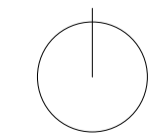
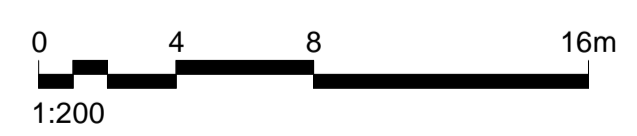
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Scale
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Client
UNIVERSITY OF WOLLONGONG

Project Name
WESTERN BUILDING

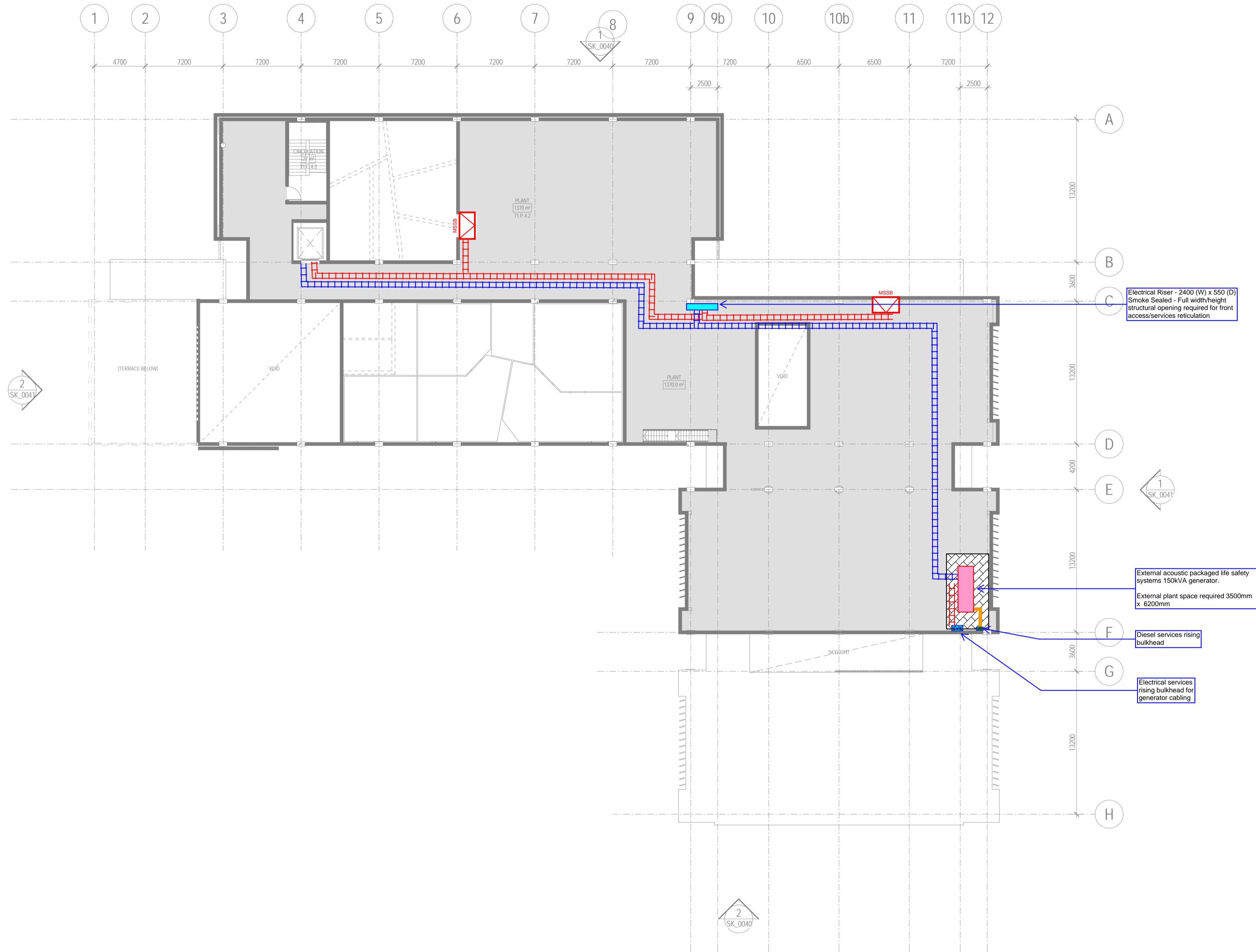
Drawing
SK_0036
SCHEMATIC_LEVEL 3
LAYOUT



UNIVERSITY OF WOLLONGONG AUSTRALIA

HASSELL
ABN 24 007 711 435

NSW Nominated Architects: Tony Grist 5350 Ross de la Motte 7398
INDICATIVE ONLY - NOT FOR CONSTRUCTION



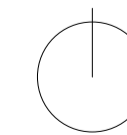
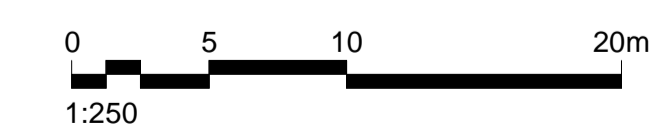
Revision	Date
A SCHEMATIC DESIGN - ISSUED FOR COSTING	24/08/17
B CONSULTANT ISSUE	06/09/17
C ADD ROOM NAMES	07/09/17
D CONSULTANT ISSUE - WORKPLACE ADJUSTED	07/09/17

Scale
1 : 200 @ A1

Client
UNIVERSITY OF
WOLLONGONG

Project Name
WESTERN BUILDING

Drawing
SK_0037
SCHEMATIC_LEVEL 4
LAYOUT



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