

Liverpool Hospital Redevelopment
Stage 2.1



Project Application and
Environmental Assessment

Appendix E

Building Services and ESD Report

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Pty Ltd**

For **Department of Planning**

On behalf of **NSW Health**

July 2008



LIVERPOOL HOSPITAL REDEVELOPMENT

Stage 2.1

PROJECT APPLICATION – BUILDING SERVICES

- REV 2
- July 2008



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EXECUTIVE SUMMARY

Liverpool Hospital is a major tertiary, referral and teaching facility under the South West Area Health Service and must remain operational at all times.

The Services to be provided include but are not limited to:

- Electrical Services;
- Communication Services;
- Building Control and Security Services;
- Fire alarm and warning systems;
- Mechanical Services;
- Hydraulic Services;
- Fire Protection Services;
- Automatic Fire Detection and Alarm Systems;
- Vertical Transportation Services

STANDARDS/GUIDELINES

The engineering services shall be designed with reference to the following:

- The NSW Health Engineering Services Guidelines TS11 2005;
- Relevant Australian Standards;
- The Building Code of Australia;
- Government Department's Regulations.

Authorities and Councils such as:

- The requirements of relevant Local Councils;;
- Sydney Water Corporation;
- Integral Energy;
- NSW Fire brigades;
- Environmental Protection Authority.



Mechanical Services

Chilled Water System - The new Clinical Services Building and supplementary air conditioning systems will be cooled by new chilled water plant located in the basement to the east of the loading dock. The chilled water plant will operate on a temperature differential of 7°C – 14°C. The chiller plant will consist of two (2) screw chillers each capable of 20% of the predicted peak cooling demand and two (2) centrifugal chillers each capable of 40% of the predicted peak cooling demand. This configuration ensures that there is always 80% peak cooling capacity even with one chiller out of action. The pipework reticulation will be connected to the existing chilled water system and can provide some supplementary cooling to the existing system on a non design day in the event of an emergency.

The chillers will have a zero ozone depletion potential (ODP) and a refrigerant leak detection will be provided to the chiller plantroom.

Heat is rejected from the chillers via cooling towers located on the south east wing roof which maximises the distance from the cooling tower discharges to the outside air intakes and keeps the warm moist air out of the helicopter flight path. The cooling towers are designed with centrifugal fans with variable speed drives to minimise noise and keep maintenance technicians on the floor. These cooling towers are sized to operate on an extreme day (40.5°CDB/26°CWB) and are configured to provide cooling for both the chillers and the water cooled generators.

Hot Water System - Hot water is generated by two hot water boilers of 50% capacity each located on the roof of the south east wing for the New Clinical Services Building. The Boiler flues are located outside the helicopter flight path. Hot water is generated at 80°C and provides domestic hot water through a plate to plate heat exchanger and space heating. Water is returned to the boilers at 60°C.

Air Handling Systems - The inpatient units are served by central single zone air handling units located in the roof plantroom. This configuration is the most efficient air conditioning configuration as there is no reheat provided. Each floor can be isolated at each floor by manually closing the smoke dampers if required to isolate the ward for refurbishment.

Administration areas and consulting rooms are air conditioned by central variable air volume (VAV) air handling systems located in plantrooms throughout the building. Supply air is reduced when heating is required to the minimum air change rate as required by the NSW Health Engineering Guidelines TS-11 2005 to minimise reheat.

In general, all air handling systems are provided with economy cycles to provide free cooling by outside air when the ambient air temperature is less than the return air temperature.



When a helicopter approach is detected by a microphone mounted on the roof, the Building Management Control System will shut the economy cycle dampers and the building will operate on minimum outside air as required by AS1668.2-1991 and the Building Code of Australia. Each air handling unit will be provided with activated carbon filters for the minimum outside air requirement to remove helicopter fuel smells from the air when a helicopter is in the vicinity.

Hydraulic Services

Sewer - The proposed sewer pipe work shall connect to the existing 400mm Authority sewer main, located on the north-east side of the development.

Sanitary Plumbing - The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials will be Poly Ethylene and / or cast iron tube and fittings.

Trade Waste Plumbing - Fixtures and equipment that generate grease and/or high temperature discharges will be treated on site to the requirements of Sydney Water Corporation trade waste policy. The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials will be high density polyethylene (HDPE) tube and fittings.

Potable Cold Water - The proposed potable cold water will be connected to the site infrastructure and reticulated to all fixtures and equipment that requires cold water. Fixtures and equipment that may present a source of contamination will be fitted with a backflow prevention device suitable for the hazard rating of the procedure.

Hot and Warm Water Systems - The proposed potable hot/warm water will be generated by means of boilers and heat exchangers and reticulates to all fixtures and equipment that requires hot water. Warm water will be generated by means of a centralized warm water plant, to NSW Health requirements and guidelines and will reticulate warm water to all fixtures and equipment that requires warm water.

Rainwater Harvesting - Rainwater collected from roof areas to discharge into the storm water system on site. Storm water connection points in form of storm water pits will be provided by the civil engineering consultant. A rainwater tank adjacent to the building will collect parts of the roof rainwater for toilet flushing, surface water will not generally be collected for re-use. The overflow of this tank will also discharge into the storm water system provided by the civil engineering consultant.



Fire Services

The fire and life safety protection systems for the New Clinical Services Building have been design to comply with the current BCA2008 except where modified by the Fire Engineering Report. The New Central Energy Building has been designed to the deem to satisfy requirements of BCA2008.

They include fire sprinklers system to the New Clinical Services Building including additional connection mains & space allocation to provide future installation to protect the Existing Clinical Services Building.

Fire alarm & smoke detection system to both New Clinical Services Building & New Central Energy Buildings including additional aspirated smoke detection for the Concourse area.

Nurse Station Annunciator Panels within Patient Care Wards and Mimic Panels located in Non-Patient Care areas as part of the Fire Alarm System have been added to provide additional information on location and type of fire alarm to assist & improve Liverpool Hospital personnel to locate & deal with a fire emergency.

Sound Systems and Intercom Systems for Emergency Purposes installed to the New Clinical Services Building will limit the occupants warning to the initial compartment for a set period of time before cascading to adjacent compartments if the situation escalates, thereby reducing the overall impact to the hospital operations.

The New Central Energy Buildings will have a Building Occupant Warning System to alert occupants of the entire building.

Fire hydrants & fire hose reels have been provided to meet BCA & Australian Standards requirements to both buildings.

Foam hose reel stations have been added to the New Clinical Services Building Level 7 Helipad to protection against the additional special hazards associated with helicopter landings & takeoffs.

A comprehensive set of fire safety management and evacuation plans will be developed which are consistent with all fire and life safety protection equipment to be installed and EPA regulations relating to OH&S and fire safety.

Electrical

The power supply to the Clinical Services Building will be derived from a new high voltage (11kV) supply from Integral Energy, the origin of which is unknown at this time. A new high voltage switchroom is to be provided at ground floor level within the new CSB to terminate and control this new network supply. From this location, new high voltage cabling shall be provided within a dedicated, secure riser to the new electrical sub-station within the Plant Area at Level 6, as shown on the layout drawings.

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Within the level 6 plant area, new high voltage switchgear, four (4) 2MVA transformers, and low voltage switchgear shall be provided to supply and control the new CSB; the design philosophy being that in an emergency situation or during maintenance, any one transformation will be capable of providing necessary supply to one (1) non-essential and one essential main switchboard.

The main switchboards will be balanced as best possible on each individual mains supply and distribution of boards.

Excluding Safety Services' Main Switchboard, all other main switchboards will employ fully automated independent Power Factor Connection Systems at 98%.

All main switchboards shall be Form 3b construction, complying with AS 3439. Submain protection will be by withdrawable Air Circuit Breakers for loads 800A and higher, and moulded circuit breakers for loads lower than 800A.

Three (3) new 1400kVA emergency diesel generators shall also be provided in a separate plantroom in the level 6 plant area along with new uninterruptible power supplies' equipment to provide clean power to medical sensitive equipment and to communication equipment.

Two dedicated electrical risers shall be provided – one within the Main Switchroom at the east end and one adjacent to the mechanical plant area at the west end.

Generally, maximum voltage drop allowance on the distribution system will not exceed the following:

Consumers' Mains	0.5-1%
Submains	2%
Subcircuits	2-2.5%

An emergency and exit lighting system complying with AS2293 shall be installed throughout the building. All emergency lights shall be of the non maintained type and exit lights shall be of the sustained type.

Environmental Sustainable Design

Environmentally sustainable design for the new clinical facility is governed by the specific functional and maintenance requirements. Those options are considered appropriate that balance the functional requirements and ESD outcomes.

The building is generally orientated favourably, with longer E-W axis. Courtyards have been provided to minimise the depth of floor plates where possible and provide natural light and amenity through access to outside views.



High performance building fabric is proposed with a combination of double glazing and low-e glazing and well insulated walls and roof. Double glazing also assist in meeting acoustic and infection control requirements.

Energy efficiency is addressed by considering mechanical systems, controls and light fittings and lighting controls that meet the functional/ maintenance requirements while operating efficiently.

Water conservation is addressed by reducing potable water consumption and use of rainwater and reuse of Reverse Osmosis dialysis water, condensate water and fire test water. Additionally, to minimise irrigation needs, it is recommended that where possible native plants are selected and subsoil drip irrigation system with automatic timers are installed.

Waste sorting facilities including cardboard compactors and waste holding area have been provided in the basement. It is recommended that hospital implements a recycling and waste policy to comprehensively address all waste streams and all aspects of waste management i.e. recycling, safe handling and disposal and staff training. In this regard, Waste Management policy (issued 10/04 by Department of NSW health) for clinical facilities is recommended as the basis to form the policy.

Communication Services

All telecommunications services cabling infrastructure shall be structured end-to-end and certified Category 6 cabling infrastructure installed by certified cabling contractors. The installed structured cabling system shall be in accordance with relevant Specifications for Structured Cabling Systems and implemented in accordance with AS3080, AS3084 and 3085 recommendations.



INTRODUCTION

Liverpool Hospital is a major tertiary, referral and teaching facility under the South West Area Health Service and must remain operational at all times.

The extent of new works and refurbishment works for Liverpool Hospital Stage 2.1 are described in other sections of this document. Engineering services should be installed, modified, upgraded to suit the development.

Disruption to engineering services should be avoided, where not possible shutdowns should be approved by the Hospital executive then coordinated through the hospital transition coordinator and the Project Director team.



Mechanical Services

STANDARDS AND REGULATIONS

The mechanical services will be designed in accordance with the recommendations of the following standards:

- Mechanical ventilation and air conditioning: To AS 1668.1 1998 and AS 1668.2 2002 and the Fire Engineers report;
- Microbial control: To AS/NZS 3666.1;
- New South Wales Local Government Act;
- Building Code of Australia 2008;
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act;

MECHANICAL SERVICES SYSTEMS

The proposed mechanical services systems for the new CSB consist of the following plant:

- Basement air cooled chiller plant, pumps and chilled water pipework reticulation system;
- Hot water boilers located on the roof , pumps and hot water pipework reticulation system to provide space heating nad domestic hot water heating
- Cooling Towers located on roof;
- Central chilled water and hot water air handling systems located in dedicated plantrooms. These systems include single zone, variable air volume and multizone systems. Dedicated local fancoil units are provided for meeting rooms, Comms rooms and specialist medical procedure areas with high equipment heat loads.
- Toilet, garbage, welding, medical gas bottle store, laundry, isolation room, OPA and plaster room exhaust systems.
- Air conditioning to the lift motor rooms and main switchroom.



SMOKE MANAGEMENT SYSTEMS

- Pressurisation systems to fire stairs and fire isolated corridors as required by the DeFire Fire Engineering Report.
- Smoke exhaust to the concourse as required by the DeFire Fire Engineering Report.
- In the event of a fire, the mechanical services will shut down on a general fire trip as per the DLA BCA report.



Hydraulic Services

STANDARDS AND REGULATIONS

- AS3500.1 -4 National Plumbing Code all parts;
- AS2845 Water Supply Backflow Prevention Devices and Atmospheric vacuum breakers;
- AS 5601 Australian Gas Installation Code
- NSW Code of Practice (Plumbing and Drainage);
- Local Council Regulations and Development approval conditions;
- New South Wales Local Government Act;
- Building Code of Australia 2008
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act.

HYDRAULIC SERVICES OVERVIEW

The hydraulic services generally consist of the following:

- Sewer, sanitary plumbing and drainage
- Rainwater collection, treatment and reticulation (for toilet flushing only)
- Trade waste drainage and plumbing
- Domestic cold water reticulation
- Domestic hot and warm water reticulation
- Natural gas reticulation
- Reverse Osmosis reticulation

SCOPE OF WORK

The hydraulic services design philosophy for the Liverpool Hospital project is as follows

Milestone 1:

Scope of works of the new Clinical Services Building (CSB) is as follows:

- Sanitary drainage and pre-treated trade waste drainage from the new CSB building to discharge into the existing 400mm Sydney Water sewer main, located north of the building, adjacent to the Mental Health Building.
- Trade waste systems generated within the new CSB to be collected separately and comprise of the following:
 - Laboratory trade waste from laboratories only

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- Kitchen trade waste from retail areas or food outlets
- Nuclear trade waste from the I₁₃₁ (Iodine₁₃₁ a special medical isotope) treatment area
- Intractable waste from the ambulance delivery dock area
- Rainwater collected from roof areas to discharge into the storm water system on site. Storm water connection points in form of storm water pits will be provided by the civil engineering consultant. A rainwater tank adjacent to the building will collect parts of the roof rainwater for toilet flushing, surface water will not generally be collected for re-use. The overflow of this tank will also discharge into the storm water system provided by the civil engineering consultant.
- Hydraulic Services under pressure, such as domestic cold, warm and hot water services and the toilet flushing systems (NPCW), will be reticulated throughout the building to each fixture and fitting as required
- Hot water will be generated by means of duty stand-by plate heat exchangers receiving primary hot water from the mechanical plant. The hot water system will comprise a hot water storage capacity of 65 degree C water in accordance with AS3500 and have 3hours storage capacity in accordance to TS11.
- Gas supply from existing medium pressure gas on site to be extended to the new building to supply the building services plant on L6 and any other gas consumer in the building.
- Reverse Osmosis Water (RO) to be generated and reticulated, in local to use plant areas, in order to reduce extensive pipe lengths, which have an adverse effect on thermal sanitisation procedures

Milestone 2:

The scope of works of the refurbishment of the existing Clinical Services Building (CSB) is as follows:

- All drainage and or laboratory trade waste pipe work of new or relocated fixtures and fittings to be connected to the existing drainage and trade waste system of the building.
- Cold water and hot water for new or relocated fixtures and fittings to be connected to the existing cold and hot water system.
- Existing hot water plants to remain unchanged and refurbished fixtures to be connected to the appropriate hot water systems.

Milestone 5:

- Drainage of fixtures and fittings from the extension of the CEB to be connected to the existing sewer pipe work of the existing CEB.



- Cold water for new fixtures and fittings in the extension of the CEB to be connected to the existing cold water supply of the existing CEB.
- Hot water for the extension of the CEB to be generated by means of gas fuelled hot water units.

There will be no provision for trade waste in the extension of the CEB.

SEWER, SANITARY PLUMBING & TRADE WASTE PLUMBING

Sewer

The proposed sewer pipe work shall connect to the existing 400mm Authority sewer main, located on the north-east side of the development

Sanitary Plumbing

The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials will be Poly Ethylene and / or cast iron tube and fittings.

Trade Waste Plumbing

Fixtures and equipment that generate grease and/or high temperature discharges will be treated on site to the requirements of Sydney Water Corporation trade waste policy. The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials will be high density polyethylene (HDPE) tube and fittings

HOT / WARM & COLD WATER AND NON-POTABLE WATER (NPCW) SUPPLIES

Potable Cold Water

The proposed potable cold water will be connected to the site infrastructure and reticulated to all fixtures and equipment that requires cold water. Fixtures and equipment that may present a source of contamination will be fitted with a backflow prevention device suitable for the hazard rating of the procedure. The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials for pipes up to 20mm will be cross linked polyethylene (Pe-X) and type 3 polypropylene (type 3 PP-R) tube and fittings for pipes 25mm and over.

Hot and Warm Water Systems

The proposed potable hot/warm water will be generated by means of boilers and heat exchangers and reticulates to all fixtures and equipment that requires hot water.



Warm water will be generated by means of a centralized warm water plant, to NSW Health requirements and guidelines and will reticulate warm water to all fixtures and equipment that requires warm water.

Water temperatures will be controlled by thermostatic mixing valves (TMV) to the requirements as scheduled in AS 3500.4 2003 and as tabled below.

AREA	TEMPERATURE
General Reticulation and Kitchen Fixtures	>60 ⁰ C
Fixtures in Ablution Areas	<50 ⁰ C
Fixtures for People with Disabilities	<43 ⁰ C

The system will be installed in accordance with AS 3500.4 – 2003, and the NSW Code of Practice 2006. Materials for pipes up to 20mm will be cross linked polyethylene (x-pe) and type 3 polypropylene (type 3 ppr) tube and fittings for pipes 25mm and over.

Non Potable Water (NPCW)

Rainwater from roof areas will be collected, filtered, treated and re-used for toilet flushing only. NPCW will be reticulated to all toilets and urinals. In times of long periods without rain the NPCW system will be topped-up by potable water. Materials for pipes up to 20mm will be cross linked polyethylene (x-pe) and type 3 polypropylene (type 3 ppr) tube and fittings for pipes 25mm and over. All pipe work will be colour-coded to Authority's Water requirements.

DESIGN CRITERIA FOR HYDRAULIC SERVICES

- Earth Quake Code
- AS3500 – National Plumbing Code all parts
- NSW Department of Health AMMS assets management system
- NSW Health Memorandum of approved warm water systems
- Gas Code
- NSW Code of Practice (Plumbing and Drainage)
- New South Wales Local Government Act
- Building Code of Australia 2008

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- NSW Health Department Engineering Services and Sustainable Development Guidelines: TS11
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act
- Additional fire services requirements: NSW Fire Brigade and Council of Fire and Accident Underwriters of Australia.
- The requirements of all authorities having jurisdiction over the site.



Fire Services

STANDARDS AND REGULATIONS

The fire and life safety services will be designed with the guidelines and recommendations of the following standards:

- AS 1670.1 – Fire detection, warning, control and intercom systems - System design, installation and commissioning;
- AS 1670.4 – Fire detection, warning, control and intercom systems - System design, installation and commissioning - Sound systems and intercom systems for emergency purposes;
- AS 4428.1 – Fire detection, warning, control and intercom systems – control and Indicating Equipment;
- AS/NZS 1668.1 – The use of ventilation and air conditioning in buildings - Fire and smoke control in multi-compartment buildings;
- AS 2118.1 - Automatic Fire Sprinkler systems;
- AS 3000 – Electrical installations (known as the Australian/New Zealand Wiring Rules);
- AS 2419.1 – Fire hydrant installations;
- AS 1221 – Fire hose reels;
- AS 2441 – Installation of fire hose reels;
- AS 2444 – Portable fire extinguishers;
- AS 2941 – Fixed fire protection installations – Pumpset systems;
- AS1851 – Maintenance of Fire Protection Equipment;
- AS 1530.4 & AS 4072.1 Passive Fire
- New South Wales Local Government Act;
- Building Code of Australia 2008;
- EP&A act Regulation 2000
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority, New South Wales Occupational Health and Safety Act 2000 and New South Wales Occupational Health and Safety Regulation 2001;
- BCA report prepared by Davis Langdon Australia
- Fire Engineering Report, dated June 2008 prepared by Defire.
- NSW Health Engineering Services and Sustainability Development Guidelines, Technical Services TS11 dated December 2007



FIRE SERVICES OVERVIEW

The essential fire services generally consist of the following fire and life safety protection systems:

- Automatic sprinklers;
- Automatic fire alarm & smoke detection system;
- Sound systems and intercom systems for emergency purposes;
- Fire hydrants;
- Fire hose reels;
- Fire extinguishers;
- Passive fire stopping systems;
- Automatic fail safe devices;
- Smoke hazard management control.

SCOPE OF WORK

The scope of works for the Milestone 1: New Clinical Services Building & Milestone 2: New Central Energy Building consists of modifications, alterations and additions for a new hospital & engineering buildings for the following essential services:-

The works will be completed in a single stage within the proposed project programme.

The Fire Engineered Report includes for the following :

- Semi-recessed fast response sprinkler type only.
- Approved fast response wall-wetting sprinklers to glazed section of fire walls
- 2 hour water supply to suit wall-wetting sprinkler requirements
- Monitoring of all sprinkler system water supply isolation valves
- Fire alarm & smoke detection
- Concourse smoke hazard management
- Modified Sound systems and intercom systems for emergency purposes coverage with nurse call interface.

FIRE SPRINKLERS

New fire sprinklers will be installed to the entire New Clinical Services Building to BCA2008 Part E1.5 & AS2118.1 – 1999 requirements & will incorporate the following.

- One (1) off fire sprinkler installation to each level with additional fire sprinkler installations to the Concourse & Basement Car Park.



- Fire Sprinkler Valve Room located on the Ground floor containing the sprinkler control valves with adjacent Fire Pump Room containing fire sprinkler electric & fire hydrant diesel booster pumps.
- Water supply will be provided from the extension of the existing Towns Mains in Elizabeth Street via a new fire sprinkler booster valve for use by the NSWFB, located adjacent the existing fire sprinkler boosters' on the opposite side of the road adjacent the existing Clinical Services Building main entry.
- Grouping of sprinkler main crossovers in the Basement to the 3 off fire services risers.
- Provisions of additional sprinkler control valves within the Fire Sprinkler Valve Room for future extension to the existing Clinical Services Building and existing Education Building.
- Reticulation of pipework to automatic sprinkler heads from each sprinkler control valve.
- A series of flow switches with solenoid testing arrangements are installed into the sprinkler pipework to indicate a sprinkler operation within a fire compartment.
- The sprinkler system has a grade 3 water supply with a fire sprinkler booster pumpset.

AS2118.1 – 1999 sprinkler system with the following hazard classifications

Area	Hazard Classification
Offices & Wards	Light Hazard
Concealed Ceiling Spaces	Light Hazard
Plant Rooms & Levels 1 & 2 Concourse	Ordinary Hazard 1
Car Park	Ordinary Hazard 2
Storage areas, Ground Floor Concourse including Retail	Ordinary Hazard 3

FIRE DETECTION AND ALARM SYSTEM

New smoke detection & alarm systems will be installed to the entire New Clinical Services Building and New Central Energy Building to BCA2008 Part E2.2, AS1670.1 – 2004, AS1668.1 – 1998 requirements & will incorporate the following:

- New addressable Sub Fire Indicator Panel and Fire Fan Control Panels located in the Fire Sprinkler Valve Room on the Ground Floor.
- Grouping of fire electrical wiring in cable tray crossovers in the Ground level to the 2 off fire electrical service risers.

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- New addressable Data Gathering Panel located in the west side of the Level 6 Plant room within the EWIS Remote Rack Room adjacent to the Existing Clinical Services Building.
- Fire alarm zones to align with EWIS zones & fire compartments (Note: multiple fire zones may be required within each EWIS zone)
- Non-programmable Nurse Station Annunciator Panels within Patient Care Wards or Mimic Panels located in Non-Patient Care areas as part of the Fire Alarm System, to provide early indication of fire alarm locations within each fire compartment.
- Addressable photo optical or ionisation type smoke detectors will be used throughout most areas. Heat detectors will be used in areas not suitable for smoke detectors. Smoke detection will be provided with the mechanical systems for Smoke Hazard Management.
- Alarm verification up to 30 seconds delay for smoke detectors (Note: Alarm acknowledgement facility is not available in a hospital building)

SOUND SYSTEMS AND INTERCOM SYSTEMS FOR EMERGENCY PURPOSES

New sound systems and intercom systems for emergency purposes will be installed to the entire New Clinical Services Building to BCA2008 Part E4.9 and AS1670.4 – 2004 requirements & will incorporate the following.

- New Sub Emergency Control Panel and located adjacent to the Sub Fire Indicator Panel and Fire Fan Control Panels in the Sprinkler Valve Room on the Ground Floor.
- Grouping of fire electrical wiring in cable tray crossovers in the Ground level to the 2 off fire electrical service risers.
- New EWIS remote amplifier racks located in the west side of the Level 6 Plant room within the EWIS Remote Rack Room adjacent to the Existing Clinical Services Building.
- Cone type speakers located within ceilings, horn speakers within car parks & exposed areas, strobe type visual indicators where required (interfaced with EWIS).
- Supplemental strobe type visual indicators may be required along patient care wards to provide additional warning if speakers are removed from patient care rooms.

BUILDING OCCUPANT WARNING SYSTEM (BOWS)

New building occupant warning system (BOWS) will be installed to the entire New Central Energy Building to BCA2008 Part E2.2 and AS1670.1 – 2004 requirements & will incorporate the following:

- Cone type speakers located within ceilings, horn speakers within exposed areas, strobe type visual indicators where required.
- The system will be powered from the Central Energy Building sub FIP and shall initiate evacuation tones throughout all areas following a fire alarm.



DISTRIBUTION PIPING AND WIRING SYSTEMS

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

FIRE HYDRANTS

New fire hydrant will be installed to the entire New Clinical Services Building and New Central Energy Building to BCA2008 Part E1.3, AS2419.1 – 2005 requirements & will incorporate the following:

- Fire hydrants for the New Clinical Services Building are located within fire stairs & additional internal hydrants & fire hose reels located in Fire Hose Reel cupboards within 4.0 m of each fire compartment's horizontal exit on each level. Additional fire hydrants & fire hose reels may be located within fire compartments to provide coverage.
- The fire hydrant diesel booster pump will be located in the Fire Pump Room Valve Room located adjacent the Fire Sprinkler Valve Room on the Ground Floor.
- Water supply will be provided from the extension of the existing Towns Mains in Elizabeth Street via a new fire hydrant booster valves for use by the NSWFB, located on the opposite side of the road from the Existing Clinical Services Building main entry.
- External fire hydrants shall be installed to protect the New Central Energy Building

FIRE HOSE REELS

The fire hose reels throughout the building to comply with BCA2008 Part E1.4 and AS2441 – 2005.

FIRE EXTINGUISHES

The fire extinguishers throughout the building to comply with BCA2008 Part E1.6 & E1.10 and AS2444 – 2001 requirements.

PASSIVE FIRE PROTECTION

All fire services passing through any walls, floors and ceilings required to have a fire resistance level (FRL) rating will be sealed with approved passive fire protection systems to satisfy BCA2008 Part C3.15 and Spec C3.15, AS1530.4 and AS4072.1 requirements.

FIRE SAFETY MANAGEMENT

A comprehensive set of fire safety management and evacuation plans will be developed which are consistent with all fire and life safety protection equipment to be installed and EPA regulations relating to OH&S and fire safety. AS3745 would be used as a guide.



DESIGN CRITERIA FOR FIRE AND LIFE SAFETY SERVICES

System	Standards	Criteria
Automatic Sprinklers	BCA 2008 Part E1.5 and Specification E1.5 AS.2118.1-1999	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Automatic Fire Detection and Alarm System	BCA 2008 Part E2.2 and Specification E2.2a AS 1670.1	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Automatic Fail - Safe Devices	BCA 2008 Part D 2.21	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions. Manufacturers Specifications.
Sound systems and intercom systems for emergency purposes	BCA 2008 Part E4.9 AS 1670.4	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Fire Hydrants	BCA 2008 Part E1.3 AS 2419 AS 3500	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Fire Hose Reels	BCA 2008 Part E1.4 AS 2441 AS 3500	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Portable fire extinguishers	BCA 2008 Part E1.6 & E1.10 AS 2444	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.
Passive Fire Protection	BCA 2008 Part C3.15 and Specification C3.15 AS 1530-4 AS 4072.1	To comply with BCA2008, Fire Engineering Report and Crown Project Application Conditions.



Electrical

STANDARDS AND REGULATIONS

The design and construction shall be in accordance with the current issues and amendments of the Building Code of Australia and all relevant Australian Standards and the requirements of all Authorities having jurisdiction over the project.

The following nominated standards have particular relevance for compliance on this project:

- TS11 2005;
- AS/NZS 3000.2000 - SAA Wiring Rules;
- Service Rules, Regulations and Requirements of relevant electrical supply authority;
- NSW Service and Installation Rules;
- The requirements of the Australian Telecommunications Commission;
- AS 2202, parts 1-5, Intruder Alarm systems;
- AS 2293 “Emergency Lighting to Buildings”;
- AS 1680 – Interior Lighting;
- New South Wales Local Government Act;
- Building Code of Australia 2008;
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act.

ELECTRICAL SUPPLY

Energy Provider: Integral Energy

The electrical supply characteristics of the power supply to the site are:

- 11kV, 50 Hz. incoming supply to the Site;
- 415V 50 Hz within the building facility;
- MEN earthing throughout;
- The fault level at the point of supply to the main switchboard is 50 kA.



SUB-MAINS AND DISTRIBUTION BOARDS

Sub-mains

Sub-mains will be divided into three categories as defined as following:

Category A – Essential Services

- Fire Services;
- Fire Detection and Alarms;
- EWIS;
- Lifts.

Note: All the above supplies will utilise fire rated cables such as Radox and Firestop.

Category B – Critical Care Services

Operating Suite (Lighting and power);

Intensive Care / High Dependency Units (Lighting and power);

CT Scanner and Radiology Areas (Plant, lighting and power);

Coronary Care Unit

- Cardiac Catherer Unit;
- Days Procedures Rooms;
- Mechanical Handling plant to the above areas (including chilled water);
- Critical areas where 100% of general purpose outlets are to be connected to diesel generators

Note All above supplies will not use fire rated cable

General Services

- General lighting and power throughout areas not included above;
- General mechanical plant, which is separate from the requirements for Category A systems;
- Offices, Administration;
- Hydraulics Services.

Note: All above supplies will not use fire rated cable

The sizing of sub-mains will be based on both maximum demand and voltage drop, to comply with the requirements of the relevant standards.



Distribution boards

Lighting and power circuits within each area shall be protected from distribution boards located in electrical cupboards/risers. Separate distribution boards will be provided for diesel generator supplies, non-essential supplies, and UPS-powered outlets where appropriate.

All distribution boards are fitted with the appropriate circuit breakers to control the circuits nominated, each chassis to have a minimum of 33% spare capacity.

GENERAL POWER OUTLETS

The number and configuration of power outlet shall be as defined in AS3000. All outlets shall be labelled to indicate the distribution board and circuit breaker of origin. An extra gang on all switches / GPO with a “proprietary slip in” insert shall be the method of labelling.

RCD protection is required to all general purpose power outlets.

All circuits shall be protected by means of a 30mA earth leakage circuit breaker (RCD).

Power socket outlets connected to the non-essential supply shall have a white face plate and outlet with a “white” operating switch.

Power socket outlets connected to the essential supply shall have a white face plate and outlet but have a “red” operating switch.

Body Protected Areas

Panel-mounted, 10 amp power socket outlets shall be provided in accordance with the installation requirements of AS3003. All outlets shall be protected by means of a 10mA earth leakage circuit breaker (RCD) which shall be located in the patient care area (and not at the distribution board).

Each patient location shall be connected to two separate circuits, each originating from different distribution boards.

Cardiac Protected Areas

Panel-mounted, 10 amp power socket outlets shall be provided in accordance with the installation requirements of AS3003. In addition to the requirements for Body Protection Areas, full emphasis shall be provided regarding earthing within the patient care area.

Each patient location shall be provided with a minimum of two dedicated circuits from individual distribution boards, which shall not be shared with other patients.



Visual and audible alarm shall be provided at each staff station for each cardiac protected area to alert nursing staff when a circuit breaker trips in a patient area. The audible alarm would be muted at the staff station, but the alarm lamp would remain on until the relevant circuit breaker has been reset.

Medical Services Panels and Pendants

Medical services pendants shall be provided to ICU patient locations.

Medical services panels shall be provided to all other areas as required during Design / Development.

All panels and pendants shall have a power component, voice/data, nurse call, medical gas and other monitoring components as required. Generally, medical services panels shall be powder-coated or stainless steel as agreed.

Panel material and finishes will be specified by the architect.

Generally all distribution boards will be fitted with circuit breakers with the appropriate RCD protection,

Cable Tray and General Wiring

Cable tray will be installed throughout the new works within cable risers / cupboards and for horizontal floor cabling (located in the ceiling voids). All to have a minimum of 30% spare capacity.

Separate cable trays in the above general locations shall be installed for the following services:

Lighting and Power Cable Trays:

- Electrical non essential sub-mains
- Electrical essential sub-mains
- UPS sub-mains

Communications and Miscellaneous Services Cable Trays:

- Communications backbone cabling for copper and fibre optic services
- Fire and Safety Services
- Nurse Call
- MATV / Pay TV
- Security
- BMS



Cable trays in main cupboards shall be admiralty pattern hot dipped galvanised type.

Cable support system for horizontal distribution of services in the ceiling space shall be equal to RAMSET – FASTRAK and the model selected for the specific service to be installed (ie light duty for voice/data and heavy duty for lighting and power services).

Wiring in Patient Protected Areas

Operating Rooms shall be protected with line isolation monitors. The ICU areas shall be cardiac protected by residual current devices rather than line isolation monitors. Other areas shall be body or cardiac protected as required by TS11. All body and cardiac areas shall comply with the requirements of the latest edition of AS3003.

POWER FACTOR CORRECTION

Large numbers of fluorescent lamps used in an installation create an inherently low power factor. This is the relationship between “apparent” and “real” power and is represented by a number between zero and one. The higher the number the less wasted energy required to make the lighting circuits operate. Obviously electronic ballast lighting control gear (high power factor) alleviates this problem to a certain extent.

It is advantageous in these circumstances to invest in automatic correction capacitor banks to lift low power factor installations closer to unity, i.e. a power factor of one, which is the ideal situation.



LIGHTING

The general and specific lighting layouts will be designed in accordance with a number of lighting standards as part of detailed design as follows:

AS 1680 Part 1 and TS 11	-	General lighting levels;
AS 1680 Part 2 and TS 11	-	Specific lighting levels.
AS 1765		Artificial lighting for Clinical Observation

Lamps / Fluorescent Lamps

Linear Fluorescent Lamps

Group B Areas

Utilisation of K19 prismatic diffusers, the fluorescent lamps will be T8 (20mm dia), triphosphor with a colour temperature of 4000°k and a Colour Rendering index (Ra) of at least 84. With electronic ballast

The use of the new T5 (16mm diameter), triphosphor tube will be restricted due to the high surface brightness of the tube and the associated glare that it creates when used with prismatic diffusers.

Other Departments

The fluorescent lamps will be a mixture of T8 (20mm diameter) and T5 (16mm diameter). All lamps will have a colour temperature of 4000°k with Ra of 84, except where located in Operating Rooms, where the Ra shall be 94 minimum.

Compact Fluorescent Lamps

Compact fluorescent lamps will be used in conjunction with down lights and specific fluorescent luminaires, the range of which shall be as follows:

Up to 26 watt	TC/D type
36, 40 & 50 watt	TC/L type

The colour temperature of these lamps will be 4000°k with Ra of 84.

Incandescent Lamps

These are generally discouraged and it is not expected to use these lamps due to their poor light output, high energy use and very limited lamp life.



LIGHTING CONTROL

The provision of local lighting control and other energy saving techniques shall be employed to minimise energy usage throughout the proposed hospital fitout.

EMERGENCY LIGHTING

An emergency and exit lighting system complying with AS2293 shall be installed throughout the building. All emergency lights shall be of the non maintained type and exit lights shall be of the self-luminous type.

The head end PC shall be located in the Security Room in the Basement, or as directed by "Hospital User Group".

The system to be used throughout the new Clinical Services Building shall be stand-alone.

The overall system will report only to, but not be controlled by the Hospital B.M.S. system. This would be a common alarm only, not individual lamp/fail/fault information.

EXTERNAL LIGHTING

External lighting shall be provided to the roof plant. External lighting shall generally comprise long life metal halide HID lamps in vandal resistant luminaires. Low glare luminaires shall be used to ensure that safety and amenity are maintained.

The external lighting shall meet the requirements of the AS4485.1.

EXTERNAL LIGHTING CONTROL

The switching of external security lighting shall be by contactors controlled by photo electric switches. Local over-ride facilities shall be provided for maintenance.

The photo electric switches shall be mounted above the roof line in easily accessible locations, clear of any obstructions that may affect their operation.

CLOCKS

A master clock system will be required in some dedicated areas:

MATV

The existing reticulated MATV network will be extended into the new CSB to cover patient locations as well as waiting / reception areas.

The MATV network will provide "PAY TV" to patient locations, which will include FOXTEL channels together with "Free-to-Air" channels, including AM radio. These channels will be available to each patient on a hire basis. With regard to waiting areas, "Free-to-Air" channels only will be available.

SINCLAIR KNIGHT MERZ



LIGHTNING PROTECTION

Lightning protection will be a Faraday cage type installation.

VALUE ADDED STRATEGIES

Energy management associated with the electrical services will basically cover areas as follows:

- Lighting control
- The use of energy efficient luminaires, lamps and control gear
- Power factor correction at the Main Switchboards

Lighting Control

General patient lighting within the inpatient units will be locally controlled as they are 24 hour facilities.

Administration and general non-patient areas that are typically a “nine to five” operation will be furnished with a lighting control system such as “C-Bus”, which will ensure that these areas are switched off out-of-hours; this system shall be fully adjustable. Facilities will be provided to override this control sequence should any area be occupied out-of-hours.

In any of the aforementioned areas, where practical and appropriate, light level sensors shall be incorporated, chiefly within perimeter zones, to detect the daylight level and control the artificial lighting. This facility would be incorporated into the lighting control management system.

Further, in suitable areas such as archive rooms and less frequently used store rooms, wall on/off switches shall be used.

Energy Efficient Luminaires

All luminaires will be fitted with electronic control gear to provide the most energy efficient means of operation.

Lamps will be selected for their energy efficient operation. The use of the T5 fluorescent lamp will be utilised as stated previously; this lamp is rated at 28 watts compared with the T8 lamp rated at 36 watts.



ESD (Environmentally Sustainable Design)

THERMAL EFFICIENCY

The building is generally orientated favourably, with longer E-W axis. Courtyards have been provided to minimise the depth of floor plates where possible and provide natural light and amenity through access to outside views.

A combination of double glazing and Low-e glazing will be provided to maximise the energy efficiency and acoustics quality.

ENERGY EFFICIENCY

Mechanical system is designed to provide single zoning and VAV based system to allow management of low occupancy areas. All AHUs (except for the core areas) will have economy cycle and VSDs. Meeting rooms will have separate fan coil units to allow the system to be turned off when unoccupied. Large waiting areas have CO₂ monitoring to adjust the ventilation rates depending upon the occupancy levels. Treatment areas will have independent conditioning to be controlled through the BMS. The concourse area will have displacement ventilation, one of the most effective ventilation systems due to the controlled air flow it provides.

Displacement ventilation has been provided for the concourse. Displacement ventilation can provide improved ventilation effectiveness due to controlled air flow in the space, uses less energy and may also assist in infection control.

A combination of T5 (for administrative area) and T8 lighting (for clinical areas) will be provided based on the functional requirement.

The car park will have a combination of natural ventilation system and exhaust fan assisted system controlled by CO monitoring, separate monitoring of ventilation system and lighting system in the car park will be enabled.

WATER EFFICIENCY

Rainwater will be collected in a large underground storage tank that also allows storage of condensate water (from AHU stacks), RO dialysis water and fire test water. To monitor all water uses, separate metering will be provided for mechanical system, cooling tower and hot water plant.

RECYCLING AND WASTE

Waste management in the context of hospitals is extremely complex with the waste stream covering clinical, chemical, radioactive waste in addition to recyclables, paper, general and organic



waste. It is therefore an important aspect of the efficient and environmentally responsible operation of hospitals.

Waste sorting facilities e.g. cardboard recycling and compacting facilities, waste holding areas for different waste stream (e.g. general, cytotoxic, radioactive etc.) have been provided in the basement with access to collection services.

It is recommended that a waste management policy is adopted during the operation of the hospital. In this regard, reference is made to the Waste Management policy (issued 10/04 by Department of NSW health) for clinical facilities. It is recommended that an operational waste management plan is devised based on this policy directive.

According to policy document, some of the recommended strategies for the effective management of waste are¹:

- Waste management committees, plans and waste audits
- Waste minimisation, avoidance, segregation, recycling and re-use
- Waste labeling and containment
- Proper waste handling, storage and transport
- Correct waste treatment / disposal
- Staff training and education

OTHER INITIATIVES

- All refrigerant will be zero ODP (R407 C or R134 A)
- Separate sub-metering will be provided for supplies rated at 400 amps and above
- Power factor correction will be applied at the Main Switchboards
- Low VOC paints and flooring will be specified
- Whole of life stewardship of products and materials will be considered where possible
- Cement will have 15-20% recycled aggregates (e.g. fly ash) – to be confirmed
- Where possible, subsoil drip irrigation with automatic timer will be provided for irrigation
- Where the depth of soil allows, native plants will be provided
- EMP/EMS (to be confirmed)

¹ Waste Management Guidelines, Department of Health NSW. August 1998



Communications/Security Systems

OBJECTIVES

Telecommunication systems shall be provided throughout the hospital fitout as required by the user groups.

The project shall include the provision of the following services:

- Telephone services.
- Data services.
- MATV services;
- Nurse Call.

NURSE CALL SYSTEM

The nurse call system would generally be micro-processor based, with Ethernet data interface modules mounted within the floor communication distributor rooms. It is expected to introduce ceiling-mounted alpha-numeric annunciator panels within corridors and/or at staff stations.

COMMUNICATION SYSTEM

All telecommunications services cabling infrastructure shall be structured end-to-end and certified Category 6 cabling infrastructure installed by certified cabling contractors. The installed structured cabling system shall be in accordance with relevant Specifications for Structured Cabling Systems and implemented in accordance with AS3080, AS3084 and 3085 recommendations.

All structured cabling telecommunication outlets, patch panels, cabinets, racks and cables shall be systematically and permanently labelled in accordance with the relevant standards.

Telecommunication/Data Outlets

All telecommunication/data outlets shall be Category 6 RJ45 type. Outlets shall be provided as detailed in the room data sheets to locations as nominated by the user group.