CME Building

Concept Design Report – Engineering Services

Transport for NSW

04 November 2022

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1. Introduction

1.1 Purpose of this report

This report details the concept design proposals for the engineering services and supports State Significant Development (SSD) Development Application (DA) No. SSD-39971796 for the heritage conservation and adaptive reuse of the former Chief Mechanical Engineer's Building (CME Building) in North Eveleigh, which is submitted to the Minister for Planning pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Transport for NSW is the proponent for the SSDA.

This report covers the engineering services as detailed below:

– Hydraulic services including the sanitary drainage, stormwater, water supply and domestic cold and hot water.
– Mechanical services including the air conditioning and ventilation services
– Electrical services including power supply and power systems, lighting, communication systems and security systems
– Fire services including fire hydrant, fire sprinkler, fire alarm and fire hose reel systems

1.2 Scope and limitations

This report: has been prepared by GHD for Transport for NSW and may only be used and relied on by Transport for NSW for the purpose agreed between GHD and Transport for NSW as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Transport for NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.3 Background

1.3.1 Site Description

The site comprises the former CME Building (**Figure 1**) and immediate surrounds (**Figure 2**). The site is identified as 505 Wilson Street, and forms part of Lot 5 in Deposited Plan 1175706.

Originally constructed in 1887 and subsequently extended to keep pace with the expansion of the NSW railways and demand for engineering services, the CME Building is of State heritage significance. The CME Building is listed on the NSW Heritage Register (SHR No. 5014147) and Transport for NSW's s170 Register. The statement of significance provided on the NSW Heritage Inventory outlines the significance of the site:

> *The building is a very fine late Victorian railways office on a scale above all other such structures in the State. The building reflects the importance of the railway engineers in the development of the State and its closeness to the Eveleigh workshops (mainly under the control of the Mechanical Branch) indicates the confidence in railway construction. The building is in a style not often seen in Sydney and is a rare survivor. More often this form of building is in evidence in the country where the pressure of development*

is less. It is an important element in the town and streetscape of Wilson St, Redfern, particularly to close proximity to the railway workshops.

The CME Building is located within the Redfern North Eveleigh Precinct (**Figure 3**). The Redfern North Eveleigh Precinct is located within the wider Redfern-Waterloo Authority Sites SSP. The Redfern North Eveleigh Precinct is 10 hectares of land owned by Transport Asset Holding Entity (TAHE) at the southern edge of Redfern Station, located between the rail corridor and Wilson Street.

The Redfern North Eveleigh Precinct, including the CME Building, is the subject of an approved Part 3A Concept Plan (MP08_0015) which continues to apply to the land pursuant to Schedule 2 of *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*. TfNSW is currently preparing a SSP Study for the Paint Shop Sub-Precinct within the wider Redfern North Eveleigh Precinct, which was exhibited between 26 July and 25 August 2022. It is noted that the SSP Study indicates that the Concept Approval would be surrendered should rezoning of the Paint Shop Precinct occur.

Figure 1 - Chief Mechanical Engineer's Building (existing), viewed from Wilson Street

Figure 2 – Aerial showing extent of works
Source: Nearmap/Ethos Urban

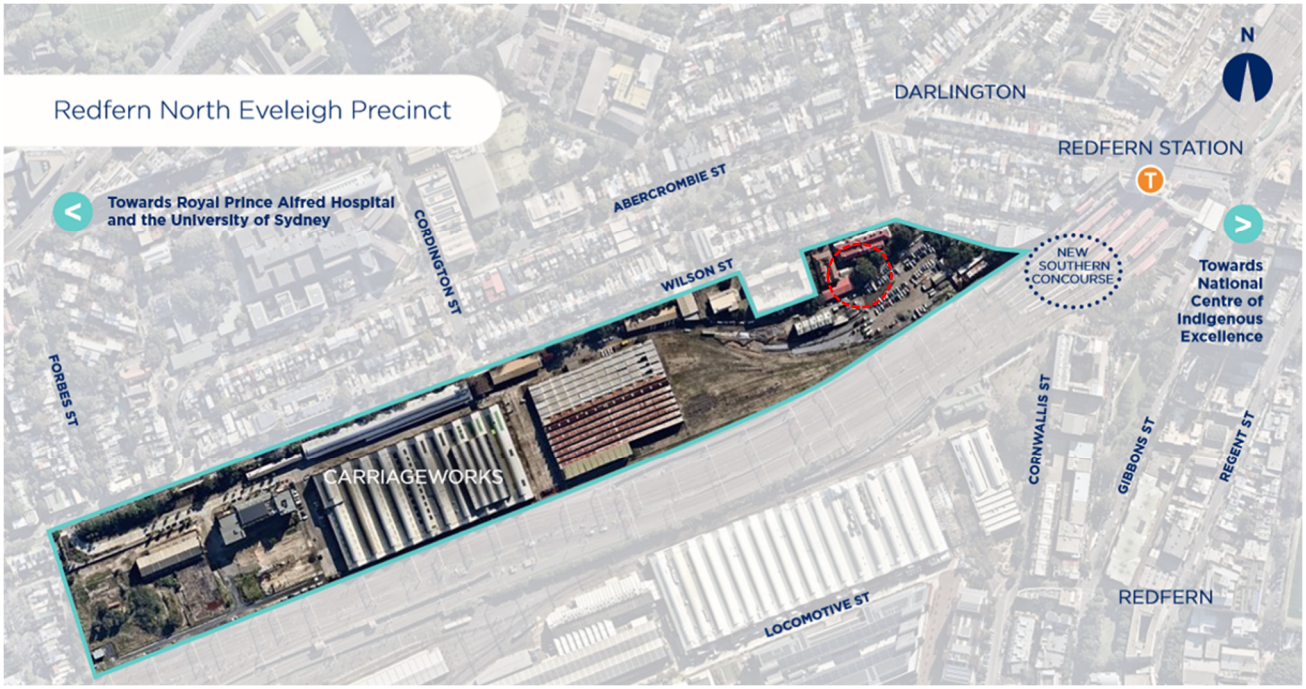


Figure 3 - Redfern North Eveleigh Precinct (CME Building outlined in red)

Source: TfNSW

1.3.2 Overview of Proposed Development

The application seeks consent for the heritage conservation and adaptive reuse of the CME Building, which includes:

– Internal and external heritage conservation works to make the building suitable for adaptive reuse, including painting, repairs and refurbishment of the existing building (primarily internally) and installation of services to support future usage for offices or the like;
– Building upgrades to ensure compliance with the Building Code of Australia, including accessibility and fire safety requirements;
– Removal of any hazardous building materials; and
– Minor landscaping works.

No significant additions (except those necessary to facilitate suitable access and fire egress) or substantive demolition of external heritage fabric is envisaged as part of the project. Internal changes comprise the removal of some internal walls and alterations to building fabric to create suitable spaces and compliant paths of travel.

1.3.3 Assessment Requirements

The Department of Planning and Environment have issued Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as follows:

– Design Quality – engineering services

1.4 Assumptions

This concept design report is based on the following:

– Services brief for the CME Building excluding the provision of an external electric vehicle charging station and removal of the requirement to demolish the services to the toilet block
– Return brief prepared for the CME Building
– Concept drawings prepared by the Architect and Landscape consultant
– Preliminary assessment of the credit requirement to achieve a 5 star Green Star rating for the Building

2. Hydraulic Services

2.1 Scope

The hydraulics services are for the design and documentation of the proposed CME building development and include:

– Rainwater drainage, harvesting, treatment, and reuse.
– Sanitary plumbing and drainage.
– Sanitary Fixtures and Tapware [as specified by Architect].
– Domestic cold-water reticulation.
– Domestic hot water and warm water reticulation.
– Backflow protection.
– Connections to site infrastructure.
– Associated Authority plumbing applications and negotiations (excluding fees and charges);
– All co-ordination between Hydraulic Services and other services trades including mechanical, fire sprinklers, irrigation and building structure.

2.2 Design Criteria

Refer to architectural schedule for sanitary fixture and tapware selections.

Minimum fixture flow rates

Table 1 Minimum fixture flow rates

Fixture	Max flowrate (l/min)	WELS Rating
Basins (including DDA)	6	TBC
Sinks	9	TBC
Showers	9	TBC
Urinals	N/A	N/A
Water Closets (including DDA)	N/A	N/A

2.2.1 Water Services

The potable cold water supply system for the male and female bathroom amenities, kitchenettes and garbage / mechanical plant room shall meet the following minimum operational and design criteria:

Table 2 potable water operational requirements

Function	Design Criteria
Working velocities in pipes shall be limited to a maximum of	1.6m/s
Maximum operational pressure at outlet	500kPa
Minimum operational pressure at outlet	250kPa

The potable hot water supply system for the male and female bathroom amenities, kitchenettes and garbage / mechanical plant room shall meet the following minimum operational and design criteria:

Table 3 Hot water operational requirements

Function	Design Criteria
Working velocities in HW flow pipes from heaters shall be limited to a maximum of	1.2m/s
Maximin operational pressure at outlet	500kPa
Minimum operational pressure at outlets	250kPa
Hot water storage temperature shall be set at a minimum of	60°C
Thermostatic mixing valves to all accessible amenities at	42°C
Thermostatic mixing valves in all other areas to be set at	50°C

2.2.2 Compliance

The key Standards, Codes and Regulations for the hydraulic services systems include:

– Plumbing and Drainage Part 1: Water Service: To AS/NZS 3500.1:2018
– Plumbing and Drainage Part 2: Sanitary Plumbing and Drainage: To AS/NZS 3500.2:2018
– Plumbing and Drainage Part 3: Stormwater Drainage: To AS/NZS 3500.3:2018
– Plumbing and Drainage Part 4: Hot Water Supply System: To AS/NZS 3500.4:2018
– Building Code of Australia 2019 Volume 1 (Amnd 1)
– Plumbing Code of Code of Australia 2019 Volume 3
– Electrical Installations (Australian and New Zealand Wiring Rules): To AS/NZS 3000:2018

2.3 Sanitary Drainage

Sanitary drainage and plumbing systems: Designed in accordance with AS/NZ 3500.2 and Local Authority requirements including:

- In ground drainage, shall have adequate inspection openings to surface to enable ease of maintenance. Where possible main drains to be run external to the building.
- Sanitary waste shall be connected via a new gravity connection point anticipated at the front of the site to the existing Sydney Water sewer infrastructure.
- Provide provision for safe release of effluent from the connection point (ORG and/or reflux valve).
- Vents and drainage pipes will be constructed to provide flexibility for future building requirements and fixture reconfigurations.
- Additional drainage systems will be provided to cater for discharge from mechanical, fire and hydraulic plant and equipment as required.
- Sanitary vents shall be terminated to atmosphere, through the highest roof level.
- Sanitary plumbing located over acoustic sensitive areas will be acoustically wrapped in accordance with the acoustic engineers and best practice requirements.
- All non-metallic pipes penetrating floor slabs, fire and smoke walls and any fire rated element will be provided with an approved fire stop collar to match the required FRL of that element.
- All pipes will be adequately supported and securely fixed. Such supporting and fixing to be carried out without causing any distortion, damage or stress on the pipes or pipe joints. Pipes will be supported at each collar and at spacing as listed in the appropriate Australian Standard.
- Supply and install tundishes in areas required for mechanical / plant drainage. Tundishes will be recessed in wall type with viewing panel or chrome plated where exposed.
- Pipelines shall be laid true to line and bore from point to point.
- Pipelines shall be graded in accordance with the Authorities requirements and as required under AS/NZS3500.2.
- Provide and install clear-out inspection fittings to provide rodding access to all lines for ease of maintenance.

2.4 Rainwater Collection & Re-use

Designed in accordance with Local Authority regulatory requirements & AS/NZ 3500.1 and AS/NZS 3500.3, rainwater shall be collected to Sydney Water, local council and Australia Rainfall Runoff requirements.

A storage/rainwater collection tank combined with Onsite Detention Tank (OSD) is situated at the rear of the site. Due to the sites heritage constraints the rainwater tank and OSD is provided below ground with the combined tank overflow connecting into the authority civil stormwater drainage system.

Harvested rainwater is intended to be collected from a portion of the CME building roof via external downpipes, and the stored rainwater shall be treated / filtered to class' A' water quality prior to re-use via rainwater pumps for site irrigation supply purposes.

2.5 Stormwater Drainage System

The stormwater drainage system from the CME building extends from the base of the external downpipes and discharges to the civil stormwater and civil OSD system provided by others.

2.6 Water Supply

A new potable water connection for the CME building development is provided from the existing site potable water supply via the existing authority meter and existing site RPZD assembly located at the front of the site boundary near Wilson and Little Eveleigh Street.

A new fire mains connection from the existing authority main at the front of the site in Wilson Street shall be provided for new CME fire services. The fire main services connected to the authority main shall be reticulated up to the fire booster(s) within the site boundary on Wilson Street and terminated for continuation by fire services Contractor. Refer to section 5 for further fire services information.

2.7 Domestic Water

2.7.1 Potable Cold Water

Potable cold water delivery to fixtures, fittings, equipment and plant throughout the CME development, shall include:

Backflow prevention provided on:

– incoming water supplies (to Sydney Water requirements).
– To zoned areas.
– On individual fixtures, where required by AS/NZS3500.1.
– Rainwater tank potable cold water switching device.
– Fire Services.
– Mechanical provisions.
– Irrigation provisions.

Potable cold water shall be supplied, at minimum, to the following:

– Amenities.
– Fit out areas.
– Mechanical equipment.
– Heated domestic water heaters.
– Refuse/waste Room.
– Rainwater tank potable cold water switching device.
– Capped provision for irrigation.

The cold water system will incorporate stop valves, which shall be located in readily accessible locations to enable individual area isolation for maintenance purposes.

Excessive water pressures to be reduced by providing individual adjustable pressure reducing valves on the outlet of the control valves.

Fixtures, fittings and equipment shall be provided with the minimum WELS rating as nominated by the ESD consultant to meet Green Star requirements.

The following water metering strategy shall be adopted;

– Authority Metering.
– Potable domestic main water meter.
– DCV bypass water meter on fire services.
– Sub meters for future fit out provisions (TBC).

2.7.2 Potable Hot and Warm Water

Heated domestic hot water shall be generated utilising electric instantaneous 3 phase type hot water units located in bathrooms and kitchenette amenities, close to point of use and within accessible locations.

Thermostatic mixing valves for warm water delivery shall be provided in wall recessed stainless steel cabinets to provide temperature reduction in all amenity showers, basins and accessible fixtures as required.
Hot water insulation will have a zero flame and smoke index and be 25mm thick (min) wall thickness with a K value of 0.04 w/m K for all bathrooms and kitchenette amenities.

Dead legs in the heated water system shall be avoided as much as practical and every heated water outlet shall have full temperature within 10 seconds.

Instant chilled / boiling type service units are provided close to point of use within kitchen sink cupboards and located on ground and first floor kitchenette areas.

2.8 Building Management System (BMS)

Hydraulic systems monitored shall include:

– Sub water meters.
– Rainwater pumps set including;
  - Each pump failure;
  - Each pump run.
– Rainwater storage tank;
  - High level alarm;
  - Low level alarm.
– Rainwater treatment system fault.

3. Mechanical Services

3.1 Scope

The Scope of the Mechanical Services comprise the Air-conditioning and Ventilation Services which include:

– Air conditioning systems to serve all occupied areas to suit a class 5 commercial office
– Filtered and conditioned fresh air distribution to each space.
– Cooling to Communications Rooms
– Mechanical ventilation to the toilets and pantries. etc.
– Provision for future tenant exhaust systems
– Building Management and Control System (BMS).

3.2 Design Criteria

3.2.1 Design Conditions

External:: Summer 31.1^{0}C dry bulb ,22.7^{0}C wet bulb

Winter 7.2^{0}C dry bulb

Internal:	22.5°C ± 1.5°C Dry Bulb and nominal 50% Relative Humidity (No direct humidity control except by virtue of the coil selection)
Outside Air:	50% higher rates of Outside Air than the recommended outside air quantities detailed in AS 1668.2:2012 to comply with the 5 star Green Star requirements. Include CO2 monitoring to maintain the internal CO2 level less than 800ppm
Supply Air:	Based on heat load requirements.
Exhaust Air:	Toilets To AS1668.2: 2012
	Mechanical and electrical rooms; to suit equipment requirements.
Supplementary Outside Air:	0.3 l/s/m² NLA to every floor for tenant use
Supplementary exhaust air:	100l/s per floor
Temperature zoning	Separate temperature zones are required for each room in the ground and first floor areas

3.2.2 Internal Heat Gains

Lighting 5 W/m^2

Small power 15 W/m^2

3.2.3 Noise levels design

Comply with AS2017: 2017

3.2.4 Occupancy

The total occupancy for the building shall be 1 persons per 10m² NLA

3.2.5 Compliance

The key Standards, Codes and Regulations for the mechanical services systems include:

- National Construction Code 2019.
- AS 1668.1:2015 - The use of ventilation and air-conditioning in buildings – Fire and smoke control in buildings
- AS 1668.2: 2012 – The use of ventilation and air-conditioning in buildings – Mechanical ventilation in buildings
- AS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- AS 3666 Set 2011– Air-handling and Water Systems of Buildings – Microbial Control
- AS/NZS 3000:2018 – Electrical Installations
- AS 1324.2:2003 – Air Filters for Use In General Ventilation
- AS 4254.1:2021 – Ductwork for air handling systems in building – flexible duct
- AS 4254.2:2012 – Ductwork for air handling systems in building – rigid duct
- AS 4426:1997 – Thermal insulation of pipework, ductwork and equipment selection, installation and finish
- Local Electricity Supply Authority
- Occupational Health and Safety Codes

3.3 Air Conditioning

3.3.1 General

The mechanical system is based on the following principles:

– Minimum noise and vibration characteristics.
– Proven design.
– Appropriate for application and climate.
– Limited space available in the first floor space for the reticulation of the services
– Limited height available in the sub floor space on the ground floor for the reticulation of services
– Minimum disturbance of the heritage fabric of the building
– Reliability.
– Durability.
– Flexibility for future churn. This shall include clearly defined separation of services and specification of clear ceiling zones of sufficient height to permit the reticulation and relocation of each service
– Ease of maintenance.
– Ease of replacement of parts, consumables and whole item.
– Design criteria and building performance in accordance with requirements and recommendations in the reference standards.
– Efficient operation at full load, part load and after-hours operation – this requires a balance between initial capital cost and ongoing operation and maintenance costs. The system shall have the lowest total cost solution having regard to functional requirements, operation costs, future maintenance and initial costs.
– Plant selection shall be in accordance with recognised design guides e.g. AIRAH Design Guides as follows:
    - DA02 Noise Control
    - DA09 Load Estimation and Psychrometric
    - DA15 Air Filters
    - DA03 Duct Design
    - DA13 Fans

All plant shall be commissioned in accordance with a recognised standard such as ASHRAE Guideline 1 or CIBSE Commissioning Code M.

3.3.2 ESD Design Objectives

The building is to be designed to achieve a 5 star Green Star rating.

To meet energy budget requirements, the building will have energy and environmental conservation measures to minimise energy consumption without compromising the specified accommodation standards. The following has been considered for the Heating, Ventilation and Air Conditioning Systems:

– Use of direct expansion variable flow refrigerant systems with energy efficient part load performance
– Provision of variable speed drives to outside air fans with variable flow
– Include a 50% increase to the outside air rates specified in AS 1668.2 with CO2 monitoring to allow the outside air to modulate and maintain a maximum of CO2 le vel of 800ppm
– Use of high efficiency electric motors
– Control of the mechanical services with a direct digital control system incorporating energy saving algorithms
– Consideration of the provision of a mixed mode air conditioning system allowing the use of natural ventilation through opening windows when outside ambient conditions are appropriate.

3.3.3 Air conditioning Options

The total area to be air conditioned is in the order of 1100m² with an estimated cooling load less than 150kW and the heating load less than 100kW.

The existing building will require some cooling and heating to provide acceptable temperature control. The provision of passive cooling and heating would require considerable modification to the fabric of the building including increasing the thermal insulation of the walls, floors and windows together with the introduction of ventilation chimneys into the building. Due to the heritage requirements this is not considered practical, and an active cooling and heating system will be required to provide suitable comfort conditions in the building.

A number of different options for air conditioning the building have been examined and these options are summarised below:

Chilled/Heating Water System

This option would include the following:

– An air cooled chiller with circulation pump located in the outdoor plant space
– An air cooled heat pump with a circulation pump located in the outdoor plant space to provide heating
– Insulated chilled water and heating water pipes reticulated underground between the plant space and the sub floor space of the ground floor
– Insulated chilled and heating water pipework reticulated through the building to the fan coil units
– Ducted fan coil units located in the roof space and ground floor sub floor space or free standing fan coil units located on the floor of the rooms.
– A separate ducted outside air system comprising outside air intakes, filters, fans and ducting through the roof space and vertical risers to the ground sub floor space to reticulated outside air though the building. Outside air would be distributed to the first floor via linear slot ait outlets in the first floor ceiling and to the ground floor via swirl outlets in the ground floor.

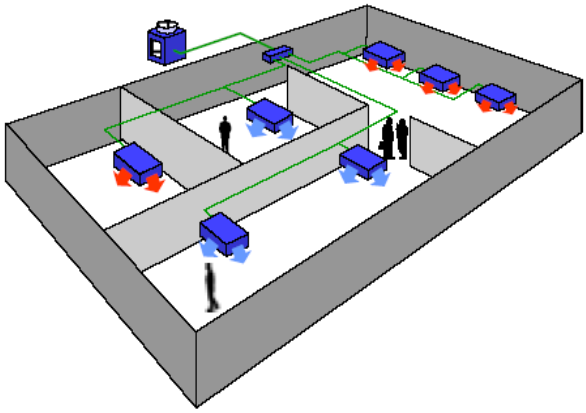
The advantages and disadvantages of this option are outlined below:

Table 4 Chilled / Heating Water System assessment

Advantages	Disadvantages
The use of chilled water would allow the use of an underfloor displacement air system for the ground floor. The use of direct expansion refrigeration system would result in a supply air temperature too low to use for an underfloor system	Higher capital cost than a direct expansion system
Good temperature control	The chiller and heat pump will take up more space that the condensers for an air-cooled refrigeration system
The chillers can use lower GWP refrigerants than direct expansion systems	The pipework will be larger and more difficult to fit into the available floor space than using refrigerate pipework
Can be controlled directly via a BMS	The system will only have one source of cooling or heating so if these break down, no cooling or heating would be available.
	More likelihood of leaks or condensation drips from the use of chilled water pipework

Variable Refrigerant Flow System

A VRF air-conditioning system would comprise the following:



- Air cooled heat pump condensing units located in the outdoor plant space. These are fitted with variable speed refrigeration compressors to provide both cooling and heating via reverse cycle operation.
- Refrigeration pipework would be reticulated in ground to the sub floor space of the ground floor and reticulated via the sub floor space of the ground floor and vertical risers to the first floor
- Ducted fan coil units located in the roof space and ground floor sub floor space or free standing fan coil units located on the floor of the rooms.
- A separate ducted outside air system comprising outside air intakes, filters, fans and ducting through the roof space and vertical risers to the ground sub floor space to reticulate outside air though the building. Outside air would be distributed to the first floor via linear slot air outlets in the first floor ceiling and to the ground floor via swirl outlets in the ground floor.

VRF systems are complex and contain microprocessor-based electronics, which ensure efficient operation. Central to VRF control is their ability to automatically vary refrigerant flow from the outdoor unit in response to the heating/cooling load of the building.

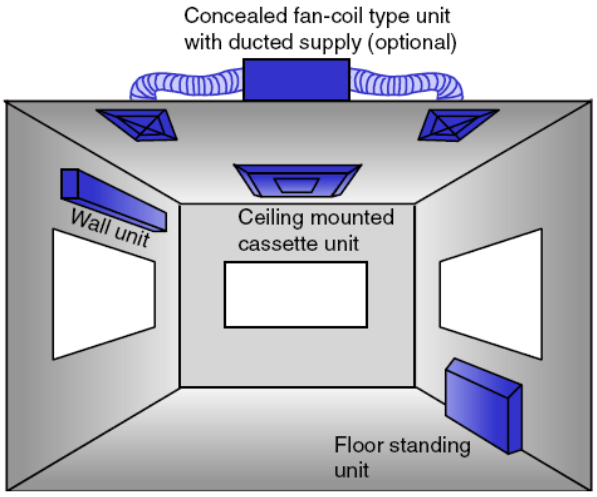
The advantages and disadvantages of this option are outlined below:

Table 5 Variable Refrigerant Flow System assessment

Advantages	Disadvantages
The refrigerant pipework is smaller than the chilled and heating water and requires only one set of pipes. The pipework will have less impact on the building fabric	Cannot be used for an underfloor ducted system as the supply air temperature is too cold
Lower capital cost than the chilled water/ heating water option	Requires a High Level Interface to connect the controls to a BMS
The air-cooled condensers require less plant space that the chiller and heat pump	
Can provide both heating and cooling simultaneously and can	

Advantages	Disadvantages
There will be multiple condensers so on failure of one unit, air conditioning to all the building is not affected	
More energy efficient than a small, chilled water/ heating water system	

Ducted Vs Free Standing Fan Coil Units



There are options to use ducted fan coil units or free-standing air fan coil units. The use of a high wall unit is only considered suitable for the Communications room. The use of ceiling mounted cassette units is not considered appropriate for this building due to the openings required in the heritage ceilings and visual impact of the units.

The ducted unit option would include:

– Ducted fan coil units located in the roof space with Sheetmetal and flexible ductwork between the FCU and supply and return air outlets in the ceiling to distribute the air to the space.
– Ducted fan coil units located in the sub floor space of the ground floor with return and supply air outlets located in the floor of the ground floor.

Note there is no space available to locate the FCUs in the first floor floorspace and insufficient space in the ground floor corridor to fit the FCUs ductwork and other services.

The free-standing fan coil units will comprise free standing fan coil units located on the ground and first floor with no supply and return air ductwork.

A comparison of these systems are as follows:

Table 6 Ducted FCU comparison

Advantages	Disadvantages
The fan coil units would be hidden in the roof space and underfloor space	May be insufficient space in the roof space to fit the FCUs and ductwork
Better air distribution that the free standing FCUs	Require excavation of the sub floor ground floor space to provide a minimum of 450mm clear space
	As the FCUs for the ground floor need to be located in the sub floor space, a direct expansion VRF system is not suitable and a central chilled and heating water system would be required
	Require a large number of openings in the first floor ceilings and ground floor for the air outlets and access to the FCUs

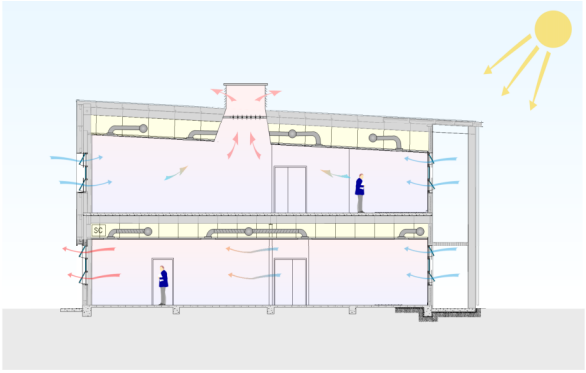
Table 7 Free Standing FCU comparison

Advantages	Disadvantages
Does not require space in the roof space or under the ground floor	The FCUs will be exposed in the rooms
Least effect on the heritage fabric including the ceilings and floor	Air distribution is not as good as good
Only localised excavation in the ground floor sub floor is required	
Allows the use of a VRF direct expansion refrigeration system	

3.3.4 Other Considerations

The provision of individual FCUs in each space will allow the provision of a mixed mode air conditioning system.

Mixed mode is not considered a system in itself but an enhancement that can be applied to an air conditioning system to improve energy consumption. A mixed mode system can be defined as a system that utilises either air conditioning to a space to control temperatures and when external conditions are appropriate utilises natural ventilation in lieu of air conditioning to control space temperature. In this building the FCUs would be arranged to shut down when the windows in the room are open



Key points

- Energy efficient means to provide outside air and control space temperatures to buildings
- Potential to create healthier internal environments
- Can provide greater occupant satisfaction due to increased sense of control of system
- Provides more reliability as each system can act as a backup of the other
- Extends life of mechanical plant as it will run less.

Limitations

- More expensive than air-conditioning only
- Openable windows will have security implications
- Open windows can be a source of noise entering the building
- Entrance of insects etc through openable windows needs to be considered
- Building operators may require special training
- Occupants need to understand building operation.

3.3.5 Proposed Air Conditioning System

The proposed air conditioning system for the building is a Variable Refrigerant flow system using free standing fan coil units with a separate ducted outside air system with air outlets in the first-floor ceiling and ground floor.

This system is selected for the following reasons:

- Least impact on the heritage fabric and only limited penetrations are required in the first-floor ceiling and ground floor for the outside air outlets
- The provision of the VRF system provides an energy efficient system with less plant area and smaller space required for the pipework.
- Allows the provision of a hybrid air conditioning to allow the use of natural ventilation by opening the windows when the conditions are appropriate.

3.3.6 Heritage Impact

The mechanical services will be configured to minimise the impact on the heritage fabric of the CME Building. These considerations include:

- Minimising penetrations in the ceilings and floors
- Provision of ducting in the roof space and sub floor space below the ground floor to reticulated ductwork.
- Minimising service risers and locating the risers in consultation with the heritage consultants to minimise the impact on the Heritage fabric.

– Provision of a service zone in a dropped ceiling in the ground floor corridor to allow reticulation of the services to the first floor.
– Routing the services including pipework between the floor joists of the first floor and following the changes of direction in the floor joists to minimise the impact of the service reticulation in these areas.

3.4 Ventilation Systems

The proposed ventilation systems are made up of two components, being outside air and exhaust systems.

3.4.1 Outside air Systems

Outside air will be provided to all occupied areas of the building and include supplementary outside air to allow for future meeting rooms etc.

The outside air systems will comprise the following

– Air intakes located in the valley of the roof so they are not visible form the ground level.
– Ducted outside air complete with filters and variable speed fans located in the roof space.
– Sheetmetal and flexible ductwork in the roof space to linear slot outlets in the first-floor ceiling to supply outside air to the first floor.
– Sheetmetal droppers from the roof space to the ground floor sub floor space and ductwork reticulated in the sub floor space to floor mounted swirl outlets to serve the ground floor.
– Take off points in the roof space and sub floor space of the ground floor for future tenant use.
– Provision of CO^2 sensors to modulate the speed of the outside air fans to maintain the CO^2 levels below 800ppm.

3.4.2 Exhaust systems

The toilets and pantries will be provided with ducted exhaust systems comprising ductwork and fans located in the roof space with exhausts discharging through the roof.

3.5 Controls

3.5.1 Building Management System (BMS)

A central BMS shall monitor and control the operation of all the Mechanical Services systems within the buildings.

A comprehensive building management system utilizing direct digital control and front-end monitoring systems shall be provided for the control, operation and monitoring of all the major plant systems.

The operational status of all the Mechanical Services systems shall record back to the BMS together with all alarms.

The BMS system shall also, where required, control the timed operation of certain non-Mechanical systems.

The BMS shall also have provisions as required to achieve a 5 star Green Star rating. These include

– Monitoring the electrical and water consumption using sub meters
– Provide a demand management system to control the peak electricity use – the details of this will need resolution during the detailed design stage.
– Provision of a demand management dashboard that shows the peak demand target, current, historical demand, the demand shedding priorities and enabling button alongside the critical performance characteristics (usually comfort temperature)

4. Electrical Services

4.1 Scope

The scope of work for the Electrical Services comprises the following:

– Installation of power and communication lead mains to support future commercial tenants.
– Electrical services design to allow for multiple commercial tenants and design to suit a base building configuration with future fit outs.
– Provide metering for multiple tenants.
– Design of lighting system, small power layout and communication system to suit the base building.
– Reticulate power and communications cabling including cable pathways for future tenant fit outs.
– Heritage consideration is paramount with special consideration for cable reticulation through the building.
– Installation of security system, including proximity card system or equivalent to building and external gates.
– Installation of Switchboard, Distribution board and communication racks.
– New electrical supplies to other services such as mechanical, hydraulic and fire services as required.

4.2 Design Criteria

4.2.1 Compliance

The key Standards, Codes and Regulations for the Electrical Services includes:

– National Construction Code 2019
– AS/NZS 3000-2018 Electrical Installations (known as the Australian/New Zealand Wiring Rules)
– AS/NZS 3008.1.1 2017 Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions
– AS/NZS 3013-2005 Electrical installations – Classification of the fire and mechanical performance of wiring system elements
– AS 61439 Low voltage switchgear and control gear assemblies
– AS/NZS 3760-2010 – In service safety inspection and testing of electrical equipment
– AS 3851 The calculation of short-circuit currents in three-phase A/C. systems
– AS/NZS 4836-2001 Safe working on low-voltage electrical installations
– AS/CA S009: 2020 Installation requirement for customer cabling
– AS 2834 1995: Computer accommodation
– AS 1428.1:2009 Design for access and mobility – General requirements for access – New building work
– AS 1428.2-1992 Design for access and mobility – Enhanced and additional requirements – Buildings and facilities
– AS/NZS 1680.1:2006 Interior and Workplace Lighting - General principles and recommendations
– AS/NZS 2053.1:2001 Conduits and fittings for electrical installations Part 1: General Requirements
– AS/NZS 2293.1:2018 Emergency lighting and Exit Signs for Building
– AS/NZS 4282:201 Control of the Obtrusive Effects of Outdoor Lighting
– AS 60529 Degrees of Protection provided by Enclosures (IP Code)
– SAA HB 29 Communication Cable Manual

Note: Some of the above Australian Standards are mandated by law; others represent current acceptable practice in case law. Where interpretation is necessary refer to advice from the appropriate Chief Engineer.

4.2.2 Existing configuration

A visual and non-invasive site inspection was undertaken on 16th June 2022. The findings of the inspection are noted in the section below:

Incoming supply and Distribution boards

The existing supply to the CME Building is supplied via an existing aerial supply along Wilson Street and is connected to the existing Main Switchboard/Meter Panel mounted on a private pole at the front of the premise.

The existing switchboard / meter panel has a 63A main switch. Existing cable containment is generally a mix of external inground cabling and mix of surface mounted containment and ceiling recessed cabling within the building.

An existing 400A rated Switchboard is currently located at the back entrance of the building and is unconnected. It appears unused and was believed to be part of a main supply upgrade that did not proceed. The switchboard condition has deteriorated in the interim.

There are several Distribution Boards and MSSB located along the corridor of building and will be removed and replaced for the new works.

No secondary supply has been identified, CME Building has only a single power supply.

Metering equipment

Existing Ausgrid meter panel is located on a private pole within the front of the premise.

Lighting, emergency lighting and lighting control

The general lighting installation is aged and at the end of life.

The existing lighting system within the building comprises of linear battens and troffer luminaires. All luminaires inside the building appear using fluorescent lamp.

The back side of the building are installed with gooseneck lights of a heritage nature. The front side of the building limited quantity of internal facing spot lights.

Existing lighting control is via manual switch.

There is no existing emergency lighting sighted during the site inspection.

General power

The existing general power installation is typical consisting of subcircuits supplying equipment as required throughout the building.

Communication

There are existing communication distribution frames located along the corridor. This will be removed for the new works.

Security

There is an existing nx-16 access control system near the front entry of the facility. There appears to be no CCTV at the facility.

Maximum Demand

The existing facility has been unused for a period of time, with no meaningful existing maximum demand available.

A preliminary maximum demand has been undertaken based on AS/NZS 3000 utilising square meter rates for an office facility. This has been estimated at approximately 200A. A detailed maximum demand will be calculated based on AS/NZ 3000 Table C3 in future stages of the design. A 30% spare capacity allowance will be added for future expansion.

4.3 Upgrade Requirements

The current drawings and documentation are at Concept Stage and will be subject to further design development. Certain details are not yet shown at this stage and will be further defined and designed in subsequent design stages.

The following upgrade requirements have been determined based on a site inspection, scope of work, calculations, interpretation of standards, and consultation with providers.

4.3.1 Power system

Supply Authority Connection

A previously approved ASP connection for a new supply from substation S.7224 was undertaken prior to the commencement of this project. It has however been several years since the approval was provided. It is anticipated that a new connection will need to be negotiated.

Metering equipment

Existing Ausgrid tariff metering shall be replaced with new as part of main switchboard. New sub-metering will be provided for future multiple tenants. Meters shall be connected to a monitoring system capable of capturing and processing the data produced.

Main Switchboard

A new Main Switchboard shall be provided to the proposed electrical room. New consumer mains to be provided from the Ausgrid substation (subject to application for connection).

4.3.1.1 Distribution Board

Existing Distribution Board will be removed and replaced with new. One Distribution Board for each floor with submain from the Main Switchboard. Total for circuit capacity to allow for 50% increase in circuits.

Enclosure to be non-combustible construction to comply with D2.7 of the BCA.

Cabling and Containment

A new underground cable containment shall be provided for the new incoming submains from the Substation Kiosk to the existing Main Switchboard.

The proposed cable route between Main Switchboard and Distribution Boards will be via combined services route / cable tray on the underfloor space ground floor and first floor. Separate cable tray on the same route shall be provided for the final circuits. Access hatch will be provided for maintenance purposes.

New electrical cabling and containment shall be compliant with relevant standards.

General Power

All new general power outlet and associated containment shall be in accordance with relevant Australian Standards.

4.3.2 Lighting system

New lighting and associated sub-circuits and containment will be provided to internal and external parts of the building in accordance with relevant standards.

Inground luminaires \ ground mounted projectors shall be utilised to highlight the existing heritage columns at the front entry. Glare guards shall be used where required.

External wall washers shall be utilised to accent the Northern façade, luminaires shall be installed in a concealed manner within the awning.

LED strip lighting shall be provided to highlight details including the tympanum above entry areas.

Internal luminaires shall be suspended where possible and supplemented with the use of wall mounted luminaires.

Where possible external luminaires will utilise a warm colour temperature (2700k or under).

New emergency lighting and associated sub-circuits and containment to internal portions of the building in accordance with relevant standards.

Where required to coordinate with heritage ceilings, surface mounted emergency lights shall be provided to avoid cutting large holes within the ceiling. Exit lights to be wire suspended.

Lighting controls shall be provided via motion sensor with contactor and override switch arrangement. Dimming shall be provided within internal luminaires and external luminaires where required to meet curfew requirements.

Lighting calculations will be provided in the next design stage.

4.3.3 Communication system

Complete operational telecommunication passive cabling system shall be provided in accordance relevant Australian Standards 11801 and 14763.2

Existing Distribution frames and all associated containment located along the corridor shall be removed. All existing connections shall be removed and new structured cabling (cat6A) provided from the new Communication Distribution rack located at the proposed communication room.

A new communication lead mains shall be provided to new communications network termination device (NTD)

A system of cable trays and conduits shall be provided in the underfloor space and roof space to allow for communication cable reticulation from the communication distribution rack.

The communications cable tray shall be sized to a 30% fill capacity with sides minimum 50mm high.

All new communications outlets and associated containment shall be in accordance with relevant standards.

4.3.4 Security system

Access control system and associated containment shall be provided to three (3) ground building entrance doors, proposed Communication room and external gates. Perimeter detection to be provided as required.

4.3.5 ESD Design Objectives

The building is to be designed to achieve a 5-star Green Star rating.

To meet energy budget requirements, the building will have energy and environmental conservation measures to minimise energy consumption without compromising the specified accommodation standards. The following has been considered for the Power and Lighting System:

– Accessible energy metering for all common uses, major uses, and major sources.
– Meters to be connected to a monitoring system capable of capturing and processing the data produced by the meters.
– Meters and automatic monitoring systems shall be:
    - Provided with continual information (up to 1-hour interval readings)
    - Commissioned and validated per the most current 'Validating Non-Utility Meters for NABERS Ratings' protocol.
    - All meters to have accuracy declarations and/or certificates
    - Sub-meters that are not to be used as utility (billing) meters should either have Certificates for accuracy issued by NMI or a test certificate from the European Measuring Instruments Directive - 2004/22/CE

- Where the building's Gross Floor Area (excluding car parking areas) is smaller than 1000m^2, unless specialist equipment with an annual power consumption of 100kwh/annum, is present in the building, a single meter for energy will comply with this minimum requirement.

– The monitoring system shall be:
  - Accurately and clearly present the metered data and include reports on consumption trends for the automatic monitoring system.
  - Be developed in accordance with a recognised Standard, such as CIBSE TM39 Building Energy Metering.
  - Raise an alarm when the energy or water use increases beyond certain parameters and automatically issue an instant alert to the facilities manager.
– All LED lighting installed has no observable effect as per the standard IEEE 1789-2015
– Lighting sources have a min. CRI 85 or higher
– Lighting sources shall meet best practice illuminance levels for each task within each space type with a maintained illuminance that meets the levels recommended in AS/NZS 1680.1:2006
– Maintained illuminance values shall achieve a uniformity of no less than that specified in Table 3.2 of AS/NZS 1680.1:2006
– All light sources shall have a min. of 3 MacAdam Ellipses.
– Glare from light sources shall be limited within the regularly occupied areas. Three options shall be provided for demonstrating compliance:
  - Performance method
  - Two prescriptive methods
– The building will use 10% less energy compared to a reference building. Energy use is measured as MJ/year.
– There is an opportunity to install PV cells on the north facing slope of the roof which is not visible from the ground level. This will be further investigated during the detailed design stage.
– All outdoor lighting shall comply with AS/NZS 4282:2019 Control of the obtrusive, at this stage, it is believed that compliance will be required to category A3 and R2. This will be reviewed during further design stages.
  - See extract of Table 3.1 and Table 3.2 of AS/NZS 4282 below.
– The system shall comply with both pre- and post-curfew requirements.
  - Control of direct illuminance - direct illuminance from external luminaires on the project produces a maximum initial point illuminance value no greater than 0.5 Lux to the site boundary and 0.1 Lux to 4.5 metres beyond the site into the night sky.

TABLE 3.1

ENVIRONMENTAL ZONES

Zones	Description	Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA Dark Sky Parks. Major optical observatories No road lighting -unless specifically required by the road controlling authority
A1	Dark	Relatively uninhabited rural areas No road lighting - unless specifically required by the road controlling authority
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas
A3	Medium district brightness	Suburban areas in towns and cities
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas
TV	High district brightness	Vicinity of major sports stadium during TV broadcasts
V	Residences near traffic routes	Refer AS/NZS1158.1.1
R1	Residences near local roads with significant setback	Refer AS/NZS 1158.3.1
R2	Residences near local roads	Refer AS/NZS 1158.3.1
R3	Residences near a roundabout or local area traffic management device	Refer AS/NZS 1158.3.1
RX	Residences near a pedestrian crossing	Refer AS/NZS 1158.4

NOTE: Recreational areas are not considered commercial.

TABLE 3.2

MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS

Zones	Vertical illuminance levels (E_v) lx		Threshold increment (TI)		Sky glow
	Non-curfew	Curfew	%	Default adaptation level (L_{sd})	Upward light ratio
A0	See Note 1	0	N/A	N/A	0
A1	2	0.1	N/A	N/A	0
A2	5	1	20%	0.2	0.01
A3	10	2	20%	1	0.02
A4	25	5	20%	5	0.03
TV	See Table 3.4	N/A	20%	10	0.08
V	N/A	4	Note 2	Note 2	Note 2
R1	N/A	1	20%	0.1	Note 3
R2	N/A	2	20%	0.1	Note 3
R3	N/A	4	20%	0.1	Note 3
RX	N/A	4	20%	5	Note 4

NOTES:

1 For A0, E_v shall be as close to zero as practicable without impacting safety considerations.

2 Refer to AS/NZS 1158.1.1.

3 Refer to AS/NZS 1158.3.1.

4 Refer to AS/NZS 1158.4.

5 N/A means 'Not Applicable'.

6 For an internally illuminated sign in an A2 zone, $L_{sd} \leq 0.25$ cd/m^2.

4.3.6 Heritage Impact

The electrical services will be configured to minimise the impact on the heritage fabric of the CME Building. These considerations include:

– Provide illumination to enhance the external heritage façade of the building while minimising impact on the residences across the road and night light pollution.
– External goose neck heritage luminaires are currently subject to review for refurbishment if part of the heritage fabric or replacement with similar if not.
– Minimising penetrations in the ceilings and floors.
– Provision of containment in the roof space and sub floor space below the ground floor and first floor.
– Minimising service risers and locating the risers in consultation with the heritage consultants to minimise the impact on the Heritage fabric.
– Provision of a service zone in a dropped ceiling in the ground floor corridor to allow reticulation of the services to the first floor.
– The size of existing heritage door openings may impact the type of equipment which can be provisioned. The future design stages and construction will need to take this into account for equipment modularity and assembly.

5. Fire Services

5.1 Scope

The fire services are for the design and documentation of the proposed CME building development and include:

- Fire Sprinkler system
- Fire Hydrant System
- Fire Detection system
- Portable Fire extinguisher
- All co-ordination between Fire Services and other services trades including mechanical, hydraulics, irrigation and building structure.

5.2 Fire Hydrant System

The overall building footprint is more than 500 m^2 and will required fire hydrant system. A fire hydrant system will be provided with a fire hydrant booster assembly and internal fire hydrants.

Fire hydrant system will be installed in accordance with BCA E1.3 and AS2419.1-2005.

5.3 Fire Sprinkler System

The building is not required to provide fire sprinkler system. However due to the nature of the type of construction, a performance solution would require the installation of fire sprinkler system to the building.

The building will be provided with Light Hazard category.

A fire sprinkler booster will be installed at the entrance of the building. An alarm valve is proposed to be installed under the stair access. The current location is not compliant to the requirement of BCA Spec E1.5. However, it is proposed to support the location via a performance solution.

Sprinklers will be provided throughout the building including the concealed space in accordance with AS2118.1-2017.

5.4 Fire Alarm System

Fire detection and Alarm System will be provided throughout the building in accordance with AS1670.1-2018. An addressable Fire Indicator Panel will be provided at the entrance of the building.

The fire panel will be interlink to the fire sprinkler system and will be monitored and connected to fire brigade via ASE.

Fire detectors, speakers will be provided throughout to comply with the requirement of AS1670.1

5.5 Portable Fire extinguisher

Portable fire extinguisher shall be provided throughout the building in accordance with BCA E1.6 and AS2444. ABE Powder type will be provided to office area for Class A hazard and CO2 will be provided for electrical hazards.

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