ONE SYDNEY HARBOUR

State Significant Development (SSD6960)
Stage 1B Basement – Barangaroo South

Services Report

One Sydney Harbour – SSD6960
Stage 1B Basement, Barangaroo South
Services Report

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Prepared By	Alex McBurney
Checked By	Andy Findlay
Approved By	Dean Dallwitz
Project Manager	Laze Kelepurovski
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Technical Enquiries	General Enquiries
Alex McBurney	Andy Findlay
Lend Lease, Design, Building Pty Limited	Lend Lease Building Pty Limited
Telephone: (02) 9236 6465	Telephone: (02) 9236 6199
Mobile: 0411 028 055	Mobile: 0429 265 132
Email: alex.mcburney@lendlease.com	Email: andy.findlay@lendlease.com

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1.0 Introduction

This report has been prepared by Lend Lease Design for Lend Lease Building Pty Ltd (Lend Lease) in support of a State Significant Development Application (SSD 6960) submitted to the Minister for Planning pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The Development Application (DA) seeks approval for construction of the Stage 1B Basement and associated works at Barangaroo South as described in the Overview of Proposed Development section of this report.

1.1 Overview of Proposed Development

The Stage 1B Basement DA seeks approval for the construction of a four level basement to accommodate parking for the Stage 1B Residential Buildings (subject to separate development applications). The works include the construction of common plant and services, loading docks, waste rooms and storage areas, as well as structural cores and associated building services for the Stage 1B Residential Buildings and provision of services to connect the proposed Crown Hotel development. The proposed Stage 1B development also includes above ground elements such as roads, car park ramps and risers, and temporary public domain and landscaping works.

It is noted that site preparation works, including demolition, remediation and excavation, are covered under SSD 5897.

1.2 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District, bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east; and bounded to the south by a range of new development dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Barangaroo Reserve, Barangaroo Central and Barangaroo South.

The Stage 1B Basement DA Site area is located within Barangaroo South. The Development Application Site is located on land generally known and identified in the approved Concept Plan MP06_0162 (as modified) as Blocks 4A and 4B and part of the public domain area between those blocks and Block 5.

1.3 Reference Drawings

This report is based on the following reference drawings:

Drawing No.	Revision	Drawing Title
BB2_PA2_A000	Rev A	Title Sheet
BB2_PA2_A001	Rev A	Aerial Location Plan
BB2_PA2_A002	Rev A	Survey Plan
BB2_PA2_A003	Rev A	Demolition Plan
BB2_PA2_A100	Rev A	BASEMENT PLAN LEVEL B0
BB2_PA2_A101	Rev A	BASEMENT PLAN LEVEL B1
BB2_PA2_A102	Rev A	BASEMENT PLAN LEVEL B2
BB2_PA2_A103	Rev A	BASEMENT PLAN LEVEL B3
BB2_PA2_A104	Rev A	BASEMENT PLAN LEVEL B4
BB2_PA2_A105	Rev A	BASEMENT PLAN LEVEL B5
BB2_PA2_A300	Rev A	SECTION 01
BB2_PA2_A301	Rev A	SECTION 02
BB2_PA2_A302	Rev A	SECTION 03
BB2_PA2_A303	Rev A	SECTION 04
BB2_PA2_A400	Rev A	BUILDING ELEMENTS - GROUND FLOOR
BB2_PA2_A401	Rev A	BUILDING ELEMENTS - PODIUM 1
BB2_PA2_A402	Rev A	BUILDING ELEMENTS - PODIUM 2
BB2_PA2_A501	Rev A	BUILDING ELEMENTS - ELEVATIONS

2.0 Electrical Services

2.1 Introduction

This section describes the electrical services for the basement area of Barangaroo South Stage 1B. Other documents describe the scope of work in other areas such as the Ground Plane, Podium and in the residential towers themselves.

The electrical services covered in this document include the following:

a) High Voltage Cabling Infrastructure
b) Substation
c) Consumers Mains
d) Main Switchboards
e) Sub mains
f) Distribution Boards
g) Earthing
h) General light and power sub-circuit cabling
i) Lighting Fittings
j) Lighting Control System
k) Emergency and Exit Escape Lighting including computer monitoring systems
l) Power connections to all electrically operated equipment.
m) Energy metering and monitoring system
n) Standby power system
o) Lightning protection and surge diversion

2.2 High Voltage Cabling Distribution

Power to Barangaroo South Stage 1A development is proposed to be provided by 33kV Ausgrid feeders originating at Pyrmont Switching Station. These feeders will be upgraded to service the additional load of the Barangaroo South Stage 1B development. The supply to the development and the proposed Crown Hotel development if approved may change and is subject to negotiation and agreement with Ausgrid.

The Barangaroo South Stage 1B development will be provided with incoming power from the Barangaroo South Stage 1A private high voltage embedded network infrastructure or from Hickson Road subject to negotiation of the supply with Ausgrid. A substation will be established on the Building R4A podium level of Stage 1B to service the residential buildings, retail and associated uses, subject to design development.

The high voltage cabling is proposed to be owned, operated and maintained by the Lend Lease Living Utilities business, and so will be a private electricity asset. In the event that the supply is via the existing 11kV network it is likely that the high voltage will remain the property of Ausgrid. The private electricity network will be designed such that it could be transferred to Ausgrid ownership in the future, if so required. The high voltage supply for Stage 1B will originate from substation No.6 located in Stage 1A. If negotiation with Ausgrid results in supply via the existing 11kV triplex network the supply will originate from Hickson Road. A triplex set of high voltage cables configured in N-1 redundancy will be provided to serve the substation in Stage 1B (substation No.10). The 33kV cabling will be run in a pit and duct system which will be 2 hour fire rated throughout its length. The pit and conduit system will also carry fibre optic cabling associated with the power distribution system's control, monitoring and protection.

2.3 Substation

One substation will be provided to service the Barangaroo South Stage 1B precinct. The substation will service:

- The basement
- The Ground Plane

- The podiums
- Residential Towers R4A, R4B and R5.

The substation will be part of the Lend Lease Living Utilities Embedded network and so will be privately owned, operated and maintained. However the substation will be designed so that it could be handed to Ausgrid in the future, if so required.

This substation will be configured with three (3) 33kV/400V transformers each rated at 1500kVA. These transformers will be configured to provide an N-1 level of redundancy which will provide substation availability even in the event of one (1) transformer failure. It is proposed that the substation be located in Level 1 of the podium area of Building R4A.

All cooling load for Barangaroo South Stage 1B will be provided by the District Cooling Plant (DCP) located in Barangaroo South Stage 1A Basement. Thus cooling loads have not been included in the maximum demand estimate for Stage 1B.

The calculated maximum demand equates to less than 80% of the substation capacity, which conforms to Ausgrid's recommendations for spare capacity for planning purposes.

The supply of HV to the proposed Crown Hotel site is from via Stage 1B or Stage 1A depending on the negotiation and agreement with Ausgrd. Provision for the supply of the HV cabling to the proposed Crown Hotel is included in this developrment application.

2.4 Standby Power System

A diesel generator system will be provided in the Stage 1B basement for standby power in the event of a mains power failure. The following will be backed up by standby power:

- Basement Fire safety essential services,
- Basement Communications/security equipment,
- Basement emergency hydraulic equipment, eg sewer ejector pumps, emergency water pumps, stormwater pumps.

A diesel fuel storage system is located in Stage 1A, which supports 24 hours of autonomy. Fuel may be pumped from Stage 1A to the standby power system in Stage 1B. Alternatively a separate fuel storage facility may be provided within the Stage 1B basement.

Although there is no statutory requirement to provide standby power to the residential buildings or retail areas, additional capacity in the Stage 1B Basement generator will be provided to service limited standby power to the residential towers.

2.5 Carbon Abatement

A method of carbon abatement will be provided within the Barangaroo South Stage 1B Basement. The quantum of carbon abatement will equate to a minimum of 1706 tonnes CO_2 per annum.

There are several possible methods to achieve the required carbon abatement. These may include:

- Natural gas fired reciprocating engine generator with heat recovery
- Natural gas fired gas turbine generator(s) with heat recovery
- Natural gas fuel cell generator with heat recovery.

Heat recovered from the engine(s) will be used within the residential tower buildings.

Depending on the technology used, the electrical generator may also be used to provide or supplement the standby power requirements of the Stage 1B Basement.

2.6 Power Distribution System

2.6.1 Consumer Mains

The consumer mains will be installed from the point of attachment in the Barangaroo South Stage 1B substation to the site main low voltage switchboard located in the Building R4A Podium. The consumer mains will generally consist of "Best Practice" XLPE/PVC insulated and sheathed cables with copper conductors. However, fire rated cabling will be used for mains to switchboards supplying fire or lift services equipment designated as essential / emergency. Essential and emergency designated services are outlined in the NCC report. The consumer mains will be rated for the full output of the substation.

2.6.2 Main Switchboards

A site Main switchboard will be provided adjacent to the Stage 1B substation in the Building R4A podium. This will divide the bulk supply from the substation into components as follows:

- Basement
- Ground Plane
- Podium Tenants
- Podium House services
- Tower R4A apartments
- Tower R4A common services
- Tower R4B apartments
- Tower R4B common services
- Tower R5 apartments
- Tower R5 common services

A dedicated main switchboard will be provided for the basement in a main switchroom located in the Stage 1B basement. Main switchboards will also be provided for each building under separate DAs.

The main switchboard board will be free standing type, compartmented in accordance with Form 4b of AS3439 and have a degree of protection of IP42 as set out in AS3439.

The main switchboard will be equipped with:

- Load break fault make switches for isolation of incoming supply with the exception of the switchboards supplying fire services equipment
- Circuit breakers for control of outgoing submains
- Sealed compartments for Supply Authority metering current transformers
- Multi-function power quality meters on the incoming supplies
- The following electricity meters are proposed in line with Green Star requirements:
    - Car park lighting
    - Car park power
    - Air handling plant;
    - Carpark supply and exhaust
    - Lifts
    - Tenant services;
    - Any additional items which demand more than 100kVA

The meters will report to the metering and monitoring system, where all reports will be generated.

2.6.3 Tariff Metering

House services located within the Barangaroo South Stage 1B Basement will be metered at the main switchboard with the tariff meters located in the main switch room.

2.6.4 Submains

Submains will be "Best Practice" XLPE/PVC insulated type with copper conductors. Fire rated cabling will be provided for submains to fire safety services equipment.
Submains will be installed to:

- Lighting and general purpose power distribution boards
- Lift circuit breaker panel
- Mechanical services boards
- Hydrant booster pump panels (where required)
- Fire services distribution boards (where required)
- House services distribution boards
- Hydraulic services
- Tenant services
- Power Factor Correction equipment

2.6.5 Distribution Boards

House services distribution boards will be located throughout the Stage 1B basement to limit final subcircuit lengths and the number of poles per distribution board. They shall be dead front totally enclosed miniature circuit breakers types and will be located in switchrooms and electrical distribution rooms/cupboards.

Each board will have a main isolating switch and spare space will be provided on boards for future final sub-circuits.

The boards will contain contactors, interposing relays and step down transformers to allow switching of public areas, carparking and external lights by the lighting control system with a High Level Interface to the Building Management and Control System (BMCS).

Form of segregation will be minimum Form 1.

2.6.6 Final Sub-circuits

Generally all final sub circuit cabling for power and lighting circuits will be "Best Practice" thermoplastic sheathed cable with copper conductors. Conduit will be provided where necessary for protection of cables in walls.

In the carpark and plantrooms, conduits will be cast-in concrete where possible.

2.7 Lighting

2.7.1 General

Lighting in general will be compliant to the following standards, unless otherwise noted:

- AS1680 – Internal Lighting
- AS1158 – External Lighting (where applicable for street lighting and ground plane public domain)
- NCC – Appendix J

2.7.2 Basement Lighting

The lighting in the Stage 1B undercover car parks will consist of enclosed LED fittings. All luminaires will be mounted to the concrete soffit or chain suspended.

Transition lighting as per Australian Standards will be provided at undercover carpark entries to allow drivers' vision to adapt to the indoor lighting levels.

The lighting to the loading dock areas will consist of low bay LED or metal halide fittings to suit the layout.

Lighting to internal service areas, passages, offices, amenities, plant and store rooms will be LED type.

Lighting in the basement will be designed to provide not less than the following maintained average illumination levels:

- Carparks – 50 lux
- Loading docks - 80 lux
- Corridors – 40 lux
- Communications rooms – 400 lux
- Office areas – 320 lux.
- Plant Rooms – 160 lux
- Amenities – 160 lux

2.7.3 Lighting Control

The lighting control will be via a dedicated lighting control system with a High Level Interface to the BMCS, which will hold the time schedules of operation. Lighting control contactors will be located in each distribution board which will control blocks of lights throughout the areas of the carpark through motion detection.

Dimming of the driveway lights will be provided during times of low occupancy, which will be sensed by motion detectors.

Local switching control will be limited to plantrooms where the lighting will be controlled by switches located within the room.

Lighting to store rooms, amenities, back of house areas and service corridors will be provided with motion detector control. Lighting to loading docks will be provided with motion detector control complete with time clock with manual over ride facilities.

2.7.4 Exit and Emergency Escape Lighting

Exit and emergency escape lighting will be provided in all areas in accordance with NCC requirements and AS2293. The building emergency and exit luminaire system will be comprised of single point units, installed in all areas.

The central monitoring system will be provided for testing, certification and monitoring of the emergency and exit lighting system in all areas. Either a mains injection system or a wireless based system will be used. The central monitoring system shall be independent of the monitoring system in Barangaroo South Stage 1A Basement.

Emergency lights will be surface mounted enclosed LED for the carparks and plantrooms complete with an LED emergency pod.

Exit signs will be LED types.

2.8 General Purpose Power Outlets and Power Connections

General purpose power outlets will be provided throughout the basement to facilitate cleaning and for connections to and operation of equipment. All power outlets will be protected by Earth Leakage Circuit Breakers (ELCBs).

Power outlets will be provided as follows:

- Carpark – Every 60 metres
- Amenities – one double outlet each

- Communications rooms – one 20 Amp single phase outlet per rack.

Power connections will be provided to equipment such as:

- Hydraulics pumps
- Urinal flushing valves
- Security panels

2.9 Energy Metering and Monitoring System

An energy metering and monitoring system will be provided and will include electrical, water, gas and thermal meters to enable load profiles to be produced in 15 minute intervals. The reporting system will provide reports to enable building function to be monitored and reports to be prepared.

The system will store and display a minimum of 24 months historical data on site. The system will be web based and capable of offsite access via the internet.

The electrical energy metering will be installed to measure categories of load as follows:

a) Main incoming supply for each main switchboard.
b) Main switchboard busbar sections for:
    - House light and power.
    - Essential safety services.
    - Car park lighting
    - Car park power
    - Air handling plant
    - Carpark supply and exhaust
    - Other Mechanical systems.
    - Lifts/Vertical Transportation.
    - Tenant services
c) Any other sub-main load greater than 100kVA
d) Local power generation such as standby power or carbon abatement

Refer to the other discipline sections for details of metering and monitoring points on those services.

2.10 Lightning Protection and Surge Diversion

Lightning protection systems of the above ground buildings will pass through into the basement and connect into the site wide earthing system. This will utilise the building steel reinforcing and its tie wire connections as the down conductors in accordance with AS1768. Equipotential earthing points will be provided in the main switch rooms.

Surge diversion will be included in the Stage 1B main switchboard located in the basement.

2.11 Earthing

Generally the earthing system will comprise an earth grid component formed out of interconnected structural steel, reinforcement associated with concrete piles, slabs and footings. The embedded earth grid component will also form what is defined in AS/NZS 3000 as the earth electrode.

Connection to the earth grid will be through welded connection earth tags.

2.12 Regulations and Authorities

The whole of the work will be carried out in accordance with:

- AS/NZS 3000 - S.A.A. Wiring Rules
- Other Australian Standards which are applicable
- NSW Service and Installation Rules
- Special Local Requirements of Ausgrid
- The requirements of NCC
- All Authorities which having jurisdiction over this installation

3.0 Communications

3.1 Telecommunications Infrastructure

The Telecommunications Service Provider/s (TSP) selected to service Barangaroo South Stage 1B and supported buildings will be agreed by the stakeholders.

Lead-in cabling will enter the site via a bank of ducts sufficient for the TSP's copper and fibre service requirements and in compliance with all relevant standards and guidelines. The sizing, quantity and configuration will be agreed with the stakeholders and proposed carriers.

A Campus Distribution Room (CDR) will be established within the Barangaroo South Stage 1B Basement and will accommodate:

- Lead-in cabling termination and distribution equipment and other telecommunications entrance facilities suitable for primary telecommunications service and a minimum of three (3) additional TSP's.
- Mobile Carrier and Development equipment for Distributed Antenna System (DAS) "hotel" arrangement system.
- Integrated Communications Network (ICN) Head end and core distribution equipment.
- Trade Services headend equipment.
- Support for life safety systems including fire indicator panels and lifts.

Each residential building will have its own Building Distribution Room (BDR) provided under separate DAs. The CDR tie cabling will terminate in each of the BDR's on suitable frames, racking and other required equipment.

An Ethernet/IP-based Integrated Communications Network (ICN) will be established to support base-building systems data transfer between devices and systems with all associated head-end equipment provided within the CDR. ICN equipment will generally be provided in the CDR, BDR, riser or plant rooms housed within dedicated panels or 19" communications racks. ICN node cupboards/racks will be located throughout the Stage 1B basement and will ensure that the entire basement may be serviced by copper data cabling with maximum cable lengths as per AS3080.

Horizontal cabling will be provided with a minimum performance of Cat6 Class E and will be shielded. This will service all IP enabled end devices for all trades.

Provision of communications connections to the proposed Crown Hotel development site will be via Stage 1A and Barangaroo Avenue and via Barton Street originating from Hickson Road.

The requirement for Wi-Fi coverage will be determined by the stakeholders.

Space will be provided in the Stage 1B BDR for separation of all systems should the developments be split in future.

3.2 Reticulation and Cable Management

The Barangaroo South Stage 1B Precinct will be provided with dedicated incoming communication service cables from the selected TSPs (fibre and/or copper) which will be reticulated to the CDR.

Backbone cabling will be provided from the CDR to the Stage 1B Basement BDR, ICN panel locations throughout the Stage 1B Basement and to the location of components of the various base-building systems.

Where cabling is required to rise through the Stage 1B Basement, dedicated communications risers will be provided. These risers will contain cabling and distribution equipment to service residential and retail tenants (under other DAs) in addition to the Stage 1B Basement house/common area requirements. These communications risers will also accommodate MATV and In-building Mobile Coverage (IBC) distribution cabling and equipment.

The location of the ICN panels will be vertically aligned wherever possible such that backbone cabling will indicatively also utilise these risers. The ICN panels will be cabled in a redundant arrangement utilising both separate cables and diverse pathways wherever possible.

3.3 MATV

A single dedicated clear space will be provided for an antenna and Foxtel satellite dish located above the roof top plant room on one of the towers to service the entire Barangaroo South Stage 1B Precinct. The final tower to be utilised for the head-end will confirmed subject to an assessment of the wind loads and visibility of relevant transmission towers and satellites and will be under the DA for that building.

The Stage 1B Basement system will be suitable for Freeview digital television and radio and Foxtel Pay TV service in compliance with Foxtel requirements including FD-T-E-2325 -Transparent Digital Transmodulator (TDT) Network Specification.

Where a private xPON TSP is selected the xPON equipment will be required to be suitable for Radio Frequency over Glass (RFoG) operating on the common telecommunications fibre infrastructure to carry the MATV signal around the Stage 1B Basement. However should a copper or public provider (e.g. NBNCo.) be selected, a separate conventional MATV system will be provided.

3.4 In-Building Mobile Coverage

In-building mobile coverage (IBC) will be provided to 100% of of the Stage 1B Basement including lifts. The head-ends will be located within the CDR.

The IBC will operate over a distributed antenna system (DAS) with, typically, omni-directional antennas surface mounted throughout the Stage 1B basement. These will be located, wherever possible, external to any plant room areas. Cabling to antennas will be via soffit mounted conduits where there is no false ceiling available.

The performance of the IBC will conform to the requirements of the Mobile Carriers Forum (MCF) Guidelines 2014. A SISO system is currently proposed.

The stakeholders will select a lead carrier who will be consulted to ensure compliance of the system.

3.5 Standards and Design

The communications services installation shall be developed in accordance with the following standards:

- CCM (Communications Cabling Manual)
- AS/CA 008
- AS/CA 009
- AS/NZS 1367
- AS 1417.1
- AS 1417.1(Int)
- AS/NZS 3000
- AS/NZS 3080
- AS/NZS 3084
- AS/NZS 3085.1
- AS/NZS 4053
- AS/NZS 4540
- AS 4599.1
- AS 4933.1
- ITU-T G.984

- ITU-T G.987
- AS/NZS CISPR 13
- AS/NZS CISPR 20
- Foxtel Installation Manual for Multi Dwelling Units, Multi Residential Estates and Commercial Installations
- Foxtel Installer Handbook Satellite Multi Dwelling Units & Commercial
- FD-T-E-2325 -Transparent Digital Transmodulator (TDT) Network Specification
- ACMA and Telecommunications Service Provider Guidelines
- Mobile Carrier Forum (MCF) Guidelines 2014
- National Construction Code/Building Code of Australia

4.0 Security

4.1 Infrastructure

The Stage 1B basement will be provided with a standalone access control, intruder detection and CCTV service. These systems will interface to a precinct security room located in the Stage 1B Basement for overall monitoring and management.

The Stage 1B Basement's security system headend will be housed in a dedicated security control room located within the Stage 1B basement with any necessary data gathering panels distributed within the risers or cupboards, which will be monitored. Generally intercoms, CCTV and access control/intruder detection panels will be IP based.

The Stage 1B Basement security system will be separate but integrated with the systems serving:

- Residential Towers R4A and R4B
- Residential Tower R5
- Retail

The security system will operate on a converged IP network (ICN). The security system requirements will be coordinated with the ICN and Structured Cabling System (SCS) providers and will utilise open protocol (i.e. non-proprietary).

4.2 Access Control

Barangaroo South Stage 1B Basement will be provided with an access control system, which will control access by proximity card to:

- Lifts (part of building DA)
- Car Parks
- Main Entries

The card type (and format) will be coordinated and be as per the rest of the Barangaroo South Development and the Stage 1B development will utilise "HID MultiClass SE" readers for consistency across the development.

Conduits will be provided in the fire stairs for future installation of proximity card access control and intercoms to allow re-entry on select levels.

Access control will be coordinated with any fire engineered solutions.

4.3 CCTV

The Stage 1B basement will be provided with a CCTV surveillance system. CCTV cameras will provide coverage of:

- All entries and exits to/from publicly accessible spaces
- Main Lobbies and Mail Rooms
- Car park entrance and Loading Docks
- Entries to Major plant areas (including switchrooms, substations, heat exchanger rooms and standby generator plant)

The cameras will be Internet Protocol (IP) based, High Definition (minimum 1MP) and connected to a digital recording system; either through Digital Video Recorders (DVR's) or hard drive Local Area Network (LAN) based system capable of storing not less than 30 days of video footage at 6fps at D1 resolution. The system will have the capability to be monitored at a central security facility with the ability to have the images viewed from alternate locations (e.g. building concierge).

4.4 Intruder Detection

All Stage 1B Basement perimeter doors, fire stair doors, plant room doors and access controlled doors will be monitored via reed switches, with monitoring and alarms via the standalone security head end system.

Where fire stairs are secured to prevent re-entry, intercoms and/or warning systems will be provided to meet the requirements of the NCC and these systems will be connected to the intruder detection system for monitoring.

4.5 Intercommunication System

Carpark entry points will be provided with an IP based video intercom call system which will allow calls to apartments or the building manager. Lifts will have intercom interface provisions and the carpark entry will be provided with a video intercom interfaced to the building and basement systems. This forms part of the scope of the building above.

Conduit provision for future installation of fire stair re-entry intercoms will be provided.

4.6 Standards and Design

The security services installation will be developed in accordance with the following standards, or the current relevant Standards:

- AS/NZS 2201
- AS 4806

5.0 Vertical Transport

All residential tower lifts penetrate the basement and provide access to all levels of the Stage 1B Basement and carpark for the residents. The ground floor retail has a goods lift serving from loading dock to ground which forms part of the DA for that building.

6.0 Fire Services

6.1 Introduction

This section describes the fire services for the basement area of Barangaroo South Stage 1B. Other documents describe the scope of work in other areas such as the Ground Plane, Podium and in the residential towers themselves.

Fire Services to be provided accordance with National Construction Codes requirements is as follows:

- Combined Automatic Sprinkler / Hydrant Systems
- Hose Reel Systems
- Fire Detection and Alarm Systems
- Sound System and Intercom System for Emergency Purposes.
- Centralised Fire Water Supplies
- Centralised Fire Alarm and Evacuation Control Monitoring.

6.2 Infrastructure Fire Water Supplies

The Barangaroo South development Fire Water infrastructure consists of a centralised main pump and tank facility located in Barangaroo South Stage 1A Basement. The water supply is a grade 1 supply, as defined by AS2118, and consists of an incoming Sydney Water Corporation (SWC) main connection from the main in Hickson Road, and secondary full capacity water storage tank.

Multi stage pumps feed three separate pressure stage ring mains that feed the entire Stage 1A precinct. These will be extended to Barangaroo South Stage 1B to feed all systems within that area. These mains are to be further extended within the Stage 1B Basement to feed the adjacent proposed Crown Hotel development in Stage 1C to provide a reticulated fire services mains system throughout the Stage 1C basement.

6.3 Fire Protection Systems

6.3.1 Key Design Criteria

The Stage 1B Basement will be fully protected by a combined sprinkler/hydrant system, and full electronic detection and alarm systems. to be designed and installed in accordance with all relevant Australian Standards, NCC and authorities requirements.

- The Stage 1B Basement will be fully sprinkler protected in accordance with AS2118
- Hydrants and hose reels will be installed throughout in accordance with AS2419 and AS2441 respectively
- Fire hydrants will form part of a combined sprinkler and hydrant system
- The water supply will be grade 1 and will incorporate an on-site water storage tank
- A Fire Brigade Booster valve assembly will be located at street level at the entry to the Stage 1B basement to allow the Fire Brigade to boost the sprinkler and hydrant system during firefighting operations.
- The Stage 1B basement will have a dedicated Fire Control Room located in the Stage 1B Basement to house the main fire control panels and will act as the centre of operations for the fire brigade.
- A smoke detection system will be provided in accordance with AS1670 and AS1668
- A smoke hazard management will beprovided in accordance with AS1668 and fire engineered solution.
- A fully addressable fire indicating panel will be provided to indicate the specific individual detector or device that has alarmed is provided
- The Stage 1B Basement system has an Evacuation Warning System designed to AS 1670 including Warden Intercom Phones and Break Glass Alarms throughout the basement.
- Portable fire extinguishers will be provided in common areas and plant rooms in accordance with AS 2444.

6.3.2 Automatic Sprinkler Systems

- The entire basement will be protected by an automatic sprinkler installation complying with the requirements of the NCC and relevant Standards including AS2118.6.
- Water supply will be a grade 1 supply provided from the site wide fire water supply infrastructure in the Stage 1A basement.
- The system will be a combined sprinkler/hydrant system, fed from the fire pumps in the Stage 1A basement.
- Sprinklers will be wet type with the following classification and hazard ratings
    - Parking Areas – Ordinary Hazard 2
    - Basement Loading Docks, and retail storage –OH3
- The density of sprinkler heads will be designed to suit the hazard classification as required by AS 2118 – 1999.
- All heads in ceiling voids, plant rooms and in back of house areas will be brass finish type with no escutcheon.
- All heads fixed to the underside of suspended ceilings in office usage areas and toilets will be semi-recessed sprinklers with two piece white escutcheon plates.
- Sprinkler heads will be positioned to conform to an acceptable pattern and appearance
- A Fire Brigade booster valve assembly will be provided at ground level near the main entry or as determined in consultation with the relevant authorities
- Fire services test water will be collected and reused.

6.3.3 Fire Hydrant & Hose Reels

- A Fire Hose Reel (FHR) and internal fire hydrant system supply service will be provided to the Stage 1B Basement in accordance with Authority requirements and the NCC.
- The system will form part of a combined sprinkler/hydrant system in accordance with AS2118.6 and will be a pressurized system, fed from the main fire pumps
- Hydrants will be located within the fire stairs on each level using 65mm stortz connections with plastic cap and chains..

- Hose reels will be provided on each level adjacent to the fire stairs using 36 metre hose reels or as required by the fire engineering
- Hose reels will be part of a separate system fed and pressurized from the domestic water supply.

6.3.4 Smoke Detection & Alarm System

The fire indicator panel/fire control panels will be compatible with the addressable smoke detection system and will be located in the Fire Control Room in the Stage 1B Basement. The system will be fully compatible with the networked systems throughout the Barangaroo South precinct and will communicate with the main Fire Control Centre located in the Stage 1A Basement via a fibre optic network loop.

The system will interface with the following:

- Addressable smoke detection system
- Mechanical ventilation and smoke control system
- Fire sprinkler system monitoring (as applicable)
- Sound System and Intercom System for Emergency Purposes
- BMCS and Building Information System for monitoring purposes and information and alarm status display only.
- The Fire Indicator Panel (FIP) will provide an additional 25% space to allow the capability to receive additional inputs (25% per floor) for tenant installed systems such as MASDS or sub-FIP's.
- The system will be capable of accepting and interfacing with alternative suppression systems, i.e. gas suppression and or pre-action for tenant communications rooms in localized areas.
- Smoke detectors will be provided in accordance with AS1670/1668, pending finalization of the fire engineering for the project.
- Smoke detectors will be generally photo optical type. Use of specialized early warning smoke detection devices such as multipoint aspirated detectors, will be as required by the fire engineering for the project during detailed design.

6.3.5 Sound System & Intercom System for Emergency Purposes

- A Sound System and Intercom System for Emergency Purposes (SSISEP) will be provided throughout the Stage 1B basement in accordance with the NCC and relevant codes to an open plan layout, and to address other specialised spaces such as plant rooms, etc.
- The SSISEP will provide ordered, staged evacuation of the Stage 1B Basement in the event of a fire alarm.
- A master evacuation control panel will be located with the FIP in the Fire Control Room located in the Stage 1B Basement.
- The system will incorporate Break Glass Alarm points and Warden Intercom Phones on every level to communicate back to the Fire Control Room.
- A PA Facility will be provided at the MECP to allow announcements either level by level or whole of building/precinct.

6.3.6 System Operation and Interfaces

In the event of fire, the fire sprinkler system will automatically carry out the following functions:

- Provide water discharge (at the required density)
- Interface with the Fire indicator Panel
- Interface with the SSISEP system via the master fire indicator panel
- Interface with the BMCS via the master Fire Indicator Panel and security system
- Sound the local alarm
- Transmit an alarm to the Fire Station
- Cause the air-conditioning & mechanical systems to operate in fire mode.

6.3.7 Fire Safety Engineering

The Stage 1B Basement will be designed and built in accordance with the requirements of the NCC. There will be instances through the design development process whereby NCC compliance will be gained via an engineered solution. Some instances where this will be developed include but are not limited to:

- Travel distances to egress points within the floor plate.
- Access to plant and back of house areas from a fire egress stair/path.
- Reduction to two hour FRL for retail spaces.
- Sprinkler coverage to lobby entries

6.4 Portable Extinguishers

Portable Fire Extinguishers will be provided to the requirements of NCC but as a minimum to plant rooms and Hose Reel cupboards throughout.

6.5 Regulations & Authorities

All of the above will be designed in accordance with the National Construction Code and Australian Standards, as varied by any Fire Engineered Solutions(s) generated on the project. Incorporation of any Fire Engineered Solution and centralised, shared system infrastructure will be at the negotiated acceptance of the NSW Fire Brigades representatives.

The whole of the work will be carried out in accordance with:

- National Construction Code
- Requirements of Fire & Rescue NSW
- AS2118.1, AS2118.6, AS2419, AS2441
- AS1670 and AS1668
- Other Australian Standards which are applicable
- All Authorities having jurisdiction

7.0 Hydraulic Services

7.1 Introduction

This section describes the hydraulic services for the basement area of Barangaroo South Stage 1B and provision for the proposed Crown Hotel development. Other documents describe the scope of work in other areas such as the Ground Plane, Podium and in Residential Towers.

The Hydraulic Services to be the basement are defined as two scopes.

Common Hydraulic Service Infrastructure:

- Common services serving more than one strata, or services operated by Green Utilities.

Stage 1B Basement Hydraulic Service Scope:

- Services Dedicated for the Basement

The Hydraulic services covered in this document include the following:

Common Services:

a) Sydney Water Water Mains and Incoming Water Supplies
b) Jemena Gas Mains
c) Lend Lease Living Utilities Recycled Water Supply
d) Sewer Drainage Collection System
e) Dedicated Swimming Pool Drain Down System

Stage 1B Basement Hydraulic Services

a) Sewer Drainage and Sanitary Plumbing
b) Grease Waste Systems
c) Rainwater Plumbing Systems
d) Car Park Drainage System
e) Basement Ingress Water Drainage
f) Domestic Water Supply
g) Recycled Water Supply
h) Hot Water Supply
i) Incoming Fire Water Services
j) Gas Supply
k) Sanitary Fixtures and Tapware

7.2 Common Hydraulic Services

7.2.1 Sydney Water Water Supply Infrastructure

A Sydney Water Ring Main is proposed to be located within the elevated roadways around the site, interconnecting with the Sydney Water mains in Hickson Road. Incoming supplies from this main shall be extended to the Stage 1B Basement Water Meter Room. Incoming Fire Supplies will be extended to Booster Valve locations or fire valve rooms for the Stage 1B Basement and the individual buildings. Stage 1B will be serviced separately to Stage 1A.

The water main reticulation will be designed in accordance with Sydney Water and WSA codes.

7.2.2 Jemena Gas Supply Infrastructure

A new gas supply will be provided to the precinct from the Jemena Gas Supply network in Hickson Road. Jemena is currently reviewing the strategy and is considering two options for the for the gas supply. The final supply strategy will be a result of negotiation and agreement with Jemena.

The current Jemena preferred option is for a single high pressure supply to the site. A secondary regulator installation will be provided on the Hickson Road boundary of the site, and low pressure gas reticulated to each of the buildings from the regulator room.

The second option is to provide a 7 kPa Gas main extension within Globe Street to supply points into the two towers. Each building would be provided with low pressure reticulation extending from the Jemena street main.

Jemena have indicated that the supply to the proposed Crown site would be a separate high pressure feed and is subject to negotiation with Jemena.

The Jemena mains extensions will be designed by Jemena in accordance with Jemena Design requirements.

7.2.3 Lend Lease Living Utilities Recycled Water Supply

A recycled Water supply will be extended from the Stage 1A recycled Water supply connection point in the Stage 1A Level B1 Basement. A 150mm service will extend through the basement to metering points for the Stage 1B Basement and the individual buildings. A 150mm provisional connection point will be terminated at the north side for extension to Barangaroo Central and Barangaroo Reserve.

The recycled water reticulation shall be design in accordance with AS3500

7.2.4 Common Sewer Drainage Collection System

A common gravity sewer drainage collection system will be provided in the Stage 1B Basement level B1 for connection of the buildings over and to the proposed Crown Hotel development. The services below ground floor plane will discharge to the common gravity service by private pumping stations and rising mains. The gravity main will be extended as far as practical for maximum service to the ground floor plane. The residential towers will drain by gravity to the Recycled Water Treatment plant to negate the requirement for pumping and associated emergency storage.

The gravity sewer main will be extended to the Recycled Water Treatment Plant (RWP) located within Stage 1A Basement for treatment and reuse as non-potable recycled water.

The common sewer drainage collection system will be design in accordance with AS3500.

7.2.5 Common Swimming Pool Drain-Down System

A common swimming pool drain down system will be provided in the Stage 1B Basement level B1 for connection of the buildings' swimming pool drain down and the proposed Crown Hotel development.

The swimming pool drain down will extend to the Recycled Water Treatment Plant trade waste tank located within Stage 1A Basement for discharge as trade waste to Sydney Water Sewer.

7.3 Basement Hydraulic Services

7.3.1 Sewer Drainage and Sanitary Plumbing

Sewer Drainage will be provided within the Stage 1B basement collecting waste from all proposed fixtures and waste points to sewer pump stations located in the basement, and discharging to the common gravity sewer infrastructure, draining to the Recycled Water Treatment Plant inlet works.

Sewer drainage will be provided in accordance with AS3500.

Pipeworks will be HDPE or CI. Where compliant with the Environmental Performance requirements, approved PVC material may be used.

All sanitary plumbing pipework will be concealed from view where practicable. Soil waste and vent pipes suspended within carparks will be located so that they are not susceptible to vehicular damage.

Sewer pumping equipment will have n+1 redundancy. Pumping chambers will have minimum 8 hours emergency storage. Where feasible the pumping chambers in the lower basement structural slab will be minimised. Larger central pumping stations above the base slab will be provided with smaller dedicated pump out pits in minor service rooms discharging to the larger central transfer pumping stations above the lower slab.

7.3.2 Grease Waste Systems

Grease waste plumbing and drainage will be provided within the Stage 1B basements to service the wet loading docks.

The retail tenancies in the podium over will require grease arrestors to be installed within the Stage 1B basement. The Stage 1B basement hydraulic services design will include the servicing of the grease arrestor rooms and dedicated sewer pumping stations.

Arrestors will be provided in dedicated rooms located in the Stage 1B basement. As the grease arrestors generally will be at loading dock level, they will not be able to drain by gravity to the Blackwater Treatment Plant. The arrestors will have dedicated pump out pits (with 8 hours storage) or drain to a nearby service room pump pit where feasible.

Grease waste plumbing and drainage pipework is proposed to be HDPE or similar. Pipework is to be installed at a minimum 1:40 gradient.

7.3.3 Rainwater Plumbing Systems

The Stage 1B Basement rainwater plumbing system comprises the pipe network collecting ventilation duct and entry ramp stormwater run-off. The stormwater will be collected into sump pumps and pumped to the site civil stormwater drainage system.

Rainwater pipework will be HDPE or CI. Where compliant with the Environmental Performance requirements, approved PVC material may be used.

7.3.4 Car Park Drainage System

A car park plumbing system will be provided draining the Stage 1B Basement car park slab areas and sealed mechanical ventilation ducts as required.

The stormwater will be collected into sumps and pumped to a central car park treatment system, for discharge as trade waste to the Sydney Water sewer system.

Pipework will be HDPE or CI. Where compliant with the Environmental Performance requirements, approved PVC material may be used.

7.3.5 Basement Ingress Water Drainage

The intent of the building structure is to exclude subsoil water infiltration through the Stage 1B basement walls and floor. No sub soil drainage lines are proposed to be installed external to the basement walls.

An ingress water collection system is proposed on the inside walls of the Stage 1B basement at the perimeter in case of ground water infiltration. The collection system shall be a system of edge spoon drains draining to pump out pits integral with the structure. Upper level spoon drains will discharge to a conical outlet piped to the lower level.

The ingress infiltration water may be contaminated, and will be pumped to the Barangaroo South Stage 1A sub soil treatment plant for disposal as trade waste to Sydney Water sewer.

Design flow for Stage 1B and 1C combined is 1kL per day.

Ingress water collection system pipework will generally be HDPE, or approved PVC material.

7.3.6 Water Services

Water services will be in accordance with AS3500 and Sydney water requirements. Pipework will be copper tube to AS1432, or XLPE pipework in accordance with AS3500.1.

Domestic hot and cold water services design criteria	
Minimum Pressure at outlets	250 kPa
Maximum Pressure at outlets	600 kPa
Maximum distribution pipework pressure	750 kPa
Maximum velocity internal pipework	1.6 m/s
Maximum velocity external pipework	2.1 m/s

The incoming potable water supply will be provided with Sydney Water water meter.

The recycled water supply to the basement shall have a green utilities Recycled Water Billing Meter.

Note: The water meters, filters and booster pumps serving the buildings may be located in dedicated rooms or service areas within the Stage 1B basement but are not part of the basement scope of work.

Potable Water

The Stage 1B basement and the proposed Crown Hotel development will be provided with a dedicated water system extended from mains pressure Sydney Water towns' mains supply. The basement water supply will provide water to water usage points.

Potable water usage points within the service rooms dedicated to a building shall be fed from the buildings domestic potable water supply.

Recycled Water

Recycled water services will be installed in accordance with AS3500.1 coloured lilac. Recycled water will be reticulated to all flushing fixtures, and to wash down points.

Hot Water

A hot water supply shall be provided to wet compactor loading dock wash down.

7.3.7 Gas Service

The incoming services from the Jemena Gas Mains feeding the buildings will be located within the Stage 1B basement at high level, but are not part of the basement scope of works. The meters and regulators serving the buildings may be located in dedicated rooms or service areas within the basement but are not part of the basement scope of work and will be covered under the building DA.

7.3.8 Metering

Authority Meters will be provided to:

- Incoming Water Supply to the basement (Supplied by Sydney Water)

Recycled Water Billing Meters will be provided to:

- Areas in the basement associated with the buildings over. There will be one meter each for R4A, R4B and R5 located in the Stage 1B basement.
- One recycled Water billing meter for the Stage 1B common basement area.

Environmental Performance Meters will be provided to

- Potable water meters to
  - High water usage areas
  - Loading docks
  - Monitoring of incoming basement water supply meter
- Recycled Water Meters to
  - Loading Docks
  - Monitoring of Lend Lease Living Utilities Basement Recycled Water Billing Meter

7.3.9 Tapware

Tapware will be provided for washing down and cleaning of the basement areas only including the docks, grease arrestor and garbage areas.

7.4 Regulations and Authorities

The whole of the work will be carried out in accordance with:

a) AS3500
b) Sydney Water requirements
c) Other Australian Standards which are applicable
d) The requirements of NCC
e) All Authorities which having jurisdiction over this installation

8.0 Mechanical Services

8.1 Introduction

This section describes the Mechanical Services for the basement area of Barangaroo South Stage 1B. Other documents describe the scope of work in other areas such as the Podium and the residential towers themselves.

The Mechanical Services covered in this document include the following:

Barangaroo South Mechanical Services Infrastructure

- Energy Transfer Station
- Booster Pump Room
- DCP Primary Chilled Water Reticulation

Stage 1B Barangaroo Mechanical Services

- Carpark Ventilation
- Loading Dock Ventilation
- Electrical Infrastructure Ventilation
- Plantroom Ventilation
- Grease Arrestor Room Ventilation
- Waste Room Ventilation
- Diesel Generator Ventilation
- Amenities Ventilation
- Perimeter Wall (HHERA) Ventilation
- Smoke Management System
- Communications Room Air Conditioning
- Facilities Room Air Conditioning
- Mechanical Services Control System

8.2 Stage 1B Basement Mechanical Services

There are two major areas of Mechanical Services for Stage 1B. One is the extension of the site wide mechanical services infrastructure system from Stage 1A. The other area is the provision of the mechanical services required to service Stage 1B. These services consist of the provision on the mechanical ventilation systems required in the common basement areas as well as to a smaller extent air conditioning systems required for various infrastructure systems and BOH spaces.

8.2.1 Basement Stage 1B – Mechanical Services Infrastructure

The cooling requirements of Stage 1B are serviced by an extension of the District Cooling Plant that resides within the Barangaroo South Stage 1A basement. This same extension will service the proposed Crown Hotel (Stage 1C) part of the development. The basic elements of this cooling infrastructure are:

- Chilled Water Reticulation System
- Stage 1B/1C Chilled Water Booster Station
- Residential Energy Transfer Stations
- Site Wide Cooling Energy Consumption Metering
- Control Interface to the DCP

8.2.2 Basement Stage 1B Mechanical Cooling Systems

The air conditioning to the Barangaroo South Stage 1B Basement will consist for a number of distinct systems, providing both equipment and comfort conditioning where required. Generally the systems will be dedicated to the areas served, including:

Facilities Management Office	Comfort Conditioning
ICN Facilities	Equipment Cooling
Communications Rooms	Equipment Cooling

8.2.3 Basement Stage 1B Mechanical Ventilation Systems

The ventilation to the Barangaroo South Stage 1B Basement will consist for a number of distinct systems, providing supply and/or exhaust where required. Generally the systems will be dedicated to the areas served.

Ventilation Systems include:

Loading Dock Ventilation	Supply & Exhaust
Residential Carpark Ventilation	Supply & Exhaust
Electrical Substations	Exhaust
Electrical Switch Rooms	Supply
Diesel Generator Rooms	Exhaust
Intermediate Diesel Booster Pump	Supply & Exhaust
General Plant Rooms	Supply
Blackwater Treatment Facilities	Exhaust
Perimeter Ventilation (HHERA)	Natural
Amenities (showers/toilets)	Exhaust
Bicycle Storage	Supply
Obnoxious Discharges	Exhaust
Garbage Rooms	Exhaust
Grease Arrestor Rooms	Exhaust
Gas Meter Room	Exhaust
Back of House Areas & Stores	Supply
Lift Lobbies	Supply
Fire Control Rooms	Supply
Smoke Management	As required

Intakes and Discharges will generally be via louvered panels and shafts from the podium areas or where necessary through buildings with as much discretion as design practicality permits. In the specific case of exhaust, the discharge will follow the requirements of standards and codes and generally be a minimum of 3 metres above adjacent trafficable areas.

8.3 Mechanical Services Infrastructure Description

8.3.1 DCP System – Overview

The DCP primary chilled water feeds Stage 1B and provision for Stage 1C at the southern boundary of the Stage 1B basement where it abuts the Stage 1A basement. Four pipes (two off supply, two off return, each pair sized at nominal 70% total cooling capacity) will feed into directly into a booster pump room. From the booster pump room a dedicated primary chilled water piping reticulation system will serve the buildings' Energy Transfer Station. The Stage 1B chilled system is a two-pipe system sized at 100% of the total peak cooling demand.

8.3.2 Chiller Water Booster Pump Room

The Stage 1B Basement Booster Pump Room houses an array of chilled water pumps. The function of the booster pumps is to provide the required pressure to serve the various buildings' energy transfer stations. There are dedicated pumps for Stage 1B with another set of dedicated pumps to serve the proposed Crown Hotel development (Stage 1C). The operation of the pumps is in response to the cooling demands of the respective Stages. The Stage 1B booster pump array will consist of;

- Two off low load pump
- Four off high load pumps

8.3.3 Energy Transfer Station

Each of the three residential buildings will have a dedicated Energy Transfer Station (ETS) located in the Stage 1B Basement. These stations consist of building specific arrays of chiller water heat exchangers and associated secondary chilled water pumps that serve the buildings' air handling plants cooling requirements.

The secondary-chilled water system is not part of these Basement works – the secondary chilled water system is part of the design of the individual buildings. The retail component of the buildings will also be provided with dedicated secondary pumps and chilled water piping reticulation system. The interface between the secondary and Stage 1B Basement Chilled Water infrastructure is at the secondary flange connection at the heat exchangers.

For the two tallest buildings (towers 4A and 4B) there will be two arrays of heat exchangers in the Stage 1B Basement ETS - one each for the low rise and high rise to manage the differing pressure regimes. All heat exchanger arrays will consist of two heat exchangers, each 70% of total peak cooling capacity.

8.3.4 Chilled Water Consumption Metering

Each energy transfer station in the Stage 1B Basement will be provided with a chilled water energy consumption meter. These meters will be connected to the DCP and will be used for both billing purposes as well as control functions.

Further to these meters there will be additional chilled water consumption meters to be installed on the secondary chilled water system, notionally one meter per residential rise and retail. These meters will be owned by the DCP and given to buildings for installation and use. The primary function of these secondary meters is to allow the building owner to manage (including sub-billing) the secondary chilled water system, however the secondary function of these meters is to act as check meters to the main billing meter.

8.3.5 DCP Controls Interface

A controls interface will be provided within each Stage 1B Basement Energy Transfer Station to communicate the cooling requirements of the building back to the DCP. These interfaces will connect back to the main DCP control system utilising the site wide ICN (Integrated Communications Network).

8.3.6 Heating Hot Water

It is envisaged that there will be very little heating hot water (for space heating) required within Stage 1B Basement. Whatever heating hot water is required will be provided as an extension of the base building heating water system that serves the building above. Each such connection will be fitted with a hot water energy consumption meter for operational and billing purposes.

8.3.7 Air Conditioning

In the areas defined below, Stage 1B Basement areas will be provided with dedicated air conditioning systems. Systems will generally consist of above-ceiling mounted chilled and/or hot water fan coil units connected to the base building infrastructure. Each unit will be complete with ducting, grilles, controls, electrics and all necessary fittings. Each unit will have a fresh air connection to mix return air before passing a filter bank back into the fan coil unit. Such areas include:

Locker Rooms and Amenities

Locker rooms will be provided with ducted fresh air, predominantly to provide make-up for the adjacent showers and toilets. These systems will be a once through system with fresh air conditioned air via chilled water/hot water fan coil unit. Locker rooms and amenities will be controlled by occupancy sensors.

Facilities / Operations

Facilities such as staff rooms, operations, dock office and security offices will be generally served via a dedicated chilled water/hot water fan coil unit complete with ducted fresh air. In general these systems will be concealed in the ceiling space complete with supply ductwork, fittings and return ductwork. Controls will be via the BMCS as well as local over-rides. Further consideration will be given to the use of reverse cycle split AC units complete with local self-contained controls as an alternative.

Building Distributor and Communication Rooms

Building Distributor rooms will be served via a dedicated chilled water fan coil unit. Generally these units will be located inside of the room served in an exposed location. Controls will be via the BMCS.

ICN (Integrated Communications Network) Campus Distributor Rooms

The Campus Distributor Rooms and ICN rooms will be provided with a Computer Room Air Conditioning (CRAC) system consisting of dedicated specialised chilled water fan coil units connected to the base building cooling infrastructure. The CRAC units will be wall mounted console types.

8.4 Barangaroo Basement Ventilation System Overview

The Barangaroo Stage 1B Basement will be served by a number of ventilation systems generally comprising sheetmetal ductwork and an electrically powered supply or exhaust fan; either drawing in outside air through a dry media filter for distribution by grilles or diffusers, or discharging waste air to the outside of the building. The main systems are as follows:

8.4.1 Loading Dock/Carpark Ventilation

The enclosed Stage 1B Basement carpark and loading dock areas will be provided with mechanical exhaust and supply systems. The system will be a “performance engineered” mechanically ventilated system that complies with the performance requirements of AS1668.2. As far as practical these ventilation systems will be dedicated to the different usages of the spaces served.

Generally, the systems will be comprised of masonry shafts and plenums (with some ductwork) and axial/centrifugal flow fans complete with silencers and VSD’s. All systems will be demand controlled varying the volume in response with the level of contaminants sensed.

Carparks and docks will be supplied air at a rate of approximately 75% - 90% of the exhaust flow rate. The exhaust flow rate will be calculated for individual areas as a function of vehicle engine capacity and estimated movement by the method outlined in AS1668.2. Ventilation will be via a combination of ducted and plenum supply and exhaust systems, both of which will be fan-powered. Where possible the vehicle ramps will be utilised for supply of outside air due to make-up air replenishment. The air will be entrained across the space by a pressure differential, diluting airborne contaminants and then exhausted through plenums located on opposing sides of the carpark or dock.

In lieu of assumed traffic movements inherent in the Australian Standard 1668.2, the Loading Dock and Carpark ventilation will be analysed via Computational Fluid Dynamics (CFD) based on applicable carpark traffic studies in order to provide a performance-based ventilation system. Loading Dock Fans will be variable speed and controlled by field NO and CO sensors. CO sensors will be installed in the Stage 1B Residential Carpark Levels. These sensors will ensure fans increase air quantities when the chemical concentrations approach upper limits. The use of thrust fan ventilation is also under consideration should this prove advantageous in difficult air distribution spaces and any remaining specific dilution issues will be identified during the CFD analysis process and overcome accordingly. The

control system ensures that the contamination levels are within acceptable code requirements whilst minimising energy consumption.

Intake and Discharge will be via shafts through the closest possible structure located above. The ventilation opportunity is dependent on the particular intake/discharge and will be as discreet as practicality permits.

These ventilation systems although not required as an essential service, will be able to operate as smoke clearance systems.

8.4.2 Generator Room

Ventilation to this room is required to maintain the combustion process and dissipate the radiant heat losses from the machinery when operational.

The ventilation design concept for the generator room uses the radiator fan that is already equipped with the genset, to also be utilised as the ventilation fan. As the generator is used to back-up essential services, the supply air will be drawn in through a dedicated outside air shaft. The air is drawn across the room at low level by a supply register or a louvered panel, fire damper and sufficient acoustic attenuation. A portion of the air (machine dependent) will be consumed within the engine's combustion chamber before being exhausted via the flue system.

The vast majority of the air will pass over the machine at a rate sufficient to dissipate the radiant heat losses, through the radiator and be driven into exhaust plenum which lead to the riser and the podium roof above and discharge to atmosphere. The exhaust plenum will incorporate further attenuation to ensuring sound levels at the discharge point will be within acceptable levels.

8.4.3 General Plant Room Ventilation

Stage 1B Basement plant rooms will be ventilated to Australian Standard or process requirements – whatever the greater. Variable speed, time and temperature controlled fans will be used. Ducted supply systems will be employed and sized to satisfy (at least) the minimum outside air requirements and where applicable, provide adequate ventilation for any personnel. Plantrooms include:

- Energy Transfer Stations,
- Electrical Switchrooms,
- Hot Water Plants.

8.4.4 Perimeter Wall Ventilation

An array of small in-line fans around the perimeter will exhaust the void between the basement wall and the diaphragm wall. These fans are part of the environmental risk mitigation and will operate at all times.

8.4.5 Amenities

Amenities will be served by ducted exhaust, with make-up air being generally provided from adjacent supplied areas. Occupancy sensors will be employed to control fan speed and energy consumption.

8.4.6 Back of House Areas and Stores

Small back-of-house (BOH) areas and stores will not be generally provided with mechanical ventilation, they are predominantly not occupied and therefore strictly do not require outside air. Occasionally these areas will be temporarily occupied and their ventilation is via the "borrowed ventilation" concept. In this case the spaces which surround stores and BOH areas will have sufficient ventilation to account for the minimal required outside air. This technique overcomes the need for dedicated ventilation to such small spaces. In some cases, where the BOH or Storage areas are particularly large it may be necessary to provide minimum outside air supply to ensure health and safety (rate varying according to the purpose of the space).

All occupied areas will have minimum outside air provisions.

8.4.7 Waste Areas

The waste areas include:

- Garbage Rooms
- Grease Arrestor Rooms
- Bin Rooms

These areas will have a dedicated exhaust system that essentially can operate 24/7 at 100% capacity. The exhaust will be drawn at high level while the make-up will be from the surrounding generally ventilated area via a low level wall grille and non-return damper.

8.4.8 Smoke Management

Smoke Clearance

In accordance with the NCC the carpark and loading dock system will be able to be remotely controlled by the Fire Brigade for smoke clearance purposes. To enable manual control by authorized fire personnel, each fan will be provided with an ON-AUTO-OFF control device installed in the Fire Fan Control Panel (FFCP). Note: this system, while automatic, is not required to be installed as a smoke spill system as defined under AS1668.1. In the event of a fire within the Stage 1B Basement supply air fans will default to shut down and exhaust air systems will operate at 100% capacity on activation of a fire alarm or sprinkler system in carpark or dock.

Stair Pressurisation

The Stage 1B Basement is greater than two levels; therefore where the egress corridors and fire stairs pass through the basement to egress at street level, they will be provided with a stair pressurisation system.

8.5 Related Systems

8.5.1 Control Systems

The Stage 1B Basement infrastructure mechanical services will be served by two distinct control systems. One system will be dedicated interface into the District Cooling Plant in Staged 1A and is based on PLC / SCADA…The other control system is a conventional open systems BMCS and will serve the remaining mechanical services, predominantly the Stage 1B Basement HVAC services. Both systems will be connected to the Integrated Building Communications Network.

8.5.2 Electrical

Air conditioning and ventilation equipment will generally be serviced from mechanical services switchboards located throughout the basement. Submains to these mechanical services switchboards are by the Electrical Trade.

8.5.3 Metering and Monitoring

A metering and monitoring system will be provided to measure electrical and thermal energy consumption within the Stage 1B Basement. The functions of this system include:

- ENERGY Management
- Green Star requirements
- Billing – where applicable

Further to this metering and monitoring system, thermal meters will be provided (as part of the DCP Controls) to be installed in the Energy Transfer Stations. The primary function of these meters is control however they will also be used for the billing of chilled water consumption.

8.6 Design Basis

The following design criteria are proposed.

8.6.1 Air Conditioning

Design Conditions

	Indoor Summer	Indoor Winter	Outdoor Summer	Outdoor Winter
Air Conditioning	22.5°C ± 1°C DB	22.5 ± 1.5°CDB	32.0°C DB / 23.0°C WB	7.0°C DB
Comms Rooms	22.5°C ± 1°C DB	22.5 ± 1.5°CDB	32.0°C DB / 23.0°C WB	7.0°C DB

Humidity control will generally not be provided however it is normal for the plant to operate in the range of 40% to 60% RH.

Outside Air Rates
Generally to AS1668.2 1991
Equipment Heat Loads
As advised by the designer of the equipment within the rooms that house the equipment.
Communications Rooms will be based on an equipment heat load not exceeding 200 watts/m^2.

8.6.2 Mechanical Ventilation

Generally to AS1668.2 1991

8.6.3 Noise and Vibration

Carpark	NR 65
Plantrooms	NR 65
Other Areas	As required by AS2107
At any point on the property	55dBA (to be confirmed by Acoustic Consultant)

Vibration of the plant will not cause annoyance to occupants in the normally occupied areas of the building.

8.7 Regulations and Authorities

The whole of the work will be carried out in accordance with:-

- AS1668.1 and AS1668.2
- The National Construction Code
- The requirements of NABERS and Greenstar as determined applicable
- All Authorities which having jurisdiction over this installation

9.0 Conclusion

The proposed Barangaroo South Stage 1B Basement and proposed Crown Hotel development will be serviced either from connections to the existing Stage 1A infrastructure or from new dedicated connections from external utilities' infrastructure. The basement will be serviced using modern but proven building services engineering techniques which will result in an energy and water efficient outcome.