IPART
New South Wales

Independent Pricing and Regulatory Tribunal

Network Operator and Retail Supplier Licence Application Form

8 Chifley Square

Mirvac Real Estate Pty Ltd

Appendices Section 3

APPENDIX 3.3.1

INSURANCE CERTIFICATES (CONFIDENTIAL SUBMISSION ONLY)

APPENDIX 3.4.1 PART I

DEVELOPMENT AGREEMENT

(CONFIDENTIAL SUBMISSION ONLY)

APPENDIX 3.4.1 PART II

PLANET PLUMBING GROUP CAPABILITY STATEMENT

planet
plumbing group

MANAGING DIRECTOR'S MESSAGE

I am delighted to present to you the Planet Plumbing Group Corporate Profile. Planet Plumbing is built on a foundation of core values that are shared across each and every member of our team. These core values have assisted Planet Plumbing grow into a national leader in hydraulic services. We understand the most important items in our industry are safety, time, cost, and quality, while protecting our environment. With this in mind Planet Plumbing collaborates with our clients from project inception, to deliver the best possible outcome. We are driven to achieving a legacy through a synergized approach, based on integrity and satisfaction, building unsurpassed relationships, creating innovative, sustainable hydraulic solutions. We look forward to working with you on your next project.

Regards

A. Alafaci
Group MD

CREATE, INSPIRE, DELIVER.

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INSPIRED PARTNERS FROM CONCEPT TO COMPLETION.

Our passion for innovation and proactive nature has seen Planet Plumbing become one of Australia's premier providers of hydraulic solutions for large-scale building projects. Spanning the entire country, our substantial footprint is setting us apart as a valuable partner for successful project developments.

With extensive experience in all aspects of hydraulic engineering, our expertise and solid core values make Planet Plumbing a valuable alliance partner for success.
Our certified quality management system ensures the highest quality workmanship, at every stage of the process, to deliver exceptional and unsurpassed project results.
While our work speaks for itself, our greatest strength comes from our ingrained culture of building solid client and supplier relationships, maintaining open lines of communication, from concept to completion and beyond.

We are Australian owned, with offices throughout the nation and are dedicated to delivering inspired solutions to developments nationwide. We understand 'time is money' and therefore work is completed on time, every time with guaranteed performance.
Our safety and environmental awareness ensures each and every project is completed safely, with minimal impact on the surrounding environment.

Australia's premier providers of hydraulic solutions for large-scale building projects.

History

NO PROBLEMS, ONLY SOLUTIONS.

Proudly Australian owned, Planet Plumbing was founded in 1995 and since then has been driven to successfully establish a reputation for providing quality hydraulic solutions to a range of clients across a broad range of industries.

Word of Planet Plumbing's 'no problems, only solutions' approach quickly spread, and as the demand for innovative, cost effective partnerships grew, so too did our company. Today, we have dedicated offices throughout the nation and numerous contracts across the country, ranging from simple maintenance and servicing to major infrastructure and construction projects.

Our capacity to completely manage projects from conception to completion is founded on our wealth of diverse internal experience, at every stage. Currently involved in hydraulic design, development and construction of some of Australia's most prestigious projects, our broad-based capabilities have seen us gain an enviable reputation as a trusted expert and leader in the installation of hydraulic services.

We have dedicated offices throughout the nation.

The added advantage of local, national and global procurement capabilities.

Core Values

TAILORED SOLUTIONS THROUGH UNDERSTANDING AND INPUT.

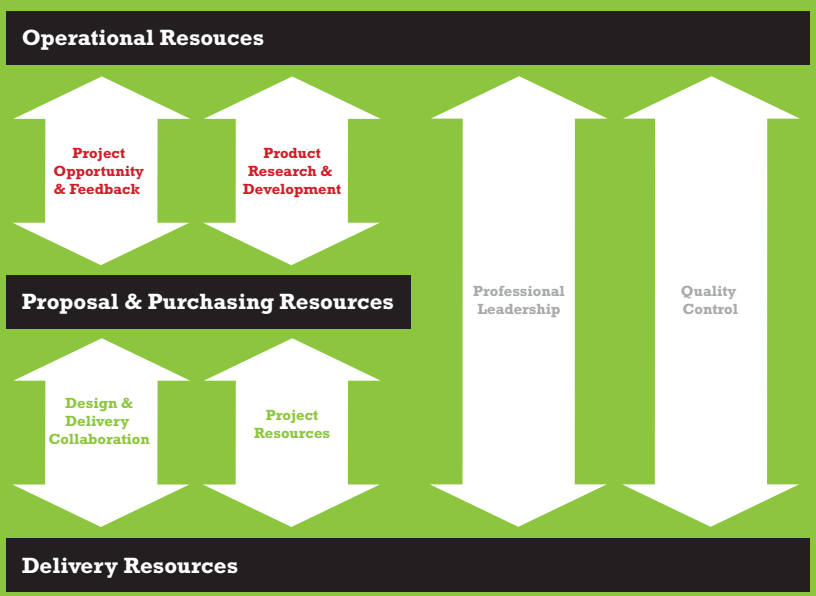
Constantly looking for new opportunities and ways to further develop our already strong offering, Planet Plumbing is investing in expanding its global reach into the US, New Zealand, the Pacific Islands and the UK. For our clients, this global exposure and experience will deliver not only a world of new possibilities but also, the added advantage of local, national and global procurement capabilities, leading to greater cost benefits on every project.

Mission Statement:
Through innovation and inspiration, Planet Plumbing aims to continually improve the efficiency of project development from concept to completion to deliver a service, which far exceeds our client's expectations.

Quality Statement:
Our quality of work is a reflection of our business and as such we are proud to be part of an industry quality assured system, formally certified compliant to AS/NZS ISO 9001. All employees, from tender to construction are dedicated to strictly adhering to our quality control procedures, set out in our Quality Manual to ensure a superior level of service deliverability to minimise risk and build our reputation as a quality service partner.

TRUSTED AND RELIABLE PROJECT PARTNERS.

As a company with a strong focus on deliverability, our success comes not only from our external collaborations, but also our internal. Our three-tiered structure is designed for open throughput of communication, leading to greater insights, creative solutions and project results beyond expectations.



Greater insights, creative solutions and project results.

Philosophies / Policies

IT'S NOT WHAT WE DO, IT'S HOW WE DO IT.

Healthy and Safety:
Safety is not just another box to be ticked. Before any work commences, our committed team ensure the work environment meets and maintains the highest level of safety, minimising injuries and project downtime. Fully compliant with the strictest of government regulations our Health and Safety Policy is another way we're helping our clients manage risk while delivering exceptional project results.

Environmental:
At every level of our business we're committed in our effort to minimise the environmental impact of our projects.
From choice of material, waste disposal, efficiency of machinery and power, right down to the recycled paper of this brochure, sustaining our environment, sustains a future for us all.

Innovation:
As an industry innovator we take pride in driving and developing the growth of the plumbing and hydraulic sector. Through strategic partnerships, alliances and relationships with like-minded organisations and government departments we're helping to build an industry based on the highest possible work standards, setting the benchmark for the industry and raising the bar for our competitors.

Rehabilitation Policy:
In our business, our people are our most valuable asset. In the unlikely event of an injury, our Rehabilitation Plan ensures our staff receive the support they need to rest, recover and return to pre-injury duties.

● Safety is not just another box to be ticked.

Culture & People

OUR STRENGTH, OUR PEOPLE.

Employee Wellbeing:
We are committed to fostering a balanced ''worklife'' environment, ensuring every employee enjoys a healthy balance of work and family life. This essential mix is pivotal to ensuring happy employees, minimising the risk of workplace injury and reducing staff tournover. We encourage all employees to maintain high levels of personal fitness, with our employees having access to dedicated staff gyms, which may be used at the employee's discretion.

Employee Equality.
We are committed to our belief in the equality of all employees, regardless of demographics, and as such do not discriminate when employing new and valuable staff members into the Planet Plumbing team. We encourage the employment and career development of women in the workforce and are proud to operate a business with a diverse employee background. Our Indigenous Program recognizes the valuable contribution of both Aboriginal and Torres Straight Islanders, providing opportunities in employment and career development to build a skilled workforce, advancing the sustainability of the nations Indigenous community.

Training and development:
Advancing in industry is easy when you harness the passion, drive and enthusiasm of a talented team. At Planet Plumbing we encourage further training and development of all our employees wishing to increase their skills, expertise and efficiency, allowing progression within the Hydraulic and project management fields.

Every employee enjoys a healthy balance of work and family life.

Apprentice Program:
With a strong belief in the fostering of new industry talent, we offer our apprentices the opportunity to take on the challenges of the construction industry in a safe and experience rich environment. Apprentices value greatly from the opportunity Planet Plumbing's experience can deliver with exposure to a range of projects from maintenance contracts to large-scale national developments.

National Presence

ALL OVER DOWN UNDER.

Our national exposure allows us the benefit of securing local product on a larger scale, offering the combined benefits of both faster implementation and support of the local economy. With capabilities in all Australian cities Planet Plumbing is leading the industry in innovative and sustainable plumbing and hydraulic solutions nationwide.

Nationally, recent project numbers have exceeded 200 million to date.

Financial Stability

SOLID FOUNDATIONS.

With a presence spanning the nation, our capacity for flexibility is unsurpassed in the industry. Nationally, recent project numbers have exceeded $200 million to date, with an increasing focus on projects with hydraulic values in excess of $10 million to maximise our resources and capacity, making us the clear supplier of choice for projects of this magnitude.

Ownership of all operating premises as well as a fleet of heavy machinery.

We have the ability to meet the financial and risk management criteria required by both the private and government sectors for large construction projects.

Planet Plumbing's extensive asset pool includes ownership of all operating premises as well as a fleet of heavy machinery, plant, excavators, tools and equipment.

A PASSION FOR CREATION.

Through client and market demand, Planet Plumbing has evolved into a highly experienced broad-based supplier of innovative hydraulic solutions.

Spanning a number of industries and market sectors, our knowledge and scope of work includes, but is not limited to:

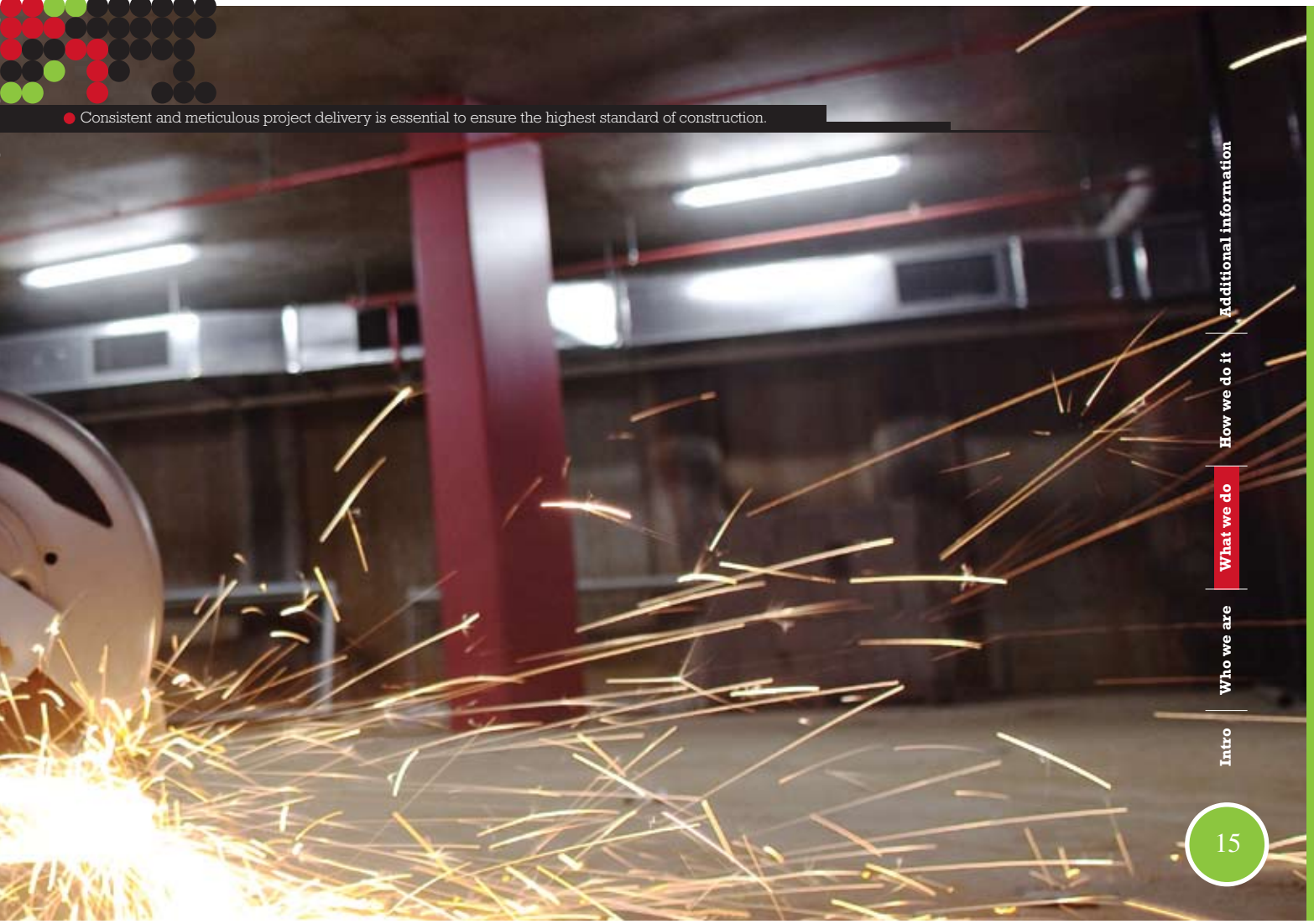
- maintenance and repair contracts
- complex medical and dental centers and day surgeries
- nursing homes
- laboratories
- commercial buildings
- industrial buildings
- schools
- government projects including civil and public works
- major high rise developments
- hospitals
- retail
- infrastructure
- defence
- correctional centres
- apartments
- thermostatic mixing valves and backflow prevention
- fitouts
- greenstar buildings
- mining and resources

- Completely manage a project from concept to completion.

INSPIRED SOLUTIONS ACROSS A RANGE OF INDUSTRIES.

Our clients.

Abigroup Contractors P/L
Amalgamated Constructions P/L
Australand P/L
AW Edwards P/L
Badge P/L
Built P/L
Broad Constructions P/L
Diploma Constructions P/L
Equiset P/L
Fugen Constructions P/L
Grindley Constructions P/L
Grocon Constructors P/L
Hutchinson Builders P/L
John Holland P/L
Laing O'Rourke P/L
Leda Design & Construct QLD P/L
Lipman P/L
Mirvac Group P/L
Probuild Constructions P/L
Richard Crookes Constructions P/L
Southern Cross Constructions P/L
St Hilliers Constructions P/L
Taylor Projects P/L
Watpac P/L



Consistent and meticulous project delivery is essential to ensure the highest standard of construction.

EVERYTHING YOU EXPECT AND A LITTLE BIT MORE.

- We constantly source new products and solutions.

Experienced Estimators.
Planet Plumbing's centralised and experienced estimating department works closely with our onsite estimators to ensure realistic budgets are set and met. Our vast experience in accessing each client's individual needs often provides cost saving alternatives in the process.

Our design and estimating teams harness the latest technology, accessing 'real-time' product libraries and suppliers from around the globe to deliver the most efficient and accurate designs and estimates in the industry.

Procurement Strength.
We confidently offer our clients competitive pricing due to our national procurement strength. Working with only the highest quality supply chain partners, we constantly source new products and solutions, enabling us to incorporate the latest and best in hydraulic technology into our projects – at the best price.

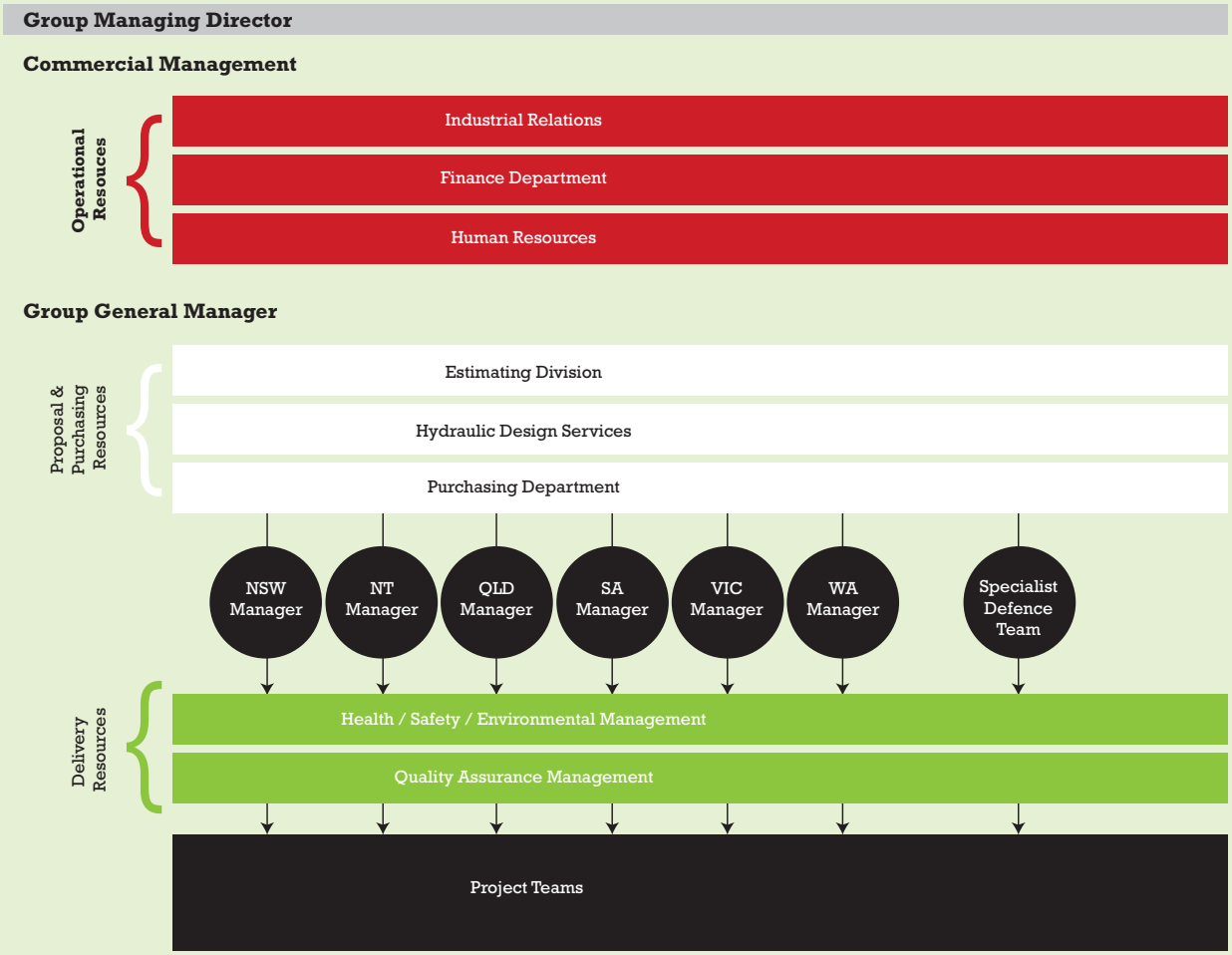
Extensive experience across a range projects and market sectors has seen Planet Plumbing recognised as the number one project partner for hydraulic solutions to the building industry. With a history comprising numerous successful tier-one developments, Planet Plumbing's track record forms a solid foundation on which prospective clients can build a successful partnership.

A TRACK RECORD, WHICH SPEAKS FOR ITSELF.

BUILT TOUGH.

Our three-tiered structure is designed to maximise efficiency.

Organisational:
Our strong executive management framework, comprising of highly experienced business managers with a diverse range of technical and commercial skills, is dedicated to the sustainability and future of the Planet Plumbing business. Overseen by the Managing Director, our three-tiered structure is designed to maximise efficiency of channels to deliver responsive turnaround of critical decisions to drive project progress. Though nationally operated, each state benefits from a dedicated Manager, who oversees local projects and developments to ensure projected targets are met. State managers are supported by our national Finance, Purchasing and Design divisions, allowing them to benefit from national resources, while maintaining a local focus.



Systems & Procedures

EVERY STEP WE TAKE ENSURES QUALITY.

Quality is assured at every step of the development process with constant monitoring and surveillance carried out by all Planet Plumbing staff, to ensure compliance and conformance with the highest Australian standards.

Formally certified compliant to AS/NZS ISO 9001 (certification number 8303) our employees follow formal set procedures covering;

- Client and Supplier liaison and project planning
- Management of design process
- Management of official documentation
- Procurement and materials delivery management
- Construction and installation process
- Quality testing and verification activities across all project phases.

Dedicated site managers ensure all site staff adhere to our Quality Management system and take great pleasure in producing work of an exceptionally high and superior quality for our clients.

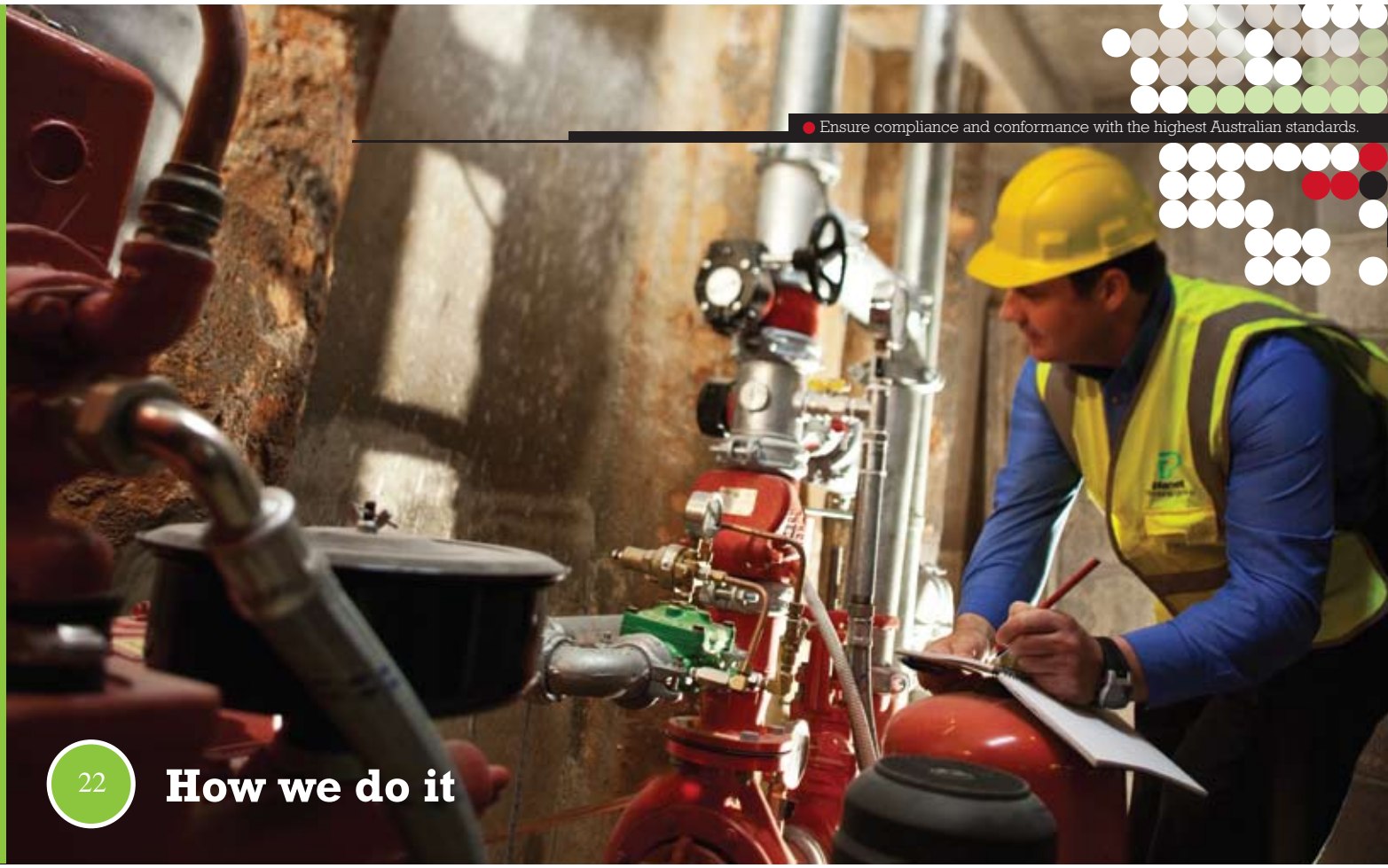
Innovation and Value-adding

Our passion to exceed at every phase of development drives us to seek out new and innovative solutions to go well beyond the expectations of our clients. Our commitment to value management guarantees the monitoring of all transactions from estimates through to sign-off.

These include:

- Improving project safety
- Saving time while reducing costs
- Strategic problem solving
- Increased quality and efficiency
- Effective use of available resources

It's this innovation which has built our company and reputation over the years and is the driving force behind our 'no problems, only solutions' company credo.



Ensure compliance and conformance with the highest Australian standards.

TO DELIVER THE BEST, WE DEMAND THE BEST.

Greenstar.
Planet Plumbing is a fully certified Greenstar Accredited Professional and experienced in the environmentally friendly Greenstar space. Abiding by these voluntary guidelines is just another step we have taken to ensure the sustainability of our environment.

National Code of Practice.
As a nationwide provider, we pride ourselves on meeting the building requirements of the National Code of Practice, as laid out by the Australian Government.

This accreditation not only ensures we qualify for the broadest range of projects, but also ensures they are carried out to an exceptional standard.

Defence.
For major contracts, the Australian Defence Force requires all contractors to comply not only with Australian Standards, but also the stringent Defence supplement. Planet Plumbing is proud to be Australian Defence accredited and a supplier of choice to the Australian government.

Planet Plumbing is proud to be Australian Defence accredited.

OUR PARTNERSHIP BEGINS HERE.

Through extensive experience across a broad range of industries, we are proving the value of our ''no problems, only solutions'' mantra. And as the demand for innovative solutions and partnerships continues to grow, our unique capabilities and passion to deliver are proving Planet Plumbing as a key project collaborator for developments of any scale.

When planning your next development, you can rely on Planet Plumbing to deliver innovative solutions, on time, on budget and above all expectations.

Planet Plumbing is NCOP Compliant.

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APPENDIX 3.4.1 PART III

8 CHIFLEY SQUARE HYDRAULIC SPECIFICATIONS

Mirvac Projects Pty Limited
8 Chifley Square
AFC Issue - Hydraulic Services

Rev 4 | 21 December 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10
201 Kent Street
Sydney
NSW 2000
Australia

ARUP

Document Verification

ARUP

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		Name	Dijana Cupac	Mike Dodd	Andrew Johnson
		Signature			
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		Signature			
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		Name	Dijana Cupac	Mike Dodd	Andrew Johnson
		Signature			
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			Prepared by	Checked by	Approved by
		Name	Dijana Cupac	Mike Dodd	Andrew Johnson
		Signature			

Issue Document Verification with Document ✓

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1 Preliminaries

1.1 Definitions and Interpretations

Within this specification and the related drawings the following words shall have the meanings described:

Principal	Mirvac Constructions Pty Ltd
The subcontractor	The entity specifically responsible for the works described in this package
Approve, To approval	Approval by the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works. This may be the Project Manager or Site Manager.
Building Trades	The entity specifically responsible for the construction of the building structure and fabric. Excludes the services trades such as electrical, air conditioning and plumbing.
Give notice, submit, supply, furnish, and similar expressions	Give notice, submit, supply, furnish and the like to the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works.

1.2 Tender Return

The Tender Return Documents and Form at the back of this document shall be completed and returned with the Tender.

The Subcontractor shall identify as shown, the various elements within the Tender. Elements should not be grouped together.

Incomplete or missing tender return forms shall not be accepted and, may render the submission as a non-compliant tender.

The Principal does not bind himself to accept the lowest or any tender and is not responsible for any cost incurred in the preparation of any tender.

1.3 Roles and Responsibilities

1.3.1 Specification Objectives

The intent of this specification and the associated documents is:

- To provide a clear statement of technical and performance requirements against which compliance can be assessed;
- To enable other interested parties to assess their obligations and to understand expectations of them;
- To define the Quality Assurance expectations of the Principal as they apply to the Subcontractor.

1.3.2 Design responsibilities

1.3.2.1 General

This specification and the referenced drawings describe the works sufficiently for a Subcontractor to understand the extent and nature of the works, the quality of the works required and to submit a tender.

Carry out additional design processes as required to enable construction. Such processes include, but are not limited to, the preparation of drawings sufficient to allow construction of purpose made components, such as switchboards; and to allow for detailed co-ordination in specific locations.

1.3.2.2 Subcontractors Responsibilities

The Subcontractor is to possess specialist trade expertise necessary to complete the works in accordance with the documentation. The Subcontractor has the following additional obligations:

- To raise in good time, issues requiring design input or clarification, including;
  - Interpretation and co-ordination of the specification and drawings;
  - Problems in complying with the specification;
  - Omissions from the specification and drawings;
  - Suggested alternatives or substitutions;
- To certify compliance with the Subcontract documents, including all variation instructions, at Practical Completion;
- To certify compliance with Authority requirements;
- To pay all fees applicable to the works;
- To obtain all Authority permits and certificates to allow the progress of the work;
- To provide manufacturer's and construction drawings;
- To provide samples and prototypes where specified;
- It is the Subcontractors responsibility to ensure that all services are installed such as to meet the design intent indicated on the tender documentation. The Subcontractor shall undertake all necessary on site coordination, with other services and structure, such as to meet the design intent. The Subcontractor shall coordinate this detail with all other services and structure during preparation of shop drawings and prior to installation. The contract drawings do not indicate the presence of other services not included in this contract. Details of other services, supports for suspended ceilings, etc should be obtained from the Principal and the relevant Subcontractor. The Subcontractor may offer alternatives to both services reticulation routes and system configuration, however all offered alternatives shall be well considered, fully designed, and seek to improve the system function and/or cost. No alternatives shall be implemented until written approval is obtained from the Principal
- Access: Whether or not indicated on the documentation the Subcontractor shall provide suitable access to all plant equipment that will require to be

maintained or serviced. Access provisions shall be in accordance with manufacturers recommendations and in compliance with Occupational Health and Safety. Any areas where this cannot be achieved shall be notified to the superintendent;

- No extras of any kind will be allowed if work and equipment has to be removed and replaced.

1.4 Scope of Works

1.4.1 Project

This specification covers the Hydraulic Services works associated with 8 Chifley Square, Sydney. The project involves the design and construction of a new multi-storey PCA Premium grade tower, which comprises 3 basement levels, 21 levels of office accommodation and multi level plant floors. Office accommodation will be configured as 1, 2 and 3 storey villages providing a total Net Lettable Area (NLA) of circa 19000m2. The existing building is to be demolished to allow the construction of the new site.

Systems within the building shall be installed to best practise standards to minimise energy consumption, reduce greenhouse gas emissions and to allow the building to achieve the targeted NABERS Energy and Green Star objectives. The services design has been developed to provide flexible and adaptable systems which will serve the requirements of the building and can be reconfigured to suit future re-planning of office areas.

The commercial office spaces are split into a combination of double (2) or triple (3) level interconnected villages and single contiguous floor plates. Villages are connected by stairs through an internal atrium and the design allows for villages to be subdivided in the future into single floors or into three (3) sub tenancies per single contiguous floor.

1.4.2 Hydraulic Design

The works comprise the supply, installation, testing, commissioning, certification maintenance and warranty, of the hydraulic services listed below. All work shall comply with AS3500, the requirement of all local authorities having jurisdiction, Australian Standards/Codes and manufacturers' requirements. Work is to be carried out by trades' people having at least five years experience and accreditation. All works are to be installed to first class trades principles.

The hydraulic systems are to include:

- Domestic cold water system including mains connection, water meters, tanks, reduced pressure zone devices, cold water booster pumps and reticulated service supplying plant, fixtures and fittings throughout the building;
- Domestic hot water system including hot water plant including heat exchangers, TMVs, circulation pumps and reticulated service supplying basebuild fixtures and fittings throughout the building;

- Non-potable water system including water meters, control systems, tanks, reduced pressure zone devices, transfer and booster pumps and reticulated service supplying sanitary fittings within the building;
- Sewer drainage and sanitary plumbing system including sump pumps;
- Trade waste systems including grease arrestor, insulation of all pipework and partial trace heating;
- Carwash drainage including oil separator
- Rainwater gullies, outlets, planter drainage and downpipes, rainwater and OSD storage tanks, overflows, pumps, GPT and stormwater drainage including connection to existing storm water main ~~Civil pit prior to GPT~~;
- All fixtures and fittings as specified by the architect.
- Fire Hydrant tank and liners for the Sprinkler tanks and new connections to the Sydney water main in Elizabeth street for both the fire services.
- Subsoil drainage including pump out pit:
- Water treatment plant for rainwater including filtration, chlorine dosing and reticulation.
- Natural gas service. The system is to include mains connection, pressure regulator, gas meter, interlock with fire and mechanical services and safety devices as per AS5601.2004 and AGL gas fitting rules for both basebuilding and trigeneration plant;
- Hose reel Service including reduced pressure zone device;
- Hydraulic interfaces with black water treatment plant and sewer mining connection and trigeneration plant;
- Provision of potable, NPCW, sewer, trade waste and gas to retail tenancies as identified.
- Provision of all BMCS monitored water and gas meters identified in the meter schedule.
- Controls and connection to the BMCS of all components specified in the data sheets and the controls section of this specification;
- Acoustic Insulation of all sanitary drainage and rainwater drainage where passing through tenanted areas;
- Painting of all exposed pipework as required by the colour code specification;
- Supports and labelling of all hydraulic services including riser checker plate where required;
- Provision and submission of all samples, equipment, fittings and fixtures specified and required;
- Provision of penetrations for all hydraulic services;
- Submission of ITPs (inspection and test plans);
- Full testing, commissioning and demonstration of the works at completion;
- Compliance and Provision of documentation for all Green star requirements as identified in this specification;

- The preparation of installation and construction documentation including shop drawings and installation and as installed drawings, essential services manuals, operating and maintenance manuals;
- The provision of a full and comprehensive Maintenance Regime and Warranty during the Defects Liability Period;
- The Subcontractor is to hand over the spare parts scheduled as part of this specification at the end of the defects period.

1.4.3 Obvious Work

The works under the subcontract include all those minor parts not necessarily explicitly specified and which are reasonably and obviously necessary as part of the works to be provide a fully working services system.

1.4.4 Notices and Fees

The Subcontractor is to give all notices, pay all fees, charges, levies, tax and deposits and otherwise conform with the requirements of all properly constituted Authorities with respect to the contract.

1.4.5 Design Responsibilities

The Specification and Drawings describe the scope, nature, quality and performance requirements of the Hydraulic services installation. The Subcontractor is to return a fully compliant bid with costs for the equipment specified within the schedules and data sheets. The Subcontractor may make proposals for equipment of alternative supply however, these are to be itemised and costed separately to allow the design team and Principal to review. All equipment proposed by the Subcontractor is to be equal in performance and quality to that originally specified. His proposal is to clearly identify the saving offered and a written confirmation that all costs are included within the saving. The Subcontractor shall remain responsible for ensuring that he has included for any hidden costs associated with the proposal such as any alterations to pipework or power supplies etc. that the equipment change has brought about. The Principal shall accept no future claims for additional costs due to the Subcontractor's omission to accurately address all additional costs associated with his proposal for alternative supply.

The Subcontractor shall develop the information contained on the Tender drawings into installation drawings incorporating all necessary co-ordination between other services and trades, including manufacturer specific dimensions and the access spaces for the operation and maintenance of the equipment. Where specific space is required for access, this shall be indicated on the installation drawings. The Subcontractor shall produce builders work drawings in accordance with the Subcontract programme in order to allow slab penetrations, plinths, sleeves, etc. to be provided throughout the building in a timely manner consistent with the construction programme.

The bid documents include architectural information detailing the construction of the building. Many services routes and installation details shall require special consideration due to either absence of conventional covering devices such as false ceilings and dry lining or the close proximity of finishes, ceilings and walls etc.

The Subcontractor is to ensure all works are fully coordinated and detailed prior to starting on site.

The Subcontractor shall take all reasonable measures and care in the incorporation of the services into the building as a whole.

The Subcontractor shall carry out additional design development processes as required to enable construction. Such processes include, but are not limited to:

- The preparation of drawings sufficient to allow construction of hydraulic systems;
- Allow for detailed co-ordination in specific locations e.g. plantrooms, risers, corridors and ceiling voids etc;
- Technical co-ordination of all the elements forming the hydraulic services works and any suppliers;
- Co-ordination with the Architect, Engineer and other trades;
- Where the Subcontractor wishes to use alternative methods or equipment he is to fully evaluate and submit a detailed report on any proposals;
- Preparation of safety method statements particular to specific tasks;
- Preparation of method statements for plant installation and critical activities;
- Production of co-ordination drawings;
- Production of fully dimensioned installation drawings;
- Production of builders work drawings for the services installation including the determination of the size and location of penetrations in walls and floors;
- Production of installation wiring drawings for the works;
- Production of shop drawings of equipment and fabricated units;
- Production of manufacturer specific drawings certified as relating to the project;
- Production of record drawings for all services;
- Undertake detailed spatial co-ordination of the services with respect to all other works and trades including the detailing of interfaces, the Subcontractor is responsible for ensuring all interfaces are covered and that there are no scope gaps;
- Confirm final calculations: pump duties, hot water calculations etc;
- Design and co-ordinate the supports for the services and equipment;
- Detail access ways and spaces for the services;
- Design of guide and expansion systems for all services including requirements at movement joints etc;
- Design and select fire stopping for all services penetrations including testing and certification;
- Deign and select all fire rating of pipework through Fire corridors, FCRs or other fire isolated areas;
- Select valves for the services systems to meet requirements of the BMCS specification;

- Select anti-vibration systems for the plant and equipment;
- Evaluate soil bearing capacity and design external thrust blocks on water services;
- Determine final size and position of access panels to allow servicing of concealed services;
- Determine the requirements for access floors and gantries within risers and provide where necessary to allow safe unimpeded access to the hydraulic services;
- Ensure the coordination across discipline for loads – for example, the electrical loading of equipment, the heat rejected by equipment, the need for water at a certain pressure and flow rate etc;
- Co-ordinate the construction works for the services installations;
- Develop the details of the electrical wiring and control diagrams for all equipment supplied showing all interconnections between equipment to enable the necessary wiring to be undertaken;
- Provide details of proposed plant removal strategy in event of future plant replacement;
- Prepare commissioning works method statements according to relevant CIBSE codes, Green star requirements and proposed by the independent commissioning agent;
- Determine the settings for electrical protection equipment, time delays, time switches, balancing valves, flow regulating valves, dampers and the like;
- Detail the earthing and bonding requirements for all engineering services and architectural and structural elements requiring earthing and bonding.

1.4.6 Program

The works is governed by a program determined by the Principal. Ensure that the works carried out under this package is in accordance with that program. Provide a separate program for this package of the works identifying specific milestones including:

- Commencement on site;
- Submission of Shop Drawings;
- Approval of Shop Drawings;
- Commissioning;
- Submission of first draft of as-built drawings and operating and maintenance manuals;
- Provision of Fire Safety Schedule and Compliance Certificates;
- Defects Inspection;
- Completion on site;
- Submission of final copies of as-built drawings and operating and maintenance manuals;
- Practical Completion;

- Defects Liability Period;
- Final inspection.

1.5 Sustainability Objectives

This section details the Green Star and National Australian Built Environment Rating System (NABERS) Energy targets of 8 Chifley Square. This specification includes clauses that are related to these targets; however the Subcontractor should refer to the ESD Specification for general requirements. The objectives of this section are written so that the Base Building achieves the following:

- Green Star – Office Design and As Built v2 minimum Overall Weighted Score of 75 points aiming at a minimum Green Star Office Design and Green Star Office As-Built rating of 6 Stars.
- A target to achieve a NABERS Energy rating for Base Building of 5 Star + 60% in design.

The Subcontractors shall be aware of environmental benchmarks and be involved in the project construction to deliver the environmental targets set by the design team and the Principal. The Principal and Subcontractors shall comply with all requirements included here and the ESD Specification.

Subcontractor Involvement in Green Star and NABERS Energy Compliance

The Subcontractor's role and involvement has implications in the design, construction, hand over and operation of the building. It is the Subcontractor's responsibility to actively request relevant documentation and instruction from the Principal during the different stages of the Green Star rating and review process. The Subcontractor, in accordance with the Principal, must collect and compile for submission all necessary information as outlined in this specification, the ESD Specification, and as required to achieve a 6 Star Green Star Office As Built rating.

It is the Subcontractor's responsibility to verify the requirements of the Green Star submission in terms of each credit according to the most recent Green Star As Built credit summary provided by the Principal.

The Principal must prepare and submit documentation required for the Green Building Council of Australia (GBCA) in a presentable and appropriately formatted "Green Star - Office As Built v2" as required for submission. The formatting of the submission should be in accordance with the requirements stated by the Green Building Council of Australia. Some of the requirements are listed below:

- All supporting Green Star related documents (copy of receipts, letters, reports, drawings etc.) shall be ordered according to the relevant Green Star Credit Category and filed in the above mentioned folder(s) in the appropriate section.
- All letters must be formally signed and dated letters on company letterhead nominating this specific job.
- Reports must be appropriately formatted and equipped with a title page, job information and table of contents.

- All supporting documents and receipts must be collected and filed in above mentioned folder and if not specifically mentioning this job, must be referred to in a letter which states relevant job and Principal information.
- All documents shall clearly highlight requested information

The final As Built certification shall be achieved prior to the end of the defects liability period.

1.6 Detailed Description Of Systems

1.6.1 Incoming Potable Cold Water Service

The domestic cold water service shall be installed to comply with NSW Code of Practice (Plumbing and Drainage), AS 3500, Sydney Water requirements, manufacturer's instructions, all relevant codes, standards and requirements of authorities to ensure completion of the work.

The domestic cold water main shall be extended from a new connection to the Sydney water main in Hunter Street and connect to the incoming water meter and reduced pressure device located within the water meter room at Basement 1. The existing building water connection should be investigated for potential re-use if suitable.

The Subcontractor shall make application, obtain updated pressure enquiry, provide shop drawings, pay fees, obtain from Sydney Water, deliver to site and install in position a water meter in accordance with the Sydney Water's requirements.

All water supplied to the development shall pass through this meter although further sub meters for major building users are to be provided. All meters are to be monitored on the BMCS. Refer to water meter schedule.

The incoming main shall connect to the cold water pressurisation unit located in the water meter room at Basement 1.

The non-boosted incoming cold water main shall serve directly.

- Sprinkler tank FS-T-01 located on level B3;
- Fire Hydrant tank FH-T-01 located on level 3.
- Retail connections at Plaza level and B1
- Black water plant and EA supply located at B2
- FHR located between B3 and Level 3

The boosted cold water service (CW-TP-01) shall supply the following:

- Cold water tank CW-T-01 located on level 33;
- Non-potable water tank NPCW-T-01 located on level 33;

All other building cold water fitting shall be served from the cold water storage tank CW-T-01. Top levels of the building shall be served via a cold water pressurisation unit located adjacent to the cold water tank. Levels 27 and below shall be served via gravity.

The cold water service shall supply the following:

- Mechanical plant including heating system;
- Hot water heaters located on level 31;
- Fixtures and fittings on all levels;
- Fire hose reel system via double check valve;
- Wash down points in garbage room, car wash bay and GA hose tap.

Pressure reducing stations shall be installed on the CWDS to ensure code compliant delivery pressures. These are to include duel reducing stations on the risers.

The domestic cold water service shall supply sinks, basins, showers, hot water heaters, hose taps and quick fill points, mechanical services and connect to fixtures in positions indicated on the drawings.

The Subcontractor shall install isolating control valves in the positions shown and in other required positions so that single and groups of fixtures including pipe sections, may be isolated for repairs and maintenance without major interruption of supply to the inhabitants of the building.

Backflow prevention devices shall be installed in the plantrooms and on mechanical services as required by code.

Stop cocks shall be installed in positions documented on the drawings and required by code including all bathrooms and plantrooms.

1.6.2 Non-Potable Cold Water Supply System

The non-potable water service shall be installed to comply with NSW Code of Practice (Plumbing and Drainage), AS 3500, Sydney Water requirements, manufacturer's instructions, all relevant codes, standards and requirements of authorities to ensure completion of the work.

The non-potable cold water shall be provided from treated rainwater and from the black water plant located on Basement 2. The NPCW from the black water plant is then transferred via pumps NPCW-TP-01 and the treated rainwater is transferred via pump RW-TP-01 located at level 4. These two NPCW supply streams combine at the tank NPCW-T-01 located on Level 33. Controls are to prioritise the rainwater supply over the black water supply.

All NPCW fittings are supplied via the NPCW tank NPCW-T-01 by gravity from level 27 and below and via a non-potable water pressurisation unit NPCW-BP-01 located on level 33 serving levels 28 to 33.

The NPCW shall supply the following:

- Cooling towers
- All WCs and Urinal fittings within the building;
- ~~Wash down points in garbage room, car wash bay and GA hose tap.~~
- Irrigation points;

Stop cocks shall be installed in positions documented on the plans including all bathrooms and plantrooms. NPCW meters linked to the BMCS shall be provided for irrigation supplies, WC/Urinal supply and cooling tower supply ~~and garbage room/car wash bay~~. Refer to NPCW meter schedule.

A project requirement is that minimum 90% of the water supplied to the cooling towers shall be supplied by NPCW to achieve Greenstar requirements.

1.6.3 Domestic Hot Water Service

The hot water supply installation for the building shall be installed to comply with NSW Code of Practice (Plumbing and Drainage), AS 3500, Sydney Water requirements, manufacturer's instructions, all other relevant codes, standards and requirements of authorities to ensure a safe domestic hot water service is installed throughout the building.

Domestic hot water will be provided from gas fired hot water heaters HWH-01 - 5 located on level 31 and fed from the boosted CWDS. All hot water heaters shall have provision for safe waste drainage, pressure relief overflows, discharging in accordance with Australian standards. The hot water flues are to terminate above roof level in accordance with Code.

The boosted CWDS feed shall pass through a heat exchanger supplied by the mechanical contractor to enable pre-heat from the Mechanical plant when conditions allow.

A circulating return will be incorporated throughout the building to ensure domestic hot water is delivered to the fitments efficiently and that all fitments have hot water available to them quickly.

Three pressure zones shall be provided with heat exchangers and circulating pumps located at levels 31, 19 and 5. The configuration allows transfer of domestic hot water that is centrally generated whilst managing pressures in the system.

Hot water returns are to be distributed to all remote fitments and thermostatic mixing valves. The thermostatic mixing valves are to be configured so as to serve a maximum of 3 fitments further reducing the length of dead leg. Thermostatic mixing valves shall be installed in all amenities below basins to maintain 42°C temperature of hot water supply to all outlets. Where vanity units are not provided purpose made stainless steel lockable cabinet shall be provided by the subcontractor.

All hot water pipework and fittings shall be insulated to minimise heat loss from the system. Allowances shall be made for expansion and contraction of the pipework.

Groups of fixtures are to be configured to allow them to be isolated without affecting adjacent fittings.

Hot water meters are to be provided to ~~kitchens~~ the garbage room linked on the BMCS.

1.6.4 Sanitary Sewer Drainage and Plumbing

The sanitary sewer drainage and plumbing shall be installed to comply with NSW Code of Practice (Plumbing and Drainage) and AS/NZS 3500, Sydney Water requirements, manufacturers' instructions, all relevant codes, standards and requirements of authorities to ensure a satisfactory installation.

The system shall incorporate stacks and vent pipes within the main hydraulics risers and discreet stacks behind basins and urinals. The lowest two floors of any stack shall be taken to a second vented system to manage pressure variations. Floor wastes shall be provided in front of basins, urinals and cleaner sink and floors shall be graded to these. The traps shall be maintained with the discharges from the basins/sink adjacent being routed through them. Gully traps shall be provided in all plantrooms with a hose tap provided to allow charging of the trap.

The intent is for the existing building basement drainage connection shall be reused and made good by the subcontractor with new boundary trap and OFG. The hydraulic contractor is to allow as a line item a new connection to Sydney waters Elizabeth Street sewer.

All sanitary drainage from the building shall be reticulated to the black water incoming buffer tank BW-BT-01 located on Basement 3 via the trash screen BW-TS-01 within the black water plant room. Tank and trash screen by others.

A motorised diversion valve shall be provided allowing diversion via gravity to the outgoing building sewer connection that is to be utilised in the event the black water plant is not operating or when dictated by the BMCS. The valve is to close on power failure conveying waste water from the building.

All sanitary drainage from Plaza to B2 is to drain to sump SP-02 where it shall be pumped to the sewer main upstream of the motorised diversion valve.

A sump with pumps SP-01 shall be provided in the Basement 2 black water plant room. A pumped rising main shall be installed to connect to the outgoing sewer main downstream of the motorised valve. This sump and pumps form part of the black water scope of works. The pipework and connection to the sewer main is by Hydraulic contractor. The waste water from the garbage room floor wasted (with bucket traps) is to gravitate to SP-01.

Drainage from the B1 carwash bay is to be reticulated by the hydraulic contractor to the holding tank and oil separator located in the black water plant room. Discharge from the separator shall be to SP-01

A separate pipework stack for the waste stream from the Cooling tower treatment plant shall be provided from Level 33 to the black water plant. This shall have a motorised valve to enable diversion of this flow direct to the gravity drain under the dictates of the BMCS. The valve is to close on power failure conveying waste water from the building.

Bunding shall be provided to mechanical plant items as identified on the drawings. Gullies in these locations shall be outside the bunded area to prevent, where possible, inorganic matter entering the foul drainage system.

All drainage pipework at high level within the generator and trigeneration room is to be made of copper which is suitable for high temperature.

Each significant change of direction and grade shall have an access provided to allow for cleaning and clear outs.

Noise transfer throughout the building via sanitary plumbing shall be attenuated by insulation of the pipelines as detailed in this specification.

A separate new sewer connection shall be provided from the sewer main on Hunter street where a connection to the black water plant shall be made to allow sewer mining. Effluent will be returned to the sewer via the building sewer line on Elizabeth Street. The building is anticipated to be a net importer of sewage.

Vent pipes from the Black Water Plant shall be provided by the Hydraulics Subcontractor to above roof level. Cross relief vents are to be provided on vent stacks in accordance with code.

All plant room floor wastes are indicatively shown. Subcontractor to allow for full coordination with mechanical services and the ventilation of these wastes back to the vent riser

Air admittance valves may be utilised in plant rooms these are to be located at mid level on the wall to enable maintenance.

1.6.5 Trade Waste

Tenants' (1 No) vertical waste stack shall be provided throughout the building with plugged off waste branches and vents provided at each floor level for Tenant usage. All trade waste pipes are to be insulated and routed to the grease arrestor located below the Basement level 2 slab as identified on the drawings. Trade waste pipework is to be trace heated where running horizontally (Level 17, L3 and B2. Trade waste connection and ventilation is to be provided to one of the retail units as identified on the drawings.

Grease arrester (GA-01) is to be provided connecting to sump pump SP-02. Camlock pump out shall be located at B2 for pump out of grease arrester.

Contractor is to comply with all trade waste requirements.

1.6.6 Incoming Natural Gas Service

A new incoming natural gas service shall be installed to comply with regulations contained in AS 5601, AGL codes and manufacturers requirements.

A new natural gas service connection is to be made to the 1050KPa gas main in Elizabeth Street, this main shall be extended within Basement level 2 and up into the regulators in the gas meter room at Basement 1. The meter room will contain a (35KPa) gas meter for the trigen plant and the building's (7KPa) Utility meter; the Subcontractor is to allow for completing the gas supply application, producing shop drawings, liaison and negotiation with the supply authority, the provision of the meter and connecting the service to the building for use.

The natural gas supplies will reticulate from the meter room to the main hydraulic services riser and up the building to serve the following functions:

- Cogen plant located on level 32 separate dedicated 35KPa supply
- Gas fired hot water plant located on level 31 through a building sub meter;

- Gas fired mechanical plant located on level 33 through a building sub meter;
- ~~Sub-metered branch connection for future Tenant kitchen use on Levels 18 and 30.~~
- Capped off connections on each floor for future tenant.

All gas meters, solenoid valves and detection and wiring are to be provided and installed by the Hydraulics subcontractor. The natural gas fired hot water units shall have individual flues discharging to atmosphere in accordance with AS 5601.

Where the gas supply lines pass from one construction zone to another, through a construction joint area, allowance for movement between the zones shall be made.

The Subcontractor shall be responsible for installing all required control valves, regulators, fittings, pipework fixings and connections to all appliances.

The Subcontractor shall pressure test, purge and charge all lines and fixtures with natural gas. Fixtures shall be tested for use prior to handover. A consumer gas plan shall be provided in the FCR.

All gas exceeding 7KPa is required to be located in a fire rated duct that is ventilated at the top and bottom. The 35KPa gas pipe is to be located at the southern wall of the main hydraulic riser as identified on the drawings and ventilated at top and bottom. Where passing horizontally in the basement it is proposed to have a pipe in pipe approach to ensure system containment. Contractor to allow for full fire protection of the incoming gas main.

1.6.7 Storm water Drainage System

The storm water drainage system shall be installed to comply with AS 3500, Sydney Water regulations, City of Sydney Council requirements, manufacturers requirements, codes and specifications to ensure a fully working storm water drainage system for the project.

The installation shall collect rain water from the roofs, as detailed on the drawings, and discharge to the rainwater collection tank RW-T-01 via first flush diverters RW-FF-01&2 located at level 4, the first flush is to be reticulated to the overflow from OSD-T-01. Rainwater stored within RW-T-01 shall be discharged under the dictates of the BMCS for treatment via pump RW-TP-01 through the rainwater treatment plant (RW-F-01 and RW-CL-01) before reticulation to the roof top NPCW tank NPCW-T-01. Subcontractor to allow for full rainwater treatment and provision of 12 months' supply of all chemicals and filters from handover. New roof surfaces have been added to L18 and L30 which are to drain via gravity. The total catchment remains unchanged.

Council require an On Site Detention (OSD) volume of 32m3 to be provided and a Permitted Site Discharge (PSD) of 48 l/s at a 1:100year ARI. It is proposed to utilise 50% of this OSD provision within the RW-T-01 and to have an overflow from this tank to a dedicated 16m3 OSD tank RW-OSD-01 located on Level 3 which shall have an orifice plate restricting discharge to the external storm water main at a rate of 32 l/s. This tank shall have an emergency gravity overflow. ~~The outgoing gravity storm water main is to be installed as close to the external wall at B2 and as elevated as code allows to maximise clearance in car spaces below.~~

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Due to construction constraints the intent is to utilise the existing site storm water connection to Philip Street. This has necessitated in a change to a pumped storm water drainage solution for the plaza level.

Heat shrink

The outgoing gravity storm water main passes through the main electrical switch room – drip trays and leak detection tape (Raychem or equal approved) connected to the BMS are to be located under all pipework in electrical rooms to identify any possible leakage. The storm water pipe within the substation is to be concrete encased to limit possible leakage paths. In addition a manual valve is to be provided at the B1 within the cold water pump room that would (in an emergency) enable all storm water drainage to be diverted to Elizabeth street with no storm water passing through the pipework in the switch room and substation. Clear outs are to be provided at all changes in direction to enable clearing of any blockages these are to be accessed from outside any of the electrical spaces. A storm water reflux valve is to be provided as close to the outlet as possible in accordance with Sydney water requirements. HDPE is to be utilised for all storm water passing through electrical rooms.

PVC

All rainwater pipework at high level within the generator and trigeneration room shall be suitable for high temperatures. Copper shall be used alternative material may be considered if detailed performance at constant elevated temperatures can be provided. Drainage shall be coordinated so as to not pass over any electrical equipment. Drip trays and leak detection tape (Raychem or equal approved) are to be provided below all pipework in electrical rooms.

The reverse podium roof level at Level 18 shall be drained via gravity fully coordinated with structure and services connecting into the roof top system discharging to RW-T-01.

~~Plaza level rainfall south of grid line C and canopy drainage shall be connected directly to the outgoing storm water pipe bypassing the OSD.~~

All ~~other~~ Plaza level drainage shall be routed to the basement level OSD tank RW-OSD-02 located within the black water plant room ~~which shall have an orifice plate restricting discharge to the external storm water main at a rate of 3.8 l/s~~. This tank is to have an emergency high level gravity overflow to the B2 carpark storm water (SP-04) pumpout system;. Incoming grated drain on carpark ramp forms part of Hydraulic scope. Rainwater pipework at B2 shall be installed at highest possible invert to ~~ensure that drainage passes over structural penetration in the vehicle ramp and~~ allows maximum depth in RW-OSD-02.

The combined discharge from both RW-OSD-01, RW-OSD-02 ~~and the plaza area south of gridline C~~ is to be within the sites PSD of 48 l/s. This forms part of the Council Storm water strategy.

Gravity discharge from RW-OSD-02 shall reticulate through an internal Gross Pollutant trap (GPT) (Type STC2 or similar) before being pumped out by dedicated storm water pumps SP-05 at a maximum discharge rate of 16 l/s. The pumps to be on emergency power. Gravity overflow from the pump well to spill to the carpark ramp

All gravity and pumped storm water is to reticulate to the existing storm water main on Phillip Street as part of the Hydraulic scope.

~~The two storm water mains are to connect to the Civil pit prior to the (GPT). The Civil pit and GPT are by others but the connections through the basement wall is part of the Hydraulic scope.~~

Drainage is to be provided on top levels of external stairs to remove wind driven rain.

Storm water drainage shall be installed in positions materials, sizes and grades indicated on the drawings and documents and in accordance with code.

All storm water design shall meet the requirements of Green star credit Emi-5.

Subsoil drainage is to be provided as indicated on the drawings. New Ag lines shall be installed at basement level 2 and 3 with connecting pipes from the bottom of the existing basement walls draining to the storm water sump pump SP-04 at B3. Clear out turn ups for the subsoil drainage are to be provided min every 10m and at all junctions to allow wash through. To note - there is existing basement subsoil drainage. This is to be abandoned due to extensive additional excavation required.

1.6.8 Fire systems

The hydraulic subcontractor is to provide connections from the domestic cold water main on Elizabeth Street for the fire systems terminating 300mm above slab.

The Subcontractor shall make application, provide shop drawings, pay fees, in accordance with the Sydney Water's requirements.

The new mains connections shall be installed to comply with NSW Code of Practice (Plumbing and Drainage), AS 3500, Sydney Water requirements, manufacturer's instructions, all relevant codes, standards and requirements of authorities to ensure completion of the work.

The fire hydrant tank and butyl lining for the sprinkler tanks shall be provided by the Hydraulic contractor including all associated overflows and level controls.

1.6.9 Hose Reel Service

The development will be provided with a boosted and gravity metered hose reel service throughout supplied from the boosted cold water service pumps CW-BP-01 and the CWDS, the service will be installed in copper or galvanised mild steel by the hydraulics subcontractor.

The bottom of each Hose reel riser shall be routed to a washdown supply to promote regular changes of water and limit stagnation.

Hose reels are located on the drawings and installed to AS 2441-2005

1.6.10 Controls

The hydraulic services systems have various components that require controlling or monitoring by the BMCS. Details of the controls can be found within the controls section of this specification and the BMCS specification.

1.7 Works for others – Interfacing and responsibilities

1.7.1 General

This specification has been prepared to describe the materials and workmanship requirements for the hydraulic systems.

The hydraulic systems interface with other trades and services within the building and shall require works not traditionally within a Hydraulics package e.g. controls wiring, power cabling and provision of noggins in walls. It remains the Subcontractors responsibility to determine how he wishes to procure the works and to ensure all interface items are adequately covered within his return. The Principal shall not entertain any omissions or scope gaps on the grounds of inadequate packaging by the Subcontractor.

All concrete cutting, chasing, coring, cutting and making good for hydraulic services are to be included; all fire rating of pipework and fire collars of all services at each floor are to be included.

1.7.2 Mechanical Services

Provision of water and gas supply to mechanical equipment including; cooling towers, hot water heaters and F&E tanks capped off within 1 metre of the equipment and including an isolation valve. This is to be part of the hydraulic works.

Provision of 'quick fill' water supply points capped off within 1 metre of the required fill point and including an isolation valve and required backflow prevention device. This is to be part of the hydraulic works.

Provision of a hose cock adjacent the cooling towers with a hose connection vacuum breaker in accordance with AS5300.1.

Hose taps situated over or in close proximity of a floor waste which is not charged automatically. This is to be part of the hydraulic works.

Sewer drainage floor wastes or tundishes provided in practical and approved locations for the purpose of condensate discharge. Hydraulics Subcontractor to provide in locations detailed by mechanical Subcontractor.

Tundish for nominated air conditioning units (Goods Lift LMR L33, HR LMR L31, LR LMR L20, Lift Lobby L3, security, switchrooms and 2x distribution rooms in basement;

Floor wastes to plantrooms;

Permanent water makeup to the condenser water, chilled water and hot water feed and expansion tanks terminating with an isolating valve within 1m of the system connection, this may included non-potable connections to condenser water loop (of suitable water quality);

For drain down of cooling tower provide bunded floor waste;

Gas meters and incoming mains to supply terminating with an isolating valve within 1m of the system connection in the hot water heater room (gas trains to be provided by mechanical trade). The hydraulic contractor is to provide the gas solenoid valve, gas detection system, emergency buttons and interconnecting wiring.

1.7.3 Electrical Services

Actual demand information for all hydraulic plant is to be provided by the hydraulic Subcontractor and coordinated to enable the correct provision of sub mains supplying such equipment by the electrical Subcontractor.

Power is to be provided to hydraulic equipment requiring such i.e. pumps, trace heating, control panels, etc. by the electrical Subcontractor. The electrical Subcontractor will provide either GPOs or tails for final connection by the hydraulic Subcontractor.

The hydraulic contractor is to provide a water supplies to the substation to meet Energy Australia's requirements.

1.7.4 Fire Services

Mains water connection to the sprinkler and fire hydrant storage tank is to be provided by the hydraulic Subcontractor. Sprinkler tank lining and Hydrant sectional tank including overflows from sprinkler and fire hydrants tank are to be provided by the Hydraulics subcontractor.

New mains connections for the sprinkler and hydrant boosters is to be provided terminating 300mm above the ground for extension by the Fire contractor.

Hydraulic Subcontractor to provide final termination of cabling to gas shut off valves from supply by Fire contractor to gas meter room.

1.7.5 BMCS

Hydraulic sub-contractor is to provide all water meters for connection by the BMCS.

Water meters with pulse outputs and valves are to be provided by the Hydraulics Subcontractor, controls wiring, transducers and sensors are to be provided by the BMCS Subcontractor. Sensors to be provided within packets provided by the hydraulics Subcontractor.

1.7.6 Irrigation

Provide capped off metered NPCW supply to irrigated areas for extension by Irrigation contractor. Provide drainage to planter areas to be coordinated with Irrigation subcontractor and all other services.

1.7.7 Black water plant

Hydraulic Subcontractor to provide incoming pipework into the black water plant room terminating with a valve and flange. Final connection by black water plant supplier.

Vents and other hydraulic services extending from the Black water plant room are to be continued by the Hydraulic subcontractor from 1m within the black water plant rooms locations to be nominated and coordinated by the black water contractor.

Hydraulic contractor is to provide the motorised diversion valves for the sewer services and connect the BMCS. Black water contractor is to interface the operation of these valves with the BMCS.

1.7.8 Trigeneration

Provision of water supply and gas supply to the trigeneration plant. The hydraulic contractor is to provide the gas solenoid valve, gas detection system, emergency buttons and interconnecting wiring. For further details refer to the separate document Cogent Schedule 3a.

1.7.9 Civil

~~Hydraulic Subcontractor to provide incoming pipe work to Civil storm water pit. Pit and GPT and down stream works provided by Civil contractor.~~

Hydraulic subcontractor to provide all drainage and turn ups within the basement for the plaza drainage. Drainage channels installed by Civil contractor with all turn ups, down pipes installed and provided by Hydraulic contractor. Location of penetrations to be carefully coordinated between the two trades.

1.7.10 Joinery Trades

Information relating to the basin and sink cut out sizes within bench tops is to be coordinated with the joinery trade Subcontractor. Set out by the hydraulic Subcontractor.

1.8 Works by Others

1.8.1 General

This section details those works required to enable the hydraulic services to be installed.

1.8.2 Building Trades

a) Concrete coordination- Provided by structural trades to set-out by the hydraulic Subcontractor

- Bases and plinths for equipment excluding steel fabricated bases provided as part of the equipment.

b) Masonry coordination- Provided by bricklayer to set-out by the hydraulic Subcontractor

- Plant enclosures and service risers are to be provided.

c) Structural steel coordination- Provided by structural steel subcontractor to set-out by the hydraulic Subcontractor

- Lifting beams for equipment.

d) Ceiling coordination- Provided by builder to set-out by the hydraulic Subcontractor

- Access panels and hatches;
- Removal and replacement of ceiling tiles;
- Co-ordination of all penetrations (coordination by subcontractors).

e) Ventilation of gas meter room and risers is to be provided by penetrations by the builder

1.8.3 Mechanical Services

Natural ventilation of gas meter room provided by the mechanical subcontractor.

Ventilation for rooms with gas burning appliances is to be provided by louvers by the mechanical Subcontractor.

Ventilation for the black water plant room is to be provided by the mechanical contractor.

Condensate drainage to floor wastes is to be provided by the mechanical contractor.

1.8.4 Electrical Services

Sub-mains to hydraulic services Control Panels and/or switchboards including sufficient tails to allow final termination are to be provided by the electrical contractor.

Power supply for water heaters and pumps, urinal flushing solenoid valves, trace heating and hot water circulation pumps are to be provided by the electrical contractor.

1.8.5 Fire Services

Drainage piping from the Sprinkler test valves and Sprinkler control valves for the testing of fire services are to be by the fire sub-contractor. Double check valves on the brigade boosters are by the fire sub-contractor. These are identified on the fire services drawings.

Fire subcontractor is to coordinate with the hydraulic contractor location of drain point and flow requirement for the pre-action sprinkler system.

Drainage piping from the Sprinkler test valves and Sprinkler control valves for the testing of fire services by Fire sub-contractor.

Fire contractor to provide cabling from FIP to the gas shut off valves with final terminations by Hydraulics for fire trip shut off.

1.8.6 Security Services

Provision of door monitoring to hydraulic plant room entrances and all associated work.

1.8.7 Civil

~~Final connection to Storm water main is by Civil subcontractor. Hydraulic contractor to provide connections to the Storm water pit prior to the GPT for each of the storm water services.~~ Plaza drainage channels are by Civil contractor with down pipe location and penetration by Hydraulic Subcontractor.

Hydraulic contractor responsible for final connection to existing storm water main on Phillip Street.

1.8.8 BMCS

Refer to BMCS specification and Section 5.

1.8.9 Landscape

Extension from metered NPCW supply by landscape contractor.

1.8.10 Black Water Services

Black water plant and treatment process in Basement 2 forms part of a separate scope of works. Refer to drawings for scope demarcation.

The interface with the black water contractor required is as follows:

All hydraulic services shall be provided to the black water plant room components with final connections to be made by the black water contractor. The components are as follows:

Incoming trash screen – BW-TS-01 – By specialist

Buffer tank BW-BT-01 - By other

Complete Black water treatment process BW-MBR including all controls and tertiary– By Specialist

Black water sump pump SP-01 – By Specialist

Sewer mining pumpset SM-TP-01- By Specialist

Transfer pumps NPCW-TP-01 – By Hydraulics contractor

All hydraulic incoming and outgoing services are to terminate 1m within the black water plant room by the hydraulic contractor.

1.9 Site Conditions

The climate at site shall be considered semi tropical, with mean site ambient temperatures ranging between 40°C and 0°C with a relative humidity up to 100%. All equipment and materials supplied shall be capable of withstanding these conditions.

1.10 Standards And Regulations

All work shall meet the requirements of national and local authorities and shall be in accordance with the following in so far as they apply to the work:

- Building Code of Australia;
- Australian/New Zealand Wiring Rules AS/NZS 3000:2000;
- National Plumbing and Drainage Code AS 3500;
- NSW Code of Practice (Plumbing and Drainage);
- CIBSE Commissioning Codes;
- Sydney Water requirements;
- Gas Authority Regulations;
- All applicable Australian Standards;
- Work Cover requirements;
- All Health Authority Requirements;
- State Fire Brigade requirements;
- All Local Council regulations.

2 Converged Network Option

2.1.1 Introduction

The Converged Network (CN) concept is to provide an integrated, open, expandable and flexible solution for the building's control and monitoring systems, whereby the nominated systems/equipment communicate over a common network and are fully interoperable.

It is not envisaged that the converged network concept will have an impact on the control and monitoring systems associated with hydraulic services. However, due consideration will be given to any proposals from the Hydraulics Contractor that contribute towards the converged network concept.

3 Hydraulic Services Requirements

3.1 Roles and Responsibilities

The following information is provided as an explanation of the roles and responsibilities of various entities involved in the works. It does not form the basis of contractual arrangements between the entities. The roles and responsibilities of the Principal and the Subcontractor under the contract are covered in the documents which contain the conditions of the contract between the parties. Additional detailed information relating to requirements pertaining to particular discipline works are provided in the next section.

It remains the contractors responsibility to deliver fully working hydraulic systems in accordance with the specification incorporating all the necessary ancillary components where required.

3.1.1 Subcontractors Construction Responsibilities

The Subcontractor is to possess specialist trade expertise necessary to complete the works in accordance with the documentation. The Subcontractor has the following additional obligations:

To raise in good time, issues requiring design input or clarification, including

- Interpretation and co-ordination of the specification and drawings;
- Problems in complying with the specification;
- Omissions from the specification and drawings;
- Suggested alternatives or substitutions;
- To certify compliance with the Contract documents, including all variation instructions, at Practical Completion;
- To certify compliance with Authority requirements;
- To pay all fees applicable to the works;
- To obtain all Authority permits and certificates to allow the progress of the work including drawing submissions;
- To provide manufacturer's and construction drawings;
- To provide samples and prototypes where specified.

3.1.2 Subcontractors Design Responsibilities

The Subcontractor shall be responsible for the design activities listed below in addition to those activities normally undertaken through the custom and practice of the industry.

The project shall be fully co-ordinated and compatible with the remainder of the project design.

Design responsibilities include:

- Ensure the coordination across discipline for loads - for example, the electrical loading of equipment, the heat rejected by equipment, the need for water at a certain pressure and flow rate and the like;
- Co-ordinate the construction works for the services installation;
- Develop the details of the electrical wiring and control diagrams for all equipment supplied showing all interconnections between equipment to enable the necessary wiring to be undertaken;
- Determine the settings for electrical protection equipment, time delays, time switches, balancing valves, flow regulating valves, dampers and the like;
- Detail the earthing and bonding requirements for all engineering services, architectural and structural elements requiring earthing and bonding;
- The preparation of drawings sufficient to allow installation/construction of hydraulic systems;
- Allow for detailed co-ordination 1:20 minimum in specific locations e.g. plantrooms, risers, corridors, ceiling voids etc.;
- Technical co-ordination of all the elements of the hydraulic works and any suppliers;
- Provision of flushing and chlorine injection points within the pipe systems sufficient to allow cleansing and sterilisation upon completion of the works;
- Co-ordination with the Architect, Engineer and other trades;
- Where the Subcontractor wishes to use alternative methods or equipment he is to fully evaluate and submit a detailed report on any proposals;
- Preparation of safety method statements particular to specific tasks;
- Preparation of method statements for plant installation and critical activities;
- Production of co-ordination drawings;
- Production of fully dimensioned installation drawings;
- Production of builders work drawings for the services installation including the determination of the size and location of penetrations in walls and floors and of plinths;
- Production of installation wiring drawings for the works;
- Production of shop drawings of equipment and fabricated units;
- Production of manufacturer specific drawings certified as relating to the project;
- Production of record drawings for all services;
- Undertake detailed spatial co-ordination of the services with respect to all other works and trades including the detailing of interfaces. The Subcontractor is responsible for ensuring all interfaces are covered and that there are no scope gaps;
- Confirm final calculations: pump duties etc.
- Design and co-ordinate the supports for the services and equipment;
- Detail access ways and spaces for the services;

- Design of guide and expansion systems for all services including requirements at movement joints etc;
- Design and select fire stopping for all services penetrations which must be tested and certified;
- Select meters valves for the services systems to meet requirements of the BMCS specification;
- Select anti-vibration systems for the plant and equipment;
- Evaluate soil bearing capacity and design external thrust blocks on water services;
- Determine final size and position of access panels to allow servicing of concealed services;
- Determine the requirements for access floors and gantries within risers and provide where necessary to allow safe unimpeded access to the hydraulic services;
- Develop a detailed commissioning procedure for all the services and a programme dovetailing with the construction programme;
- Provide two hard copies and one electronic copy of all drawings, manuals and submissions for review by the design team.

3.1.3 Required Submissions

Provide in good time to allow review without impediment to the programme the following, the Subcontractor is to allow 14 working days for the review of drawings by the design team:

- Copies of correspondence with Authorities;
- Certified schedule of compliance for all plant and equipment, prior to placing orders;
- Certified schedule of competency for all tradesmen intended to work on the project;
- Factory test results where applicable;
- All product data, performance test and commissioning results required by this specification;
- Shop drawings for fabrication and installation of all equipment and items supplied;
- Develop detailed inspection, test and commissioning plan and program for every section of the work including the development of a detailed commissioning procedure for each system and piece of equipment including but not limited to pressure testing, flushing precommisioning, work, sectional testing, final whole system testing and setting to work;
- Detail the procedure to be used to complete the task;
- Record the skill or competency of the person undertaking the work;
- Submit the review or testing procedure to assure satisfactory completion of the task;

- Confirm the person within the Subcontractor's organisation authorised to sign off the hydraulic works as accepted;
- Deliver Principal handover and training proposals;
- Complete record and installation drawings which show all changes to equipment and services layouts, wiring and any other items during the construction period incorporated into the works;
- Keep maintenance and service records during the defects liability period for submission;
- Provide operating and Maintenance manuals in draft two (2) months prior to practical completion and in their final form twelve days prior to practical completion. All manuals are to be professionally prepared by companies specialising in their production having greater then 10 years experience.

3.1.4 Document Management

Document are to be issued via EDC using drawing numbers conforming to those set out in Mirvac's EC manual. Document will be produced at the following sizes:

- Reports A4;
- Drawings full size, A3 and A4.

The principal requires all project related correspondence and documents to be exchanged via EDC (Electronic Document Control).

All sub-contractors will be given access to EDC through an internet web page. Each user will be issued with a logon username and password. All sub-contractors will receive user manuals and a guide for changing Internet Explorer settings as part of the EDC setup process. The principal will supply additional support for training and setup upon request.

Sub-contractors must use the appropriate software systems required to complete its works. The following software is required for using the EDC program:

- Browser Software - Microsoft Internet Explorer 6.0 or later
- Registered documents viewer: Adobe Acrobat 6

3.2 Hydraulic Services – Design Criteria

3.2.1 Design Criteria

System	Standards	Additional Criteria
Potable & non-potable water mains	Water Reticulation Code of Australia WSA 03-1999. Sydney Water supplement to Water Reticulation Code of Australia – March 2000	
Gas mains	AS5601/AG601/AG1697	Installed to Gas Authorities requirements.
Sewer mains	Sewerage Code of Australia WSA 02-1999. Sydney Water supplement to Sewerage Code of Australia – March 2000.	
Domestic Cold Water	AS/NZS 3500.1 NSW Plumbing code of Practice	Installed to local authority requirements water velocity not to exceed 2.0m/s.

Domestic Hot & Blended Water	AS/NZS 3500.4. NSW Plumbing Code of Practice	Installed to local authority requirements water velocity not to exceed 2.0m/s.
Domestic Sewer Drainage & Sanitary Plumbing and trade waste.	AS/NZS 3500.2 NSW Plumbing Code of Practice	Installed to local authority requirements minimum grade of 2.5% for 40-65mm, 1.65% for 80-100mm and 1% for 150mm pipelines.
Natural Gas	AS5601/AG601/AS 1697	Installed in compliance with: - AGL requirements - Manufacturers instructions - Maximum pressure drop of 1.5kPa from meter to most disadvantaged appliance.
Rainwater Plumbing	AS/NZS 3500.3 NSW Plumbing Code of Practice	Installed to local authority requirements.
Stormwater Drainage	AS/NZS 3500.3 NSW Plumbing Code of Practice	Installed to local authority requirements. Manufacturer requirements.
Fixtures & Fittings	AS/NZS3500, AS1172.2, AS1432,AS1730,MP52	Installed to manufacturers requirements. Watermark licensed. Accredited Australian Standards mark.

3.3 Hydraulic Services – Quality Assurance

3.3.1 Pre Testing

Provide an Inspection and Test Plan (ITP) to cover the specific requirements herein and those required by the Installers own QA Procedures. Carry out the inspections in accordance with the ITP prior to test of the related part of the work.

Carry out inspection checks prior to proceeding with testing. No water is to be allowed into systems until ready for flushing to commence. Flushing is to be undertaken to ensure all construction debris is removed from inside the pipework. The following list is to be used as a guide and expanded to cover all components installed taking on board all manufacturer specific requirements.

- Verification that the systems or parts thereof are completely visible for inspection during the testing procedures;
- Correct labelling and colour coding of all pipework and equipment;
- Completion of all joints from main supply through to all fixtures and fittings or as separately documented within the ITP;
- Pipework and equipment is adequately fixed and supported;
- Allowances for expansion have been provided and expansion joints securely fixed where required;
- Measured locations of all pipework and equipment has been recorded for inclusion into As built Drawings;

- Cold water is supplied to tapware marked 'cold' on the right hand side or below and hot/warm is supplied to tapware marked 'hot' or 'warm' on the left hand side or on top as applicable;
- Fixtures and appliances are correctly fixed in position and secured to manufacturer's requirements;
- All grate types including floor wastes, showers, rainwater outlets, pits, grated drains and the like are securely fixed in position and flush or slightly below surrounding surface levels;
- Inspection openings, clear outs, caps, plugs, pit covers and the like are securely fixed and tightened as appropriate;
- All back flow prevention devices have been installed correctly including all required valves and fittings;
- Vibration eliminators have been provided at pump connections and other locations called for within the documentation;
- All hot water tempering devices are installed including access for maintenance;
- Verification of air gap provisions for discharges to tundishes and floor wastes as well as potable water storage inlets;
- Correct materials, joint, valves, equipment, fixtures and fittings have been installed in accordance with the documentation or otherwise approved in writing;
- Adequate clearances have been provided between hydraulic and other related services;
- Check all related wiring for loose connections in control panels and other connected equipment;
- Ensure hydraulic equipment such as electric hot water heaters are not electrically energised;
- Applied voltage testing to all electrically insulated connections.

3.4 Testing

3.4.1 Equipment

Provide all necessary equipment to carry out the tests including gauges, thermometers, compressors, measuring devices and the like. Provide, if requested, a list of equipment to be used and calibration certificate for each device valid for the duration of the project.

3.4.2 Defects

Rectify and retest as soon as practical after any defect becomes known including any failure consequences, at no extra cost.

3.4.3 Leakage Testing

Shall be undertaken as soon as possible after installation. All items of plant, fixtures and other related equipment not designed to withstand the test pressures shall be disconnected or isolated from the systems being tested. All filters are to be removed/looped out prior to filling.

The relevant systems shall be tested in accordance with the following schedule, sectional testing is acceptable however all parts of all systems are to be tested.

The Subcontractor is to allow for a single full system pressure test on completion of all systems and ensure all necessary components are in place to achieve this i.e access doors on stacks and vents

The design team are to be notified of the timing of all tests:

Service	Test Type	Pressure	Duration
Domestic Hot & Cold Water, Hosereel Service & all Non potable water	Water	1.5 times operating pressure	2 hours
Sewer and Stormwater Drainage	Water and Air	To flood level not to exceed 3 metres head and 30kPa for 3 mins	To AS/NZS 3500.2 and AS/NZS3500.3
Sanitary Plumbing, Rainwater and all dry vents	Water and Air	30 kPa for 3 mins	To AS/NZS3500.2
Gas	Air	7kPa or 1.5 times operating pressure, whichever is greater	To AS5601/AG601-2004

Where called for elsewhere within the specification, a smoke test shall be undertaken to the services specified.

The Subcontractor is to allow for a single whole system test for each system prior to handover. The design team are to be notified of the timing of this test for witnessing.

All water services are to be sterilised at completion after final pressure test is complete as in accordance with AS 3500 regardless of size.

3.5 NABERS Responsibilities

- The Subcontractor is to ensure that the final selection of equipment and installation is conducted in a manner which enhances energy efficiency and the ability to achieve this target in operation. All relevant requested part load and operational performance data will be provided to Principal Contractor's Representative for approval prior to final selection.
- The Subcontractor is responsible for raising as early as possible any observed inefficiencies in equipment selection or final detailed design of systems which may adversely affect the ability of the installation to achieve Five (5) Star + 60% NABERS;

- The Principal's Representative is responsible for liaising with the ESD Consultant by submitting all information relating to final selected equipment in a prompt manner;
- The BMCS Subcontractor in conjunction with the Mechanical, Electrical, Hydraulic, Blackwater, Fire and Trigeneration Subcontractors shall demonstrate that the onsite installed and commissioned BMCS/Controls system functions and operates in full accordance with the Design Specification. The commissioning of systems shall give due regard to the proposed Trigeneration and Blackwater systems and address this in reported BMCS/Controls functionality. Once commissioned and with the entire plant running in automatic control, an Independent Commissioning Agent, employed by the Principal, shall submit to the ESD Consultant all commissioned setpoint values, trend log data and graphs for every sensor on the project, the metering data of common area lighting, carpark lighting, exterior lighting, cooling energy consumption, Trigeneration electrical output, Trigeneration thermal output, heat rejection energy consumption, lift energy consumption and supplementary cooling energy consumption and building operational profile all taken from a period of seven (7) consecutive days. This is to occur at least one month before handover to ensure that the building operates in the configuration described in the energy modelling report. To this end all services Subcontractors shall ensure that all systems are installed and commissioned with sufficient time to ensure this operational profile can be gathered by the nominated date.
- The Principal and ICA shall conduct any pre-commissioning tests prior to commencing commissioning including confirming that static tests are complete, inspecting the whole installation, completing pre-start-up checklists and rectifying outstanding items in accordance with the commissioning section within this document;
- The Principal shall co-operate and be involved with the commissioning process and the Independent Commissioning Agent for a 12-month period. This requires, at a minimum, quarterly reviews and a final re-commissioning by the Principal after 12 months of operation, in addition to fulfilling the requirements of Green Star for commissioning and building tuning.
- The Principal is responsible for involvement in the study of operational performance of all systems controlled and monitored by the BMCS and to converse with the facilities manager and ESD Consultant to identify any areas of inefficiency.

3.6 Green Star Credit Clauses

3.6.1 Commissioning Clauses (Man-2)

The Principal Contractor shall comply with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required for all services and evidence must be provided to demonstrate that the appropriate Principal Contractor, Subcontractor and trades on site performed in accordance with the CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes).

- The Principal Contractor shall transfer information and documentation to building owner/manager regarding design intent, as installed details, commissioning report and training of building management staff.

The Principal Contractor shall submit the following documents before commencement on site:

- A commissioning plan (as prepared by the Independent Commissioning Agent) including a methodology statement of the commissioning process identifying commissioning dates, the tests to be carried out and proposed operational control strategy of each system component including Trigeneration, Ventilation, Heating Systems, Cooling Systems, Electrical Systems, Lighting, Domestic Hot Water and Blackwater. The commissioning plan needs to be signed off by Project Manager before commencement on site.

The Principal Contractor shall submit the following document prior to practical completion.

- Summary commissioning report (as prepared by the Independent Commissioning Agent) including commissioning dates, tests carried out and outcomes and changes made as a result of the commissioning process. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- A copy of the documentation and information transferred to building owner/manager.
- A copy of the transmittal of the commissioning report and to at information to the building owner showing the building owner/manager as the addressee or acknowledgement from the owner/manager that that information has been received.
- A signed statement from the building owner committing to the incorporation of the commissioning requirements.

The documentation submitted by the Principal Contractor to the Project Manager should provide comprehensive information on the following:

- Design Intent
- As Installed Details
- Commissioning Report
- Training

The following is a list of minimum inclusions for this document

3.6.1.1 Design Intent

Energy & Environmental Strategy

Information on energy efficient features and strategies in relation to the building, including an overview of the potential savings – stated for economic and environmental impact –must be provided.

Monitoring and Targeting

Documentation shall include information on energy targets and benchmarks for the building type and a strategy that addresses metering & sub-metering provision and how to record and present meter readings.

Building Services

Documentation providing description of basic functions, operations and descriptions of energy saving features of the following systems are to be provided:

- Trigeneration
- Ventilation
- Heating System
- Cooling System
- Electrical Systems
- Lighting
- Domestic Hot Water (DHW)
- Blackwater

Each system shall include, as a minimum, the following information:

- A simplified diagram of the system
- An explanation of how it operates
- A list of what the main components are (including Controls) and the importance of their efficient use
- Details of maintenance, including recommended frequency
- A list of likely and tell tale signs of system failure, system "do's" and "do not's" and notes of inefficient operation.

The Principal Contractor shall provide the following documentation no later than practical completion of works:

- An extract of service specification or short report detailing basic functions and operations of building services as requirement as stated above.

The Principal Contractor shall have access to the Green Star Office Design submission to reference work that has already been completed for this credit.

3.6.1.2 As Installed Details

The Principal Contractor shall submit the following documents no later than 2 weeks after commissioning has been completed in the building.

- A complete set of As Built drawings for all, mechanical, electrical and hydraulic systems and a comprehensive Operations and Maintenance (O&M) manual. The manual and drawing set is to include information on the Trigeneration and Blackwater systems.

3.6.1.3 Commissioning Report

The Principal Contractor shall submit the following document prior to practical completion

- A report which confirms that commissioning of each system or feature is in compliance with the contract documents. The report must also include a written list of outstanding commissioning issues, records of all functional/commissioning testing undertaken and list any seasonal testing required in the future. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- The report shall include the following as a minimum:
  - Demonstrate correct operation of the mechanical ventilation system.
  - Show the Trigeneration system operates correctly and in accordance with the energy modelling report.
  - Indicate the results of noise level testing outlining the conditions under which the tests were carried out.
  - Demonstrate that the building operates in the configuration described in the energy modelling report.
  - Show the water reuse system operates correctly.
  - Indicate water meter functions correctly.

3.6.1.4 Training

It is the Principal Contractor's responsibility to ensure that building managers or staff receives sufficient training to have all the information and understanding needed to operate and maintain the commissioned features and systems. The training issues are to include:

- Design Intent – including energy and environmental features
- Review of controls set-up, programming alarms and troubleshooting
- O&M manuals
- Building operation – including start up, normal operation, unoccupied operation, seasonal changeover and shutdown
- Interactions with other systems
- Optimising energy efficiency
- OH&S issues
- Maintenance requirements and sourcing replacements
- Occupant satisfaction feedback.

Training certificate or letter stating that building manager and/or staff received training including all the issues mentioned above as a minimum. The letter should include the name of all staff that received training.

Hydraulic, Vertical Transport, Fire and Trigeneration Subcontractor shall comply with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed by the Subcontractor and trades on site performed in accordance with the CIBSE Commissioning Code M: Commissioning Management in fulfilment of the Green Star requirements only. Additional commissioning requirements may apply.

Subcontractors shall refer to the Hydraulics, Water Meters and Fire Specifications for further requirements for Commissioning.

Note that the commissioning requirements listed above are required in fulfilment of the Green Star requirements only. Additional commissioning requirements, not listed may apply.

3.6.2 Commissioning – Building Tuning (Man-3)

All Subcontractors shall comply with the following requirements:

- Enter a maintenance agreement that includes a commitment to a 12-month commissioning tuning period after handover, including minimum quarterly reviews and a final recommissioning after 12 months of operation.

This will be achieved through on-site quarterly meetings involving all parties described below.

- Principal's Representative
- Principal Contractor's Representative
- Independent Commissioning Agent
- Architect and/or Consultant
- Mechanical and BMCS Subcontractors
- Equipment Supplier

During the tuning period, the commissioning process will include:

- Review of BMCS-generated trends.
- Monitoring the efficiency of the BMCS, Trigeneration, mechanical, electrical, lighting, domestic hot water, and IT systems during all seasonal variations for the occupied building.
- Tuning the BMCS, Trigeneration, mechanical, electrical, lighting, domestic hot water and IT systems to optimise control and time schedules to suit occupants' needs.
- On-going training of existing personnel and training of new personnel.
- Monitor complaints received from occupants/tenants and determine whether the problem lies in the discrepancy between the predicted performance measured against actual performance or whether the complaint indicates a need to re-evaluate the design intent.
- Documentation of the following:
    1. Maintenance records.

2. Log of complaints, problems and corrective actions. Copies to be sent to the Mechanical Subcontractor and system designer, as well as the Mechanical and ESD Consultants.
3. Log of system performance at different load periods.
4. Modifications made based on tenant needs.

The Subcontractor shall agree to a scope of that will involve as a minimum the following roles and responsibilities during the building tuning period and as agreed between parties:

(Principal's Representative)

- Assign maintenance personnel and schedule participation in the building tuning commissioning events.
- Provide access to the building and any utilities required for the events.

(Independent Commissioning Agent)

- Review BMCS generated trends, alarming and operator logs.
- Set quarterly energy targets based on monthly NABERS energy target profile set by the Independent Commissioning Agent and measure actual performance to ensure implementation of selected measures.
- Determine non-performance issues and direct rectification of the issues.
- Ongoing training of existing personnel and training of new personnel.
- Create a commissioning plan and direct the commissioning process that covers an air distribution system, boilers, automatic controls, lighting, refrigeration, domestic hot water, water distribution, system.
- Introduce standards and strategies early in the 12-month commissioning building tuning period.
- Coordinate with the Principal's Representative, Architect, Consultants, Principal Contractor, and relevant Subcontractors throughout the 12-month commissioning building tuning period.
- Observe all testing and review and approve contractor test results.
- Prepare a final commissioning report including recommendations to the Principal's Representative regarding the performance of commissioned building systems.

(Subcontractor)

- Include the cost for 12-month building tuning in the contract price.
- Ensure participation of major equipment manufacturers in building tuning commissioning events.
- Assist the Independent Commissioning Agent in verification and performance tests.
- Revise and re-submit the commissioning report to the ESD Consultant and Independent Commissioning Agent for review and acceptance.

(Principal Contractor)

- Ensure the 12-month building tuning requirements are included in the mechanical, electrical and BMCS Subcontractor's contracts.
- Remedy deficiencies identified in verification and functional tests.

(Equipment Supplier)

- Include the cost for 12-month building tuning in the contract price.
- Demonstrate the performance of equipment as required.

The Subcontractor shall submit the following documents no later than two (2) weeks after signing of contract.

- Copies of the building tuning contract (prices may be deleted) showing the scope and timeframe of the building tuning process, demonstrating the above criteria and signed by all Subcontractors.

3.6.3 Commissioning – Commissioning Agent (Man-4)

The Principal Contractor and all Subcontractors shall comply with the following requirements:

- The Principal Contractor and Subcontractors shall liaise with the Independent Commissioning Agent (ICA).

The commissioning agent must report directly to the Principal's representatives and is the person, company or agency that will plan and carry out the overall commissioning process. The primary goal of the commissioning agent is to independently identify system deficiencies as early in the project as possible and track their status until they are corrected.

NOTE: The Independent Commissioning Agent (ICA) is engaged by the Principal's representatives.

The Principal Contractor shall submit the following documents as indicated below:

2 weeks after signing of contract:

- Obtain a copy of commissioning agent CV provided to the Principal in preparation for Green Star submission.

3 weeks prior the commissioning process is initiated:

- Evidence of the independent agent's involvement during the commissioning process EITHER through the demonstration of the agent's involvement in meetings through the provision of copies of meeting minutes and attendees OR through a list of correspondence and reporting provided by the Independent Commissioning Agent (ICA) to the design team. The assessor may also ask for copies of this correspondence to be provided.

2 weeks after commissioning has been completed in building:

- Commissioning agent report with information on the major findings and recommendations on the commissioning process summarised into one section.

The nominated commissioning agent shall comply with the following requirements:

- Review the basis of design and the design intent as well as preliminary working drawings and ensure design and documentation is commissionable. Ensure control strategies are well understood and have useful information.
- Create a commissioning plan and direct the commissioning process that covers air distribution systems, boilers, automatic controls, lighting refrigeration systems and water distribution systems in accordance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes).
- Set target requirements in the contract documents to ensure implementation of selected measures
- Coordinate with the Principal, design team, Principal Contractor and Subcontractors throughout the commissioning, testing, and a 12-month tuning process.
- Observe all testing, review and approve Subcontractor test results. Witness off site testing of equipment during construction phase. Witness equipment testing and integrated functional testing prior to practical completion.
- Review and document performance of systems during the first 12 months of operation. Provide feedback and assist fine tuning of systems. The tuning will be as a minimum quarterly reviews and a final recommissioning after 12 months of operation.
- Provide meeting minutes and attendees of commissioning process or list of correspondence and reporting provided by the Independent Commissioning Agent (ICA) to the design team.
- Ensure proper operation and maintenance (O&M) documentation for the building owner. Ensure operator training is adequate. Operator can be trained by a Subcontractor if applicable.
- Prepare a final commissioning report including alarm log, trend log data and graphs for all meters and sensing devices, recommendations to the Principal regarding the performance of commissioned building systems.
- Submit a report of building performance to the ESD consultant, including alarm log, trend log data and graphs for all meters and sensing devices.
- If any plant is operating in manual control i.e. out of automatic, investigate the reason why and include in the report to the ESD consultant.

3.6.4 Building Users Guide (Man-5)

The Principal Contractor shall comply with the following requirements:

- Provide a simple Building User's Guide, which includes information relevant to the building users, occupants and tenants' representatives.

NOTE: The building User Guide is to be produced by Arup as part of design documentation and is available on request.

All Subcontractors shall comply with the following requirements:

- Provide information and documentation as required by the Principal Contractor in producing a Building Users Guide.

The Principal Contractor shall submit the following documents no later than practical completion of works

- Confirmation that the building user's guide has been issued to the owner through the provision of the official transmittal or through a letter from the owner confirming receipt of the document.
- Provide a copy of the guide to the GBCA

3.6.5 Environmental Management (Man-6)

The Principal Contractor will provide and implement a comprehensive Environmental Management Plan (EMP) for the works in accordance with Section 4 of the NSW Environmental Management System Guidelines (1998).

The Principal Contractor shall submit the following documents prior to commencement on site:

- An Environmental Management System (EMS) and an Environmental Management Plan (EMP).

The Principal Contractor shall submit the following documents no later than 2 weeks after practical completion of works:

- A copy of the EMP clearly demonstrating compliance with the requirements of Section 4 of the NSW Environmental Management System guidelines (1998).
- Copies of all reporting created through the use of the Environmental Management Plan (EMP) as evidence that the EMP was successfully implemented in accordance with Section 4 of the NSW Environmental Management System guidelines (1998).
- A copy of the ISO 14001 certification, its applicability and its restrictions.
- Statements with the EMS or Project EMP showing that any Sub Contractors relevant to the project will adhere to the ISO 14001 requirements.

All Subcontractors shall comply with the following requirements:

- Subcontractors will adhere to the Principal Contractors ISO 14001 requirements.

Refer to Appendix A of the ESD Specification for the requirements of the EMP and EMS.

3.6.6 Waste Management (Man-7)

All Subcontractors shall comply with the following requirements:

- Provide and implement a comprehensive Waste Management Plan.
- Reuse and/or recycle at least 80% of all waste by weight (including concrete and steel).

As a minimum, this will include:

- Reuse and/or recycle at least 90% of waste concrete by weight.
- Reuse and/or recycle at least 90% of waste metal by weight.

The collection of waste for recycling should come from all construction, demolition and land clearing activities.

The Subcontractor shall provide the following documentation prior to commencement on site (All details must be forwarded to the Principal Contractor and ESD Consultant for review and approval):

- A catalogue listing the materials in the building, estimating the weights of materials to be removed and stating the proposed recycling facilities to be used, the proportion of waste to be reused or recycled by each recycling facility, and the total proportion of waste to be reused or recycled and advising on the percentage of each type of material to be recycled. This should be provided in spreadsheet format. The proposed methodology for the demolition must also be provided.
- Waste measurement methodology adopted.
- A list of appropriate recycling companies that will be employed for recycling, the costs for collection, and the timing of collection service. Any substitution of recycling companies at a later stage will require sign-off by the Principal Contractor and ESD Consultant. Substitution requests will need to include methodology documentation for the recycler in order to qualify for approval.
- Estimates of achievable rates of recycling by weight by recycling companies that will be employed.
- A copy of waste management plan used for this site.

The Subcontractor shall commit to and address in the waste management plan the following issues:

- Produce a methodology statement of the waste management process indicating the entire process from separation of waste to quantifying and recycling. The method should include recycling targets for each type of waste material.
- Establishment of an on-site waste management area for sorting and segregating waste.
- Provision for colour-coded and clearly marked waste skips or bins at the waste storage area for each of the following materials:

  ✓ Cardboard

  ✓ Timber

  ✓ Metal

  ✓ Soft Plastic

  ✓ Polystyrene

  ✓ Insulation

  ✓ Concrete

  ✓ Glass

  ✓ Bricks

The Principal Contractor and Subcontractors shall commit to and address the following issues in the waste management plan:

- At a minimum, all demolition and construction waste is to be separated into the previously delineated categories and be dealt with according to the process outlined in this section (some of the materials may be in combined skips, provided that evidence is given to demonstrate that the waste Subcontractor will separate these materials off-site).
- All waste is to be collected by appropriate recycling facilities
- All waste removed must be documented. Keep records to demonstrate actual percentage of waste recycled, including weight and volume of all wastes leaving the site and the destination and/or name of recycler/waste hauler. All receipts recording weights of material recycled are to be collected and submitted. If there is no receipt produced stating the weight of material recycled, the recycling facility will need to provide a letter indicating typical weights and percentages of each material recycled. At completion of works all receipts and associated data will be issued in a spreadsheet and summary document by the Subcontractor for review by the Principal Contractor and ESD Consultant and for submission to the GBCA.
- The Subcontractor shall issue waste reports to the Principal Contractor and ESD Consultant at quarterly intervals showing percentage of waste recycled or reused by weight.
- Ensure participation in waste minimisation training for all Subcontractors.
- Publish a waste minimisation plan for all Subcontractors to reduce on-site waste to landfill.

NOTE:

Asbestos or other hazardous materials that legally must be withheld from the general construction waste do not have to be included in the calculation for the total waste by mass.

The Principal Contractor and Subcontractor shall submit the following documents no later than practical completion of works:

- A copy of the waste disposal report that details the quantity (by weight) of waste generated by the refurbishment works and the fraction of waste re-used or recycled (by weight).
- Information that confirms that the waste re-use/recycling target was achieved for the site.
- Obtain certification from all Subcontractors confirming that the waste reuse/recycling target was achieved for this site upon completion of works.

Liabilities:

- The Principal Contractor and Subcontractor must ensure all care is taken during removal of items in order to ensure no surrounding materials are damaged.
- If under any circumstances any material becomes contaminated so as to deem it unfit for recycling due to the practice of the Principal Contractor or Subcontractor, the Principal Contractor or Subcontractor will be liable for the

cost of landfill for this material plus an additional penalty to be outlined in the contract documents.

- The Principal Contractor and Subcontractors must provide notification of any asbestos or hazardous waste that is uncovered during the strip out works. A time frame for the removal of this waste should also be provided. See hazardous waste audit regarding air monitoring and clearance certificates.
- Any recycling Subcontractor used for recycling on this project must provide a facility/service license or similar certification within two weeks of tender and prior to proceeding with any site works.
- All certification, documents, reports, and records that relate to the mass, volume, relative amount, and type of recycled material must be collected during the works and submitted with claims for stage payments.
- The Principal Contractor and Subcontractors will be liable for any material that is unjustifiably 'dumped' or not dealt with as per the recycling schedule outlined in this report.
- Any penalties received from recyclers for the contamination of recycling bins or skips will be the responsibility of the Principal Contractor and Subcontractors. This charge will attract a penalty to be outlined in the contract documents.

3.6.7 Internal Noise Levels (IEQ-12)

The Subcontractors shall comply with following acoustic requirements as a Green Star requirement (as a minimum):

- Building services noise shall meet the recommended design sound levels provided in Table 1 of AS/NZS 2107:2000

Subcontractors are required to comply with either the above requirements **OR** the requirements found on the Acoustics specifications (whichever stricter)

The Principal Contractor and Subcontractors shall submit the following documents no later than two (2) weeks after completion of commissioning and prior to practical completion:

- Extracts from the commissioning report showing the results of noise level testing and outlining the conditions under which the tests were carried out.

3.6.8 Volatile Organic Compounds (IEQ-13)

All Subcontractors shall comply with the following requirements:

- 95% of all surfaces specified to be painted must be painted with low Volatile Organic Compound (VOC) paints.
- All carpets used must be low-VOC carpets.
- All adhesives and sealants are low-VOC.

The Subcontractor shall submit the following documents for paints, carpets, adhesives and sealants no later than six (6) weeks prior to commencement of Installation/Application of materials on site:

- VOC data sheets for each product used which quote the VOC content of the product, provided by the supplier and signed by a suitably qualified representative showing that VOC levels are below those specified by Green Star compliance manual v2.

The Subcontractor shall submit the following documents no later than two (2) weeks prior to commencement of Installation/Application of materials on site:

- VOC data sheets for each product used which quote the VOC content of the product, provided by the supplier and signed by a suitably qualified representative.
- Supplier certification confirming the quantity of each product supplied.

The Subcontractor shall submit the following documents prior to practical completion:

- List of all paints, carpets and adhesives and quantities used on site.
- Subcontractor Certification which confirms that the products supplied were used in the development.

The following international standards are to be referenced for low-VOC:

Paints

- The Australian Environmental Labelling Association, Inc. Standard No: AELA 23-2005 'Australian Voluntary Environmental Labelling Standard Architectural and Protective Coatings' for carpets

Coatings must respect VOC contents as per table below for latex based products:

PAINTS	
Product Type/Sub Category	Max TVOC content (g/l of ready-to-use product)
Walls and ceilings - interior gloss	75
Walls and ceilings - interior semi gloss	16
Walls and ceilings - interior low sheen	16
Walls and ceilings - interior flat washable	16
Ceilings - interior flat	14
Trim - gloss, semi gloss, satin, varnishes and wood stains	75
Timber and binding primers *	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors *	140
Any solvent-based coatings whose purpose is not covered in table	200
Maximum TVOC Content Limits for Paints, Varnishes and Protective Coatings *EU Directive	

For solvent-based coatings the paint shall not contain VOC's in excess of 200g/litre.

For recycled paints the VOC level (averaged across batches) in the paint, must not exceed 100 g/litre.

Carpets

- Carpet and Rug Institute Green Label (U.S.) – for carpets
  - Total VOC limit: 0.5 mg/m2 per hour
  - 4-PC (4-Phenylcyclohexene) limit: 0.05 mg/m2 per hour
  - All carpet to be PVC free

Adhesives and Sealants

- Reference: South Coast Air Quality Management District (California, U.S.) – Rule 1168

Adhesives and sealants must respect VOC contents as per table below for latex based products:

ADHESIVES	
Product Type	**Maximum TVOC content* (g/litre of product)**
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall & Panel adhesive	50
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants*	250
Maximum TVOC limits for Adhesives & Sealants *Sealants used to enhance the fire- and water-proofing properties are included.	

- VOC limits are less water and less exempt compounds.
- Compliance testing: Refer South Coast Air Quality Management District Rule 1168 for testing methods and exempt compounds.

The subcontractor shall obtain approval of the design team or client before substituting the finishes listed in the schedule.

3.6.9 Energy (Ene-1, Ene-2)

All Subcontractors shall comply with the following requirements:

The base building As Built design achieves a minimum predicted rating of "5 Star + 60% CO2 reduction" using the National Australian Built Environment Rating System (NABERS) scheme simulation protocol.

Energy calculations have been provided for the Green Star Office Design submission, so the Subcontractor need only to demonstrate that the design and materials have not been significantly altered from those used for the original calculations. Alterations to the original design should be documented and it is the Subcontrators responsibility to demonstrate that any changes do not impact upon the building energy use.

The Subcontractor will receive a letter from the ESD Consultant indicating the thermal calculations produced for the Office Design submission, provided that the Office Design specifications are still relevant.

If there have been significant changes, the As Built design should be remodelled and analysed for thermal comfort. The Subcontractor is responsible for covering modelling costs arising from design changes.

The Subcontractor shall submit the following documents no later than two (2) weeks after commissioning has been completed in building.

- Extracts from the commissioning report demonstrating that the building operates in the configuration described in the energy modelling report.

The Subcontractor shall submit the following documents prior to practical completion;

- Exemptions report of all design variations between design documentation and as- built design for mechanical, electrical and façade design.
- Copies of as built drawings and performance schedules demonstrating that the mechanical, electrical and facade details and materials are the same as described in the energy modelling report. This document shall clearly highlight part load efficiency (at 20, 40, 60, 80, 100% load at 4 different condenser water temperatures and chilled water temperatures) for the selected chillers (including absorption chillers) and part load efficiencies (at 20, 40, 60, 80, 100% load) for all other plant items, including but not limited to:
  - Chiller plant
  - Boilers
  - Fans
  - Pumps
  - Trigeneration equipment
  - Blackwater equipment

The document will also specify façade glazing performance and the installed capacity of any PV system including calculations for annual hourly electrical output from the PV.

The Subcontractor, as a result of design alterations, may be requested to provide an energy report by the Principal Contractor. The Subcontractor shall submit the following documents no later than two (2) weeks after completion of Façade and Mechanical Construction Drawings:

- Energy modelling report for the as built office building which describes the energy modelling process as per the NABERS "Validation Protocol for the use of Computer Simulations to Estimate Building Energy Performance" (Version 2005-01).

3.6.10 Occupant Amenity Potable Water Efficiency (Wat-1)

The Subcontractor shall comply with the following requirements:

- All toilets to be four (4) Star WELS rated (max 4.5/3 L/min) dual flush toilets.
- All urinals to be a maximum of 0.8L/flush.
- All taps to be four (4) Star WELS rated (max 4.5 L/min) taps.
- All showers to be three (3) Star WELS rated (max 7.5L/min) showers.

The Subcontractor shall submit the following documents prior to practical completion.

- Report for any water reuse or collection systems installed detailing calculations showing capacity and predicted water savings, referring to as built drawings demonstrating the water reuse systems have been installed and extracts from the commissioning report showing that the system operates correctly. This report should confirm that these systems conform to state or territory Environmental Protection Agency/Authority requirements.
- Subcontractor certification confirming that water efficient fittings supplied were installed for this project.

The Subcontractor shall have access to the Green Star design documentation upon request.

3.6.11 Water Meter (Wat-2)

The Subcontractor shall comply with the following requirements:

- Water sub-meters shall be installed on all major water uses in the building including as a minimum cooling towers, irrigation & wash-down, recycled water and/or rainwater systems (where installed) and hot water services
- Sub-water meters shall be linked to a Building Management System (BMCS) to provide a leak detection system.

The Subcontractor shall submit the following documents prior to practical completion.

- A list of all major water uses in the building referenced to As Built drawings or As Built schematics clearly showing the locations of all water meters and the associated water use
- The as-installed point schedule for the BMCS showing that all water meters are correctly installed and extracts from the commissioning report showing that the meters function correctly.

3.6.12 Landscape Irrigation Water Efficiency (Wat-3)

The Subcontractors shall comply with the following requirements

- 90% of the water requirement for landscape irrigation is sourced from on-site rainwater collection or recycled site water.

The Subcontractor shall submit the following documents no later than two (2) weeks after completion of works.

- A report describing the rainwater collection and black water recycling systems, with calculations showing tank sizes, showing the systems will provide at least 90% of the water requirements for landscape irrigation. The report should include:
- As-installed drawings of the system that show the tank size is the same as that calculated.
- Extracts from the commissioning report showing the system operates as outlined in the report.

- Documentation that indicates the system complies with the Environmental Protection Authority's requirements.
- Please note that this volume of water for irrigation must also be included in the Potable Water Credit Calculator referenced in Section 7.5.1.

3.6.13 Cooling Tower Water Consumption (Wat-4)

The Subcontractor shall comply with following requirements:

- The cooling tower system shall be designed to achieve six or more cycles of concentration.
- The cooling system uses 90% non-potable water

The Subcontractor shall submit the following documents prior to practical completion.

- Document summarising the operation of the cooling towers, referring to extracts from the commissioning report and demonstrating that the cooling towers and water treatment system achieve 6 cycles of concentration, or better, in operation; and
- Extracts from the commissioning report demonstrating the successful operation of the system; and
- A design drawing highlighting the location of the cooling towers and any supplementary equipment that may be required to achieve six cycles of concentration and equipment associated with supplying 90% recycled water to the cooling system; and
- Details of the water treatment system for the cooling towers, clearly showing the capacity to provide 90% of cooling tower water requirements referencing as-built drawings.

3.6.14 Fire System Water Consumption (Wat-5)

The Subcontractor shall comply with the following requirements:

- Provide sufficient temporary storage for fire protection system test water and maintenance drain-downs for re-use on site or where a facility exists for the pump out and recovery of water for use off-site.

The Subcontractor shall submit the following documents prior to practical completion.

- A copy of the section of the specification that highlights the components of the fire protection system which will allow for test water and drain-downs to be re-used on-site or recovered for re-use off-site;
- As built drawings of the fire protection system water storage and re-use system; and
- A short report outlining how the fire protection system is designed to allow test water and drain-down water to be re-used on site.

3.6.15 PVC Minimisation (Mat-7)

The Subcontractors shall comply with the following requirements:

- 60% of the common uses of PVC products in buildings (by cost) must meet the Best Practice Guidelines for PVC in the built environment.

The common use of PVC in building refers only to:

- Pipes, conduit and associated fittings;
- Wire and cable insulation; and
- Flooring (vinyl flooring or a carpet containing PVC backing) and resilient wall covering products that contain PVC.

Common uses of PVC products that are re-used are excluded. The 'total cost of PVC products' for the purpose of providing cost calculations shall be determined by the cost of the entire product (excluding installation costs).

Documenting compliance of a PVC product to the Best Practice Guidelines shall be demonstrated using any of the following pathways:

- ISO 14001 certified EMS that includes the requirements of the Best Practice Guidelines;
- Independently audited manufacturer's declaration of compliance to the Best Practice Guidelines; or
- Product third party certification of compliance to the guidelines (ISO type 5 certificate or eco label).

The Subcontractor shall submit the following documents:

- Short report describing how the Credit Criteria have been met by providing:
    - An as-installed PVC schedule prepared by a quantity surveyor, cost manager, cost planner, cost estimator, or architect showing cost calculations to demonstrate how the Credit Criteria is met. The PVC schedule must provide:
        - Type of common use PVC product ;
        - Product and supplier names;
        - Indication of compliance;
        - Reference to evidence of independent verification;
        - Quantities of installed products;
        - Total costs of compliant and non-compliant products; and
        - The percentage (by cost) of the total common use PVC products that are compliant with the Credit Criteria.
        - See the ESD Specification for a PVC schedule template example that must be included with the short report.
- Evidence of independent verification from the supplier demonstrating how PVC products comply with the Best Practice Guidelines for PVC in the Built Environment.
- Confirmation from the Principal Contractor or Supplier(s) confirming that the PVC products listed in the PVC schedule have been supplied and installed.
- Any substitute PVC product of a specified PVC product is to be compliant with the Credit Criteria.

- The Principal Contractor shall be responsible for obtaining approval of the design team or client before any substitutions of PVC products where the subcontractor shall be responsible for making the Principal Contractor aware of any proposed substitutions

3.6.16 Watercourse Pollution (Emi-5)

The Subcontractor shall comply with following requirements:

- All stormwater leaving the site, at any time up to a 1-in-20 year storm event, is treated/filtered in accordance with either Victorian EPA Best Practice Guidelines for Environmental Management for Urban Stormwater OR Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.
- To demonstrate that the development does not increase peak stormwater flows for rainfall events of up to a 1-in-2 year storm.

The Subcontractor shall submit the following documents prior to practical completion.

- A summary report detailing how the system works, showing its capacity and referring to the following documents:
- Attached as-installed to-scale drawings showing the system
- Attached extracts from the commissioning report demonstrating that the system operates correctly
- Attached extracts from the O&M manual demonstrating that sufficient information has been provided for its ongoing operation.

The Subcontractor shall have access to Green Star design documentation on request.

3.6.17 Reduced Flow to Sewer (Emi-6)

The Subcontractor shall comply with following requirements:

The design outflows to the sewerage system shall be reduced by 70% based on the Green Star calculator.

The Subcontractor shall submit the following documents no later than six (6) weeks prior to the commencement of Hydraulic works on site.

- Attached as-installed drawings of the treatment facility;
- A report detailing how any installed and claimed black water treatment facilities work, clearly showing calculations demonstrating capacity (under various rainfall conditions) and clearly referring to the following: construction drawings of treatment facility, extracts from commissioning report and letter confirming that the system meets all EPA requirements.
- Clear consistency with outputs from Potable Water Calculator to be demonstrated as inputs for the Sewage Water Calculator.

The Subcontractor shall submit the following documents no later than two (2) weeks after completion of commissioning.

- Attached extracts from the commissioning report demonstrating that the facility is operational.
- Letter confirming that the system meets all state EPA requirements and evidence of the relevant authority approval.

The Subcontractor shall have access to the Green Star design documentation upon request.

3.6.18 Insulant ODP (Emi-9)

The Subcontractor shall comply with following requirements:

- Demonstrated that the specification of thermal insulation avoids the use of ozone depleting substances in both its manufacture and composition.

The Subcontractor shall submit the following documents prior to practical completion.

- A copy of the sections of the specifications which refer to insulation where the requirements for that insulation are stipulated.
- Supplier certifications verifying that all insulants listed were supplied to the site. The supplier should certify that insulants did not use ozone depleting substances in manufacture or provide data sheets confirming this for all insulants.
- Subcontractor certification that the insulants referenced by the supplier were the ones installed for this building. This certification should list all insulants installed.

3.7 Hydraulic Services – Materials and Finishes

3.7.1 Standards

Material	Form	Standards
Coated steel	Galvanised structural hollow sections	AS 1163
	Zinc-coated sheet	AS 1397
	Coating class for sheet	Comply with AS 1397 Appendix B
	Pre-painted sheet	AS 2728 Category 1
Copper and copper alloys	Casting	AS 1565
	Plate, sheet and strip	AS 1566
	Rods, bars and sections	AS 1567
	Pipe	AS 1432
Fasteners	Bolts and screws	AS 1111
	Hexagon nuts	AS 1112
	Metal washers	AS 1237
	Machine screws	AS 1427
	Pressed nuts	AS 1474
	Self-drilling screws	AS 3566
	Tapping and metallic drive screws	AS BASEMENT94
	Electroplating	AS 1897

	Galvanising	AS 1214
Envirocrete		AS 1379
Steel fabric reinforcement		AS 1304

3.7.2 Factory Finishes

Finish visible joints made by welding, brazing or soldering using methods appropriate to the class of work (including grinding and buffing) before further treatment such as painting, galvanising or electroplating.

Before applying coatings to metalwork, complete cutting, drilling and other fabrication and prepare surfaces to AS 1627.

Apply finishes as follows:

Finish	Parameter or Type	Value
Galvanising	General	AS/NZS 4680
Electroplating	Zinc Nickel and Chromium Service condition number	AS 1789 AS 1192 At least 2
Equipment Paint System	Prime coat to metal surfaces generally Prime coat to zinc annealed sheet Undercoat Full gloss enamel finish coats, oil and petrol resistant	P-32 or P-62 P-13/4 or P-13/5 U-23 E-24, two coats
Two-pack Liquid Coating	Primer Top coat, internal use Top coat, external use Application Finish	Two-pack epoxy primer to GPC C-29/7 Proprietary polyurethane or epoxy acrylic system Proprietary polyurethane system Spray Full gloss

3.8 Hydraulic Services – Installation

3.8.1 General

Install equipment and services plumb and fixed securely. Organise reticulated services neatly. Provide for independent movement in both structure and services.

Arrange services so that those running together are parallel with each other and with adjacent building elements. Under suspended ground floors, keep services at least 150mm clear above ground surface and ensure maintenance access is not impeded.

Provide permanent fixtures attached to equipment for lifting heavy items of equipment as recommended by the manufacturer.

Except within plant rooms or elsewhere as documented, conceal all piping.

3.8.2 Services Connections

If the Supply Authority is to carry out part of the works, including any supply only component, make the necessary arrangements. Install equipment supplied but not installed by the Supply Authority.

Connect to the Supply Authority's services or service points. Carry out any excavation and reinstatement required to do so.

3.8.3 System Integration

Interconnect system elements so that the installation performs its required function. Liaise as required to ensure such integration.

No services are to be installed within ceiling voids or at high level within spaces where slabs are insulated sandwiched in the insulation layer.

3.8.4 Penetrations

Liaise regarding the provision of penetrations through building elements for the purposes of carrying out the work as follows:

- Co-ordinate the requirements for penetrations;
- Provide appropriate sleeves in all penetration locations, frames, duct, flange etc as required for the penetration taking into account the fire, acoustic, vibration, vermin, air flow and weather sealing requirements relating to the penetration;
- Do not penetrate any structural building element, membrane element or fire rating element of the construction without approval;
- Secure sleeves, frames, duct, flange etc in such a manner that the integrity of the penetration can be checked and assured and to allow future access;
- Material for forming core holes/sleeves gms pipe and shall have a diameter of at least 50mm greater than the pipe it serves or be specifically manufactured pre-fabricated sleeves with appropriate slab seals;
- Provide fire rated sleeves and collars around services that pass through floors, walls and roof structures complying to AS 1530 and the BCA 2010 requiring fire resistive construction (i.e. FRL rating);
- Provide sleeves through external water proof membranes with cast/ductile Iron pipes c/w flanges at the membrane interface. The mating flange is to be provided post membrane installation in order to pinch the membrane and form a continuous water tight seal;
- Services passing through sleeves externally into the ground are to be caulked with a fabricated hydrophilic O ring sized to match the gap between the outside of the service and the inner wall of the sleeve;

3.8.5 Fixing

General

If equipment and services are not suitable for fixing to non-structural building elements, fix directly to structure, to approval, and trim around holes in non-structural elements.

Use proprietary fasteners capable of transmitting loads imposed and sufficient to ensure the secure fixing of the equipment under all modes of operation. Do not use explosive charged fixing devices.

Special Construction Systems

In post-tensioned or pre-stressed structural systems, obtain approval to apply fixings in each location. Avoid zones where drilling or penetration is prohibited.

Independence of Fixing

Services must be fixed independently of any other service. Do not fix pipework to air conditioning ducting or electrical cabling supports. Removal of any fixing shall not cause any other system to have its fixing removed.

3.8.6 Metalwork

Integrity

Use metalwork capable of transmitting the loads imposed and sufficient to ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces. Construct to prevent rattle or resonance.

Electrolytic Action

Prevent wet contact between electrolytically dissimilar metals by using electrically insulating barriers between the contact zones. Such treatment shall be to written approval by the Project Manager.

Brazing

Ensure brazed joints have sufficient overlap to provide a mechanically sound joint. Do not use butt joints relying on the filler metal fillet only.

Ensure the brazing alloy wets all surfaces and fills the clearance between the overlapping parts.

Filler metal shall comply with AS 1167.1 with 15% silver content for copper-to-copper joints and for copper-to-brass joints.

3.8.7 Site Painting

Tradesmen

Use only qualified tradesmen painters.

Generally

If exposed to view and where subject to corrosive environments, paint new services and equipment including in plant rooms except chromium, anodised aluminium, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Repaint proprietary items only if damaged, to approval.

Do not combine paints from different manufacturers in a paint system.

Standards

Comply with the requirements of AS 2311 Sections, 3, 6 and 7 or AS/NZS 2312 Sections 5, 8 and 10 as applicable.

Application

Apply the first coat immediately after substrate preparation and before any contamination of the substrate. Ensure each coat of paint or finish is uniform in colour, gloss, thickness and texture and free of runs, sags, blisters or other discontinuities.

Damaged Galvanising

Galvanised surfaces which have been cut or welded or otherwise damaged shall be repaired, with a repair system that matches the layers of the coating that have been damaged and in such a manner as to restore the full protective system. Repairs shall be carried out before the base metal or the surrounding areas are damaged by exposure to atmosphere, using "Zinga Liquid Galvanising".

Paint Systems

Use the following systems:

Substrate	1st Coat	2nd Coat	3rd Coat	4th Coat
Iron and steel	P-32	U-16/1	E-15/3	E-15/3
Copper	C-29/2	C-29/2	E-24	E-24
Zinc-coated steel	P-13/4	U-16/1	E-15/3	-
Organic or inorganic zinc primed metal	U-16/1 (Zinga Liquid Galvanising)		-	-

3.8.8 Pipework Painting

The following schedule describes the required colours for relevant hydraulic services to AS 2700.

Service(s)	Colour Name	AS 2700 Colour	AS 2700 Ref No.
Drinking Water Domestic Cold Water Domestic Hot Water	Green	Jade	G21
Natural Gas	Yellow – Ochre	Sand	Y44
Non-Potable water service	Lilac	Lilac	P23
Sewer Drainage Sanitary Plumbing Stormwater and Grease waste	Black	Black	-
Fire Services	Red	Signal Red	R13

3.9 System identification

3.9.1 Systems to be Labelled

The following systems and components are to be labelled:

- Incoming mains water including operating pressure;
- Boosted Cold water service including operating pressure;
- Hot water service flow and return including operating pressure;
- Non Potable water including operating pressure;
- Cooling tower supply water including operating pressure;
- Natural gas services including operating pressure;
- Pumped sewer lines (including pump-out unit reference);
- Sanitation stacks;
- Waste stacks;
- Trade waste stacks;
- Rainwater down pipes internally;
- Dry vents to sanitation (including system served);
- Sump vents (including pump-out unit reference);
- Hose reels.

3.9.2 Marking

General

Mark equipment, piping, valves and conduits, to provide a ready means of identification.

Standard

Piping, valves and conduits to AS 1345 as applicable.

Labels

Minimum lettering height 5mm

Bevel or round edges of label plates thicker than 1.5mm

Externally – use engraved and filled lettering on brass or stainless steel, or cast metal, or to approval. Do not use engraved two-colour laminated plastic labels

Internally – use two-colour laminated plastic or other approved system.

Pipework Labelling

Located each side of valves and at 3000mm centres generally for pipe runs. If a pipe run located within a room does not exceed 3000mm, then labelling shall be provided to indicate that service.

Lettering Heights

Lettering heights shall be suitable for the application given the pipe diameter, required viewing distance and status of the label or instruction.

Letters shall be as specified in AS 1744 series C or D capitals are recommended. As a guide, under good visibility conditions, a letter height of at least 1mm for each 0.4m of required reading distance shall be provided.

Location of Marking

Markings, labels and signs shall be located where they may be readily seen. Warning and operational labels must be located to ensure visibility before a person can be placed at risk and to ensure positive identification before operation.

Text

The text on the label, warning sign or marking shall match the identification on the Work-As-Executed drawings and any Operation and Maintenance Manuals.

3.10 Hydraulic Services – Completion

3.10.1 Work-As-Executed/Installed Drawings

The following outlines the minimum requirements for subcontractors As – executed/Installed drawings. Refer to Mirvac's Building Information Modelling Brief for supplementary requirements

Include correct and accurate services diagrams involving Layout Plans, Schematic Diagrams, Circuit Diagrams including all labelling references for valves, pumps, pits and the like. Include accurate locations of in-ground, under-suspended-floor and in-ceiling systems.

The drawings produced by the contractor for this project shall include:

- Full detailed layout of all systems (1:100)(1:50);
- Plantroom layouts and sections (1:20);
- Schematics of each system (NTS);
- Relevant control schematics;
- Double line representation for all pipework 65mm diameter and over on 1:50 scaled layouts;
- Relevant panel layout drawings;
- Manufacturers drawings for all items of plant;
- Labelling in sequence of all valves, pumps and pits and the like on plan layouts and schematics.

The Contractor shall submit the following documents no later than 2 weeks after commissioning has been completed in the building.

A complete set of as built drawings for all, hydraulic systems and a comprehensive Operations and Maintenance (O&M) manual.

- Submit one copy of the draft O&M manual 4 weeks before date for practical completion. Include provisional record drawings, preliminary performance data and temporary insertions for items that are not yet finalised;
- Submit three sets of final volumes within 2 weeks of practical completion. Incorporate all feedback, corrections and notes as applicable.

3.10.2 Commissioning Report

The Contractor shall submit the following documents prior to practical completion:

- A report which confirms that commissioning of each system or feature is in compliance with the contract documents. The report must also include a written list of outstanding commissioning issues, records of all functional/commissioning testing undertaken and list any seasonal testing required in the future. This summary report must demonstrate compliance with the CIBSE Commissioning Codes and BSRIA document. The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- The report shall include the following as a minimum:
- Sterilisation record sheets.
- Pressure testing record sheets
- Show the correct operation of all system components.

3.10.3 Commissioning

The Sub Contractor shall provide the Contractor with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required and evidence must be provided to demonstrate that the appropriate Contractor, sub-Contractor and trades on site performed in accordance with the ASHRAE Guideline 1 or the CIBSE Commissioning Codes.

Provide a commissioning sheet for item of plant or other equipment to include the following items and any additional items required by the Installers ITP. Carry out all pre-testing and testing inspections and tests as specified elsewhere.

Commissioning shall include, but not be limited to the testing, balancing, sterilisation, tagging, certifying and bringing into full working operation the hydraulic systems on this project.

The systems are to be pre-cleaned, tested and commissioned in accordance with the following:

- CIBSE- Commissioning Code M;
- CIBSE- Commissioning code W;
- BSRIA- Guide AG1/2001.1.

The following commissioning procedures shall include, but not be limited to the following:

- For each item of equipment such as pumps, carry out full commissioning tests in accordance with the manufacturer's specification. Otherwise carry out tests to establish that the equipment controls operate correctly, that all remote indications operate correctly and that the equipment is capable of performing in accordance with the specification. Incorporate into the record any factory test results as applicable;
- Correct operation of all tapware and hose taps including required flows, pressures and temperatures;
- Fixtures, fittings and equipment are securely fixed in position as intended for operation;
- Correct rotation of all motors;
- Correct operation of all controls, indicators and instrumentation;
- Verification of existence of all required safety notices and signage;
- Painting and labelling of all services and equipment;
- Cleaning of all appliances and equipment of dust, soot, cement/concrete droppings and alike;
- Provision of isolation and balancing valve tagging which shall identify valves numerically, service type and area/s served which correspond to As Built Drawings;
- Correct operation of interfaced shut off and warning systems with other services;
- Noise transmissions from services and equipment complies with specification requirements;
- Correct operation of all gas fired appliances and flued systems;
- Electrical isolation or continuity testing as applicable;
- Pressure testing of the service;
- Full chlorination and subsequent flushing of all pipework regardless of size prior to putting into service, chlorination is to be undertaken by a specialist commissioning and pipe cleansing company;
- Prior to commissioning starting the contractor is to provide a fully detailed proposal for review of the works he is to undertake and the methods to be employed.

3.10.4 Maintenance

The maintenance period is the defects liability period under the contract, starting from the date of Practical Completion for the Works.

During the maintenance period the contractor is to carry out periodic inspections and maintenance work as required by statutory regulations and recommended by manufacturers of supplied equipment, and promptly rectifies faults.

The contractor shall attend emergency calls within 2 hours.

The contractor shall submit details of maintenance procedures and program, relating to installed plant and equipment 6 weeks before the date for practical

completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

The contractor shall report to the designated representative of the Principal on arriving and before leaving the site. Comply with all security procedures established on the site of the works.

Maintenance shall be carried out at times and in a manner that shall have the least impact on the tenants.

Submit in binders which match for all services the Operating and Maintenance Manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures. Such information shall include materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed logbook pages recording the operational and maintenance activities performed up to the time of practical completion.

Include test and approval certificates.

At each service visit record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. Obtain the signature of the designated representative.

Reports unsigned won't be recognised and the Principal can either have additional services carried out to the required number or deduct the cost of disputed visits.

If referenced documents require that logbooks or records be submitted, include this material in the Maintenance records.

During the defects liability period, the Contractor shall complete all maintenance items requested of them.

At least 4 weeks before the date for practical completion submit a schedule of spare parts necessary for maintenance of the installation.

3.10.5 Training

It is the Sub Contractor's responsibility to ensure that building managers or staff receive sufficient training to have all the information and understanding needed to operate and maintain the commissioned features and systems. The training issues are to include:

- Design Intent – including energy and environmental features
- Review of controls set-up, programming alarms and troubleshooting
- O&M manuals
- Building operation – including start up, normal operation, unoccupied operation, seasonal changeover and shutdown
- Interactions with other systems
- Optimizing energy efficiency
- OH&S issues
- Maintenance requirements and sourcing replacements

- Occupant satisfaction feedback.

  Training certificate or letter stating that building manager and/or staff received training including all the issues mentioned above as a minimum. The letter should include the name of all staff that received training.

4 Hydraulic Systems

4.1 Standards

The following schedule identifies those standards applicable to the hydraulic services systems.

AS 1074	Steel tubes and tubulars for ordinary service
AS/NZS 1167	Welding and brazing – Filler metals
AS 1172.2	Water closets of 6/3 L capacity or proven equivalent – Cisterns
AS 1345	Identification of the contents of pipes, conduits and ducts
AS 1379	Specification and supply of concrete
AS 1428 (All parts and subsections)	Design for access and mobility
AS 1432	Copper tubes for plumbing, gas fitting and drainage applications
AS 1478.1	Chemical admixtures for concrete, mortar and grout – Admixtures for concrete
AS 1646 (All parts and subsections)	Elastomeric seals for waterworks purposes
AS 1657	Fixed platforms, walkways, stairways and ladders – design, construction and installation
AS/NZ 2033	Installation of polyethylene pipe systems
AS 2129	Flanges for pipes, valves and fittings
AS 2441	Installation of fire hose reels
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1	Aggregates and rock for engineering purposes – Concrete aggregates
AS/NZ 2845 (All parts and subsections)	Water supply – backflow prevention devices
AS/NZS 2865	Safe working in a confined space
AS 3688	Water supply – copper and copper alloy body compression and capillary fittings and threaded-end connectors
AS 3855	Suitability of plumbing and water distribution systems products for contact with potable water
AS 3972	General purpose and blended cements
AS/NZS 2280	Ductile iron pressure pipes and fittings
AS/NZS 2648.1	Underground marking tape – Non-detectable tape
AS/NZS 4331(All parts and subsections)	Metallic flanges
AS 1357 (All parts and subsections)	Water supply – Valves for use with unvented water heaters;
AS 1397	Steel-sheet and strip – hot dipped zinc-coated or aluminium/zinc-coated;
AS 1566	Copper and copper alloys – Rolled flat products;
AS 1910	Water supply – Float control valves for use in hot and cold water;

AS 2239	Galvanic (sacrificial) anodes for cathodic protection;
AS/NZS 3000	Wiring Rules;
AS 3498	Authorisation requirements for plumbing products – Water heaters and hot-water storage tanks;
AS 3688	Water supply – Metallic fittings and connections
AS 4032.1	Water supply – Valves for the control of hot water supply temperatures – Thermostatic mixing valves – Materials, design and performance requirements;
AS/NZS 3500 (All parts and subsections)	National Plumbing and Drainage;
AS/NZS 3666 (All parts and subsections)	Air-handling and water systems of buildings – Microbial control;
AS5601/AG601	Gas Installations
	Sydney Water Requirements
	Gas Authority Requirements
AS/NZS 1518	External extruded high-density polyethylene coating for pipes
AS 1530 (All parts and subsections)	Methods for fire tests on building materials, components and structures –
AS 1572	Copper and copper alloys – Seamless tubes for engineering purposes
AS 1697	Installation and maintenance of steel pipe systems for gas
AS 1722 (All parts and subsections)	Pipe threads of Whitworth form
AS/NZS 1869	Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas
AS 2129	Flanges for pipes, valves and fittings
AS 2430*	Classification of hazardous areas
	*All parts and subsections
AS 2700s	Colour standards for general purposes
AS/NZS 2717.1	Welding – Electrodes – Gas metal arc – Ferritic steel electrodes
AS 2718 (All parts and subsections)	Plastics pipes and fittings for gas reticulation – polyethylene – outside diameter series – pipes
AS 2738	Copper and copper alloys – Compositions and designations of refinery products, wrought products, ingots and castings
AS 3673	Malleable cast iron threaded pipe fittings
AS 3723	Installation and maintenance of plastics pipe systems for gas
AS 4041	Pressure piping
AS/NZS 4130	Polyethylene (PE) pipes for pressure applications
AG 201	Approval requirements for manual shut-off valves
AG 208	Approval requirements for jointing compounds and materials for use in gas pipe joints

AG 212	Approval requirements for quick-connect devices
AG 214	Approval requirements for automatic shut-off valves and vent valves
AG 216	Approval requirements for limited flexibility connectors for gas
AS3814/AG501	Industrial and commercial gas fired appliances
AG 604	Approval requirements for flue cowls
AG 605	Approval requirements for twin-wall metal flues
AG 807	Approval requirements for natural gas flexible hose and hose assemblies for pressures above 2.6 Mpa.
AS 1260	PVC-u pipes and fittings for drain waste and vent application
AS 1631	Cast grey and ductile iron non-pressure pipes and fittings
AS 1646	Elastomeric seals for waterworks purposes
AS 1650	Hot-dipped galvanised coatings on ferrous articles
AS 2758 (All Parts and Subsections)	Aggregates and rock for engineering purpose
AS 3571 (All Parts and Subsections)	Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
SAA MP52	Manual of authorisation procedures for plumbing and drainage products.
AS/NZS 1170	Structural design actions
AS 1628	Water supply – Metallic gate, globe and non-return valves;
AS 1650	Hot-dipped galvanized coatings on ferrous articles;
AS 2200	Design charts for water supply and sewerage;
AS 2638 (All Parts and Subsections)	Gate valves for waterworks purposes;
AS 3517	Capillary fittings of copper and copper alloy for non-pressure sanitary plumbing applications;
AS 3578	Cast iron non-return valves for general purposes;
AS 3579	Cast iron wedge gate valves for general purposes;
AS 3680	Polyethylene sleeving for ductile iron pipelines;
AS 3705	Geotextiles – Identification, marking and general data;
AS 3725	Design for installation of buried concrete pipes;
AS 3795	Copper alloy tubes for plumbing and drainage applications;
AS 3855	Suitability of plumbing and water distribution systems products for contact with potable water;
AS 3996	Metal access covers, road grates and frames;
AS 4058	Precast concrete pipes (pressure and non-pressure);
AS 4060	Loads on buried vitrified clay pipes;
AS 4087	Metallic flanges for waterworks purposes;
AS/NZS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings

AS/NZS 2566 (All Parts and Subsections)	Buried flexible pipelines;
AS/NZS 4129(int)	Fittings for polyethylene (PE) pipes for pressure applications;
AS/NZS4327	Metal-banded flexible couplings for low-pressure applications.
AS/NZS 1365	Tolerances for flat-rolled steel products
AS/NZS 1594	Hot rolled steel flat products
AS 1628	Water supply – Metallic gate, globe and non-return valves
AS 1718	Water supply – Copper alloy screw-down pattern taps
AS 3579	Cast iron wedge gate valves for general purposes
AS/NZS 3008.1.1	Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions
AS/NZS 3013	Electrical installations – Classification of the fire and mechanical performance of wiring systems
	Building Code of Australia Volume 1 Class 2 to Class 9 Buildings Section E – Services and Equipment;
	Building Code of Australia Volume 1 Class 2 to Class 9 Buildings Section E – Services and Equipment Part E1.4 Fire fighting equipment – Fire hose reels;
AS 1006	Solid stem general purpose thermometers
AS 1271	Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels
AS 1349	Bourdon tube pressure and vacuum gauges
AS 4706	Pressure gauges for regulators used with compressed gas cylinders
AS/NZS 1595	Cold-rolled, unalloyed, steel sheet and strip
AS 1939	Degrees of protection provided by enclosures for electrical equipment (IP code)
AS 2338	Preferred dimensions of wrought metal products
AS/NZS 3121	Approval and test specification – Insulating mouldings
AS 1074	Steel tube and tubulars for ordinary service
AS 1210	Pressure vessels
AS 1345	Identification of the contents of pipes, conduits and ducts
AS/NZS 1518	External extruded high-density polyethylene coating for pipes
AS 1530 (All Parts and Subsections)	Methods for fire tests on building materials, components and structures –
AS 2430 (All Parts and Subsections)	Classification of hazardous areas
AS/NZS 2648.1	Underground marking tape – non-detectable tape
AS 2944.1	Plastics pipes and fittings for gas reticulation – Polyamide – Pipes
AS 2944.2	Plastics pipes and fittings for gas reticulation – Polyamide – Fittings
AS 4176	Multilayer pipes for pressure applications - Multilayer piping systems for hot and cold water plumbing applications

4.2 Hot Water

4.2.1 Insulation

Insulation shall not be applied until the service has been inspected, pressure tests and sterilisation has been completed and pipework has been cleaned, removing any scale, rust, grease and debris.

All HWS F and R pipework shall be lagged with fire retardant, closed cell foam 20mm incorporating a press seal fastener/factory laminated aluminium foil equal to 'Thermotec'.

4.2.2 Thermostatic Mixing Valves

Thermostatic mixing valves shall be "Enware Aquablend1500 ATMS700R" or equal located under basins within a recessed stainless steel box and set at 42 degrees C. Thermostatic mixing valve shall be located as detailed on hydraulic drawings.

4.2.3 Sterilisation of Pipework

Required after final pressure test is complete as for cold water in accordance with AS 3500 regardless of size.

4.3 Gas standards

4.3.1 Gas Meter Set Components

The meter sets shall include all valves, regulators, fittings and ancillary items necessary to comply with AG 601 and Local Authorities requirements to ensure adequate supply to all required appliances. If the gas meter is installed in a sealed mechanically ventilated enclosure a gas leak detector shall be installed and shall be monitored at all times.

4.3.2 Gas Guard Safety Shut Off Valve

Gas guard safety shut off valves shall be provided by the individual retail tenancies. The hydraulic contractor shall coordinate with mechanical and fire contractors for final location and connections to mechanical and fire services.

4.3.3 Isolation Valves

Ball valves to be used. Lever handles to above ground valves above 20mm diameter.

Valve head adapter matching the valve head shall be provided on all below ground valves.

Provide unions or flanges on each side of valves to allow for removal.

The location of all valves to be made easily accessible.

4.3.4 Water and Dust Clearing Provision

Provision shall be made in accordance with AG 601, clause 4.10.

4.3.5 Valve Pits

Required for all below ground valves.

Cast Iron Box with hinged cover finished flush with surrounding surface level.

Cover to be permanently marked 'G' or 'Gas'.

4.3.6 Depth of Cover

In accordance with AG 601. Follow general contour of land.

4.3.7 Backfill

Provide 100mm soft sand fill all around pipework.

Marker tape with the word 'Gas' to be placed 150mm above pipe.

4.3.8 Identification

In accordance with AG 601, clause 4.1.12.

4.3.9 Distance from Buildings

Minimum 1m from any building.

4.3.10 Buried Pipework Protection

Wrap with 'DENSO' tape when pipework penetrates or is concealed with masonry structures and is within corrosive areas.

4.3.11 Branch Connections for Future Use

Terminate pipe branch in pipe with welded or screwed cap.

Provide branch isolation valve prior to pipe termination.

4.4 Sewer Drainage and Sanitary Plumbing Service

4.4.1 Depth of Cover

In accordance with AS/NZS 3500.2.2 clause 3.7.

4.4.2 Inspection Openings

At each change of direction and at 30m intervals.

Additionally provide inspection openings in accessible locations so that each section of pipework can be cleaned.

4.4.3 Branch Connections for Future Use

Terminate pipe branch with socket connection and a watertight screwed or sealed cap.

4.4.4 Sound Insulation

All Sanitary Pipework in ceiling spaces and bulkheads above occupied areas and as specified elsewhere within this specification.

Type – Soundlag 4525C

Manufacturer – Pyrotek or equal

Installation – Strictly in accordance with manufacturer's instructions.

4.4.5 Standard Floor Wastes and Shower Outlets

Floor waste grates shall be 100mm square stainless steel with screwing removable grate.

Samples shall be provided.Each floor waste shall be cast into the slab with a 300mm-diameter drip flange with 4 x 6 mm holes into the riser.

4.4.6 Plant Room Floor Waste

Floor drains equal to Galvin Engineering Pty Ltd Model No DV4S12R shall be installed to all plant room areas.

4.4.7 Bucket Trap Floor Waste

Bucket trap floor waste equal to Galvin Engineering Pty Ltd Model No DB4D08R shall be installed to garbage rooms.

4.4.8 Clearouts

Polished brass clearouts shall be provided where indicated on drawings and as required by AS3500 within plant rooms. Clearouts located in bathroom, kitchen and tiled areas shall be chrome plated.

Clearout shall be installed flush will the surrounding floor finishes.

4.4.9 Tundishes

Where indicated on the drawings and described in the specification, provide tundishes with piped drainage to the sewer service. Tundishes where exposed within ablution areas shall be chrome plated copper.

4.4.10 Vent Pipes

Vent pipes shall extend to atmosphere in accordance with standards. Provide stays where required. Flash all penetrations and seal to make watertight. Provide approved type vent cowls, of materials to match vent pipe. Co-ordinate final vent termination locations with Project Manager, concealed from view where possible.

4.4.11 Traps

Traps which are visibly exposed within ablution and kitchen areas shall be medical quality chrome plated copper alloy with dishwasher connections where required and finished at floor or through wall with gland sealed chrome plated nut and fixed cover dome.

4.4.12 Cover Domes and Plates

Medical quality chrome plated cover domes shall be provided at all wall and floor penetrations for visibly exposed sanitary fixtures and where penetrations are made within cupboard joinery

The cover domes shall be fixed in position either by screwed nuts or with the use of a small amount of silicone sealant.

4.4.13 Expansion Joints

Supply and install approved type expansion joints to all piped services in accordance with Australian Standard and to manufacturer's instructions.

All expansion joints shall be individually fixed to an approved adjacent structure and in a manner to allow no movement but for the expansion slip joint once installed. Suspended rod hangers are not acceptable.

4.5 Pump standards

4.5.1 Pump Suction and Discharge Flanges

Flanged As 2129; Bolting AS 2528

Complete with pressure gauge connections

4.5.2 Flow Indication

Indication on casing

4.5.3 Installation Accessories

All valves, gauges, strainers, interconnecting pipework, float switches, level alarms, rising main connections, guide rails and chains.

4.5.4 Electric Motors

4.5.5 Standards

AS 1023, AS 1359, AS 1360, AS 1395, AS 1939

Explosion proof where indicated in the data sheets

4.5.6 Electrical Requirements

3 ph 415V 50Hz

4.5.7 Starting

Star Delta above 7.5Kw.

D.O.L. up to and including 7.5Kw.

4.5.8 Noise Level

Maximum NR 50 @ 1m.

4.5.9 Total Motor Efficiency

Greater than 70%

4.5.10 Noise Level

Maximum NR 50 @ 1m.

4.5.11 Preferred Manufacturer

Nossiter Pumps

4.6 Sanitary Fixtures

4.6.1 Connections

Provide unions on all pipework adjacent to equipment for ease or removal of item.

4.6.2 Materials

First quality high density vitreous china with full glazed finish in accordance with the architect's sanitary fitting schedule.

4.6.3 Guarantee

Obtain guarantees from all the respective manufacturers, guaranteeing the fixtures against faults for a period of 12 months after Practical Completion and include all guarantees within the operation and maintenance manual.

4.6.4 Colour

All fixtures within a single area to be matching colours and from the same batch to ensure colour match.

4.6.5 Protection On Site

If possible, maintain protective wrapping on all items until just prior to final handover.

4.6.6 Equipotential Bonding

Required for all metal parts. Provide tags on all metal fixtures for this purpose.

4.6.7 Installation - Generally

Allow for the supply and installation of all fixtures, bolts, brackets, putty, silicone, cement and sundry materials necessary for the faultless operation of fixtures in accordance with manufacturer's instructions.

Water closet pans shall be fixed in accordance with the manufacturers recommendations. Where fixed with mortar bed the pan is to be set onto concrete floors using 3:1 sand and cement mix. Remove appropriate tiles and scabble cement to provide additional adhesion prior to bedding pan.

Seal sanitary fixtures on sides and tops to walls and bench/counter tops with white fungal resistant clear silicone sealant.

Plug and washers shall be provided for all basins, baths and sinks as applicable. Plug and washers for sinks shall be 50mm uPVC with stainless steel flange, complete with plastic plug. Plug and washers for basins and baths shall be 40mm uPVC with plastic plug unless specified otherwise.

Seal all tapware to fixture or wall using clear roof and gutter silicone sealant.

The use of plastic or uncoated steel fixings is not permitted.

Hot tap to be on the left, cold tap to be on the right when viewed from in front of the fixture.

4.6.8 Disabled Fixtures and Fittings

To be installed to AS 1428.

4.6.9 Taps

Bright chrome plated finish in accordance with the architect's brassware schedule.

Supplied complete with anti splash nozzle, neoprene washer, o ring seal aerator and flow restrictor.

4.7 Storm water Collection Systems

4.7.1 General

Construct kerb inlets, footpath crossings and trenches where indicated on drawings.

Footpath crossing to Council requirements.

4.7.2 Sound Insulation

All pipework in ceiling spaces and bulkheads above occupied areas and as specified elsewhere within this specification.

Type – Soundlag 4525C

Manufacturer – Pyrotek or equal

Installation – Strictly in accordance with manufacturer's instructions.

4.8 Rainwater Outlets

4.8.1 General

Supply and install rain water outlets as indicated on plan. Flat roofs are to be provided with outlets as indicated on plan c/w clamping flanges to suit roof membranes as detailed on the drawings.

All joints in the rainwater system are to be made with proprietary couplings silicon/mastic or similar joints will not be accepted under any circumstances. This is to include joints between rain water outlets and down pipes whether in the roofing or guttering system.

Rainwater outlets shall be cast iron body with a domed aluminium grate equal to Galvan Engineering or equal approved.

4.9 Hose Reels

4.9.1 Standards

- Building Code of Australia Volume 1 Class 2 to Class 9 Buildings Section E – Services and Equipment Part E1.4 Fire fighting equipment – Fire hose reels;

Standard	Name
AS/NZS 1221	Fire hose reels;
AS 1851.2	Maintenance of fire protection equipment – Fire hose reels;
AS 2441	Installation of fire hose reels;

4.9.2 Type

Swinging arm type or fixed type in recessed cabinet.

4.9.3 Hose

35m x 20mm diameter 3 ply rubber hose.

4.9.4 Nozzle and Spray Pattern

20mm diameter combined jet/fan streaming metal nozzle.

4.9.5 Mounting Height

1500mm from floor to centre of hose reel.

4.9.6 Mounting Clearance

100 mm minimum clearance around drum.

4.9.7 Notices

Clear operating instructions to be posted in front of reel.

4.9.8 Valve

25mm diameter stopcock on supply line to hose located adjacent to reel complete with a 25mm union connection.

4.9.9 Operation

Hose to run smoothly off reel when pulled in any direction.

4.10 Underground Services – General

4.10.1 Location of Services

Generally as per drawings.

All below ground drainage services are to be flexibly jointed and be provided with "rocker pipes" consisting of 2 No. flexible joints at 150mm and 600mm from the face of any structure the drain passes through.

4.10.2 Excavation

Vertical Sides to all trenches.

Provide temporary shoring as necessary to be removed before trench reinstatement.

Program of works for excavation to be such that minimum length of trench to be open at any time.

Place excavated materials at least one trench depth away from edge of trench.

4.10.3 Trench Sizes

As per schedule below. Widths are soil face to soil face and include thickness for shoring.

Pipe Diameter (mm)	Trench Width (mm)
100	450 - 525
150	490 - 600
225	580 - 700
300	680 - 750
375	950 - 1050

4.10.4 Refilling of Trenches

As soon as possible, preferably immediately, after the installation and testing of the service.

Refill with original excavated material except where specific back fill is required.

Compact back fill using hand tools within 300mm vicinity of pipe.

4.10.5 Backfilling of Pipes

100mm all round pipe, 300mm on top of pipe.

Selected bedding, side support, overlay and backfill materials shall be in accordance with AS/NZS 3500.

Remove unused excavated material from site.

Progressively remove trench supports as selected back fill is reinstated in 300mm layers.

Compact back fill to density of not less than adjoining soil.

4.10.6 Reinstatement

All surfaces to be reinstated to their original state.

4.10.7 Testing

Interim testing of sections required prior to back filling.

Final testing of sections required after back filling.

4.11 Pipe Support System

4.11.1 Standards

Standard	Name
AS/NZS 1365	Tolerances for flat-rolled steel products
AS/NZS 1594	Hot rolled steel flat products
AS/NZS 3500	National Plumbing and Drainage Code
AS 5601(AG 601)	Gas Installations
Manufacturer's structural standards, recommendations and design criteria. Other relative standards and codes.	

4.11.2 Manufacturer

- Flexi Strut-Ezyclip;
- Unistrut Ltd;
- Millstrut P1000;

Or other, similar and approved.

Submit sample for approval.

For vibration and noise dampening

- Binder Engineering Pty Ltd;

Or approved equivalent or as specified otherwise.

4.11.3 General

Secure to building structure only. Explosive fixing devices shall not be used.

Brackets and pipe supports for all high and low level pipes to provide adequate vertical and lateral restraint.

The use of 'U' bolts is not permitted on plastic pipe systems.

Base plates, etc, to be separated from concrete floor by a suitable damp proof material of 3 mm minimum or dissimilar metals by insulation.

Where pipe supports are required in 'wet' conditions e.g. in balance tanks, air ducts, etc, the supports shall be etch primed and given a minimum of 2 no. coats of MIO paint DFT 50 microns each.

Where supports are used for metallic pipework, separation liners shall be provided as necessary.

Where Unistrut or similar systems are used for horizontal pipework, fixing bolts shall be provided at the lower fixing of each bracket to avoid slippage.

4.11.4 Sizing

Suitable size and strength and allow for expansion, contraction and anchoring of piping systems.

4.11.5 Materials

Mild steel supports for all pipework, pre-galvanised.

Non ferrous supports for all copper pipework, or provide with separation layer to prevent electrolytic action.

Provide high density foam insulation inserts between insulated pipework and hangers.

Cut ends to have sharp edges removed, be touched-up with a cold application galvanising paint, and finished or capped as necessary.

Hot dip galvanised when in contact with pool hall air with protective paint finish.

4.11.6 Multi-Service Support Systems

Approved prefabricated systems only designed for purpose.

Use hollow section mild steel cross members with protective paint coating.

Pipes up to 100mm to be suspended from cross member.

Pipes greater than 100mm to be supported from cross member.

4.11.7 Pipe Support Locations

To allow sufficient access for maintenance and removal of equipment.

As per relative standards and codes.

4.11.8 Pipe Support Intervals

Material	Pipe Size (mm)	Horizontal Support (m)	Vertical Support (m)
uPVC/ABS/PB/ PE/PE-X/PP-R	15-20 25-40 50-80 100 150	0.6 0.75 1.00 1.5 2.0	1.2 1.5 2.0 2.5 3.5
Copper	15-20 25 32-40 50-65 80-150	1.5 1.8 2.0 2.7 3.0	1.5 2.0 2.5 3.0 4.0
Steel	15-32 40-50 65-100 125-150	1.8 2.5 3.0 3.5	2.0 2.5 3.0 4.0

4.11.9 Support Rods Sizes

Pipe Size (mm)	Rod (mm)
15-25	6
32-80	10
100-150	12
200-250	16
350	20
400-450	24
500-600	30

4.11.10 Pipework protection

All pipework located in basement areas to be adequately protected from vehicle damage.

4.12 Pipework and Fittings – Copper

4.12.1 Standards

Standard	Name
AS 1432	Copper tubes for plumbing, gas fitting and drainage applications;
AS 1572	Copper and copper alloys – Seamless tubes for engineering purposes;
AS 1589	Copper and copper alloy waste fittings.

4.12.2 Acceptable Fittings & Joints

Up to 100mm - capillary with silver solder alloy to AS 1167 (15%SI).

Compression type to AS 3688.

Greater than 100mm - copper alloy flanges to AS 2129 Table E.

4.12.3 Identification

To AS 1432

4.12.4 Bends

Preformed. Site made acceptable for sizes up to and including 20mm diameter. Any flattening or constriction of bore will be rejected.

4.12.5 Thickness

Type B as defined in AS 1432.

4.12.6 Chromium Plating

Required on pipework and fittings where documented elsewhere within this specification.

4.12.7 Painting

Painting to be carried out after all joints are complete in accordance with General Requirement section of this specification.

Notes

- Junctions between copper and non-copper pipes shall be provided with a suitable separation dielectric to prevent electrolytic action;
- Clean joints and pipework of surplus flux and alike solder immediately after setting of joints.

4.13 Pipework and Fittings - Galvanised Steel

4.13.1 Standard

Up to 100 diameter: AS 1074.

Greater than 100 diameter: AS 1835, 1836

4.13.2 Galvanising Standard

AS 1650

4.13.3 Fittings and Joints

All pipe joints on all permanently concealed pipework 100 mm and greater to be welded to AS CB 15.

Up to 50mm diameter. - screwed to AS 1722.

Greater than 50mm diameter. - flanged to AS 2129.

Jointing by means of mechanical grooved couplings acceptable on low temperature piping (<82°C).

4.13.4 Bends

Preformed. Site made bends acceptable for diameters less than 50mm. Return to works for galvanising.

4.13.5 Thickness

Up to 100 diameter: Medium to AS 1074

Greater than 100 diameter: Schedule 40 to AS 1835, AS 1836

Note

- All galvanising to take place at works prior to threading. Paint exposed threads with cold galvanising solution.

4.14 Valves

4.14.1 Location

Allow for all valves necessary for control and regulation of the systems, including provision on all main branches, all equipment connections and all branches to equipment.

Allow adequate operational clearances.

Provide union between equipment and adjacent isolating valve to facilitate equipment removal.

All valves in easily accessible locations. Provide access hatches as necessary.

4.14.2 Selection

All valves to be suitable for systems into which they are to be fitted.

All main valves to be of one manufacturer as far as practical.

All valves to be line size unless otherwise indicated.

Valves connected to Authority Supply Service to be approved for use by that Authority.

4.14.3 Materials

Disk materials and body lining seat shall be in accordance with Australian Standards and Manufacturers recommendations, being suitably lined for resistance to the fluid being transferred.

4.14.4 Connections

Screwed up to DN 50; flanged DN 65 and over. Flange adaptors and electric separators required on flanged copper pipe.

4.14.5 Standards

Flanges to AS 2129. Bolting to AS 2528. AS 1628

4.14.6 Handwheels

Clockwise operation, extension spindles provided if necessary.

4.14.7 Markings Required

Manufacturers name, material, pressure rating, size. Indication of flow arrow required on check valves, strainers and uni-directional glove valves.

4.14.8 Labels

On all valves not immediately adjacent to apparatus controlled. Numbering system to engineer's approval.

4.14.9 Gate Valves

For the isolation of cold water supply systems where indicated on the drawings.

Body

- D.R. Brass(up to DN 50);
- Gunmetal (>DN 50 < DN 150);
- Cast Iron (> DN 150).

Bonnet

- D.R. Brass (up to DN 50);
- Gunmetal (>DN 50 < DN 150);
- Cast Iron (>DN 150).

Wedge

- D.R. Brass (up to DN 50);
- Gunmetal (>DN 50 < DN 150);
- Cast Iron (>DN 150).

Stem

- D.R. Brass;
- Inside screw non rising.

Handwheel

- Steel (up to DN 50);
- Aluminium (DN 65 – DN 80);
- Cast Iron (> DN 80).

4.14.10 Check Valves

Swing type with appropriate seals to AS 3578 and conforming to AS 1628.

(Up to 50 diameter, double flap spring return acceptable).

Body, Bonnet, Disc and Toggle.

Gunmetal.

Stainless steel or chrome plated brass ball (note: full flow ball valves).

PTFE seat.

Gunmetal lever handle (lockable).

4.14.11 Strainers

Up to DN 25

Line type strainer, line size.

Body - Gunmetal to As 1565.

Gauze - Stainless Steel 60 Mesh.

Working Pressure - 1400 kPa.

Over DN 25.

'Y' type strainer, line size.

Body

- Bronze or Cast Iron (up to DN50);
- Cast Iron or Cast Steel (greater than DN50).

Basket

- Stainless steel, perforated;
- Easily removable.

Mesh area of basket at least 4 times pipe diameter.

4.14.12 Backflow Prevention Devices

4.14.13 Double Check Detector Assembly

100mm to 150mm sizes

Criteria shall include: TO AS 2845.1

For the Main valve - Lightweight ductile iron construction with approved fusion epoxy coat inside and out, two independently operated spring loaded centre guided check valves, two non-rising stem resilient wedge gate valves, 3 resilient seated ball valve test cocks, nickel plated ball valve handles, no internal threads in body and cover, be serviceable inline with a single access cover.

For the by-pass valve - Brass body construction, two independently operated spring loaded centre guided check valves, two full port resilient seated ball valves for shut off and 3 resilient seated ball valve test cocks, entire unit serviceable inline and complete with approved water meter.

Preferred manufacturer and model: FEBCO Model 856 DCDA, RMC Watts and Tyco Keystone.

4.14.14 Reduced Pressure Zone Devices

20mm to 65mm sizes.

Criteria shall include: To AS 2845.1

Bronze body construction, two full port resilient seated ball valves for shut off and 3 resilient seated ball valve test cocks, nickel plated ball valve handles, entire unit serviceable inline and 'y Strainer upstream of the device.

Generally PRVs on down services are restricting pressures down to 200KPa.

Preferred Manufacturer – RMC Watts, FEBCO and Tyco Keystone.

4.15 Cables, Conduits and Ducts

4.15.1 Standards

Standard	Name
AS/NZS 3000	Electrical installations (also known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008.1.1	Electrical installations – Selection of cables – Cables for alternating voltages up to and including 0.6/1kV – Typical Australian installation conditions
AS/NZS 3013	Electrical installations – Classification of the fire and mechanical performance of wiring systems

4.15.2 Installation

Straight lines, grouped together, parallel to each other and parallel/perpendicular to building structure.

In false ceilings, wiring shall be concealed behind removable ceiling tiles by using cable ties fixed to a batten, hangar or catenary wires or on cable tray fixed directly to the structure. Cables shall not be laid directly on ceiling tiles.

Apply derating to cables shall bunch together.

Use loop-in, loop-out system so that cable runs are continuous from the point of supply to the final distribution point. No intermediate joints or splices shall be permitted.

Power cables shall be run in a manner that segregates them from other voltages and communications cabling.

4.15.3 Power Cables

0.6/1kV PVC insulated and PVC sheathed to

AS 3147 with copper conductors, 75EC, unless otherwise indicated on the drawings or schedules.

4.15.4 Power Cables in Air Plenums or Vertical Risers

0.6/1kV HFI-90-TP insulated, HFS-90-TP sheathed to AS 3147 with copper conductors, 90EC. Cables, cable ties, etc, shall be halogen free, Limited Fire Hazard type.

4.15.5 Control Cables

PVC insulated and PVC sheathed control cable to AS 3147 with copper conductors, 75EC.

4.15.6 Conductor Type

Stranded copper. Aluminium cables are not acceptable.

4.15.7 Conductor Sizes

Minimum 2.5 mm^2 power circuits

Minimum 1.5 mm^2 lighting circuits

Minimum 1.5 mm^2 control circuits

Size in accordance with AS 3000 and AS 3008, with due allowance for all derating factors applicable.

Reduced size neutrals not permitted.

4.15.8 Voltage Drop for ELV Circuits

10% maximum.

4.15.9 Colour Coding

A phase	Red
B phase	White
C phase	Blue
Neutral	Black
Earth	Green/Yellow

Other colours may be used for switch and control wiring

4.15.10 Conduit Type

Minimum heavy duty rigid PVC conduit to AS 2053.

Maximum 2 circuits per conduit.

Provide draw wires for all conduits.

Provide draw in boxes in long runs.

Plug conduits in buried or dusty locations with expanded polystyrene or similar to prevent dust and moisture ingress.

Conduits to be free from dirt and loose material before cables are drawn in.

4.15.11 Conduit Size

Minimum 20 mm dia. or as nominated on drawings.

4.15.12 Flexible Conduit

Final connection between fixed conduit and equipment to be flexible conduit, spiral, steel core, PVC sheathed.

4.15.13 Terminations

Crimp lugs or crimp pins, identified by numbered ferrules, and sleeved. Identification shall be made at each end of the cable run.

4.15.14 Indoor Conduit Installation

Conceal conduits in all locations except plantrooms.

Degree of protection IP 54.

Protected from mechanical damage.

Surface mounted conduit painted to match surface.

4.15.15 Structure Penetration

Seal openings around conduits or penetrations with fire retardant/water resistant sealant as required to the Supply Authority approval.

4.15.16 Cable Trays

Cable trays shall be either galvanised steel ladder type or galvabond steel perforated tray unless otherwise specified on drawings.

Maximum loading of any cable tray run shall not exceed 80% capacity as given in the Manufacturers data.

All trays shall be supported at intervals as advised in the Manufacturers data.

Supply and install all hangers, splices, bends, brackets, screws, nuts, etc. for a complete working system.

Differing voltage cables shall be on separate cable trays.

Coordinate routes with other Trades.

Show proposed routes on workshop drawings and obtain approval prior to installation.

Provide as indicated in drawings and/or schedules.

4.16 Instrumentation

4.16.1 Standards

Standard	Name
AS 1006	Solid stem general purpose thermometers
AS 1271	Safety valves, other valves, liquid level gauges and other fittings for boilers and unfired pressure vessels
AS 1349	Bourdon tube pressure and vacuum gauges
AS 4706	Pressure gauges for regulators used with compressed gas cylinders

4.16.2 General

All instruments to be supplied complete with test certificates from manufacturers. Provide one spare pressure gauge, thermometer.

All gauges are to be mounted so that they are vertical and at a height of no more than 2m from floor level.

Where mounting height is greater than 2m, a remote gauge shall be provided at lower level.

4.17 Electrical Cables and Conduit Support System

4.17.1 Manufacture

Submit sample for approval.

4.17.2 Sizing

Suitable size and strength and allow for expansion, contraction and anchoring of support systems.

4.17.3 Materials

Hot dipped galvanised steel. Cut ends shall have sharp edges removed, touch-up with a cold application galvanising paint, and finish or cap as necessary.

4.17.4 General

Secure to building structure only, to Manufacturers data and liaise with the Project Manager prior to installing support systems, cable trays and the like in order to facilitate economical and co-ordinated distribution routes. Coordinate conduit, cable, cable tray routes with other Trades. All proposed routes shall be identified on the workshop drawings.

5 Controls

5.1 Hydraulics Systems Controls

This section is to be read in conjunction with the BMCS Specification.

The new Chifley tower building contains the following hydraulics systems that have components within them that require either monitoring or control signals from the BMCS.

- Domestic Cold Water Service;
- Hot Water Service;
- Sanitary Waste Water Sump Pumps;
- Storm Water Detention Tank;
- Non potable Water Service;
- Natural Gas Service;
- Black Water Treatment System;
- Sewer mining system.
- Fire tanks.

5.1.1 Domestic Cold Water Storage Tank

Ref: CW-T-01

The domestic cold water storage tank is split into two halves and each contains a series of level switches to signal levels to the BMCS. Each section contains four alarms as follows.

Alarm Reference	Description	Operation
A-DCW-OF-1	Overflow alarm section 1.	Alarm on BMCS
A-DCW-OF-2	Overflow alarm section 2.	Alarm on BMCS
A-DCW-HL-01	High level alarm section 1.	Alarm on BMCS (tank full)
A-DCW-HL-02	High level alarm section 2.	Alarm on BMCS (tank full)
A-DCW-LL-01	Low level 20% capacity alarm section 1.	Alarm on BMCS (tank low)
A-DCW-LL-02	Low level 20% capacity alarm section 2.	Alarm on BMCS (tank low)
A-DCW-ULL-01	Ultra Low level 10% capacity alarm section 1.	Stop pumps
A-DCW-ULL-02	Ultra Low level 10% capacity alarm section 2.	Stop pumps

Each section also contains low level pump cutout switches supplied and installed by the pump suppliers. The pump cut outs are designed to suppress the operation of the pumps when the tanks are empty.

All level switches and cut outs are to be configured to allow continued operation in the event of one compartment being isolated and drained down.

5.1.2 Mains Water Booster Set

Ref: CW-TP-01

The mains water booster set lifts water from the basement intake to the roof top tank room. It is to operate under the dictates of its own internal controller. The internal controller is to have a single volt free contact to signal an alarm condition to the BMCS. The contacts are to be rated at 240Vac 5A.

5.1.3 Cold Water Booster Set

Ref: CW-BP-01

The domestic cold water booster set provides pressure boost to the hose reels and domestic cold water for the top floors of the building where gravity supply would be insufficient. It is to operate under the dictates of its own internal controller. The internal controller is to have a single volt free contact to signal an alarm condition to the BMCS. The contacts are to be rated at 240Vac 5A.

5.1.4 Domestic Hot Water Heaters

Ref: HWH 1, 2, 3, 4 and 5.

The domestic hot water heaters HWH 1-5 are packaged gas fired water heaters which will operate under the dictates of their own internal temperature sensors. The BMCS is to time the on and off sequencing of these units in order to allow shut down overnight etc.

The heaters are controlled on a time schedule from the BMCS the heaters are arranged to be operational whenever the time schedule calls for the system to generate hot water.

The heaters will be wired into the local MCC.

5.1.5 Heating Hot Water Heat Exchanger

The cold feed to the domestic hot water (DHW) system is coupled with the heating hot water (HHW) system via a plate heat exchanger. The intent is to transfer any heat from the tri-generation system that is not being used by the heating system, to the domestic hot water system. Heat transfer will be controlled by the BMCS via a 2-port valve on the HHW side of the heat exchanger to maintain a temperature of 68°C on the DHW side.

The BMCS Contractor will free issue a thermal energy meter (comprising a flow meter and temperature sensor) for installation by the hydraulic contractor.

5.1.6 Domestic Hot Water Circulating Pumps

Ref: DHWC 01, 2, 3 and 4

The pumps DHWC 01 - 4 circulate domestic hot water throughout the domestic hot water loop they are controlled on a time schedule from the BMCS the pumps are arranged to be operational whenever the time schedule calls for the system to generate hot water.

Each of the pumps will be wired into the local MCC.

The time schedule on the BMCS is configured to rotate the operation of the pumps DHWC 01 - 4 each operation cycle to ensure even wear on the pumps. The pumps have a differential pressure switch fitted across them to signal a failure to the BMCS system and energise the standby pump in the event of a failure of the lead.

5.1.7 NPCW transfer pumps

Ref: NPCW-TP-01

The non-potable water transfer pumps lift water from the basement to the roof top NPCW tank NPCW-T-01. It is to operate under the dictates of its own internal controller. The internal controller is to have a single volt free contact to signal an alarm condition to the BMCS. The contacts are to be rated at 240Vac 5A.

5.1.8 NPCW Tank

Ref: NPCW-T-01

The level 33 non-potable cold water tank is split into two halves and each contains a series of level switches to signal levels to the BMCS. Each section contains alarms and switches as follows.

Alarm Reference	Description	Operation
A-NPCW-T-OF-1	Overflow alarm section 1.	Alarm on BMCS
A-NPCW-T-OF-2	Overflow alarm section 2.	Alarm on BMCS
A-NPCW-T-HL-01	High level alarm section 1.	Alarm on BMCS
A-NPCW-T-HL-02	High level alarm section 2.	Alarm on BMCS
A-NPCW-T-RW-01	90% capacity alarm section 1	Stop RW-TP-01 and NPCW-TP-01
A-NPCW-T-RW-02	90% capacity alarm section 2	Stop RW-TP-01 and NPCW-TP-01
A-NPCW-T-RW-01	60% capacity alarm section 1	Initiate RW-TP-01 if no response initiate NPCW-TP-01
A-NPCW-T-RW-02	60% capacity alarm section 2	Initiate RW-TP-01 if no response initiate NPCW-TP-01
A-NPCW-T-LL-01	40% capacity alarm section 1	Open motorised valve CW-MV-01
A-NPCW-T-LL-02	40% capacity alarm section 2	Open motorised valve CW-MV-02

Alarm Reference	Description	Operation
A-NPCW-T-ML-01	50% capacity alarm section 1	Close motorised valve CW-MV-01
A-NPCW-T-ML-02	50% capacity alarm section 2	Close motorised valve CW-MV-02
A-NPCW-T-ULL-01	10% capacity alarm section 1	Stop pumps
A-NPCW-T-ULL-02	10% capacity alarm section 2	Stop pumps

Each section of the NPCW tank is supplied with treated rainwater and treated black water during every day use. Under normal operation the sequencing of supply to the recycled water tank is as follows:

- Rainwater feed to tanks (when available)
- Treated black water feed to tanks where levels drop to below 60% full;
- Treated black water feed to tanks until levels above 90%;
- Emergency mains water top up is also provided to each section and the 40% and 50% alarm sensors are used to provide supply from the mains during times when NPCW is unavailable to supply the system

Each section also contains low level pump cutout switches supplied and installed by the pump suppliers. The pump cut outs are designed to suppress the operation of the pumps when the tanks are empty.

All level switches and cut outs are to be configured to allow continued operation in the event of one compartment being isolated and drained down.

Level sensor to provide real time tank levels at all times.

5.1.9 NPCW Booster Set

Ref: NPCW-BP-01

The non-potable water booster set provides pressure boost for the top floors of the building where gravity supply would be insufficient. It is to operate under the dictates of it's own internal controller. The internal controller is to have a single volt free contact to signal an alarm condition to the BMCS. The contacts are to be rated at 240Vac 5A.

5.1.10 Rain water Storage Tanks

Ref: RW-T-01

Rain water storage tanks are provided at level 4 to store rainwater for reuse within the building. The tanks fill during wet weather and incorporate a series of level switches to signal levels to the BMCS. Each section contains alarms and switches as follows;

Alarm Reference	Description	Operation
A-RW-T-100%	Overflow alarm	Alarm on BMCS
~~A-RW-T-10%~~	~~10% capacity alarm section 1~~	~~Close motorised valve RW-MV-01 Open motorised valve RW-MV-03~~
A-RW-T- 10%	10% capacity alarm section 1	Stop pumps

Under normal operation the sequencing of supply to the rainwater tank is as follows:

- Rainwater from mid level tank supplied to treatment plant stops feeding tanks when levels below 10% or when HL alarm on the NPCW-T-01;

The tank contains low level pump cutout switches supplied and installed by the pump suppliers. The pump cut outs are designed to suppress the operation of the transfer pumps RW-TP-01 when the tanks are empty.

5.1.11 Rainwater Chlorination Equipment

Ref: RW-CL-01

The chlorination equipment is to be a packaged unit with all its internal control functions controlled from its own internal controller. The internal controller is to have volt free contacts to signal a common fault alarm to the BMCS. The contacts are to be rated at 240Vac 5A.

The BMCS upon receipt of this alarm signal from the equipment is to immediately shut down the chlorination equipment.

This change over will limit the quantities of untreated water being delivered to the building.

5.1.12 Rainwater Filtration Equipment

Ref: RW-F-01

The filter equipment is to be a packaged unit with all its internal control functions controlled from its own internal controller. The internal controller is to have volt free contacts to signal a common fault alarm to the BMCS. The contacts are to be rated at 240Vac 5A.

The BMCS upon receipt of this alarm signal from the equipment is to immediately shut down the filtration equipment.

This change over will limit the quantities of untreated water being delivered to the building.

5.1.13 Sprinkler Storage Tank

Ref: FS-T-01

The fire sprinkler storage tank FS T 01 has four (4) level switches within it to monitor the level. Each section contains two alarms.

Alarm Reference	Description	Operation
A-FS-OF-1	Overflow alarm section 1.	Alarm on BMCS –tank over flowing
A-FS-OF-2	Overflow alarm section 2.	Alarm on BMCS –tank over flowing
A-FS-HL-01	High level alarm section 1.	Alarm on BMCS – Indicating that the tank is not full
A-FS-HL-02	High level alarm section 2.	Alarm on BMCS – Indicating that the tank is not full

5.1.14 Hydrant Storage Tank

Ref: FH-T-01

The fire hydrant storage tank FHST-01 has four (4) level switches within it to monitor the level. Each section contains two alarms.

Alarm Reference	Description	Operation
A-FH-OF-1	Overflow alarm section 1.	Alarm on BMCS –tank over flowing
A-FH-OF-2	Overflow alarm section 2.	Alarm on BMCS –tank over flowing
A-FH-HL-01	High level alarm section 1.	Alarm on BMCS – Indicating that the tank is not full
A-FH-HL-02	High level alarm section 2.	Alarm on BMCS – Indicating that the tank is not full

5.1.15 ~~Incoming Domestic Cold~~ Water Meters

Refer to Potable and NPCW Water meter schedule. All water meters are to be monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.

~~Ref: WM-01~~

~~The Incoming mains water meter is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM-02~~

~~The water supply to the sprinkler tank is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM-03, 10 &11~~

~~The water supply to the low level retail is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM-04~~

~~The water supply to the hydrant tank is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM-05 and 9~~

~~The water supply to the two kitchens are monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM 06~~

~~The water supply to the hot water system is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM 07~~

~~The mains water supply to the NPCW tank NPCW-T-01 is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: WM 08~~

~~The mains water supply to the potable water tank CW-T-01 is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

5.1.16 ~~Incoming~~ Gas Meter

Refer to Gas meter schedule. All gas meters are to be monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.

~~Ref: GM 01~~

~~The project is provided with a gas utility meter for Cogent which is to be monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: GM 02~~

~~The project is provided with a gas utility meter which is to be monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: GM 03~~

~~The gas supply to the low level retail is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: GM 04 and 07~~

~~The gas supply to the two kitchens is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: GM 05~~

~~The gas supply to the HW plant is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

~~Ref: GM 06~~

~~The gas supply to the mechanical plant is monitored for volume flow by the BMCS. The meter is to provide pulses greater than 50 milliseconds in duration.~~

5.1.17 Sanitary Waste Water Pump Out Units

~~Ref: SP-02~~

The project incorporates sewer water pump out units. These are provided with their own packaged controllers. The control panels are arranged to operate the pumps when the sumps are full and stop pumping when the sumps are empty. The units incorporate volt free contacts for signalling to the BMCS a fault condition. The contacts are to be rated at 240Vac 5A.

5.1.18 Waste Water Pump Out Unit

~~Ref: SP-04~~

The project incorporates a storm water pump out unit. These are provided with their own packaged controllers. The control panels are arranged to operate the pumps when the sumps are full and stop pumping when the sumps are empty. The units incorporate volt free contacts for signalling to the BMCS a fault condition. The contacts are to be rated at 240Vac 5A.

5.1.19 Black Water Balance Tank

Ref: BW-BT-01 details of the black water controls are included within the black water specification.

Motorised sewer diversion valves are installed as part of the hydraulic package on the sewer lines and the cooling tower waste line at basement 2. These motorised solenoid valves fail safe close to divert all waste water out of the building. These valves are controlled via the Black water control package to control the inflow into the black water buffer tanks.

5.1.20 Over pressure Indication

There are 3 separate pressure reducing zones on each of the water services systems. Each pressure reducing assembly is to be provided with a pressure transducer monitored by the BMCS to identify pressure drift with time. The pressure transducer is to be provided by the BMCS contractor installed within a valved pocket provided by the hydraulic contractor.

The following schedule identifies the units and when the BMCS should raise an alarm;

Reference	Alarm Pressure
PRV-PW-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-PW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-PW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-NPW-HP	When the sensed pressure at midnight

Reference	Alarm Pressure
	has increased by 10% above the trended average.
PRV-NPW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-NPW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-DHW-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-DHW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-DHW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-HR-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-HR-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-HR-LP	When the sensed pressure at midnight has increased by 10% above the trended average.

Note: Trended average pressure is the average pressure sensed at midnight over the first 3 months post PC.

5.1.21 Gas shut off valves

Boiler room

An automatic gas detection system shall be installed in the boiler room. On detection of gas, the system will close the gas solenoid valve serving the room and the boiler plant shall stop. Emergency stop buttons will be installed adjacent to each exit. Activation of an emergency button will cause the gas valve to close and the boiler plant to stop. The hydraulics subcontractor shall provide the gas solenoid valve, gas detection system, emergency buttons and interconnecting wiring.

Tri-generation room

For safety reasons there shall be a hard wired interlock between the supply fan and the gas solenoid valve and the gas engine. On failure of the fan the gas valve shall close and the gas engine shall stop. Additionally there shall be emergency manual push buttons located adjacent to each exit door. On activation of either button the gas valve shall close causing the gas engine to stop. The hydraulic subcontractor shall provide the gas solenoid valve, emergency stop buttons and interconnecting wiring.

Trips from the FIP to gas solenoid valves are to be provided by the Fire contractor with final termination by Hydraulic contractor. All interlocked shuts offs are by Hydraulics.

6 Schedules

6.1 Samples

The following samples are to be provided as part of the works for comment prior to their incorporation.

Item	No.
Roof rainwater outlets	1 each
Floor drainage grate	1
Taps and brassware	1
Thermostatic mixer valve	1
Basin/sink trap	1
Chrome plated traps	1 No. of each type
Chrome plated pipework	1m 15∅
Air admittance valve	1
Insulation	1m of each type
Tundish	1 no. of each type

6.2 Spares/Consumables

The following spares are to be handed over to the principal at the end of the defects liability period.

Item	No.
Spare tap washer/ceramic insert	6 No. for each type of tap
Flow restrictors	6 No. for each different flow rate specified
Float valve washer	6 No. for each different type/size on project
Valve operating heads	2 No. for each different type/size on the project
Pressure gauge	1 No.
Temperature gauge	1 No.
Float valve	1 No. for each different type up to 20 ∅

6.3 Pipework Schedule

Item Pipework Materials	Location	Type/Duty
Sewer drainage (in ground externally)	External	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed.
Aerial sewer drainage (suspended)	Internal	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm) or Green star approved PVC
Sanitary plumbing branch lines and vents	Internal	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm) or Green star approved PVC
Trade Waste plumbing branch lines and vents	Internal	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm) and trace heated in the horizontal.
Stormwater in ground, smaller than 375mm diameter	External	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed.
RW Downpipes internal	Internal	HDPE "Geberit". Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm) or Green star approved PVC.
Domestic cold water	Internal	Copper Type A or B (AS 1432, AS 3500.1)
Non-Potable water	Internal	Lilac Stripe Cross linked Polyethylene with electrofusion couplings. But fusion will not be allowed or Stainless steel 316 "Blucher" Mapress. Roughins Cross linked polyethylene lilac colour
Hot water	Internal	Copper Type B (AS 1432, AS 3500.4)
Natural gas	Internal	Copper Type B (AS 1432, AS 5601)
Acoustic insulation	All drainage services	Pyrotek Soundlag 4525C or approved equal. As documented within specification and as required to meet acoustic engineers requirements
Hot water insulation	Pre lagged insulation	Kemlag or approved equal. As documented within specification

Item Pipework Materials	Location	Type/Duty
	Insulation to pipework where not prelagged	Thermotec or approved equal As documented within specification
RW downpipes	External	Stainless steel/copper sections to architects details matching the sizes on the hydraulic drawings
Subsoil Drainage	Internal	Polyethylene (HDPE)
Hose reel	Internal	Copper Type B.

6.4 Schedule of Rates – Hydraulic/Fire

The following schedule of rates shall be completed by the Tenderer for the purposes of variations only. Amounts shown shall be all-in and include all preliminary costs, attendance and profit. Items of equipment listed are supply and install and include labour costs assuming normal time.

	Rate	$	¢
Labour			
Tradesman	Hr		
Tradesman Assistant	Hr		
Apprentice	Hr		
Electrician	Hr		
Excavation in OTR to maximum of:			
1 metre deep	M^3		
1.5 metre deep	M^3		
2.0 metre deep	M^3		
3.0 metre deep	M^3		
Excavation in rock to maximum of:			
1 metre deep	M^3		
1.5 metre deep	M^3		
2.0 metre deep	M^3		
3.0 metre deep	M^3		
Bedding to pipes 100mm blue metal	M^3		
Backfill to pipes to 150mm above collars in sand	M^3		
Backfill to pipes up to surface level in selected excavated material	M^3		

6.5 Schedule of Prices – Hydraulic Services

6.5.1 General Preliminaries

The following schedule is to be completed as part of the tender return. It is to identify the total cost for each element allowed in the return.

Item	
Preliminaries and General Conditions (inc. man power forecasts*)	$
Production of Workshop Drawings/Installation drawings	$
Testing and Commissioning	$
O & M Manuals (including Work as executed drawings)	$
Principal Training	$
Supplies from Local Authorities, including fees	$
Supply of Samples	$
Subtotal:	$

* The contractor is to submit a man power forecast histogram with his return identifying numbers of labourers, tradesmen, supervisors and managers for the hydraulic services he shall have on site week by week for the contract duration.

6.5.2 Technical

Item	
Incoming Cold Water Main including meter, back flow prevention and pumps	$
Allowance for new water connection (if existing not reusable)	$
Domestic Cold Water System from pump (excluding tank)	$
Domestic Cold water tank	$
Domestic Hot Water System (excluding heaters)	$
Gas Fired Heaters and meters	$
Gas Service inc. meters and street connection (excluding Trigeneration supply)	$
35KPa Gas Service inc. meters serving Trigeneration	$
Sewer Drainage in slab and sump pump	$
Aerial Drainage and Sanitary Plumbing (suspended)	$
Cooling tower drainage and motorised diversion valve	$
Storm water Drainage (suspended) and Downpipes	$
Storm water Drainage in ground to GPT	$
New sewer connection (if existing not reusable)	$
Rainwater tanks and OSD tank and rainwater treatment plant	$
Sanitary fixtures and Associated Equipment	$
Taps and Water Outlets	$
Trade waste including GA	$

Item	
Oil Seperator	
Non-potable water booster and reticulation (excluding tanks)	$
Non-potable water tanks	$
Subsoil drainage and sump pump	$
Hose reel service and system	$
Fire services connections to street main	$
Fire services tanks	$
Insulation (thermal and acoustic)	$
Precommisioning	$
Pressure testing	$
Sterilisation	$
Controls	$
TOTAL	**$**

Note

The Hydraulic Contractor is to return with his tender a manpower histogram for the duration of the project identifying the number of operatives and grades present on site each day.

TOTAL COST	$

Signed:
Name:
Position:
Company Name:
Date:

6.5.3 Schedule of Equipment – Hydraulic Services

The following schedule is to be completed with the details of the manufacturer and types of equipment included for within the tender return.

Item	Manufacturer(s)	Type/Duty
Hot Water Heaters (gas fired)		
Toilet suites		
Hand basins		
Tea sinks		
Urinals		
Tapware		
Cold water meters		
Gas meters		
Hot water insulation		
Cold Water Supply booster set		
NPCW Supply booster set		
Thermostatic Mixing Valves		
Plate heat exchangers		
Hot water circulation pumps		
Balancing valves		
RPZDs		
Double check valves		
Ball valves		
Gate valves		
Hose cocks		
Floor waste and grates		
Gravity Rainwater roof outlets		

7 Equipment Data Sheets

7.1 Potable water

Item	Incoming Cold Water booster pumps
Pump No.	CW-TP-01
Location	Basement 1 water meter room
Manufacturer	Prime Pumps, Grundfos, Kelair or approved equal
Type	Vertical multi-stage / centrifugal / electric / constant speed drive
Quantity	2 main pumps (one duty and one standby)
Duty	Main (each pump) – 3.5L/s @ 113m (notes 1 and 2)
Materials	Body: Cast Iron Impeller: Stainless Steel Manifolds: Copper
Finish colour	Blue
Power	3 phase 415V 50Hz
Hydraulic accumulator	60L (PN20) Carbon steel or stainless steel
Remarks	Minimum 60% efficiency with soft start and soft stop Complete with control panel, pressure sensors, pressure switches, auto change over, and volt free contacts for BMCS interface and anti-vibration mounts.

Item	Cold Water booster pumps
Pump No.	CW-BP-01
Location	L33(external exposed to weather)
Manufacturer	Prime Pumps, Grundfos, Kelair or equal
Type	Vertical multi-stage / centrifugal / electric / variable speed drive
Quantity	1 Jacking pump 2 main pumps (one duty and one standby)
Duty	Jacking – 0.25L/s @ 31m Main (each pump) – 3.8 L/s @ 30m (notes 1 and 2)
Materials	Body: Cast Iron Impeller: Stainless Steel Manifolds: Copper
Finish colour	Blue
Power	3 phase 415V 50Hz
Hydraulic accumulator	60L (PN10) Carbon steel or stainless steel

Item	Cold Water booster pumps
Remarks	Minimum 60% efficiency. Pump to include suitable weather IP protection and anti vibration mounts. Complete with weather proof control panel, pressure sensors, pressure switches, auto change over, and volt free contacts for BMCS interface

Item	Cold Water Storage Tank
Tank No.	CW-T-01
Location	L33 (external)
Manufacturer	Tasman Tank or equal
Capacity	15,000 litre total
Size	2.5m wide x 3m long x 2.5m high
Material and Construction	Flat Base tank. Top access. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade Tank lid to be Stainless steel 316 grade.
Air gap	AS3500 registered air gap
Overflows	1 x 100mm overflow per partition
Description of operation	Tank stores potable drinking water for reticulation throughout The Water level will fluctuate with demand.
Sludge Drain	50mm at base of tank
Connections	As required by drawings. 2 x 50mm ball valve inlets. 2 x 80mm manifold outlet 100mm at base of tank.
Insulation	Provide 25mm thick thermal insulation to entire tank surface including roof. To be Rockwool suitable for external installation or equal approved
Remarks	Sectional stainless steel tank split into 2 equal partitions for maintenance complete with raised ball valve housing, lid, ladders, access and 2 x multitrode level sensors to enable real time tank level information. All plaints and supports by builder set out by Hydraulic contractor.

Notes:

1. The pump duty as shown above is indicative, the Contractor shall confirm the pump duty as part of his workshop design and shall apply and pay for a new Sydney water pressure enquiry as part of confirming pump duty.
2. Submit with detailed hydraulic calculations with isometric diagrams and pump curves for review prior to purchase and installation.
3. The booster pumps shall automatically operate when the pressure drops below the pre-set pressure limit. The pump panel shall control the pump operation so that each pump alternates after each cycle of operation. If the duty pump fails to operate, the standby pump shall be brought into operation immediately and the control panel shall indicate the non-operation of the duty pump to the BMCS. Pump operation shall be monitored by the BMCS.

7.2 Non-potable Cold Water

Item	NPCW transfer booster pumps
Pump No.	NPCW-TP-01
Location	Basement 2 Black water room
Manufacturer	Prime Pumps, Grundfos, Kelair or equal
Type	Vertical multi-stage / centrifugal / electric / constant speed drive
Quantity	2 main pumps (one duty and one standby)
Duty	Main (each pump) - 3L/s @ 156m (note 1,2&3)
Materials	Body: Cast Iron Impeller: Stainless Steel Manifolds: Copper
Finish colour	Lilac
Power	3 phase 415V 50Hz
Hydraulic accumulator	60L (PN20) Carbon steel or stainless steel
Remarks	Minimum 60% efficiency with soft start and soft stop and anti vibration mounts. Complete with control panel, pressure sensors, pressure switches, auto change over, and volt free contacts for BMCS interface

Item	NPCW booster pumps
Pump No.	NPCW-BP-01
Location	L33(external exposed to weather)
Manufacturer	Prime Pumps, Grundfos, Kelair or equal
Type	Vertical multi-stage / centrifugal / electric / variable speed drive
Quantity	1 jacking pump 2 main pumps (one duty and one standby) (note 1,2 &3)
Duty	Jacking – 0.25L/s @ 31m Main (each pump) – 3.7 l/s @ 30m
Materials	Body: Cast Iron Impeller: Stainless Steel Manifolds: Copper
Finish colour	Lilac
Power	3 phase 415V 50Hz
Hydraulic accumulator	60L (PN10) Carbon steel or stainless steel
Remarks	Minimum 60% efficiency. Pump to include suitable weather IP protection and anti vibration mounts. Complete with weatherproof control panel, pressure sensors, pressure switches, auto change over, and volt free contacts for BMCS interface

Item	NPCW Storage Tank
Tank No.	NPCW-T-01
Location	L33 (external)
Manufacturer	Tasman Tank or equal
Capacity	60,000 litre
Size	5.5m wide x 5m long x 2.5m high
Material and Construction	Flat Base tank. Top access. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade Tank lid to be Stainless steel 316 grade.
Air gap	AS3500
Overflows	1 x 100mm overflow per partition
Description of operation	Tank stores non-potable water for reticulation throughout building to NPCW uses. The Water level will fluctuate with demand. Refer to controls section for details of level controls.
Sludge Drain	50mm at base of tank
Connections	As required by drawings. 6 x inlets within raised inlet valve housing controlled via level sensors and BMS. 2 x 80mm manifold outlets 100mm from base of tank.
Insulation	Provide 25mm thick thermal insulation to entire tank surface including roof. To be Rockwool suitable for external installation or equal approved.
Remarks	Sectional stainless steel tank split into 2 equal partitions for maintenance complete with raised inlet valve housing, lid, ladders, access and all multitrode level sensors providing real time tank levels. All plinths and supports by the builder set out by the hydraulic contractor.

Notes:

1. The pump duty as shown above is indicative, the Contractor shall confirm the pump duty as part of his workshop design.
2. Submit with detailed hydraulic calculations with isometric diagrams and pump curves for review prior to purchase and installation.
3. The booster pumps shall automatically operate when the pressure drops below the pre-set pressure limit. The pump panel shall control the pump operation so that each pump alternates after each cycle of operation. If the duty pump fails to operate, the standby pump shall be brought into operation immediately and the control panel shall indicate the non-operation of the duty pump to the BMCS. Pump operation shall be monitored by the BMCS.

7.3 Domestic Hot Water

Item	Domestic Hot water heaters
Reference.	HWH-01, 2, 3, 4 and 5
Manufacturer	Rinnai (HD) or equal
Capacity	315L Storage with 200MJ/hr output
Energy Source	Gas Fired
Quantity	5 no packaged Storage vessels coupled to Heavy Duty continuous flow water heaters including flues discharging above L33.
Storage Vessel Type	Steel Pressure storage vessel with double layer Vitreous enamel coating. Maximum shell working Pressure 680 of KPa. Complete with pre-insulation, Anodes, TPR Relief Valve and required connections.
Location	L31 plantroom
Hotwater output flow	Combined output of not less than 5,000L/hr for the first hour.
Function	Allows central circulating hot water plant to serve multiple pressure zones by replacing circulating heat losses on lower pressure zones with heat from upper zone. Hot water plant cold water feed supplied via a plate heat exchanger to enable pre-heat.
Hot water output temperature	65°C

Item	Hot water circulation heat exchangers
Reference.	HX-01,02 & 03
Manufacturer	Alfa Laval or approved equal
Type	Plate type – stainless steel 316 plate
Quantity	As per drawings
Duty	Heat demand 3.5kW Flow rate 0.3 l/s Maximum pressure drop 0.5mhd
Function	Allows central circulating hot water plant to serve multiple pressure zones by replacing circulating heat losses on lower pressure zones with heat from upper zone.
Primary ΔT	3°C max
Secondary ΔT	3°C max
Operating pressure	1000kPa max

Item	Hot water circulation pumps
Reference.	DH-WC-01,02,03,04
Location	As per drawings
Manufacturer	Grundfos or equal
Type	Direct drive inline single head bronze circulator. Pipeline mounted
Quantity	As per drawings Each location shall have 2 pumps, one Duty one Stand by
Duty	0.2 l/s @ 1mhd (each)
Working temperature	65°C max
Efficiency	Minimum 75%
Electrical Supply (V/Ph/Hz)	240/1/50
Remarks	Pumps are to incorporate volt free contacts for BMCS controls The pumps are to have a differential pressure switch fitted across them to allow the BMCS to Control and monitor operation. BMCS is to rotate the duty pump each operation.

7.4 Sanitary Drainage

Item	Grease Arrestor
Reference.	GA-01
Location	Basement 2
Manufacturer	To have Sydney Water Approval
Type	Sydney water compliant Boat Type Below Ground. Intercepting B.O.D., Suspended solids, Grease
Quantity	1 no
Size	3000L
Remarks	c.w. Gas Tight Concrete and Inspection openings on outlet plus stainless steel platform and ladder. Camlock pump out line to be provided.

Item	Oil Separator
Reference.	OS-01
Location	Basement 2
Manufacturer	Clearmake or equal. To have Sydney Water Approval.
Type	Sydney water compliant separator oil/water/solids separation
Quantity	1 no
Size	Min 1000 l/hour handling capacity
Remarks	c.w. Holding tank min 1500 litre capacity, pump and all associated controls to be provided. Separator to be Stainless steel construction type 316.

Item	Sump pump
Pump No.	SP-02
Location	Basement 2
Manufacturer	Flygt, Grundfos, Kelair or equal
Type	Submersible macerator pumps
Quantity	2 main pumps (one duty and one standby/emergency assist)
Duty	(each pump) - 2L/s @ 15m (notes 1 and 2)
Materials	Body: Cast Iron Impeller: Cast Iron Manifolds: to match system piping
Power	3 phase 415V 50Hz
Remarks	Minimum 60% efficiency. The pumps are to be supplied complete with control panel, float switches, guide rails, lifting chains and volt free contacts for BMCS interface. The pump well is to be Kelair (or equal) 4,900 litre capacity manufactured fully approved model DP 1880 x 1800 fibre glass station 1880mm dia x 1800mm high fitted with medium duty cast iron gas tight cover including all internal pipework and 50mm check valves and ball valves. Depth of pit to be confirmed by contractor prior to order.

Notes:

1. The pump duty as shown above is indicative, the Contractor shall confirm the pump duty as part of his workshop design.
2. Submit with detailed hydraulic calculations with isometric diagrams and pump curves for review prior to purchase and installation.

7.5 Rainwater System

Item	First flush diverter
Reference.	RW-FF-01&2
Location	Level 4
Duty (each)	Flow: 46 l/s To trap first 200 L in a 225mm diameter pipe, and divert to tank overflow at a rate no more than 5L/minute
Pipe connection	225mm diameter
Quantity/Location	2
Remarks	Filter incoming rainwater and planter drainage prior to storage tank .

Item	Rainwater storage tank 1
Tank No.	RW-T-01
Location	L4
Manufacturer	Tasman Tank or equal
Capacity	50,000 litre total
Size	3m wide x 7.5m long x 3m high
Material and Construction	Flat Base tank. Side access. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade GMS lid is acceptable with insulation to prevent galvanic corrosion
Air gap	N/A
Overflows	1 x 300mm overflow below tank inlets to OSD tank on Level 3.
Description of operation	Tank stores rainwater for reticulation throughout The Water level will fluctuate with weather. During heavy storms may fill from empty in a number of minutes.
Sludge Drain	50mm at base of tank
Connections	As required by drawings 2 x 225mm incoming and 1 x 100mm fire hydrant test line. 2 x 50mm manifold outlet 100mm from base of tank
Remarks	Sectional stainless steel tank complete with lid, access and all multitrode level sensors to enable real time levels on the BMS. Plinths and supports by builder set out by Hydraulic contractor.

Item	Rainwater onsite detention tank
Tank No.	RW-OSD-01
Location	L3
Manufacturer	Tasman Tank or equal
Capacity	16,000 litre total
Size	2m wide x 4m long x 2.5m high
Material and Construction	Flat Base tank. Top access. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade GMS lid is acceptable with insulation to prevent galvanic corrosion.
Air gap	NA
Incoming	1 x 300mm from RW-T-01
Outlet	1 x 105mm orifice plate to limit flow to 32 l/s. Access to be provided for orifice inspection.
Overflows	1 x 300mm overflow below tank inlets
Description of operation	Tank is normally empty, and fills during storms due to throttled outlet. The Water level will fluctuate.
Sludge Drain	50mm at base of tank
Connections	As required by drawings including an orifice plate on the outlet to limit discharge to 32 l/s at 100mm from base of tank
Remarks	Sectional stainless steel tank complete with lid, and access.

Item	Rainwater onsite detention tank
Tank No.	RW-OSD-02
Location	Basement 2
Manufacturer	Tasman Tank or equal
Capacity	3,500 litre total
Size	2.5m wide x 2m long x Min 1m high
Material and Construction	Flat Base tank with side access including all associate structural support to elevate tank at required invert to be provided by the hydraulic contractor. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade GMS lid is acceptable with insulation to prevent galvanic corrosion.
Air gap	NA
Incoming	1 x 150mm and 1 x 225mm from Plaza drainage above IL 22.650
Outlet	1 x 200mm outlet. Outlet at IL21.000
Overflows	1 x 225mm overflow at IL 22.250 to SP-5 well
Description of operation	Tank is normally empty, and fills during storms due to throttled outlet. The Water level will fluctuate. Outlet from tank discharges via 90mm orifice plate to GPT to Storm water pump set SP-05. Maximum pumped discharge set to 16l/s.
Sludge Drain	50mm above base of tank.
Remarks	Sectional stainless steel tank complete with lid, and access. Access to be provided for maintenance and inspection of orifice plate. Tank base at RL20.900 which is located at high level in black water plant room supported on a free standing steel frame to be provided as part of tank.

Item	Rainwater transfer pumps
Pump No.	RW-TP-01
Location	Level 4
Manufacturer	Prime Pumps, Grundfos, Kelair or equal
Type	Vertical single-stage / centrifugal / electric / constant speed drive
Quantity	2 main pumps (one duty and one standby)
Duty	Main (each pump) - 1L/s @ 147m
Speed	2900rpm
Materials	Body: Cast Iron Impeller: Stainless Steel Manifolds: Copper
Finish colour	Green
Power	3 phase 415V 50Hz
Hydraulic accumulator	60L (PN20) Carbon steel or stainless steel
Remarks	Minimum 60% efficiency. Complete with control panel, pressure sensors, pressure switches, auto change over, and volt free contacts for BMCS interface

Item	Rainwater Filter
Reference.	RW-F-01
Location	Level 4
Type	Pressure differential activated auto Backwash Cleanable Mesh screen filters 50micron
Duty (each)	1 l/s (maximum pressure drop 10kpa)
Pipe connection	32mm diameter
Quantity/Location	Level 4 with 2 units in parallel
Remarks	Filters stored Rainwater prior to distribution

Item	Chlorine dosing
Reference.	RW-CF-01
Location	Level 4
Manufacturer	Wallace and Tiernan - Chem-Ad Series A Dosing Unit or equal
Dossing Type	Diaphragm metering pump with nominal flow 0.2 li/hr at 10 bar with auto controller. Dosing Proportional to flow rate to system.
Duty (each)	1 l/s
Dosing Concentration	2.5-3.0ppm
Chlorine agent	Sodium hypochlorite
Reservoir size	60L
Chlorine Concentration	5% to system
Monitoring unit	Chlorine to be dosed proportional to flow in flush water line. Flow to be monitored with flow meter. Residual Chlorine to be measured downstream of dosing point (2000mm) with analyser to verify dose.
Controller	Microprocessor based controller for control to 2.5-3.0ppm chlorine residual in flush water line dependant on inputs from flow meter and analyser
Pipe connection	50mm diameter
Quantity/Location	1 unit
Remarks	Dosing level to be suitable for irrigation supply.

Item	Storm water Sump pump
Pump No.	SP-04
Location	Basement 3
Manufacturer	Flygt, Grundfos, Kelair or equal
Type	Submersible pumps
Quantity	2 main pumps (one duty and one standby/emergency assist)
Duty	(each pump) – 3.5L/s @ 13m (notes 1 and 2)
Materials	Body: Cast Iron Impeller: Cast Iron

Item	Storm water Sump pump
	Manifolds: to match system piping
Power	3 phase 415V 50Hz
Remarks	Minimum 60% efficiency. The pumps are to be supplied complete with control panel, float switches, guide rails, lifting chains and volt free contacts for BMCS interface. The pump well is to be Kelair (or equal) 4,900 litre capacity manufactured fully approved model DP 1880 x 1800 fibre glass station 1880mm dia x 1800mm high fitted with medium duty cast iron gas tight cover including all internal pipework and 50mm check valves and ball valves.

Notes:

1. The pump duty as shown above is indicative, the Contractor shall confirm the pump duty as part of his workshop design.
2. Submit with detailed hydraulic calculations with isometric diagrams and pump curves for review prior to purchase and installation.

Item	Storm water Sump pump
Pump No.	SP-05
Location	Basement 2
Manufacturer	Grundfos DP or equal
Type	Submersible pumps
Quantity	3 main pumps (duty, assist, standby)
Duty	(each pump) - 8L/s @ 16m (notes 1 and 2)
Speed	2900rpm
Power	3 phase 415V 50Hz Emergency Power
Remarks	Minimum 60% efficiency. The pumps are to be supplied complete with control panel, float switches, guide rails, lifting, NRVs, chains and volt free contacts for BMCS interface. Pump well to be 2m x 1.5m x 2m tall with cover and over flow Pumps form part of OSD strategy for storm water that has passed through the Humes STC2 Gross Pollutant trap (also to be provided by Hydraulic contractor). A fully complete robust pumped storm water solution is to be provided by the contractor.

Notes:

1. The pump duty as shown above is indicative, the Contractor shall confirm the pump duty as part of his workshop design.
2. Submit with detailed hydraulic calculations with isometric diagrams and pump curves for review prior to purchase and installation.

7.6 Fire tanks

Item	Fire Sprinkler Tank and Liner
Tank No.	FS-T-01
Location	B3
Type	Butyl lining to be supplied to Concrete structural tank
Capacity	160,000 litre total (each 80,000 litres)
Size	3m wide x 13m long x 2.7m high
Air gap	AS3500 registered air gap
Overflows	1 x 150mm overflow per partition at 2450mm above tank base
Description of operation	Tank stores water reserved for fire fighting
Sludge Drain	50mm at base of tanks
Connections	As required by drawings. 2 x 100mm manifold outlets at 100mm from tank base. 2 x 50mm inlets at 2400mm from tank base 2 x 100mm inlets at 2300mm from tank base from flow test. Connections for external pressure sensor to provide tank level.
Tank Liner Material	Butyl Liner
Tank Liner Hardness	65+/-5 IRH
Tank Liner Modulus @ 300% elongation	Minimum 4.5MPa
Tank Liner Tensile Strength	Minimum 9MPa (Minimum 350% elongation at break) After aging 168h/121ºC – Minimum 7.5MPa (Minimum 300% elongation at break)
Tank Liner Tear Strength	Minimum 23kN/m
Tank Liner Ozone Resistance 96h/30ºC 50PPhm and 80% elongation	No Cracks
Tank Liner Brittle point	Max -30ºC
Remarks	Provide all connections and level sensors are to be external to the tank. Tank complete with vortex inhibitors. Tank to be completely lined internally (including column) Tank structure is documented within structural package

Item	Fire Hydrant Tank
Tank No.	FH-T-01
Location	L3
Manufacturer	Tasman Tank or equal
Capacity	25,000 litre total
Size	3.5m wide x 3.5m long x 2.5m high

Material and Construction	Flat Base tank. Top access. Tank structure (panels, bolts and bracing) to be Stainless steel 316grade GMS lid is acceptable with insulation to prevent galvanic corrosion
Air gap	AS3500 registered air gap
Overflows	1 x 150mm overflow per partition
Description of operation	Tank stores water reserved for fire fighting The Water level will constant for majority of the tanks life. Levels will drop during testing maintenance and fire events.
Sludge Drain	50mm at base of tank
Connections	2 x 100mm manifold outlet 100mm above base of tank 2 x 50mm ball valve inlets.
Remarks	Sectional stainless steel tank split into 2 equal partitions for maintenance complete with raised ball valve housing, lid, access and all multitrode level sensors and vortex inhibitor. Plints and supports by Builder set out by Hydraulics.

7.7 Meter schedule

Water Meters	**Number**	**Level**
Incoming water meter	WM-01	B1
Sprinkler tank top up	WM-02	B3
Retail water meter	WM-03	B1
Hydrant tank top up	WM-04	L3
~~L18 Kitchen water meter~~	~~WM-05~~	~~L18~~
Hot water supply	WM-06	L31
NPCW top up	WM-07	L33
Cold water tank top up	WM-08	L33
~~L30 Kitchen water meter~~	~~WM-09~~	~~L30~~
Retail water meter	WM-10	B1
Retail water meter	WM-11	B1
Carpark FHR meter	WM-12	B1
Garbage room and carwash bay meter	WM-13	B1
NPCW meters	**Number**	**Level**
Treated Rainwater meter	NPWM-01	L33
Treated Black water meter	NPWM-02	L33
NPCW to cooling towers	NPWM-03	L33
NPCW to WCs and Urinals	NPWM-04	L33
L30 Irrigation meter	NPWM-05	L30
L18 Irrigation meter	NPWM-06	L18

Water Meters	Number	Level
~~Garbage room and carwash bay meter~~	~~NPWM-07~~	~~B1~~
Plaza Irrigation meter	NPCW-08	Plaza
~~Hot water meters~~	~~Number~~	~~Level~~
~~Level 18 Kitchen~~	~~HWM-01~~	~~18~~
~~Level 30 Kitchen~~	~~HWM-02~~	~~30~~
Garbage room washdown	HWM 03	B1
Gas meters	**Number**	**Level**
Incoming meter Cogen	GM-01	B1
Incoming meter building	GM-02	B1
~~Tenancy retail meter~~	~~GM-03~~	~~B1~~
~~L18 Kitchen meter~~	~~GM-04~~	~~L18~~
HW plant meter	GM-05	L31
Mechanical plant meter	GM-06	L33
~~L30 Kitchen meter~~	~~GM-07~~	~~L30~~

APPENDIX 3.4.1 PART IV

INNACO PTY LTD CAPABILITY STATEMENT

INNACO

INFRASTRUCTURE SOLUTIONS

- TURNKEY DESIGN & CONSTRUCT
- INFRASTRUCTURE REFURBISHMENT
- O&M CONTRACTS

INNACO PTY LTD

CAPABILITY

2011/2012

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Contact Details

Level 5, 79 Victoria Avenue Chatswood NSW 2067

02 9417 7728

email@innaco.com.au

www.innaco.com.au

Rodney Boss 0413 099 144

ABN: 59 908 277 179

ACN: 119 715 052

1. Executive Summary

INNACO is accomplished in the provision of turn-key water treatment technologies and with the expertise and back up of a variety of technology suppliers, successful project outcomes are assured. INNACO is a subsidiary of Henry & Hymas consulting engineers who have been at the forefront of infrastructure design for the past decade.

The INNACO team with the expert guidance of in-house process designers, utilise the best market available technologies to match Client outcome and budget requirements.

INNACO P/L is fully backed by parent company Henry & Hymas. As may be seen in the attached documents and on the company web-site, Henry & Hymas is a skilled multidiscipline consulting company. Henry & Hymas have a wealth of water, sewer, including pressure sewer, expertise and project experience, with excellent communication and design project management systems to provide responsive and cutting edge solutions.

INNACO understands the importance of excellent project management, especially in OHS, Environment and Quality management areas and so bring people to this task with a broad level of expertise.

Our Services

- Civil, mechanical, electrical and process design.
- Environmental approvals.
- Construction.
- Commissioning and performance validation.
- Refurbishment of Infrastructure.
- Operation and Maintenance Contracts.

Sectors

- Municipal
- Industrial
- Water
- Mech/Elec
- Renewable Energy

2. Track Record

2.1. Gordon Golf Course Sewer Mining Facility

Innaco was awarded a contract with Ku-ring-gai Council for design, construction, operation and maintenance of the 300kL/d sewer mining plant and storage facility as the water supply option for Gordon Golf Course.

Concept Layout of Gordon Golf Course Sewer Mining Project

The project involves breaking into an existing sewer main which traverses the site, extracting the raw sewage and transferring via rising main to the treatment facility. The treatment facility houses the MBR (membrane bioreactor) which utilises a combination of physical, biological and chemical processes with the final step being a disinfection system to ensure the recycled water is fit for purpose. Two 1 ML storage tanks hold the treated product water.

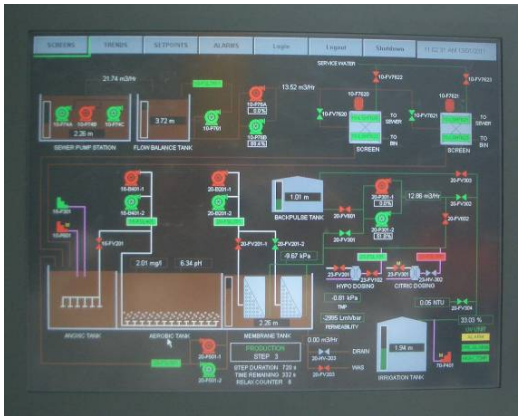
The recycled water is used to irrigate the golf course . The plant was officially opened in March 2011 and Innaco will operate and maintain the plant for a period of 15 years on behalf of Council.

Gordon Water Treatment Plant

MBR and process equipment

Treated Water buffer tank and UV

Inlet Buffer Tank and Control Cabinet



Human Interface Touch Screen Panel.

2.2. North Turramurra Recreation Area Sewer Mining Facility

Innaco is the principal contractor on the North Turramurra Golf Course Sewer Mining Scheme. The project is currently being constructed (anticipated finish is April 2012) by INNACO Pty Ltd and the technology provider chosen for the Gordon Golf Course project is GE Water. The treatment plant will utilise a combination of physical, biological and chemical processes with the final step being a disinfection system to ensure the recycled water is fit for purpose. The recycled water will be used to irrigate the golf course and the treatment plant has a capacity of 300kL/day. Innaco has developed relationships with key stakeholders such as Sydney Water and the NSW Office of Water (previously Department of Water and Energy). Innaco along with Henry & Hymas has been involved with this project from feasibility stage and has a 15 year operation and maintenance contract on the project. Reference for this project is Mr. Jay Jonasson (02 9424 0805).

3D Render of the Treatment Plant and Storage Tanks

Thrust Boring the Rising Main

Access Road Earthworks March 2011

2.3. St Ives Showground Leachate Treatment

A disused landfill tip in St Ives is being mined for irrigation water for use on the nearby showground. The disposal of the leachate was previously costing Kuring-Gai Council $400K per annum. INNACO has just completed construction of a plant to treat up to 160 KL/day. Innaco has the operation and maintenance contract of this particular plant for a period of 5 years.

Plant room

Filter backwash discharges to this bio-filter

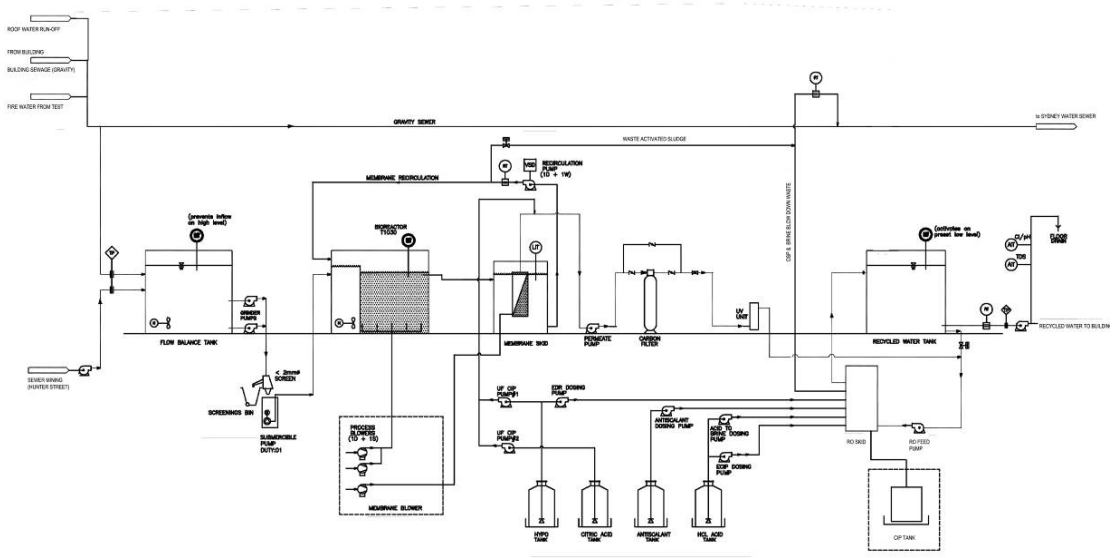
2.4. 8 Chifley Square

Innaco is currently working for Planet Plumbing on the design, supply and installation of a 50kL/day recycled water plant for providing water for irrigation, cooling towers and toilet flushing in a new commercial building at 8 Chifley Square in Sydney. Innaco is preparing the documentation under the Water Industry Competition Act (WICA) to enable operation of the scheme, full process, mechanical and electrical design, and the installation of all equipment in the treatment room. The plant is expected to be installed by October 2012 (depending on the outcome of the approvals) and ready for opening of the building in March 2013.

8 Chifley Square will be a premium grade, sustainable commercial tower on a landmark Sydney CBD site. It will stand a height of 30 storeys, with an approximate net lettable area of 19,000 square metres. The colorful building would seek both a six-star Green Star and five-star ABGR rating, the highest level of certification available under both systems.

Reference for this project is Mr. Tone Barber of Planet Plumbing 0415 555 154.

Artist impression of 8 Chifley Square



2.5. Erskine Park Landfill Leachate Treatment

Transpacific operate a landfill operation at Erskine Park. INNACO was engaged to design a treatment system to purify the leachate water prior to discharge to the environment. Full design documentation was issued in mid 2011 by Innaco and construction of the project has already started. Innaco is not undertaking the construction of this project.

2.6. Canada Bay Stormwater Improvement Works

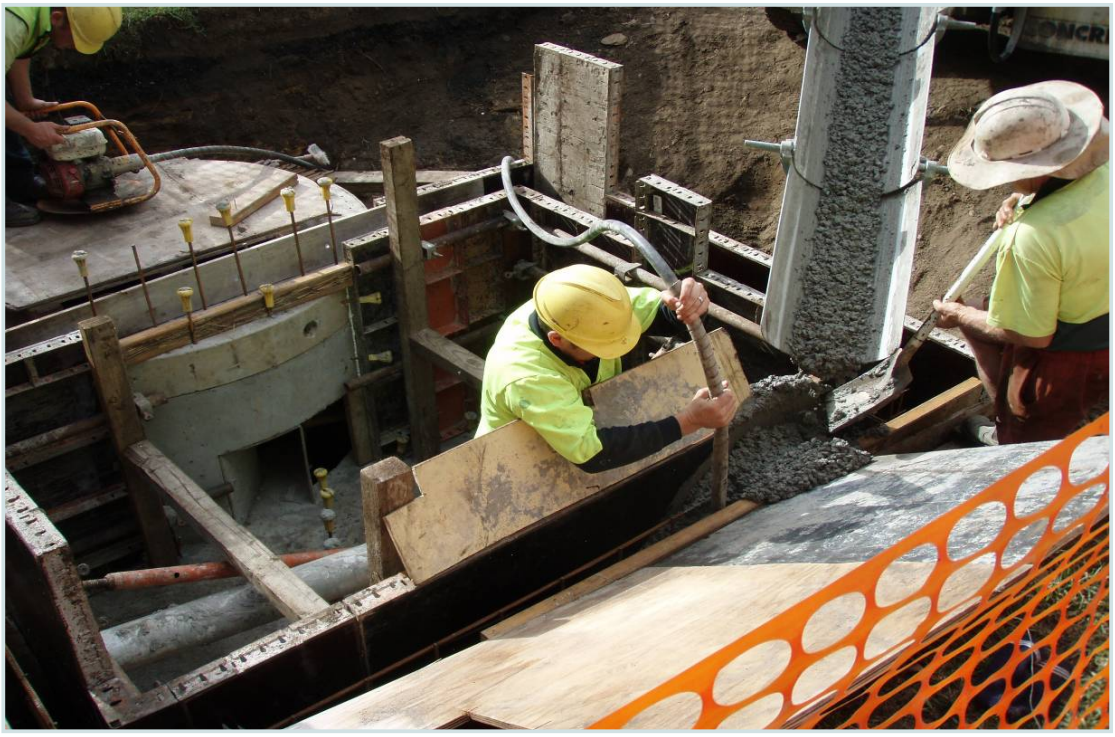
INNACO was the principal contractor commissioned for the design and construction works of stormwater quality devices at two separate locations within the City of Canada Bay Council LGA.

Site 1 – Brett Park

The Brett Park site drains residential areas in Day St and Therry St and discharges into Sisters Bay via a 1200mm wide and 700mm high box culvert. The culvert runs beneath Brett Park and the site for the GPT is in Brett Park approximately 3m downstream of the existing footpath.

Site 2 – Henley Street

The Henley Street catchment is approximately 4.25Ha and drains the residential areas in Henley Street and part of Market St. A 450mm diameter pipe (average gradient <5% according to Council plans) is the main carrier of stormwater in the area and discharges into Half Moon Bay further downstream. The preferable option was to intercept and treat the stormwater just downstream of Market St (close to Henley Marine Drive) which would ensure that Market St is treated as well as entire Henley St (except the western side). The GPT is located in the road reserve and replaced an existing pit located in a grassed driveway.



Insitu Concrete Works (Diversion Chamber)

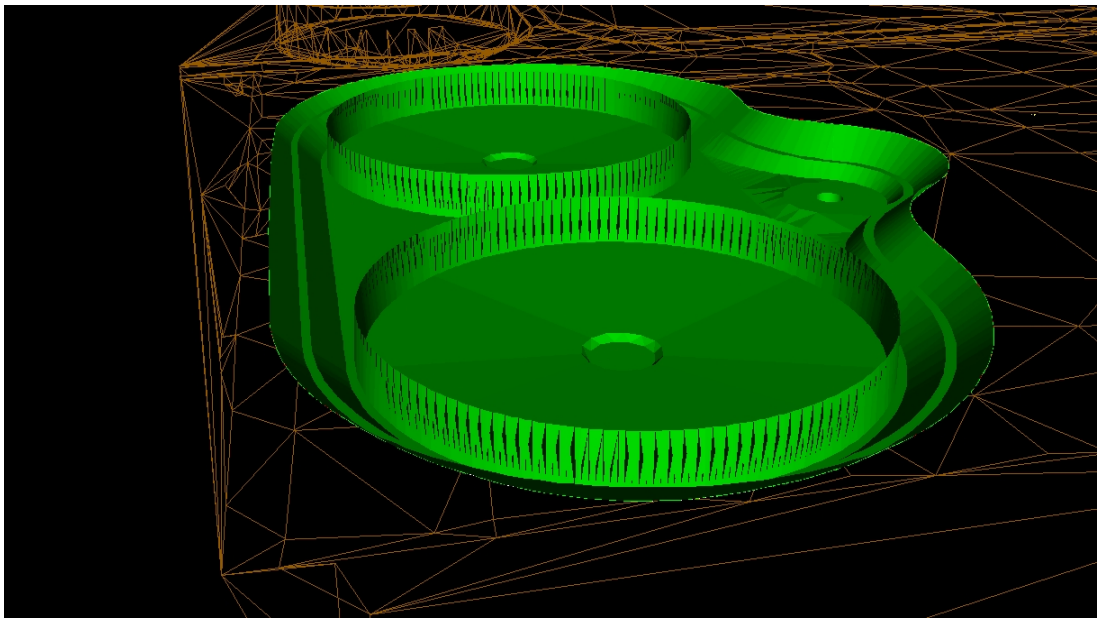
2.7. Mosman Stormwater Improvement Devices

INNACO were the principal contractor for the Design and Construct of a Gross Pollutant Trap in Hunters Park, Balmoral. The site is on the northern side of The Esplanade and the existing pipe drains into Balmoral Beach which is a very popular family beach. The project was finalised in early 2009 and the GPT is estimated to remove 4tonnes of pollution every year.

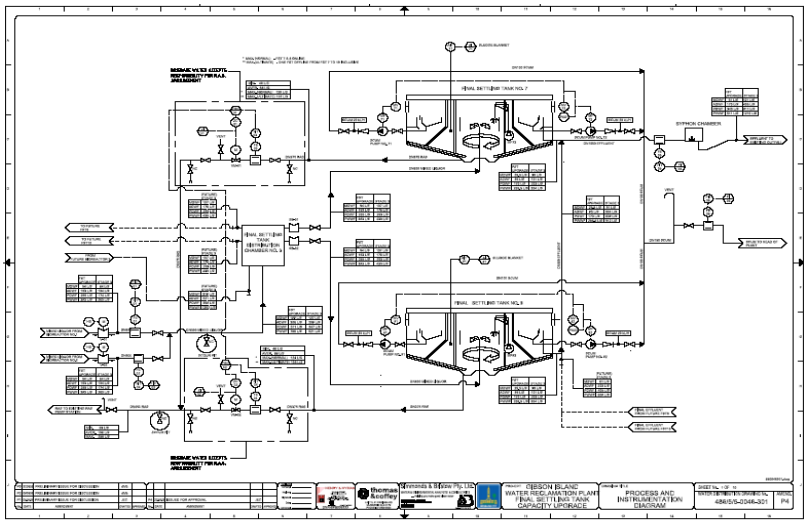
Excavation for GPT installation

2.8. Gibson Island, Brisbane – Two new Final Settling Tanks

Thomas and Coffey engaged H&H to provide Civil, Structural, Hydraulic and Process Design for two new clarifiers at one of the main Waste Water Treatment Plants for Brisbane. These are to reduce the incidence of poor quality effluent being discharged into the Brisbane River in the CBD area of Brisbane during peak rainfall events.



12D image of the Bulk Earthworks showing the tank positions. H&H image ©



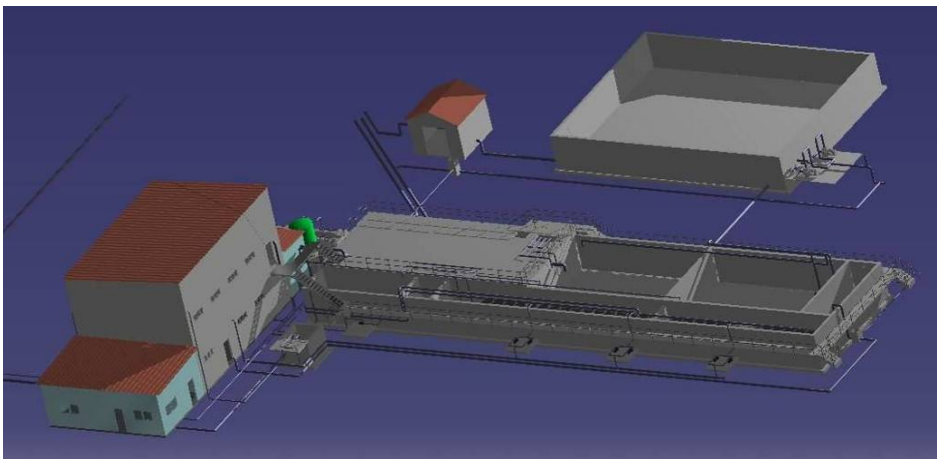
Gibson Island Process and Instrumentation Drawing, Concept Design by Brisbane Water.

2.9. Cambridge Waste Water Treatment Plant, TAS

Henry and Hymas carried out the Architectural, Civil and Structural design for this state-of-the-art Waste Water Treatment Plant. The treatment plant has a capacity of 1600kL/day ADWF,

with 800 kL per day production of Class A+ Reuse water. The plant serves the town of Cambridge and Hobart International Airport.

The facility will link to the recycled water irrigation network serving local golf courses and Westland Nurseries. The Cambridge plant will feature Membrane Bioreactor technology. The project was completed in January 2009.



3D sketch of the Cambridge Waste Water Treatment Plant

Insitu tanks in construction

Cambridge Inlet Works Building

Henry and Hymas carries Professional Indemnity insurance for any design work.

3. Company Information

3.1. Company History

INNACO P/L was developed in 2005, by Henry & Hymas, as a delivery vehicle for the design and construction of water infrastructure projects.

INNACO and Alliance Partner Henry & Hymas have a history of working collaboratively with Clients to identify and secure project cost and quality (outcome) advantages on projects.

The INNACO project team is comprised of civil, structural and water technology design experts and industry savvy construction experts in the fields of civil, building works, hydraulics and mechanical works. This broad experience has led to a creative culture, where many solutions may be considered prior to deciding the final best solution for a particular project challenge.

3.2. Financial Capacity

INNACO P/L is a subsidiary of H&H Consulting Engineers P/L (Henry & Hymas) and as such is fully backed by Henry & Hymas. Henry & Hymas is a well established (60 staff), financially stable company which has been in operation for in excess of 25 years.

Evidence of this relationship and the personal underwriting of INNACO activities by H&H and the NAB is available on request.

3.3. Key Personnel

Rodney Boss - Director

Education

Bachelor of Engineering (Hons)

Experience

Rodney has worked for Henry & Hymas from graduation in 1995. He has been involved in a large variety of projects utilizing Tilt-Up, Precast, Composite Steel Frames, Portal Frames, Conventional and Post-Tensioned Concrete construction systems

Rodney has been responsible for structural design of the following projects:

- Noosa Reef Hotel Redevelopment – Residential Apartments – Deep retaining in Sand
- Dale Street Brookvale – Top Down Construction, exposed structural steel
- SK Steel Eastern Creek – Steel Portal Frames incorporating Gantry Cranes, Heavily loaded slab on Ground for steel coil storage
- Certification of temporary building structures for Sydney Olympics – Aluminium portal frames up to 40m clear span

Darren Ritchie – Construction Manager

Education

Bachelor of Civil Engineering

Experience

Darren has more than 8 years experience in site inspection and construction supervision. He has extensive knowledge and experience in all OH&S and EH&S requirements and documentation and the organisation of staff and sub-contractor to achieve a successful outcome of the project. Darren is also the Construction Supervisor and Manager for the water recycling projects with Ku-ring-gai Council. Some of the major projects Darren has supervised include:

- Woolworths Supermarket Development - Glenorie
- Erskine Park industrial subdivision, Erskine Park
- Gordon Golf Course Sewer Mining
- St Ives Vegetation Landfill Water Reuse Project
- North Turramurra Golf Course Sewer Mining
- 8 Chifley Square
- Cronulla Park Stormwater Harvesting Scheme - Installation of primary treatment

Peter Warren – Construction Manager

Education

Bachelor of Civil Engineering

Experience

Formerly the Engineering Manager for CDS Technologies (Rocla P/L) Peter has niche expertise in the provision of D&C water/sewer treatment solutions. Responsible for all CDS

Design, Construction and Maintenance for Australia and Asia Licensees over a 10-year period and with a Certificate in Local Government Engineering, Peter is well positioned to understand Client needs and match solutions accordingly. Some of Peter's recent projects are as follows:

- Kogarah Water Recycling Trial – 2006; planned and project managed a successful trial of recycling raw sewage extracted from a local sewer main to produce irrigation water for Beverley Park Golf Club and Kogarah Council. This process used CDS Technologies Fine Solids Separator plus a Biological process and Disinfection. The trial has led to a $2.5m contract for CopaWater (now Eimco Water Pty Ltd).
- Sydney Airport Car park Gross Pollutant Traps $1m 2006/7
- Sydney Water Stormwater Environmental Improvement Program - 4 projects $1.5m – 2004 to 2006

- Sydney Olympic Park Authority Install 30 CDS Gross Pollutant Traps 1997 to 1999.

Peter has exceptional knowledge in the water design and construction industry and has an excellent understanding of approvals processes involved with all aspects of water recycling schemes. Peter will be responsible for all construction management including construction environmental management plans, site specific management plans, inspection and test reports etc.

Dr Lars Herngren – Design Manager

Education

Master of Science Civil Engineering

PhD Urban Water Quality

Experience

Lars Herngren is H&H's Principal Water Engineer and has extensive experience and in-depth understanding of wastewater treatment and reuse processes, exceptional understanding of hydraulic and hydrological processes and an excellent knowledge and experience of stormwater treatment measures and stormwater drainage. Lars has a Master of Science in Civil Engineering from the Royal Institute of Technology (Sweden) and completed a PhD in urban water quality with QUT in Brisbane. Lars has major experience from dealing with stakeholders and the community in water reuse projects. Major projects with Henry & Hymas include:

- Figtree Falls Eco Resort and Village – Master Planning and Project Management
- 8 Chifley Square – Design and approvals of Water Reuse System
- Canberra Institute of Technology - Water Recycling Feasibility Study
- Woolworths Glenorie Water Recycling Scheme – Authority approvals of a blackwater recycling scheme
- Gordon Golf Course – Design and approvals of sewer mining scheme
- North Turramurra Golf Course – Feasibility investigations and concept development of a water recycling scheme
- Cliff Oval – Detailed Design of stormwater harvesting scheme
- Clovelly Beach – Detailed Design of stormwater harvesting scheme

Barry Lin – Operations Engineer

Education

Bachelor Degree of Mechanical & Electrical Engineering, graduated in 1992. Guangzhou University Science and Technology Institute.

Skills

Chemical Water and wastewater treatment equipment design, fabrication, installation, supervision, commissioning, operation, control and maintenance

- Cooling tower / boiler / wastewater / dust control
- Pulp and paper's chemical feeding systems
- Electric engineering equipment design, installation, supervision, commissioning and maintenance
- Switchboard, 415V motor control centers, DCS, power transformers, electric motors (DC motors, AC single-phase motors, AC three-phase motors-squirrel cage induction, wound rotor & synchronous), cables (HV power, LV power, control, instrumentation, communications), inverters, PLC/HMI

Experience

Barry joined INNACO in August 2011 and has been managing the Gordon Golf Course Sewer Mine. Previous experience includes:

GE Infrastructure Water & Process Technologies (Australia)

Barry was the Maintenance Engineer for GE's fleet of mobile water treatment plants. This included scheduling and carrying out maintenance of plants on site and also between projects. Plants ranged from 10 to 200kl/hour involving potable, sea water, brackish water and waste water reuse systems. The systems involved operation and maintenance of a broad range of technologies, including Ion Exchange, multi media filtration (MMF), brackish water Reverse Osmosis (RO), sea water RO, Electro Dialysis Reversal (EDR), Ultrafiltration (UF) and Membrane Bio Reactors (MBR).

GE Infrastructure Water & Process Technologies (China) - Field Service Engineer

- CNOOC and Shell Petrochemicals Company Limited. Cooling Tower water treatment.
- Nanjing BASF-YPC. Cooling Tower water treatment.
- Shanghai BP SECCO Petrochemical Co., Ltd. Chemical dosing optimisation.
- Shaoguan Smelter Plant. Polymer dosing installation.
- Dongguan Humen Power Plant. UF, RO, EDI Installation and Commissioning.

3.4. Quality Assurance

INNACO operates a Quality System accredited for 'Substantial Implementation'. We are in the process of enhancing the system to achieve full certification to AS/NZS ISO 9001:2000 Quality Management Systems Requirements.

INNACO develops a specific Management Plan for each commission undertaken. The Plan is tailored to the project to ensure that all of the elements are considered and planned for adequately. These include the following elements:

- Time - detailed programme of works and resource allocation.
- Cost - financial milestones and rates detailed.
- Quality - KPIs nominated and appropriate checklists and forms set out.
- OHSE - KPIs nominated and thorough risk assessment completed.

- EMP - KPIs nominated and site specific EMP developed and adhered to.

We undertake a consultative approach in the development of all elements of Quality Plan, involving the client where appropriate to ensure the Plan meets the needs of the project and the client's expectations prior to commencement. Our assigned Quality Officer will be our 'single point of contact' for the completion of the Plan and the delivery of the project in accordance with the Plan. The focus on quality management, systems and results provides the foundation for the INNACO service delivery model.

3.5. Occupational Health Safety & Rehabilitation System

INNACO has implemented OH&S management system and OH&S is considered a priority from project concept through to final delivery. We work proactively with our staff & sub-consultants to provide advice and support in managing OH&S. H&H Managers are responsible for the safe performance of activities within their area of responsibility & must accept that all safety incidents & their impact on health are preventable and continually aspire towards this. All employees are responsible for performing their duties in a manner which ensures their own safety and that of others. To achieve the above we will:

- Ensure that all health & safety instructions are to be applied in conjunction with relevant legislation, codes of practice etc.
- Assess health & safety in all stages of planning, design & construction.
- Incorporate hazard control systems.
- Commit sufficient resources to ensure effective implementation of safety management systems.
- Ensure all employees & sub-consultants are trained, skilled, informed & equipped to carry out all work in a safe manner.
- Provide a program of continuous education & learning to enhance safety awareness & skill level.
- Promote consultation with health & safety representatives & employees.
- Implement & maintain client health and safety requirements.
- Provide a review system for all health and safety management systems to ensure continued compliance and to provide improvements.

We ensure all sites are managed through a process of:

- OH&S Compliance Audits & Risk Assessments
- If applicable - WMS, Site Inductions & Ongoing Site Inspections
- Investigate, Report & Promptly Rectify OH&S Matter.

We take our OH&S responsibilities as Managing Consultant very seriously and ensure that we are aware and comply with legislation & client requirements.

3.6. Risk Management

Innaco maintains the following risk management procedures that are compliant with AS/NZ 4360 – 1995: Risk Management:

- RM01 Risk Management Procedure
- RM02 Behavioral Science Procedure
- RM03 Risk Assessment Procedure
- RM04 OHS & Environmental Threat Identification Procedure
- RM05 Global Environmental Threats Register

The standard procedure for adopting a risk management approach is;

Step 1 Identify the hazards (i.e. source) if there is a regulation, advisory standard, code of practice or any other guidance material identified, then as a minimum follow the information contained in this material.

Step 2 Assess the risk (i.e. frequency, duration and outcome of the consequences).

Step 3 Determine what control measures to take (i.e. evaluate methods of removing, reducing and controlling the risks). Note: Legislative requirements must be implemented as a minimum standard.

Step 4 Implement the control measures.

Step 5 Evaluate and Review the actions taken to ensure that they have been effective.

3.7. Environmental Management

INNACO P/L recognise that development activities have an impact on the environment, and that the challenge is to ensure that impact is a positive and well-managed one. Protecting and enhancing the environment both by preventing pollution events occurring and by designing and managing processes to prevent near miss occasions are integral to our business operations. It is our policy to invest and operate in a way to ensure this is not compromised. The requirements of the Environmental Management System, as it will relate to our commissions, are typically expected to be:

- All legislative requirements will be met, and appropriate auditing and compliance established to ensure standards are consistently met.
- Community relations are an integral part of INNACO's business. Our staff are drawn from construction, technical and customer service backgrounds with key awareness of the high standards of information and understanding required for public works. Additionally, the aim is always to ensure that information is provided and the works made clear so that there is minimal need for any complaints from the public. Complaints management is unfortunately necessary as a consequence of works

undertaken. Our specialist staff handle this in a sensitive, confidential and professional manner, drawing on their experience in private industry, local and state government roles.

INNACO P/L is implementing an Environmental Management System that has been developed to achieve the following:

- ISO AS/NZ 14001:2004 compliance, to ensure continual improvement in environmental performance.
- Ensure compliance with stated objectives and targets for improved environmental performance.
- Achieve continual improvement in environmental performance through regular audits and management reviews.
- Comply with relevant environmental legislation, codes of practice and other regulatory requirements.

3.8. Insurance Coverage

INNACO carries full coverage for Professional Indemnity, Public Liability, Annual Contract Works and Workers Compensation.

Prof. Indemnity	Public Liability	Contract Works	Workers Comp
$10,000,000	$20,000,000	$15,000,000	
QBE Insurance	CGU Insurance	Allianz	Gallagher Bassett
AO 7998207 PID	15T 1709236	71-0178561-CAR	20WOR0187792122

APPENDIX 3.4.1 PART V

LETTER OF INTENT FOR OPERATION & MAINTENANCE

(CONFIDENTIAL SUBMISSION ONLY)

APPENDIX 3.5.1 PART I

DEVELOPMENT CONSENT

City of Sydney

ABN 22 636 550 790
GPO Box 1591 Sydney NSW 2001 Australia
Town Hall House 456 Kent Street Sydney NSW 2000 Australia

Phone +61 2 9265 9333 Fax +61 2 9265 9222
council@cityofsydney.nsw.gov.au www.cityofsydney.nsw.gov.au

10 January, 2012

MIRVAC PROJECTS PTY LTD
C/- Mirvac Asset Management
Level 26 60 Margaret St
SYDNEY NSW 2000

SECTION 96 MODIFICATION APPROVAL FOR 8-12 CHIFLEY SQUARE , SYDNEY
APPLICATION NO: D/2008/368/I

Dear Sir/Madam

I refer to your application dated 10 January 2012 to modify the consent for Development Application No. D/2008/368/H in the following manner:

- Amend Conditions 1B and 88 to facilitate the staged construction of the project.

You are advised that your application for modification has been **approved** under Section 96(1A) of the Environmental Planning and Assessment Act 1979. A copy of the Notice of Determination of the original development application is attached with the amendments resulting from the modification shown in ***bold italics***.

This approval is limited to only those amendments requested in your Section 96 application dated 10 January 2012. Approval is not granted for any other items which may have been amended on the submitted drawings and for which approval has not been specifically sought.

This approved modification may require an amended Construction Certificate which must be obtained from your Certifying Authority (Council or private accredited certifier). Building work must not commence until an amended Construction Certificate has been approved.

The Council officer dealing with this application is Michael Soo.

Please contact this officer if further information is required.

Yours faithfully

GRAHAM JAHN
Director - City Planning, Development & Transport

Notes:

Modification of development consent in accordance with Section 96 of the Act shall not be construed as the granting of development consent, but reference to a development consent, is a reference to the development consent so modified.

Section 96(6) of the Act confers on an applicant who is dissatisfied with this determination a right of appeal to the Land and Environment Court and the Court may determine the appeal.

For the reasons for imposing conditions, refer to the Notice of Determination for the original development consent.

Modification of a development consent does not remove the need to obtain any other statutory consent necessary under the Environmental Planning and Assessment Act 1979, or any other Act.

The conditions of consent of the development application have been modified with the consent of the applicant.

City of Sydney

ABN 22 636 550 790
GPO Box 1591 Sydney NSW 2001 Australia
Town Hall House 456 Kent Street Sydney NSW 2000 Australia

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council@cityofsydney.nsw.gov.au www.cityofsydney.nsw.gov.au

NOTICE OF DETERMINATION - APPROVAL issued under Section 80(1)(a) of the Environmental Planning and Assessment Act 1979

Development Application No.	D/2008/368/I
Applicant	MIRVAC PROJECTS PTY LTD Level 26 60 Margaret St SYDNEY NSW 2000
Land to be developed	8-12 Chifley Square , SYDNEY NSW 2000
Approved development	Stage 2 for the demolition of the "Goodsell Building"; excavation; and construction of a commercial building with an overall height, including architectural roof feature and plant, of ~~140~~ *144.15* metres ~~(RL 164.4)~~ ***(RL 168.55)***. (amended 20 October 2011 – H)
Cost of development	$157,673,640.00
Determination	The application was determined under delegation of Central Sydney Planning Committee **subject to conditions in** Schedules 1 and 2 and was granted a deferred commencement **subject to the conditions in Part A and B**.
Section 61 Contribution	A Section 61 Contribution (under the City of Sydney Act 1988) applies to this development.
Consent is to operate from	**30 March 2010**
Consent will lapse on	**30 March 2015**
Date of Section 96(1A) Modification	***10 January 2012 - I***

Reasons for conditions

Unrestricted consent may affect the environmental amenity of the area and would not be in the public interest.

Right of Appeal

If you are dissatisfied with this decision, Section 96(6) of the Environmental Planning and Assessment Act 1979 gives you the right to appeal to the Land and Environmental Court within 6 months after the date of this Notice of Determination.

Alternatively, you may request a review of the decision by the City's Small Permits Appeals panel; under Section 96AB of the Act within 28 days of the date of this notice (NB section 96AB is not applicable to integrated or designated development).

GRAHAM JAHN
Director - City Planning & Regulatory Services

CONDITIONS OF CONSENT

PART A

CONDITIONS TO BE SATISFIED PRIOR TO CONSENT OPERATING

~~The consent is not to operate until the following conditions are satisfied, within **12 months** of the date of this determination:~~

~~1. VOLUNTARY PLANNING AGREEMENT~~

~~(a) The Voluntary Planning Agreement, governed by subdivision 2 of Division 6 of Part 4 of the Environmental Planning and Assessment Act 1979 and titled "Planning Agreement" between the Council of the City of Sydney and Mirvac Projects Pty Ltd (reference KW: S063341), shall be executed by the parties.~~

~~The Planning Agreement secures the following:~~

~~(i) Foot pavement works (including procurement, supply and installation of all relevant paving, kerbing, landscaping and lighting materials) on Phillip Street pavements adjacent to Nos. 52-56) and on Hunter and Castlereagh Street pavements adjacent to No.55 Hunter and No.1 Castlereagh Street to a value of $1,338,622.00.~~

~~(ii) The design, fabrication and installation of a piece of public art in the publicly accessible area, the final form of which is to be developed in consultation with and approved by the Council, to a value of $1,570,000.00.~~

~~(b) The consent shall not operate until the applicant has provided details responding to the above matters, which shall be approved in writing by the Manager - Planning Assessments.~~

(VPA Executed and condition satisfied on 30 March 2010)

PART B

CONDITIONS OF CONSENT
(ONCE THE CONSENT IS IN OPERATION)

Upon compliance with the conditions contained in Part A, the consent will become operative subject to the following conditions, as may be amended by such other conditions that may arise as a result of compliance with conditions/information required in Part A.

SCHEDULE 1A

APPROVED DEVELOPMENT/DESIGN MODIFICATIONS/COVENANTS AND CONTRIBUTIONS/USE AND OPERATION

Note: Some conditions in Schedule A are to be satisfied prior to issue of a Construction Certificate and some are to be satisfied prior to issue of Occupation Certificate, where indicated.

(1) APPROVED DEVELOPMENT

(a) Development must be in accordance with Development Application No. D/2008/368 dated 13 March 2008 and Statement of Environmental Effects prepared by City Plan Services, dated March 2008 and the following drawings:

Drawing Number	**Architect**	**Date**
S2040	Arup	19.05.08
S2481	Arup	26.05.08
S2482	Arup	26.05.08
S2483	Arup	26.05.08

(b) and where amended by Development Application No. D/2008/368/C dated 27 September 2010 and Statement of Environmental Effects prepared by JBA Planning, dated September 2010 *and* D/2008/368/H and the following drawings:

Drawing Number	***Architect***	~~**Date**~~
S96-010 ~~C~~ D	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-011 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**

S96-013 ~~F~~ G	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-014 ~~F~~ G	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-015 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-016 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-017 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-018 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-019 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
~~S96-020 D~~	~~Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design~~ (deleted 20 October 2011 – H)	~~29.09.10~~ ~~18/02/2011~~
S96-021 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-022 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-023 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-024 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-025 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-026 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
~~S96-027 D~~	~~Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design~~ **(deleted 20 October 2011 – H)**	~~29.09.10~~ ~~18/02/2011~~
S96-030 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-031 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-032 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**

S96-033 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-040 ~~E~~ H	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-041 ~~E~~ G	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-042 ~~E~~ H	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-043 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-050 ~~E~~ G	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-051 ~~E~~ H	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **06/09/11**
S96-052 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-053 ~~D~~ F	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-054 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-055 ~~C~~ D	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-100 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-101 ~~D~~ **E**	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **10/08/11**
S96-120-1 ~~F~~ H	Lippmann Associates / Rogers Stirk Harbour + Partners / Mirvac Design	~~29.09.10~~ ~~18/02/2011~~ **26/08/11**
S96-120-2 ~~F~~ J	Lippmann Associates / Rogers Stirk Harbour + Partners	~~18/02/2011~~ **06/09/11**
S96-120-3 ~~F~~ H	Lippmann Associates / Rogers Stirk Harbour + Partners	~~18/02/2011~~ **26/08/11**

and as amended by the conditions of this consent:

(c) In the event of any inconsistency between the approved plans and supplementary documentation, the plans will prevail.

(Amended 19 January 2011 - C) (amended 4 April 2011 – E) (amended 20

October 2011 – H)

(1A) PEDESTRIAN AND DEMOLITION TRAFFIC MANAGEMENT PLAN

The measures contained with the Pedestrian and Demolition Traffic Management Plan prepared by Mirvac, dated 16 July 2010, must be undertaken as part of this consent, and are subject to the following conditions:

a. The delivery trucks must access the site via truck routes as per the CTMP submission.

b. The approved truck route plan shall form part of the contract and must be distributed to all truck drivers.

c. All vehicles must enter and exit the site in a forward direction.

d. All Traffic Control Plans associated with this Construction Traffic Management Plan must comply with Australian Standards and RTA's Traffic Control At Work Sites Guidelines.

e. The applicant must provide council with details of the largest truck that will be used during the demolition, excavation and construction, prior to the start of any work on site and obtain approval from City's Construction Regulation Unit for the use of this vehicle.

   NOTE: No dog trailers to be used without City's Construction Regulation Unit approval.

f. The developer must obtain a permit from the City's Construction Regulation Unit regarding the placing of any plant/equipment on public ways.

g. No queuing or parking is permitted in any public road.

h. All vehicles associated with the development shall be parked wholly within the site. All site staff related with the works are to park in a designated off street area, no staff are to park on the street.

i. All loading and unloading must be within the development site or at an approved "Works Zone".

j. The applicant must comply with development consent for hours of construction.

k. Any Traffic Controllers are NOT to stop traffic on the public streets including Elizabeth, Phillip and Hunter Street to allow trucks to enter or leave the site. The Roads Act does not give any special treatment to trucks leaving a construction site - the vehicles already on the road have right-of-way so that every vehicle leaving a site MUST wait until a suitable gap in traffic allows them to exit. Secondly Trucks are not (at no time) allowed to reverse into the site from the road for safety reasons.

l. The applicant must reduce truck movements to the site during the afternoon peak period.

m. City will regularly monitor the impact of truck movements to the site on

adjoining streets. City may in future ask the applicant to reduce or modify truck movements to the site.

n. Pedestrians may be held only for very short periods to ensure safety when trucks are leaving or entering BUT you must NOT stop pedestrians in anticipation i.e. at all times the pedestrians have right-of-way on the footpath not the trucks.

o. Physical barriers to control pedestrian or traffic movements need to be determined by the Construction Regulations Unit prior to commencement of work.

p. Any temporary adjustment to a Bus Stop or Traffic Signals will require the applicant to obtain approval from the STA and RTA respectively prior to commencement of works.

q. The developer must apply to the Construction Regulations Unit to organise appropriate approvals for cranes and barricades etc.

r. The developer must apply to Building Compliance Unit to organise appropriate approvals for hoarding prior to commencement of works.

s. The developer must apply to the Work Zones Co-ordinator to organise appropriate approvals for the Work Zones.

Advisory Note: These conditions are for traffic and parking impacts only and do not approve any Traffic Control Plans. WorkCover requires that Traffic Control Plans must comply with Australian Standards 1742.3 and must be prepared by a Certified Traffic Controller (under RTA regulations).

(Inserted 2 September 2010 - A)

(1B) STAGED CONSTRUCTION CERTIFICATES

Construction certificates may be issued in 3 stages, as follows:

(i) Stage 1 – excavation and construction of basement to ground level; the structure only to Level 6; and the core structure to extend to Level 10

(ii) Stage 2 – construction of the tower structure from Level 6 to top of building and facades and services from ground level to top of building, ***inclusive of public domain works,*** excluding works associated with public art, ***street signage works,*** ~~public domain~~, ground floor glass lobby box and external finishes to the ground floor and landscaping works to ground floor, mid level terrace (Level 18) and roof terrace (Level 30).

(iii) Stage 3 – construction of ~~public domain works~~ ***street signage works***, public art, ground floor glass lobby box, external finishes to ground floor and landscaping works to ground floor, mid level terrace (Level 18) and roof level terrace 9 level 30).

Any reference to 'A Construction Certificate' relates to Stage 1, Stage 2 *and* Stage 3 construction certificates unless a Stage is nominated elsewhere in that particular condition. In all other cases, conditions are to be satisfied as

specifically stated at either Stage 1, Stage 2 *or* Stage 3.

(Inserted 19 January 2011 – C) (amended 4 April 2011 – E) ***(amended 10 January 2012 – I)***

(2) PUBLIC ACCESS

(a) The ground floor (lower and upper plaza levels) shall be publicly accessible at all times, except as approved by Council.

(b) Prior to the issue of the Occupation Certificate for the development, a documentary Right of Public Access and Recreational Use is to be created and registered on the Title of the subject site. Such easement is to be defined over the lower and upper plaza levels, is to be limited in stratum to an extent that excludes the basement car parking structure below and the building above and is to be created appurtenant to Council, in terms granting unrestricted rights for public pedestrian access, without vehicles, exclusive of wheelchairs for the disabled, and rights of use by the public for passive recreational purposes to Council's satisfaction. The easement may exclude the area nominated immediately between the upper plaza café and the building (rear northern wall).

(c) Prior to the issue of the Occupation Certificate for the development, a documentary Positive Covenant is to be registered on the title of the subject site, appurtenant to Council. Such Positive Covenant is to be created in terms indemnifying Council against any claims and damages arising from the use of the lower and upper plaza levels, and is to require the maintenance, upkeep, repair and lighting of the Right of Access in accordance with the requirements and to the satisfaction of Council.

(3) GROUND FLOOR / PLAZA LEVELS / VOID

(a) The ground/plaza levels, including the proposed treatment to the northern wall, is not approved in its current form.

(b) The final detailed design of this space shall be submitted to Council for approval prior to the issue of the Stage *3* ~~2~~ construction certificate.

(c) The final design of the space shall be developed in consideration of:

(i) integration of public art;

(ii) final design details of café;

(iii) the provision of landscaping;

(iv) seating;

(v) public safety;

(vi) access and compliance with AS1428;

(vii) skateboard deterrent devices;

(viii) security; and

(ix) amenity.

(d) A high quality treatment is required to the northern wall. This may include public art, masonry elements and glazing to lift shafts (as originally proposed).

(e) The seating proposed in the eastern corner of the upper plaza is to be deleted to allow unimpeded pedestrian access from Phillip Street across the site. Alternative sitting opportunities may be considered as part of the detailed design.

(Amended 19 January 2011 – C) *(amended 4 April 2011 – E)*

(4) DESIGN MODIFICATIONS

(Deleted 19 January 2011 – C)

(5) DESIGN DETAILS (MAJOR DEVELOPMENT)

~~A materials sample board detailing all proposed finishes must be submitted to and approved by Council prior to the Stage 2 Construction Certificate being issued. The materials and colours are to be referenced to plans. Prototypes of the proposed elements are also required.~~

(a) *A materials sample board detailing all proposed finishes to the works relating to the Stage 2 Construction Certificate must be submitted to Council for approval prior to a Stage 2 Construction Certificate being issued. The materials and colours are to be referenced to plans. Prototypes of the proposed elements are also required.*

(b) A materials sample board detailing all proposed finishes to the works relating to the Stage 3 Construction Certificate must be submitted to Council for approval prior to a Stage 3 Construction Certificate being issued. The materials and colour are to be referenced to plans. Prototypes of the proposed elements are also required.

(amended 4 April 2011 – E)

(5A) COLOUR OF INCLINED COLUMNS

In principle support of a blue-grey palette for the inclined column is granted, however the final tone of this colour is not approved as part of this application and further details are required. The tone is to be selected following further consultation with Roger Stirk Harbour + Partners and discussed with the Design Competition Jury, then submitted to and approved by the Council prior to the issue of the Stage 2 Construction Certificate.

(Inserted 19 January 2011 – C)

(6) ~~CAFÉ ON UPPER PLAZA LEVEL~~

(Deleted 19 January 2011 – C)

(7) AWNING DETAILS

Detailed architectural drawings of the awning are to be submitted for approval

of Council prior to the issue of the Stage 2 construction certificate. The slope of the awning is to be reduced to a maximum 10 degrees. The drawings are to be at a scale of 1:20.

(Amended 19 January 2011 – C)

(8) CAR PARK ENTRY DETAIL

The proposed treatment to the north and south walls of the car park and the roller door are to be submitted to Council for approval prior to the issue of the Stage 1 construction certificate.

(Amended 19 January 2011 – C)

(9) ENCROACHMENT OF SUN SHADING DEVICES

Prior to the issue of the Stage 2 construction certificate, approval from Council's Properties Unit is to be obtained and any agreements executed for the encroachment of the sun shading devices onto Council property.

(Amended 19 January 2011 – C)

(10) PUBLIC ART

(a) High quality art work must be provided within the development in publicly accessible locations, in accordance with the Central Sydney DCP 1996 and the Public Art Policy.

(b) The brief for the short-listed artists, and the process for the commissioning of the artists, must be reviewed and approved by the Council before commissioning.

(c) The art work is to:

(i) be integrated with the architecture of the publicly accessible ground floor/plaza levels;

(ii) respond to the context of the space;

(iii) use the space, which may include the northern wall, as a canvas for art;

(iv) be made of materials which exhibit a robust character, suitable for the urban location, and which allow longevity in the location;

(v) incorporate structural design and certification as to the integrity of the work; and its impact on the form to which it is affixed;

(vi) not obstruct views to Chifley Square;

(vii) respect and be harmonious with the spatial qualities of the void and not dominate the space; and

(viii) not compete with the architectural expression of the building materials.

(d) Prior to the Stage 3 2 Construction Certificate being issued:

(i) the Developer is to commission the design, fabrication and installation of public art from a reputable artist with experience of public art of the nature contemplated, the final form of which is to be developed in consultation with and approved by the Council.

(ii) a detailed concept is to be submitted for approval detailing how the art work/s will be integrated into the final design of the ground floor.

(e) The approved public art shall be fully completed and installed on site prior to the issue of *any* Occupation Certificate.

(Amended 19 January 2011 – C) *(amended 4 April 2011 – E)*

(10A) GLASS LOBBY

The concept of the glass lobby to the upper plaza level, to the dimensions shown on Drawing No. S096-014 Rev D, is approved as part of this consent. Details of the final design, including the type and colour of the glass, and the material finish, number and location of support braces and all associated structures are to be submitted to and approved by the City of Sydney prior to the issue of the Stage 3 2 Construction Certificate.

Notwithstanding the above, the approval of the glass lobby does not exclude the potential for the Public Art Strategy and/or the selected Public Art itself to incorporate the lobby enclosure, including by redesign, as an integral and connected part of the Public Art.

Note: The purpose of this condition is to allow flexibility to the Public Art Strategy and selection of the final artwork at the same time as providing certainty that the glass cube structure, if not affected by the Public Art, is approved.

(Inserted 19 January 2011 – C) *(amended 4 April 2011 – E)*

(11) ~~PUBLIC ART ON HOARDING~~

(Deleted 2 September 2010 - A)

(12) DESIGN QUALITY EXCELLENCE

(a) In order to ensure the design quality excellence of the development is retained:

(i) The design architects (Lippmann Associates and Rogers Stirk Harbour + Partners) are to have direct involvement in the design documentation, contract documentation and construction stages of the project;

(ii) The design architects (Lippmann Associates and Rogers Stirk Harbour + Partners) are to have full access to the site and are to be authorised by the applicant to respond directly to the consent authority where information or clarification is required in the

resolution of design issues throughout the life of the project;

(iii) Evidence of the design architect's commission is to be provided to the Council prior to release of the *Stage 1* Construction Certificate.

(b) The design architects of the project are not to be changed without prior notice and approval of the Council.

(Amended 19 January 2011 – C)

(13) FLOOR SPACE RATIO - CENTRAL SYDNEY

The following applies to Floor Space Ratio:

(a) The Floor Space Ratio of the proposal must not exceed 13.75:1 calculated in accordance with the *Sydney Local Environmental Plan 2005*. For the purpose of the calculation of FSR, the Floor Space Area of the approved development is 21,738sqm.

(b) Prior to an Occupation Certificate being issued, a Registered Surveyor must provide certification of the total and component Floor Space Areas (by use) in the development, utilising the definition under *Sydney Local Environmental Plan 2005* applicable at the time of development consent, to the satisfaction of the Principal Certifying Authority.

(c) Prior to the Stage 1 Construction Certificate being issued, Council's written verification must be obtained, confirming that 4533.5sqm of heritage floor space was allocated (purchased and transferred) to the development, being that floor space in excess of 8:1 as specified in the *Sydney Local Environmental Plan 2005*.

(Amended 19 January 2011 – C)

(14) BUILDING HEIGHT

(a) The height of the building must not exceed RL ~~164.4 (AHD)~~ *168.55 (AHD)* to the top of the building, including architectural roof feature and plant and RL 143.6 (AHD) to the top of the roof terrace.

(b) Prior to an Occupation Certificate being issued, a Registered Surveyor must provide certification that the height of the building accords with (a) above, to the satisfaction of the Principal Certifying Authority.

(Amended 20 October 2011 – H)

(15) USE - SEPARATE DA REQUIRED

A separate development application for the fitout and use of the retail space and the cafés must be submitted to and approved by Council prior to that fitout or use commencing.

(16) COMPLIANCE WITH ACOUSTIC REPORT

(a) All recommendations contained in the acoustic report prepared by Renzo Tonin & Associates Pty Ltd, dated 26 February 2008, must be implemented.

(b) The Principal Certifying Authority (PCA) must shall ensure that, prior to the issue of an occupation certificate, a statement from an accredited acoustic consultant is provided certifying that the recommendations in the report referred to in (a) above have been implemented and that compliance is achieved with condition 26 of this consent (Noise – Mechanical Plant and Equipment).

(17) SYDNEY AIRPORT CORPORATION LIMITED

(a) The applicant / developer is to consult with Sydney Airport Corporation Limited (SACL) to ensure that the necessary approvals under the relevant legislation are obtained.

(b) Any requirements of the SACL that require design amendments are to be the subject of a section 96 application.

(18) APPROVED DESIGN ROOF-TOP PLANT

All roof-top plant and associated equipment must be located within the approved building envelope. Should the plant exceed the approved building envelope, then further approval is required from Council.

(19) SIGNS - SEPARATE DA REQUIRED

A separate development application for any proposed signs (other than exempt or complying signs under Council's exempt and complying DCPs) must be submitted to and approved by Council prior to the erection or display of any such signs.

(20) SIGNAGE STRATEGY

A separate development application is to be submitted seeking approval of a signage strategy for the building. The signage strategy development application must include information and scale drawings of the location, type, construction, materials and total number of signs appropriate for the building.

(21) SIGNS/GOODS IN THE PUBLIC WAY

No signs or goods are to be placed on the footway or roadway adjacent to the property or within the ground floor plaza levels.

(22) REMOVAL OF GRAFFITI

The owner/manager of the site must be responsible for the removal of all graffiti from the building within 48 hours of its application.

(23) NO SPEAKERS OR MUSIC OUTSIDE

Speakers must not be installed and music must not be played in any of the outdoor areas associated with the premises including the public domain. Speakers located within the premises must not be placed so as to direct the playing of music towards the outdoor areas associated with the premises.

(24) NOISE - USE (GENERAL)

The use of the premises shall not give rise to any one or more of the following:

(a) Transmission of "offensive noise" as defined in the Protection of the Environment Operations Act 1997 to any place of different occupancy;

(b) A sound pressure level at any affected premises that exceeds the background (LA90 15 min.) noise level in the absence of the noise under consideration by more than 5 dB(A). The source noise level shall be assessed as LAeq, 15 min and adjusted in accordance with EPA guidelines for tonality, frequency weighting, impulsive characteristics, fluctuations and temporal content.

(25) NOISE - MECHANICAL PLANT AND EQUIPMENT

Noise associated with mechanical plant and equipment must not give rise to any one or more of the following:

(a) Transmission of "*offensive noise*" as defined in the *Protection of the Environment Operations Act 1997* to any place of different occupancy.

(b) A sound pressure level at the boundary of any affected receiver that exceeds the background (LA90, 15 minutes) noise level by more than 5dB. The background noise level must be measured in the absence of noise emitted from the use in accordance with Australian Standard AS 1055.

(26) RESTRICTION ON USE OF CAR SPACES - COMMERCIAL WITH NO STRATA SUBDIVISION

The following conditions apply to car parking:

(a) The on-site car parking spaces, exclusive of service car spaces, are not to be used other than by an occupant or tenant of the subject building.

(b) Prior to an Occupation Certificate being issued or the use commencing, whichever is earlier, a documentary restrictive covenant, is to be registered on the Title of the development site pursuant to section 88E of the *Conveyancing Act 1919*, to the effect of (a) above. The covenant is to be created appurtenant to Council, at no cost to and to the satisfaction of Council.

(c) Any future strata subdivision of the site is to include a restriction on User pursuant to section 39 of the *Strata Titles (Freehold Development) Act, 1973* as amended, so burdening all utility car parking allotments in the Strata Plan and/or an appropriate restrictive covenant pursuant to section 88B of the *Conveyancing Act 1919* burdening all car parking part - lots in the Strata Scheme.

(27) SECTION 61 CONTRIBUTIONS PAYABLE - REGISTERED QUANTITY SURVEYOR'S DETAILED COST REPORT - SUBMITTED AND VERIFIED PRIOR TO ISSUE OF CONSTRUCTION CERTIFICATE

A cash contribution comprising 1% of the total cost of the development is payable to the City of Sydney pursuant to section 61 of the *City of Sydney Act 1988* and the *Central Sydney Contribution (Amendment) Plan 2002* in accordance with the following:

(a) Prior to the Stage 1 Construction Certificate being issued, evidence must be provided of Council's written verification of the amount of the contribution as required in (b) below, and then that the levy has been paid to the Council in accordance with this condition. Payment may be by **EFTPOS** (debit card only), **CASH** or a **BANK CHEQUE** made payable to the City of Sydney. Direct debit, personal or company cheques will not be accepted.

(b) The contribution must not be paid to the City of Sydney until it is accompanied by separate written verification by the City of Sydney of the specific amount payable. In order to obtain such verification, the "City of Sydney Registered Quantity Surveyor's Detailed Cost Report" indicating the itemised cost of the development must be completed and submitted to Council by the Certifying Authority (CA), together with copies of the plans the subject of the application for the Construction Certificate. A copy of the required format for the "City of Sydney Registered Quantity Surveyor's Detailed Cost Report" may be obtained from the City of Sydney One Stop Shop, any of the Neighbourhood Service Centres and the City of Sydney's website (www.cityofsydney.nsw.gov.au).

(c) The Council will consider the documentation submitted under subclause (b) and determine the cost of the proposed development having regard to the information submitted and to such other matters as it considers appropriate and will notify the CA accordingly.

(d) The items to be included in the calculation of the cost of development are demolition works, site remediation including decontamination, excavation and site preparation, construction costs, fit out, professional fees as part of the design (including design competitions) documentation and implementation process, fixed building machinery, equipment and appliances, kitchens and bar areas, car parking, air conditioning plant and equipment, services (fire, mechanical ventilation, electrical, hydraulic), ceilings, fire protection devices, installation of services (power, water, sewer, telephone), lifts and other essential machinery, floor coverings, *Building Code of Australia* compliance works, replacement of existing materials, fixtures and fittings, construction related insurance, assessment and construction related fees, charges and GST and any other matter not expressly excluded in (e) below.

(e) The items to be excluded in the calculation of the cost of development are the cost of land, marketing expenses (excluding display suites etc), finance and interest, building insurance after practical completion, drapery, commercial stock inventory, loose furniture, loose equipment, loose electrical appliances, minor maintenance of existing retained fixtures (patching, repainting) and stamp duty.

(Amended 19 January 2011 – C)

(28) RTA CONDITIONS

(a) All works associated with the proposed development will be at no cost to the RTA.

(b) The swept path of the longest vehicle (including garbage trucks) entering

and exiting the subject site, as well as manoeuvrability through the site, shall be in accordance with AUSTROADS. In this regard, a plan shall be submitted to Council for approval, which shows that the proposed development complies with this requirement.

(c) All demolition and construction vehicles are to be contained wholly within the site and vehicles must enter the site before stopping.

(d) The car parking areas and entry/exit need to be clearly delineated through line marking and signage to ensure smooth, safe traffic flow.

(e) Directional signposting and line-marking is required, as appropriate, for left in/left out only entry and exit movements.

(f) The developer shall be responsible for all public utility adjustment/relocation works necessitated by the above work and as required by the various public utility authorities and/or their agents.

(g) Provision is to be made for the relocation of bus zones along the development frontage while work is in progress.

(29) CAR PARKING SPACES AND DIMENSIONS

A maximum of 32 off-street car parking spaces must be provided. The design, layout, signage, line marking, lighting and physical controls of all off-street parking facilities must comply with the minimum requirements of Australian Standard AS/NZS 2890.1 - 2004 Parking facilities Part 1: Off-street car parking and Council's Development Control Plan. The details must be submitted to and approved by the Principal Certifying Authority prior to the Stage 1 Construction Certificate being issued.

(30) MOTORCYCLE PARKING

(a) A minimum of 3 spaces must be provided for motorcycles.

(b) All motorcycle spaces must be on level ground.

(31) SERVICE VEHICLES

Courier spaces and loading docks must be located close to the service entrance and away from other parking areas, as detailed below:

(a) A minimum of 4 courier spaces with minimum dimensions 2.6m x 5.4m and a minimum head clearance of 2.5 metres.

(b) A minimum of 1 loading dock(s) with minimum dimensions 3.5m x 7.5m with minimum head clearance 3.6m and 4.0m for residential developments.

Adequate space must be provided to allow manoeuvring and turning of the different sized vehicles. The design, layout, signage, line marking, lighting and physical controls for all service vehicles must comply with the minimum requirements of Australian Standard AS 2890.2 – 2002 Off-Street Parking Part 2: Commercial vehicle facilities. Details must be submitted to and approved by the Certifying Authority prior to the Stage 1 Construction Certificate being

issued.

(Amended 19 January 2011 – C)

(32) SERVICE VEHICLE SIZE LIMIT

The size of vehicles servicing the property must be a maximum length of 8.8 metres.

(33) SMALL CAR SPACES

All small car spaces must be a minimum of 2.3m x 5.0m and must be appropriately assigned to ensure all drives know the spaces are for small cars.

(34) BICYCLE FACILITIES

A bicycle facilities room must be provided close to staff / employee bicycle parking and include:

(a) 2 showers with change area; and

(b) 24 personal lockers.

(35) ACCESSIBLE CAR PARKING SPACES

Of the required car parking spaces, at least 1 must be 3.2m x 5.5m minimum (with a minimum headroom of 2.5m) and must be clearly marked and appropriately located as accessible parking for people with mobility impairment. The design and layout of accessible car parking for people with mobility impairment is to be provided in accordance with Australian Standard AS/NZS 2890.1 - 2004 Parking facilities Part 1: Off-street car parking and the *City of Sydney Access Development Control Plan 2004*. The details must be submitted to and approved by the Certifying Authority prior to the Stage 1 Construction Certificate being issued.

(Amended 19 January 2011 – C)

(36) LOCATION OF ACCESSIBLE CAR PARKING SPACES

Where a car park is serviced by lifts, accessible spaces for people with mobility impairment are to be located to be proximate to such lifts. Where a car park is not serviced by lifts, accessible spaces for people with mobility impairment are to be located at ground level, or accessible to ground level by a continually accessible path of travel, preferably under cover.

(37) STACKED PARKING EMPLOYEES OR TENANTS ONLY

Any stacked parking spaces (maximum 2 spaces, nose to tail) must be attached to the same strata title comprising a single dwelling unit or commercial/retail tenancy, subject to the maximum parking limit applying. The stacked parking spaces must be designated (with appropriate signage) for employee or tenant parking only (not visitor parking), prior to an Occupation Certificate being issued and the moving of stacked vehicles must occur wholly within the property.

(38) ALLOCATION FOR VISITOR PARKING

The visitor parking spaces must not at any time be allocated, sold or leased to an individual owner/occupier and must be strictly retained as common property by the Owners Corporation.

(39) LOCATION OF VISITOR PARKING

All visitor parking spaces must be grouped together, and located at the most convenient location to the car parking entrance. All spaces must be clearly marked 'visitor' prior to the issue of an occupation certificate or the use commencing, whichever is earlier.

(40) INTERCOM FOR VISITORS

The visitor spaces must be accessible to visitors by the location of an intercom (or card controller system) at the car park entry and at least 7m clear of the kerb line, wired to all units (prior to an Occupation Certificate being issued or the use commencing, whichever is earlier).

(41) SIGN FOR VISITOR PARKING

A sign, legible from the street, must be permanently displayed to indicate the availability of visitor parking.

(42) BICYCLE PARKING

The layout, design and security of bicycle facilities either on-street or off-street must comply with the minimum requirements of Australian Standard AS 2890.3 – 1993 Parking Facilities Part 3: Bicycle Parking Facilities except that:

(a) all bicycle parking for occupants of residential buildings must be Class 1 bicycle lockers, and

(b) all bicycle parking for staff / employees of any land uses must be Class 2 bicycle facilities, and

(c) all bicycle parking for visitors of any land uses must be Class 3 bicycle rails.

(43) VEHICLES ENTER/LEAVE IN FORWARD DIRECTION

All vehicles must always be driven onto and off the site in a forward direction.

(44) SIGNS AT EGRESS

Appropriate sign(s) must be provided and maintained within the site at the point(s) of vehicular egress, compelling drivers to stop before proceeding onto the public way.

(45) SIGNAL SYSTEM

A system of traffic lights and/or mirrors must be installed at the ends of the single lane ramp(s), to indicate traffic movement on the ramp(s). This system must be detailed on the application for a construction certificate. Any system using traffic light signals must maintain a green signal to entering vehicles at

the point of entry, and must maintain a red signal when an exiting vehicle is detected upon the ramp or driveway.

(46) HOLDING AREAS

Areas within the site must be clearly sign-posted and line marked as waiting bays for the purpose of allowing clear access to vehicles entering or exiting the site via a one-way access driveway. The details must be submitted to and approved by the Certifying Authority prior to the Stage 1 Construction Certificate being issued.

(Amended 19 January 2011 – C)

(47) SECURITY GATES

Where a car park is accessed by a security gate, that gate must be located at least 6 metres within the site from the street front property boundary. The security gate is to be operated by remote control.

(48) LOCATION OF DRIVEWAYS

The access driveway for the site must not be closer than:

(a) 10 metres from the intersection of the nearest cross street/lane.

(b) 20 metres from the intersection of the nearest signalised cross street/lane.

(c) 1 metre from the property boundary of the adjacent site.

(d) 2 metres from any other driveway of the site.

(e) 10 metres from any existing driveway or road/lane intersection located on the opposite side of the access road.

The details must be submitted to and approved by the Certifying Authority prior to the Stage 1 Construction Certificate being issued.

(Amended 19 January 2011 – C)

(49) VEHICLE FOOTWAY CROSSING

A separate application is to be made to, and approved by, Council for the construction of any proposed vehicle footway crossing or for the removal of any existing crossing and replacement of the footpath formation where any such crossings are no longer required.

All disused or redundant vehicle crossings and laybacks must be removed and reinstated in accordance with Council's standards, to suit the adjacent finished footway and edge treatment materials, levels and details, or as otherwise directed by Council officers. All construction and replacement works are to be completed in accordance with the approved plans prior to the issue of an Occupation Certificate or Certificate of Completion.

Note: In all cases the construction materials should reinforce the priority of pedestrian movement over that of the crossing vehicle.

(50) LOADING WITHIN SITE

All loading and unloading operations associated with servicing the site must be carried out within the confines of the site, at all times (and must not obstruct other properties/units or the public way).

(51) LOADING/PARKING KEPT CLEAR

At all times the service vehicle docks, car parking spaces and access driveways must be kept clear of goods and must not be used for storage purposes, including garbage storage.

(52) ARTICULATED VEHICLES

At no time is the property to be serviced by articulated vehicles or vehicles bearing containers.

(53) TRAFFIC WORKS

Any proposals for alterations to the public road, involving traffic and parking arrangements, must be designed in accordance with RTA Technical Directives and must be referred to and approved by the Sydney Traffic Committee prior to any work commencing on site.

(54) ASSOCIATED ROADWAY COSTS

All costs associated with the construction of any new road works including kerb and gutter, road pavement, drainage system and footway shall be borne by the developer. The new road works must be designed and constructed in accordance with the City's "Development Specification for Civil Works Design and Construction".

(55) COST OF TRAFFIC MANAGEMENT

All costs associated with signposting for any kerbside parking restrictions and traffic management measures associated with the development shall be borne by the developer.

(56) EXTERNAL LIGHTING

A separate development application is required to be lodged and approved prior to any external floodlighting or illumination of the building or site landscaping.

(57) REFLECTIVITY

The Principal Certifying Authority must ensure that the visible light reflectivity from building materials used on the facade of the building does not exceed 20% prior to issue of the Stage 2 Construction Certificate.

(Amended 19 January 2011 – C)

(58) AWNING MAINTENANCE

The awnings must be inspected and maintained to ensure the structural integrity, aesthetic and functional quality of the awning.

SCHEDULE 1B

PRIOR TO CONSTRUCTION CERTIFICATE/COMMENCEMENT OF WORK/HEALTH AND BUILDING

Note: Prior to the issue of the Construction Certificate, sufficient information must be forwarded to the certifying authority (whether Council or a private accredited certifier) illustrating compliance with the relevant requirements of the Building Code of Australia (and a copy forwarded to Council where Council is not the certifying authority). If Council is to be the certifying authority, please contact the Building Unit to discuss the requirements prior to submission of the application for construction certificate.

(59) ACCESS AND FACILITIES FOR PERSONS WITH DISABILITIES

(a) The building must be designed and constructed to provide access and facilities for people with a disability in accordance with the Building Code of Australia and the City of Sydney Access DCP 2004.

(b) The recommendations of the Accessibility Review prepared by Morris-Goding Accessibility Consulting, dated 20 February 2008 must be implemented.

(c) If, in complying with this condition, amendments to the development are required, the design changes must be submitted to and approved by Council prior to the relevant Construction Certificate being issued.

(Amended 19 January 2011 – C)

(60) ENERGY EFFICIENCY OF BUILDINGS

The design of the building and its services must achieve a rating of 5 stars under the Department of Water and Energy's (DWE) Australian Building Greenhouse Rating (ABGR) scheme. This can be demonstrated by:

(a) Entering into a Commitment Agreement[i] with DWE, to deliver this star rating[ii] for the base building[iii], being services traditionally supplied as 'common' to tenants[iv], such as air conditioning, lifts and common area lighting) or for the whole building[v] where there is to be one tenant to occupy the whole building. The applicant must provide a copy of the completed Commitment Agreement with their *Stage 2* Construction Certificate application; and

(b) Providing a copy of the independent energy assessment report to DWE and submitted with the Construction Certificate application, that follows the current guidelines in DWE's Australian Building Greenhouse Rating Scheme Design Energy Efficiency Review and the Energy Efficiency Design Review. This report must be based on the same documents as those submitted with the Construction Certificate.

Note: Definitions referred to in clause 1(a) above:

(c) Commitment Agreement means an agreement that is set out in accordance with DWE's Australian Building Greenhouse Rating Commitment Agreement, which is made/signed between DWE and the applicant/building owner/building manager, to design, build and

commission the premises to an agreed star rating.

(i) *Star rating* refers to the benchmarking system applied by DWE for measuring the energy efficiency of a building, and known as the *Australian Building Greenhouse Rating Scheme.*

(ii) *Base building* means central services and common areas of a building.

(iii) *Tenancies* means office space within a building covering tenant light and power. This may include tenancy air conditioning if this has been installed to service particular tenant loads, but does not include central services.

(d) Whole building means all of the building, being the fabric of the building itself and all services and fit-outs.

(Amended 19 January 2011 – C)

(61) HERITAGE INTERPRETATION STRATEGY

(a) An interpretation strategy for the site must be submitted to and approved by Council prior to the Stage 3 ~~2~~ Construction Certificate being issued.

(b) The interpretation strategy must detail how information on the history and significance of the site (specifically the pattern of development of the site and of Chifley Square) will be provided for the public and make recommendations regarding public accessibility, signage and lighting. Public art, details of the heritage design, the display of selected artefacts are some of the means that can be used.

(c) Prior to the issue of *any* occupation certificate the approved interpretation strategy must be implemented to the satisfaction of Council.

(amended 4 April 2011 – E)

(62) PHOTOGRAPHIC ARCHIVAL DOCUMENTATION (MINOR WORKS)

Prior to commencement of work (including any demolition works) an archival photographic recording of the building is to be prepared to Council's satisfaction. The recording may be in either digital or film-based form, or a combination of both, prepared in accordance with the NSW Heritage Office guidelines titled 'Photographic Recording of Heritage Items using Film or Digital Capture'. One copy of the record is to be submitted to Council to be lodged with Council's Archives.

The form of the recording is to be as follows:

(a) In A4 format, placed in archival plastic sleeves in an appropriate archival folder.

(b) The Development Application number must be noted on the front of the folder and in the report.

(c) Include a summary report detailing the project description, date and authorship of the photographic record, method of documentation and limitations of the photographic record.

(d) Each negative, slide or digital image is to be cross referenced to a photographic catalogue and photographic base plans.

(e) Include written confirmation, issued with the authority of both the applicant and the photographer that the City of Sydney is granted a perpetual non-exclusive licence to make use of the copyright in all images supplied, including the right to make copies available to third parties as though they were Council images. The signatures of both the applicant and the photographer must be included.

A digital based recording is to include:

(f) Thumbnail image sheets and a selection of A5 or A4 size images, all labelled and cross-referenced to the catalogue sheets and base plans, and processed on A4 size archival photographic paper using archivally stable inks.

(g) CD or DVD containing the report in PDF format and the electronic images saved as JPEG or TIFF files and cross referenced to the catalogue sheets.

A film based recording is to include:

(h) 35mm film images submitted as contact sheets with equivalent negatives, a selection of black and white prints 200 x 250mm, and 35mm colour transparencies, all labelled and cross-referenced to the catalogue sheets and base plans.

(Amended 2 September 2010 - A)

(63) WASTE AND RECYCLING MANAGEMENT - COMMERCIAL

(a) The Waste Management Plan accompanying this Development Application has not been approved by this consent.

(b) A Waste Management Plan is to be approved by the Certifying Authority prior to ~~a~~ *the relevant* Construction Certificate being issued. The plan must comply with the Council's Policy for Waste Minimisation in New Developments 2005. All requirements of the approved Building Waste Management Plan must be implemented during construction of the development.

UPON COMPLETION OF THE DEVELOPMENT

(c) Prior to an Occupation Certificate being issued or the use commencing, whichever is earlier, the Principal Certifying Authority must ensure that waste handling works have been completed in accordance with: the Waste Management Plan; other relevant development consent conditions; and Council's Policy for Waste Minimisation in New Developments 2005.

(64) WASTE AND RECYCLING COLLECTION CONTRACT

Prior to an Occupation Certificate being issued and/or commencement of the use, whichever is earlier, of the building the owner must ensure that there is a contract with a licensed contractor for the removal of **all trade waste**. No garbage is to be placed on the public way e.g. footpaths, roadways, plazas, and reserves at any time.

(65) ~~***NO DEMOLITION PRIOR TO A CONSTRUCTION CERTIFICATE***~~

(Deleted 2 September 2010 - A)

(66) CONSTRUCTION TRAFFIC MANAGEMENT PLAN

(a) The Construction Traffic Management Plan accompanying this Development Application has not been approved by this consent.

(b) A Construction Traffic Management Plan must be submitted to and approved by Council prior to the Stage 1 Construction Certificate being issued.

(c) The Plan shall detail construction vehicle routes, number of trucks, hours of operation, access arrangements and traffic control.

(Amended 19 January 2011 – C)

(67) VIBRATION AND NOISE MANAGEMENT PLAN

A Vibration and Noise Management Plan must be submitted to and approved by Council prior to the Stage 1 Construction Certificate being issued. The Plan shall include, however not be limited to, the following:

(a) identify noise sensitive locations near the site;

(b) identify potential impacts (i.e. exceedances of the goals at the identified sensitive locations);

(c) mitigation measures to control noise from the site, the noise reduction likely and the feasibility and reasonableness of these measures;

(d) selection criteria for plant and equipment;

(e) community consultation;

(f) details of work schedules for all construction phases;

(g) schedule of plant and equipment use and maintenance programs;

(h) noise monitoring techniques and method of reporting results;

(i) site induction details for employees and contractors, and

(j) a declaration of available technologies and the reason for the selection of the preferred technology from a noise generating perspective should

be included.

(68) DEMOLITION, EXCAVATION AND CONSTRUCTION MANAGEMENT

(a) Prior to the commencement of demolition and/or excavation work the following details must be submitted to and be approved by the Principal Certifying Authority:

(i) Plans and elevations showing distances of the subject building from the site boundaries, the location of adjoining and common/party walls, and (where applicable) the proposed method of facade retention.

(ii) A Demolition Work Method Statement prepared by a licensed demolisher who is registered with the Work Cover Authority. (The demolition by induced collapse, the use of explosives or on-site burning is not permitted.)

(iii) An Excavation Work Method Statement prepared by an appropriately qualified person.

(iv) A Waste Management Plan for the demolition and or excavation of the proposed development.

(c) Such statements must, where applicable, be in compliance with AS2601-1991 Demolition of Structures, the Occupational Health and Safety Act 2000 and Regulation; Council's Policy for Waste Minimisation in New Developments 2005, the Waste Minimisation and Management Act 1995, and all other relevant acts and regulations and must include provisions for:

(i) A Materials Handling Statement for the removal of refuse from the site in accordance with the *Waste Minimisation and Management Act 1995*.

(ii) The name and address of the company/contractor undertaking demolition/excavation works.

(iii) The name and address of the company/contractor undertaking off site remediation/disposal of excavated materials.

(iv) The name and address of the transport contractor.

(v) The type and quantity of material to be removed from site.

(vi) Location and method of waste disposal and recycling.

(vii) Proposed truck routes, in accordance with this development consent.

(viii) Procedures to be adopted for the prevention of loose or contaminated material, spoil, dust and litter from being deposited onto the public way from trucks and associated equipment and the proposed method of cleaning surrounding roadways from such deposits. (Note: With regard to demolition of buildings, dust

emission must be minimised for the full height of the building. A minimum requirement is that perimeter scaffolding, combined with chain wire and shade cloth must be used, together with continuous water spray during the demolition process. Compressed air must not be used to blow dust from the building site).

(ix) Measures to control noise emissions from the site.

(x) Measures to suppress odours.

(xi) Enclosing and making the site safe.

(xii) A certified copy of the Public Liability Insurance indemnifying Council for $10,000,000 against public prosecution for the duration of the demolition works.

(xiii) Induction training for on-site personnel.

(xiv) Written confirmation that an appropriately qualified Occupational Hygiene Consultant has inspected the building/site for asbestos, contamination and other hazardous materials, in accordance with the procedures acceptable to Work Cover Authority.

(xv) An Asbestos and Hazardous Materials Clearance Certificate by a person approved by the Work Cover Authority.

(xvi) Disconnection of utilities.

(xvii) Fire Fighting. (Fire fighting services on site are to be maintained at all times during demolition work. Access to fire services in the street must not be obstructed).

(xviii) Access and egress. (Demolition and excavation activity must not cause damage to or adversely affect the safe access and egress of the subject building or any adjacent buildings).

(xix) Waterproofing of any exposed surfaces of adjoining buildings.

(xx) Control of water pollution and leachate and cleaning of vehicles tyres (proposals must be in accordance with the *Protection of the Environmental Operations Act 1997*).

(xxi) Working hours, in accordance with this development consent.

(xxii) Any Work Cover Authority requirements.

(d) The approved work method statements and a waste management plan as required by this condition must be implemented in full during the period of construction.

(69) EROSION AND SEDIMENT CONTROL - BETWEEN 250 AND 2,500SQM

The Erosion and Sediment Control Plan accompanying this Development Application has not been approved by this consent.

Prior to the commencement of demolition/excavation/construction work, an

Erosion and Sediment Control Plan (ESCP) must be submitted to and be approved by the Principal Certifying Authority. The ESCP must:

(a) Conform to the specifications and standards contained in Managing Urban Stormwater: Soils and Construction (Landcom, 2004); the Guidelines for Erosion and Sediment Control on Building Sites (City of Sydney, 2004); and the NSW Protection of the Environment Operations Act 1997.

(b) Include a drawing(s) that clearly shows:

(i) location of site boundaries and adjoining roads

(ii) approximate grades and indications of direction(s) of fall

(iii) approximate location of trees and other vegetation, showing items for removal or retention

(iv) location of site access, proposed roads and other impervious areas

(v) existing and proposed drainage patterns with stormwater discharge points

(vi) north point and scale

(c) Specify how soil conservation measures will be conducted on site including:

(i) timing of works

(ii) locations of lands where a protective ground cover will, as far as is practicable, be maintained

(iii) access protection measures

(iv) nature and extent of earthworks, including the amount of any cut and fill

(v) where applicable, the diversion of runoff from upslope lands around the disturbed areas

(vi) location of all soil and other material stockpiles including topsoil storage, protection and reuse methodology

(vii) procedures by which stormwater is to be collected and treated prior to discharge including details of any proposed pollution control device(s)

(viii) frequency and nature of any maintenance program

(ix) other site-specific soil or water conservation structures.

(70) WATER CONSERVATION

Prior to the commencement of work, details of the water conservation (black

or grey water) must be submitted to Council for approval, in accordance with the requirements of Section 68 of the Local Government Act 1993.

(71) DILAPIDATION REPORT – MAJOR EXCAVATION/DEMOLITION

(a) Subject to the receipt of permission of the affected landowner, dilapidation report/s, including a photographic survey of the Colonial Centre building (52-56 Martin Place) are to be prepared by an appropriately qualified structural engineer prior to commencement of demolition/excavation works. A copy of the dilapidation report/s together with the accompanying photographs must be given to the above property owners, and a copy lodged with the Certifying Authority and the Council prior to the issue of ~~a~~ *the Stage 1* Construction Certificate.

UPON COMPLETION OF EXCAVATION/DEMOLITION

(b) A second Dilapidation Report/s, including a photographic survey shall then be submitted at least one month after the completion of demolition/excavation works. A copy of the second dilapidation report/s, together with the accompanying photographs must be given to the above property owners, and a copy lodged with the Principal Certifying Authority and the Council prior to the issue of an Occupation Certificate.

Any damage to buildings, structures, lawns, trees, sheds, gardens and the like must be fully rectified by the applicant or owner, at no cost to the affected property owner.

Note: Prior to the commencement of the building surveys, the applicant/owner shall advise (in writing) all property owners of buildings to be surveyed of what the survey will entail and of the process for making a claim regarding property damage. A copy of this information shall be submitted to Council.

(72) DEMOLITION/SITE RECTIFICATION (if cost is over $50m)

The following conditions apply to the development:

(b) Prior to the commencement of work (including any demolition works) documentary evidence must be provided to Council that the owner of the site has entered into a Deed with Council, the cost of preparation and execution of such Deed (including stamp duty and registration fees) to be borne by the applicant, which contains such conditions as the Council reasonably requires to ensure the matters set out in this condition are adequately provided for.

(c) Without limiting the generality of paragraph (b), the Deed must provide for:

(i) A bank guarantee to be provided in the sum of $395,250 dollars as security for the costs of such works provided that:

a. the maximum liability under the Deed must not exceed $395,250 dollars; and

b. the Council may accept a lesser amount as security if

substantiated by detailed design and Quantity Surveyor costing for works which meet the objectives of the condition.

(ii) Council to be given sufficient contractual rights to be able to ensure that in any of the following events namely:

a. demolition of the existing building has commenced but not been completed;

b. the existing building has been demolished; or

c. the site has been excavated; or

d. the erection of the structure has commenced;

(iii) that it, or any person authorised by it, may enter the site and carry out such works at the cost of the applicant (or such other person as the consent authority may approve) as may be then appropriate in the circumstances in each of the abovementioned events, to:

a. make the building safe and of an appearance acceptable to Council at ground level;

b. allow the ground level to be landscaped and of an appearance acceptable to Council from any public vantage point; or

c. for the hole to be covered to allow it to be landscaped and of an appearance acceptable to Council from any public vantage point; or

d. in the event that the new building is constructed beyond the ground floor, to allow any hoardings to be removed and the ground floor development to be completed to a tenantable stage;

AND to call on such bank guarantee to cover the cost thereof.

(d) If the site is commenced to be developed and there is suspension in activity for 6 months (or suspensions of activity which in the aggregate exceed 6 months), resulting in a building site which has an appearance not acceptable to Council, then the Council will have the readily enforceable rights to:

(i) require certain works including but not limited to those works necessary to achieve the results referred to in sub-clause © (ii)e – h to take place on the site; and

(ii) in the event of default, have the right to enter and carry out these works and to call upon security in the nature of a bank guarantee to cover the cost of the works.

(e) The Deed may, if the Director City Planning is satisfied, provide for an adjustment of the guarantee amount during the course of construction to reflect that, as the development progresses, the likelihood and nature of

the appropriate site rectification works may change. The stages of reduction will be:

(i) Stage 1 – Completion of the site excavation and all construction works necessary to complete all parts of the Development to street level, including sealing of the slab at that level.

(ii) Stage 2 – Completion of all construction works necessary to complete the structure of the Development to the roof level.

(iii) Stage 3 – Issue of the Final Occupation Certificate.

(f) If a claim for an adjustment is made, the Deed must also provide that any such claim is to be supported by the following:

(i) Certification (from an accredited certifier) that the relevant stage is complete;

(ii) Detailed schedule of completed works carried out in the relevant stage;

(g) Quantity Surveyors costing of the likely site rectification works required at each remaining stage.

(Amended 2 September 2010 - A)

(73) CONSTRUCTION LIAISON COMMITTEE

(a) Prior to the commencement of work, a Construction Liaison Committee is to be established by the developer to ensure that demolition and construction related impacts (including construction noise and vibration, loading, issues associated with construction workers and vehicles, traffic issues, management of the construction site) from the site can be dealt with expeditiously and co-operatively.

(b) The committee is to be comprised of interested parties representing potentially affected properties adjacent to and surrounding the site and interest groups, these may include but are not restricted to:

(i) properties on Hunter Street (between Macquarie and Castlereagh Street);

(ii) properties on Phillip Street (between Martin Place and Bent Street);

(iii) properties on Elizabeth Street (between Martin Place and Hunter Street);

(iv) Deutsche Bank tower;

(v) Sofitel Sydney Wentworth Hotel;

(vi) Sydney Buses.

(c) The committee shall meet prior to the submission of the final Construction Management plan to Council and prior to commencement of

works on the site to address initial areas of concern and then at monthly intervals or as considered appropriate by the Committee throughout the construction process. Details of the consultation with the adjoining sites must be submitted to and approved by Council prior to the commencement of work.

(d) Prior to the commencement of work, the Site Manager is to provide the members of the committee and all immediately adjacent/adjoining properties 24 hour contact details (including location of site office and 24 hour phone number), to ensure that any matters which arise during the construction period are addressed immediately. The site manager shall be available during normal business hours to provide information to the public about activities on site and to bring any complaints to the attention of the applicant.

(e) A register of all complaints received shall be kept by the applicant through out the duration of the project, and the register to be made available to Council on request.

(74) ASBESTOS REMOVAL

(a) All demolition works involving the removal and disposal of asbestos cement must only be undertaken by contractors who hold a current WorkCover Asbestos or "Demolition Licence" and a current WorkCover "Class 2 (Restricted) Asbestos Licence and removal must be carried out in accordance with National Occupational Health and Safety Commission (NOHSC): "Code of Practice for the Safe Removal of Asbestos" and the City of Sydney Asbestos Policy.

(b) An Asbestos Contamination Management Plan is to be prepared prior to commencement of demolition works and submitted to the principal certifying authority.

(Amended 2 September 2010 - A)

(75) CLASSIFICATION OF WASTE

Prior to the exportation of waste from the site, the waste materials must be classified to determine where the waste may be legally taken. The Protection of the Environment Operations Act 1997 provides for the commission of an offence for both the waste owner and the transporters if the waste is taken to a place that cannot lawfully be used as a waste facility.

(76) DISPOSAL OF ASBESTOS

Asbestos to be disposed of must only be transported to waste facilities licensed to accept asbestos. The names and location of these facilities are listed in Part 6 of the City of Sydney's Asbestos Policy.

(77) ASBESTOS REMOVAL SIGNAGE

Standard commercially manufactured signs containing the words "DANGER ASBESTOS REMOVAL IN PROGRESS" measuring not less than 400mm x 300mm are to be erected in prominent visible positions on the site.

(78) UTILITY SERVICES

To ensure that utility authorities are advised of the development:

(a) Prior to commencement of demolition works a survey is to be carried out of all utility services within and adjacent to the site including relevant information from utility authorities and excavation if necessary, to determine the position and level of services.

(b) Prior to the issue of a construction certificate the applicant is to obtain written approval from the utility authorities (e.g. Energy Australia, Sydney Water, and Telecommunications Carriers) in connection with the relocation and/or adjustment of the services affected by the construction of the underground structure. Any costs in the relocation, adjustment or support of services are to be the responsibility of the developer.

(Amended 2 September 2010 - A)

(79) ROAD OPENING PERMIT

A separate **Road Opening Permit** under Section 138 of the Roads Act 1993 shall be obtained from Council prior to the commencement of any:

(a) Excavation in or disturbance of a public way, or

(b) Excavation on land that, if shoring were not provided, may disturb the surface of a public road (including footpath).

(80) TEMPORARY GROUND ANCHORS, TEMPORARY SHORING AND PERMANENT BASEMENT/RETAINING WALLS AFFECTING THE ROAD RESERVE

For temporary shoring including ground anchors affecting the road reserve, a separate application under Section 138 of the Roads Act 1993 must be lodged with Council.

For new permanent basement wall/s or other ground retaining elements (not being anchors projecting under the road reserve):-

(a) Prior to the installation of any temporary ground anchors or temporary shoring affecting the roads reserve the following documents must be submitted to the Certifying Authority (CA) and a copy to Council (if Council is not the CA):

(i) Dilapidation Report of adjoining buildings/structures.

(ii) Evidence that public utility services have been investigated.

(b) If adjoining a Public Way:

(i) Evidence of a $10 million dollar public liability insurance policy specifically indemnifying the City of Sydney, valid for at least the duration of the project. The original document must be submitted to Council.

(ii) Bank guarantee in accordance with the Council's fees and

charges. The original document must be submitted to Council.

(c) Prior to commencement of work:

(i) The location of utility services must be fully surveyed and the requirements of the relevant public utility authority complied with; and

(ii) The following documents must be submitted to and approved by the Principal Certifying Authority (PCA) and a copy to Council (if Council is not the PCA):

a. Structural drawings and certification as prescribed elsewhere in this consent.

b. Geotechnical report and certification as prescribed elsewhere in this consent.

(d) Prior to issue of Occupation Certificate, the Principal Certifying Authority must receive written and photographic confirmation that the restoration of the public way has been complete in accordance with the following:

(i) All ground anchors must be de-stressed and isolated from the building prior to completion of the project.

(ii) The temporary structure, including foundation blocks, anchors and piers must be removed above and below the public way, prior to completion of project, down to a depth of 2m.

(iii) All timber must be removed.

(iv) All voids must be backfilled with stabilised sand (14 parts sand to 1 part cement).

(v) All costs for any reinstatement of the public way made necessary because of an unstable, damaged or uneven surface to the public way must be borne by the owner of the land approved for works under this consent.

(e) The Bank Guarantee may be released after the Principal Certifying Authority submits certification to Council that all the works described in (d) above have been completed and that there is no remaining instability, damage or unevenness to the public domain as a result of the development. This certification is to include relevant photographs and must be to the satisfaction of the Council's Director City Planning.

(Amended 2 September 2010 - A)

(81) ~~TELECOMMUNICATIONS PROVISIONS~~

~~(a) Appropriate space and access for ducting and cabling is to be provided within the plant area and to each apartment within the building within for a minimum of three telecommunication carriers or other providers of broad band access by ground or satellite delivery. The details must be submitted for the approval of the Certifying Authority prior to a~~

~~Construction Certificate being issued.~~

~~(b) A separate DA must be submitted prior to the installation of any external telecommunication apparatus, or the like.~~

(deleted 4 April 2011 – E)

(82) PHYSICAL MODELS

(a) Prior to a Construction Certificate being issued, an accurate 1:500 scale model of the approved development must be **submitted to Council** for the City Model in Town Hall House; and

(b) Prior to an Occupation Certificate being issued, an accurate 1:500 scale mode of the development as constructed must also be **submitted to Council** for placement in the City Model at the City Exhibition Space.

Note:

(i) The models must be constructed in accordance with the Model Specifications available online at www.cityofsydney.nsw.gov.au/Development/DevelopmentApplicationGuide/PreparingandLodgingaDA.asp. Council's model maker must be consulted prior to construction of the model for Town Hall House. The Manager of Customs House must be consulted prior to the construction of the model for City Exhibition Space.

(ii) The models are to comply with all of the conditions of the Development Consent.

(iii) The models must be amended to reflect any further modifications to the approval (under section 96 of the Environmental Planning and Assessment Act) that affect the external appearance of the building.

(83) SUBMISSION OF ELECTRONIC MODELS PRIOR TO CONSTRUCTION CERTIFICATE AND PRIOR TO OCCUPATION CERTIFICATE

(a) Prior to a Construction Certificate being issued, an accurate 1:1 electronic model of the detailed construction stage drawings must be submitted to Council for the electronic City Model.

(b) The data required to be submitted within the surveyed location must include and identify:

(i) building design above and below ground in accordance with the development consent;

(ii) all underground services and utilities, underground structures and basements, known archaeological structures and artefacts;

(iii) property boundaries and the kerb lines adjacent to the site.

The data is to be submitted as a DGN or DWG file on physical media (floppy disc or CD). All plans are to be referenced to the submitted

Integrated Survey Grid of NSW (ISG), Australian Map Grid (AMG) or Map Grid of Australia (MGA) spatially located in the Initial Data Extraction file.

(c) Within the DGN ***or*** DWG file each identified structure, feature, utility or service must be distinguished by a combination of layering and/or symbology schema. The submitted plans must be accompanied by a comma delimited text file, detailing the layering and/or symbology schema.

(d) The electronic model must be constructed in accordance with the City's electronic data protocol. The protocol provides specific details of the information required to be shown and is available online at www.cityofsydney.nsw.gov.au/Development/DevelopmentApplicationGuide/PreparingandLodgingaDA.asp. Council's Design/Technical Support staff should be consulted prior to creation of the model. The data is to comply with all of the conditions of the Development Consent.

(e) Prior to an Occupation Certificate being issued, a second and updated "as built" 1:1 electronic model, in accordance with the above requirements, of the completed development must be submitted to Council for the electronic City Model.

Note: The submitted model/data must be amended to reflect any modifications to the approval (under section 96 of the *Environmental Planning and Assessment Act*) that affect the location of any of the underground services or structures and/or external configuration of building above ground.

(84) FOOTPATH DAMAGE BANK GUARANTEE

Prior to commencement of demolition works the owner of the site must provide a bank guarantee for the sum to be determined based on the City of Sydney's Schedule of Fees and Charges as security for rectification of any damage to the public way.

Note: The bank guarantee required by this condition does not need to be provided if a separate bank guarantee is lodged as part of an approval for a hoarding over the public way. However neither bank guarantee will be released until all development works are complete to the satisfaction of the City, including rectification of damage to the public way. You should contact Council to determine the bank guarantee amount prior to payment.

(Amended 2 September 2010 - A)

(85) APPLICATION FOR HOARDINGS AND SCAFFOLDING ON A PUBLIC PLACE

(a) A separate application under Section 138 of the Roads Act 1993 is to be made to Council to erect a hoarding and/or scaffolding in a public place and such application is to include:-

(i) Architectural, construction and structural details of the design in accordance with the *Policy for the Design and Construction of Hoarding* (September 1997) and the *Guidelines for Temporary*

*Protective Structures (*April 2001).

(ii) Structural certification prepared and signed by an appropriately qualified practising structural engineer.

Evidence of the issue of a Structural Works Inspection Certificate and structural certification will be required prior to the commencement of demolition or construction works on site.

Assessment of the impacts of construction and final design upon the City of Sydney's street furniture such as bus shelters, phone booths, bollards and litter bins and JCDecaux street furniture including kiosks, bus shelters, phones, poster bollards, bench seats and littler bins. The applicant is responsible for the cost of removal, storage and reinstallation of any of the above as a result of the erection of the hoarding. In addition, the applicant is responsible for meeting any revenue loss experienced by Council as a result of the removal of street furniture. Costing details will be provided by Council. The applicant must also seek permission from the telecommunications carrier (e.g. Telstra) for the removal of any public telephone.

(b) Should the hoarding obstruct the operation of Council's CCTV Cameras, the applicant shall relocate or replace the CCTV camera within the hoarding or to an alternative position as determined by Council's Contracts and Asset Management Unit for the duration of the construction of the development. The cost of relocating or replacing the CCTV camera is to be borne by the applicant. Further information and a map of the CCTV cameras is available by contacting Council's CCTV Unit on 9265 9232.

(c) During the demolition phase of the project and prior to works proceeding above street level, the hoarding must comply with the Councils policies for hoardings and temporary structures on the public way. Graffiti must be removed from the hoarding within one working day for the duration of all works on the project.

(d) Prior to construction works proceeding above street level , the design of graphics material displayed on the hoarding awnings are to incorporate a component of public art so as to make a positive contribution to the public domain during construction.

(e) Detailed concepts for the graphics material incorporating public art are to be submitted to Council for approval prior to the issue of a construction certificate for works above street level.

(f) The component of public art on the hoarding refers to the provision of specifically commissioned artworks that do not include commercial, retail or 'lifestyle' images, and are separate from any advertising, marketing or 'lifestyle' graphics that may be included elsewhere on the hoarding. Any advertising image must be minor in nature, not be placed on highly visible areas such as street corners and the size shall comply with relevant hoarding and planning controls.

(g) Funding of the public art shall be in addition to Section 61 contributions and public domain upgrades.

(Amended 2 September 2010 - A)

(86) BARRICADE PERMIT

Where construction/building works require the use of a public place including a road or footpath, approval under Section 138 of the Roads Act 1993 for a Barricade Permit is to be obtained from Council prior to the commencement of work. Details of the barricade construction, area of enclosure and period of work are required to be submitted to the satisfaction of Council.

(87) STRATA SUBDIVISION – SEPARATE DA REQUIRED

Strata subdivision requires development consent and therefore the lodgment of a separate development application and subsequent approval from Council, or an accredited certifier, of the strata plan, under section 37 of the *Strata Schemes (Freehold Development) Act 1973.*

(88) PUBLIC DOMAIN PLAN

(a) Three copies of a detailed Public Domain Plan ***(excluding any proposed street signage works)*** must be prepared by an architect, urban designer or landscape architect and must be lodged with Council's Public Domain Section and approved by Council prior to the Stage ~~3~~ ***2*** Construction Certificate being issued for any new building work excluding approved preparatory, demolition or shoring work. It is recommended that draft plans should be submitted for comment prior to formal submission for approval.

The Public Domain Plan must be prepared in accordance with the City of Sydney's Public Domain Manual. The works to the public domain are to be completed in accordance with the approved plan and the Public Domain Manual before any Occupation Certificate is issued in respect of the development.

Note: A security deposit will be required for the public domain works, in accordance with the City of Sydney's adopted fees and charges. You should contact Council to determine deposit amount prior to payment.

(b) ***Any proposed Public Domain street signage design is to be lodged with Council's Public Domain Section and approved by Council prior to the Stage 3 Construction Certificate being issued.***

(Amended 19 January 2011 – C) (amended 4 April 2011 – E) ***(amended 10 January 2012 – I)***

(89) GROUND/PLAZA LEVELS, MID-LEVEL TERRACE (LEVEL *18* ~~15~~) AND ROOF TERRACE

(a) A detailed landscape plan of the ground/plaza levels, mid-level terrace (level 18) roof terrace, drawn to scale, by a landscape architect or approved landscape consultant, must be submitted to and approved by Council prior to the Stage ***3*** ~~2~~ Construction Certificate being issued.

(b) The ground/plaza levels shall be designed and developed to take into consideration the integration of public art, café, seating, public safety,

access, skateboard deterrent devices, security and amenity.

(c) The plan must include:

(i) Location of existing and proposed structures on the site including existing trees (if applicable);

(ii) Details of earthworks including mounding and retaining walls and planter boxes (if applicable);

(iii) Location, numbers and type of plant species;

(iv) Details of planting procedure and maintenance;

(v) Details of drainage and watering systems;

(vi) Location and fixings of public art elements;

(vii) Details of furniture and fixings;

(viii) Details of paved surfaces;

(ix) Proposed levels to ensure smooth interface between streetscape and reverse podium;

(x) Details of lighting.

All landscaping in the approved plan is to be completed prior to and Occupation Certificate being issued.

(~~b~~*d*) Prior to the Stage *3* ~~2~~ Construction Certificate being issued, a maintenance plan is to be submitted for approval of the Principal Certifying Authority and complied with during occupation of the property.

(e) All landscaping in the approved plan is to be completed prior to any Occupation Certificate being issued.

(Amended 19 January 2011 – *C) (amended 4 April 2011 – E)*

(90) STREET TREE REMOVAL

(a) No approval is granted for the removal of street trees along the Philip Street Frontage of the site. The street trees along the Hunter Street frontage are approved for removal. The street trees along the Elizabeth Street frontage are approved to be removed with the exception of the northern most street tree which must be retained.

(b) The species, number and location of street trees to be planted on Hunter Street and Elizabeth Street is to be determined in consultation with Council's Public Domain Unit and Parks and Recreation Unit and resolved in the Public Domain Plan as required by condition 88 of this consent.

(c) deleted

(d) The removal of any street tree must include complete stump removal and

the temporary reinstatement of levels so that no trip or fall hazards exist until replanting occurs. These works must be completed within one working day.

(Amended 17 September 2010 - B) (Amended 1 April 2011 - D)

(91) STREET TREE PLANTING AND MAINTENANCE

The planting of street trees is required in association with the development in accordance with the following measures:

(b) A Landscape Plan indicating the location of the street trees to be planted in association with the development must be submitted to and approved by Council prior to the issue of the Stage 3 ~~2~~ Construction Certificate. Street trees must be located and planted in accordance with the 'Trees in Footways – Guidelines for Replacement' detailed in the City's Street Tree Master Plan, and the following:

The street tree(s) must be planted:

(i) by a qualified Arborist or Horticulturist (AQF Level 3); and

(ii) before the Occupation Certificate is issued or the use is commenced, whichever is earlier.

The tree pits must be inspected by Council's Contract Coordinator – Street Trees, before and after planting.

(c) All street trees planted in accordance with the approved Landscape Plan must be maintained by a qualified Horticulturist or Arborist (AQF Level 3) for a minimum period of twelve (12) months commencing on the planting date. Maintenance includes, but is not limited to, watering, weeding, removal of rubbish from tree base, pruning, fertilizing, pest and disease control and any other operations to maintain a healthy robust tree.

(d) At the end of the twelve (12) month maintenance period, written approval must be obtained from Council before hand-over of any street tree to Council.

(e) If a street tree has been replaced due to maintenance deficiencies during the twelve (12) month maintenance period, the twelve (12) month maintenance period will start again from the date that the street tree is replaced.

(f) Three trees removed from Elizabeth Street and four trees removed from the Hunter Street frontage must be replaced at the completion of the project. The exact positions of the replacement trees must be indicated in the Public Domain plan to be approved by Council.

(g) Replacement street trees on Elizabeth Street shall comprise at least three advanced individuals at 400 litre pot sizes. Replacement street trees on Hunter Street shall comprise at least four trees at 400 litre pot sizes.

(h) The species of all replacement street trees indicated in the Public

Domain Plans should defer to the most current Street Tree Master Plan at the time of ~~*planting*~~ *lodgement of the Public Domain Plan.*

(i) All stock should conform to Natspec specifications. Council reserves the right to reject any defective or sub-standard stock that may be supplied for replacement street trees.

(Amended 1 April 2011 - A) (Amended 19 January 2011 – C)
(amended 4 April 2011 – E) (Amended 27 April 2011 – E)

(92) STREET TREE HOARDING PROTECTION

Street trees must be protected during the erection of hoardings and construction works as follows:

(a) Tree trunk and major limb protection must be undertaken before or during the installation of the hoarding. The protection must:

(i) be installed by a qualified arborist (AQF Level 3); and

(ii) include the wrapping of the tree's trunk with hessian or similar material to limit damage to the trunk and major branches, within 0.5m of the hoarding.

(b) Materials or goods, including site sheds, must not be stored or placed:

(i) around or under the tree canopy; or

(ii) within two (2) metres of tree trunks or branches.

(c) Protective fencing (1.8 metre chain wire mesh fencing) must be erected on top of the hoarding [Tree Management Team to insert location of hoarding and affected trees] to protect branches during the construction works.

(93) ALIGNMENT LEVELS

(a) Prior to the Stage 1 Construction Certificate being issued, footpath alignment levels for the building must be submitted to Council for approval. This submission must be accompanied by a plan prepared by a Registered Surveyor showing the existing location, size and levels (AHD) of all service covers, trees, poles and street furniture, kerb, gutter and alignment levels of 10m cross sections, alignment levels at proposed and existing vehicular and/or pedestrian entrances within the footway adjacent to and extending 20 metres past either side of the site.

(b) These alignment levels, as approved by Council, are then to be incorporated into the plans submitted with the application for a Construction Certificate.

(Amended 19 January 2011 – C)

(94) PAVING MATERIALS

The surface of any material used or proposed to be used for the paving of colonnades, thoroughfares, plazas, arcades and the like which are used by

the public must comply with AS/NZS 4586:2004 (including amendments) "Slip resistance classification of new pedestrian surface materials".

(95) STORMWATER AND DRAINAGE - MAJOR DEVELOPMENT

On-site detention, treatment and re-use is encouraged.

(a) Prior to the Stage 1 Construction Certificate being issued, details of the proposed stormwater disposal and drainage from the development including a system of on-site stormwater detention in accordance with Council's standard requirements and details of the provision and maintenance of overland flow paths must be submitted to and approved by Council. All approved details for the disposal of stormwater and drainage are to be implemented in the development.

(b) Any proposed connection to the Council's underground drainage system will require the owner to enter into a Deed of Agreement with the Council and obtain registration on Title of a Positive Covenant prior to *a Stage 1* Construction Certificate being issued and prior to the commencement of any work within the public way.

(c) The requirements of Sydney Water with regard to the on site detention of stormwater must be ascertained and complied with. Evidence of the approval of Sydney Water to the on-site detention must be submitted prior to the Stage 1 Construction Certificate being issued.

(d) An "Application for Approval of Stormwater Drainage Connections" must be submitted to the Council with the appropriate fee at the time of lodgement of the proposal for connection of stormwater to the Council's drainage system.

(96) MECHANICAL VENTILATION

(a) The premises must be ventilated in accordance with the Building Code of Australia and AS1668.1-1998 and AS1668.2-1991.

(b) Details of any mechanical ventilation and/or air conditioning system complying with AS1668.1-1998 and AS1668.2-1991, the Building Code of Australia and relevant Australian Standards must be prepared by a suitably qualified person certified and certified in accordance with Clause A2.2(a)(iii) of the Building Code of Australia, to the satisfaction of the Certifying Authority prior to the issue of the relevant Construction Certificate.

(c) Prior to issue of an Occupation Certificate and following the completion, installation, and testing of all the mechanical ventilation systems, a Mechanical Ventilation Certificate of Completion and Performance in accordance with Clause A2.2(a)(iii) of the Building Code of Australia, must be submitted to the Principal Certifying Authority.

(97) CONTINUED PERFORMANCE OF MECHANICAL VENTILATION

The required operation and performance of any mechanical ventilation, air pressurisation or other smoke control system must not be impaired by the proposed partitioning layout.

(98) CAR PARK VENTILATION

The car park must be ventilated in accordance with the *Building Code of Australia* and, where necessary, Australian Standard AS1668, Parts 1 and 2. Ventilation must be controlled by carbon dioxide monitoring sensors to ensure compliance with occupant health requirements while reducing energy consumption.

(99) MICROBIAL CONTROL

(a) All cooling towers and cooling and warm water systems must be operated and maintained in accordance with AS 3666.2:1995, (or AS 3666.3:2000 subject to prior notification to Council) the *Public Health Act 1991*, and *Public Health (Microbial Control) Regulation 2000.*

(b) A true copy of the annual certificate as stipulated in clause 9(2) of the *Public Health (Microbial) Regulation 2000* which certifies the effectiveness of the process of disinfection used for the water cooling system, must be submitted to Council prior to the period ending 30 June each year.

(c) Prior to commencement of the use the owner or occupier of the premises must apply to Council for the registration of water cooling systems warm water systems installed on the premises in accordance with the *Public Health (Microbial Control) Regulation 2000.*

(100) STRUCTURAL CERTIFICATION FOR DESIGN - BCA (ALL BUILDING CLASSES)

Prior to the issue of the relevant Construction Certificate, structural details and a Structural Certificate for Design in accordance with Clause A2.2(a)(iii) of the Building Code of Australia (applicable to class 2-9 building) and Clause 1.2.2(iii) of Volume 2 of the BCA (applicable to Class 1 and 10 buildings) must be submitted to the satisfaction of the Certifying Authority. A copy of the certificate must be submitted to Council if Council is not the certifying authority.

(Amended 19 January 2011 – C)

(101) CERTIFICATION OF GEOTECHNICAL INSPECTION

Prior to the issue of the Stage 1 Construction Certificate, a Geotechnical Inspection Certificate in accordance with Clause A2.2(a)(iii) of the Building Code of Australia prepared by an appropriately qualified person must be submitted to the satisfaction of the Certifying Authority and a copy submitted to Council (if it is not the Principal Certifying Authority).

(Amended 19 January 2011 – C)

(102) GEOTECHNICAL REPORT AND CERTIFICATION

Prior to commencement of any foundation or bulk excavation, a Geotechnical Report must be submitted to the satisfaction of the Principal Certifying Authority and a copy of the report must be submitted to Council (if it is not the Principal Certifying Authority).

(103) BCA - NEW BUILDINGS WORKS - CLASS 2-9 BUILDINGS

(a) Pursuant to Clause 98 of the Environmental Planning and Assessment Regulation 2000, the proposed building work must comply with the Building Code of Australia (BCA) including:

(i) Structural provisions - Part B1;

(ii) Fire resistance and stability - Part C1;

(iii) Compartmentation and separation - Part C2;

(iv) Protection of openings - Part C3;

(v) Provision for escape (access and egress) - Part D1;

(vi) Construction of exits - Part D2;

(vii) Access for people with disabilities - Part D3;

(viii) Fire fighting equipment - Part E1;

(ix) Smoke hazard management - Part E2;

(x) Lift installation - Part E3;

(xi) Emergency lighting, exit signs and warning systems - Part E4;

(xii) Damp and weatherproofing - Part F1;

(xiii) Sanitary and other facilities - Part F2;

Note: For restaurants, cafes, bars and the like, sanitary facilities (including accessible facilities for persons with disabilities complying with AS 1248.1) must be provided for customers where more than 20 seats are provided, including seating for any future footway dining facilities.

(xiv) Light and ventilation - Part F4;

(xv) Energy Efficiency - Building fabric - Part J1;

(xvi) Energy Efficiency - External glazing - Part J2;

(xvii) Energy Efficiency - Building sealing - Part J3;

(xviii) Energy Efficiency - Air movement - Part J4;

(xix) Energy Efficiency - Air-conditioning and ventilation systems - Part J5;

(xx) Energy Efficiency - Artificial lighting and power - Part J6;

(xxi) Energy Efficiency - Hot water supply - Part J7;

(xxii) Energy Efficiency - Access for maintenance - Part J8;

(b) If compliance with the deemed-to-satisfy provisions of the BCA and the matters listed in condition (a) above cannot be achieved, an alternative building solution in accordance with Part A0 of the BCA must be prepared by a suitably qualified and accredited person and be submitted to the Certifying Authority illustrating how the relevant performance requirements of the BCA are to be satisfied. Prior ~~a~~ *to the relevant* Construction Certificate being issued, the Certifying Authority must ensure that the building complies with the Building Code of Australia.

(c) The BCA matters identified in (a) above are not an exhaustive list of conditions to verify compliance or non-compliance with the BCA. Any design amendments required to achieve compliance with the BCA must be submitted to Council. Significant amendments may require an application under Section 96 of the Act to be lodged with Council to amend this consent.

Note: The provisions of Clause 94 of the Environmental Planning and Assessment Regulation 2000 have been considered in the assessment of the proposed development.

(104) ANNUAL FIRE SAFETY STATEMENT FORM

An **annual Fire Safety Statement** must be given to Council and the NSW Fire Brigade commencing within 12 months after the date on which the initial Interim/Final Fire Safety Certificate is issued or the use commencing, whichever is earlier. A copy must also be submitted to Council if Council is not the Principal Certifying Authority.

(105) FIRE SAFETY CERTIFICATE TO BE SUBMITTED

A Fire Safety Certificate must be submitted to the Principal Certifying Authority for all of the items listed in the Fire Safety Schedule prior to an Occupation Certificate being issued. A copy of the Fire Safety Certificate must be submitted to Council if it is not the Principal Certifying Authority.

(106) SPRINKLER SYSTEM

The effective coverage and operation of any sprinkler system must not be impaired by the partitioning layout and/or the coverage and operation of any fire and smoke detection system must not be impaired by the proposed partitioning layout. Any alterations to the existing sprinkler installation must comply with the *Building Code of Australia*.

SCHEDULE 1C

DURING CONSTRUCTION/PRIOR TO OCCUPATION/COMPLETION

(107) OCCUPATION CERTIFICATE TO BE SUBMITTED

An Occupation Certificate must be obtained from the Principal Certifying Authority and a copy submitted to Council prior to commencement of occupation or use of the whole or any part of a new building, an altered portion of, or an extension to an existing building.

(108) HOURS OF WORK AND NOISE – CBD

The hours of construction and work on the development must be as follows:

(a) All work, including demolition, excavation and building work, and activities in the vicinity of the site generating noise associated with preparation for the commencement of work (eg loading and unloading of goods, transferring of tools etc) in connection with the proposed development must only be carried out between the hours of 7.00am and 7.00pm on Mondays to Fridays, inclusive, and 7.00am and 5.00pm on Saturdays, and no work must be carried out on Sundays or public holidays.

(b) All work, including demolition, excavation and building work must comply with the *City of Sydney Code of Practice for Construction Hours/Noise 1992* and Australian Standard 2436-1981 'Guide to Noise Control on Construction, Maintenance and Demolition Sites'.

Note: The "*City of Sydney Code of Practice for Construction Hours/Noise 1992*" allows extended working hours subject to the approval of an application in accordance with the Code and under Section 96 of the *Environmental Planning and Assessment Act 1979*.

(109) SITE NOTICE OF PROJECTS DETAILS AND APPROVALS

A site notice is to be prominently displayed at the boundary to each frontage of the site for the purposes of informing the public of appropriate project details and relevant approvals. The notice(s) is to satisfy all of the following requirements:

(a) Minimum dimensions of the notice are to measure 841mm x 594mm (A1) with any text on the notice to be a minimum of 30 point type size;

(b) The notice is to be durable and weatherproof and is to be displayed throughout the construction period;

(c) A copy of the first page of the development approval, building approval (including any modifications to those approvals) and any civic works approvals is to be posted alongside the notice in weatherproof casing;

(d) The approved hours of work, the Principal Certifying Authority including contact address and certification details, the name of the site manager, the responsible managing company, its address and 24 hour contact phone number for any enquiries, including construction/noise complaint,

are to be displayed on the site notice;

(e) The notice(s) is to be mounted at eye level on the perimeter hoardings and is also to state that unauthorised entry to the site is not permitted.

(110) USE OF APPLIANCE OF A HIGHLY INTRUSIVE NATURE

This development consent does not extend to the use of appliances which emit noise of a highly intrusive nature (such as pile - drivers and hydraulic hammers) or are not listed in Groups B, C, D, E or F of Schedule 1 of the City of Sydney Code of Practice for Construction Hours/Noise 1992 and Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites". A separate application for approval to use any of these appliances must be made to Council.

(111) ROCK CUTTING INTO BLOCKS

Removal of rock by cutting into blocks is not permitted, unless a separate development application is submitted to, and approved by Council for these works.

(112) LIGHTING OF SITE OUTSIDE OF STANDARD CONSTRUCTION HOURS

Lighting of the site while any work is undertaken outside of Council's standard hours of construction must ensure that at no time must the intensity, hours of illumination or location of the lighting cause objectionable glare or injury to the amenity of the neighbourhood. If in the opinion of Council, injury is likely to be caused, the intensity, hours of illumination and location of the lighting must be varied so that it does not cause injury to nearby residents.

(113) NOTIFICATION OF EXCAVATION WORKS

The Principal Certifying Authority and Council must be given a minimum of 48 hours notice that excavation, shoring or underpinning works are about to commence.

(114) SYDNEY WATER CERTIFICATE

A Section 73 Compliance Certificate under the Sydney Water Act 1994 must be obtained from Sydney Water Corporation.

Application must be made through an authorised Water Servicing Coordinator. Please refer to the Building Developing and Plumbing section on the web site www.sydneywater.com.au then refer to "Water Servicing Coordinator" under "Developing Your Land" or telephone 13 20 92 for assistance.

Following application a "Notice of Requirements" will advise of water and sewer infrastructure to be built and charges to be paid. Please make early contact with the Coordinator, since building of water/sewer infrastructure can be time consuming and may impact on other services and building, driveway or landscape design.

The Section 73 Certificate must be submitted to Council or the Principal Certifying Authority prior to an Occupation Certificate or subdivision/strata certificate being issued.

(115) EROSION AND SEDIMENT CONTROL

The Soil and Water Management Plan (SWMP) or Erosion and Sediment Control Plan (ESCP) which has been approved by the Principal Certifying Authority must be implemented in full during the construction period.

During the construction period;

(a) erosion and sediment controls must be regularly inspected, repaired and maintained in working order sufficient for a 10 year Average Recurrence Interval (ARI) rainfall event;

(b) erosion and sediment control signage available from Council must be completed and attached to the most prominent structure visible at all times when entering the site for the duration of construction; and

(c) building operations and stockpiles must not be located on the public footway or any other locations which could lead to the discharge of materials into the stormwater system.

(116) PROTECTION OF STREET TREES DURING CONSTRUCTION

All street trees adjacent to the site not approved for removal must be protected at all times during demolition and construction, in accordance with Council's Tree Preservation Order. Details of the methods of protection must be submitted to and be approved by Council prior to the issue of the Stage 1 Construction Certificate and such approval should be forwarded to the Principal Certifying Authority. All approved protection measures must be maintained for the duration of construction and any tree on the footpath which is damaged or removed during construction must be replaced.

(Amended 19 January 2011 – C)

(117) COVERING OF LOADS

All vehicles involved in the excavation and/or demolition process and departing the property with demolition materials, spoil or loose matter must have their loads fully covered before entering the public roadway.

(118) VEHICLE CLEANSING

Prior to the commencement of work, suitable measures are to be implemented to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the site. It is an offence to allow, permit or cause materials to pollute or be placed in a position from which they may pollute waters.

(119) LOADING AND UNLOADING DURING CONSTRUCTION

The following requirements apply:

(a) All loading and unloading associated with construction must be accommodated on site.

(b) A Works Zone is required if loading and unloading is not possible on site. If a Works Zone is warranted an application must be made to

Council at least 8 weeks prior to commencement of work on the site. An approval for a Works Zone may be given for a specific period and certain hours of the days to meet the particular need for the site for such facilities at various stages of construction. The approval will be reviewed periodically for any adjustment necessitated by the progress of the construction activities.

(c) The structural design of the building must permit the basement and/or the ground floor to be used as a loading and unloading area for the construction of the remainder of the development.

(d) If, during excavation, it is not feasible for loading and unloading to take place on site, a Works Zone on the street may be considered by Council.

(e) In addition to any approved construction zone, provision must be made for loading and unloading to be accommodated on site once the development has reached ground level.

(120) NO OBSTRUCTION OF PUBLIC WAY

The public way must not be obstructed by any materials, vehicles, refuse, skips or the like, under any circumstances. Non-compliance with this requirement will result in the issue of a notice by Council to stop all work on site.

(121) ACCESS DRIVEWAYS TO BE CONSTRUCTED

Approved concrete driveways are to be constructed for all vehicular access to the construction site in accordance with the requirements of Council's "Driveway Specifications" to the satisfaction of Council.

(122) USE OF MOBILE CRANES

The following requirements apply:

(a) For special operations including the delivery of materials, hoisting of plant and equipment and erection and dismantling of on site tower cranes which warrant the on-street use of mobile cranes, permits must be obtained from Council for the use of a mobile crane. The permits must be obtained 48 hours beforehand for partial road closures which, in the opinion of Council will create minimal traffic disruptions and 4 weeks beforehand in the case of full road closures and partial road closures which, in the opinion of Council, will create significant traffic disruptions.

(b) Mobile cranes operating from the road must not be used as a method of demolishing or constructing a building.

(c) Special operations and the use of mobile cranes must comply with the approved hours of construction. Mobile cranes must not be delivered to the site prior to 7.30am without the prior approval of Council.

(123) SURVEY CERTIFICATE AT COMPLETION

A Survey Certificate prepared by a Registered Surveyor must be submitted at the completion of the building work certifying the location of the building in

relation to the boundaries of the allotment.

(124) STREET NUMBERING – MAJOR DEVELOPMENT

Prior to an Occupation Certificate being issued, street numbers and the building name must be clearly displayed at either end of the ground level frontage in accordance with the *Policy on Numbering of Premises within the City of Sydney*. If new street numbers or a change to street numbers is required, a separate application must be made to Council.

SCHEDULE 2

PRESCRIBED CONDITIONS

The prescribed conditions in accordance with Clause 98 of the Environmental Planning and Assessment Regulation 2000 apply where there is building work:

1. The prescribed conditions are as follows:

   (a) The work must be carried out in accordance with the requirements of the *Building Code of Australia* (as in force on the date the application for the relevant construction certificate is made).

   (b) This condition does not apply:

      (i) to the extent to which an exemption is in force under Clause 187 or 188, subject to the terms of any condition or requirement referred to in Clause 187(6) or 188(4) of the *Environmental Planning and Assessment Regulation 2000*; or

      (ii) to the erection of a temporary building.

2. In the case of residential building work for which the *Home Building Act 1989* requires that there be a contract of insurance in force in accordance with Part 6 of that Act, that such a contract of insurance is in force.

APPENDIX 3.5.1 PART II

CITY OF SYDNEY APPROVAL TO INSTALL SECTION 68

City of Sydney
ABN 22 636 550 790
GPO Box 1591 Sydney NSW 2001 Australia
Town Hall House 456 Kent Street Sydney NSW 2000 Australia
Phone +61 2 9265 9333 Fax +61 2 9265 9222 TTY +61 2 9265 9276
council@cityofsydney.nsw.gov.au www.cityofsydney.nsw.gov.au

13th January 2009

File No : S070523.

Mr R. Wilson
Development Manager
Mirvac Projects Pty Ltd
L26, 60 Margaret Street
Sydney
NSW 2000

Dear Mr Wilson

APPROVAL TO INSTALL A SYSTEM OF SEWAGE MANAGEMENT

S68 PART C (5), LOCAL GOVERNMENT ACT 1993

INSTALLATION OF A SEWER MINING & BLACKWATER TREATMENT FACILITY

Site: 8 – 12 CHIFLEY SQUARE, SYDNEY, NSW 2000

Pursuant to the provisions of Section 94 of the Local Government Act 1993, (the "Act"), you are hereby notified that the section 68 application including the plans and details prepared by Clearwater Technology Pty Ltd, Project no A0041 dated June 2008 submitted to Council to install and construct a system of sewage management have been accepted and approved following consultation with NSW Health and the Department of Water and Energy and is subject to the approval conditions contained in the attached schedule.

Date of Approval : 12th January 2009

Approval to operate from: 12th January 2009

If you are dissatisfied with this determination, section 176 of the Act gives you the right of appeal to the Land and Environment Court; alternatively, you may request a review of the determination under section 100 of the Act within 28 days of the date of this notice.

In accordance with the requirements of s113 of the Act, the details of this consent will be placed on the Councils Register concerning approved systems of sewage management.

If you have any queries concerning this determination please contact Andrew McMillan, Senior Health Surveyor by telephone 02 9246 7816, by email amcmillan@cityofsydney.nsw.gov.au or by fax 9265 9750.

Yours sincerely

Azmeena Ahmed

Health Compliance Manager

13th January 2009

File No : S070523.

Mr R. Wilson
Development Manager
Mirvac Projects Pty Ltd
L26, 60 Margaret Street
Sydney
NSW 2000

Dear Mr Wilson

APPROVAL TO INSTALL A SYSTEM OF SEWAGE MANAGEMENT

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If you have any queries concerning this determination please contact Andrew McMillan, Senior Health Surveyor by telephone 02 9246 7816, by email amcmillan@cityofsydney.nsw.gov.au or by fax 9265 9750.

Yours sincerely

Azmeena Ahmed

Health Compliance Manager

LOCAL GOVERNMENT ACT 1993

S68 Part C (5) Condition of Approval to Install a System of Sewage Management

FILE NO; S070523

SITE: 8 – 12 Chifley Square, Sydney, NSW 2000

FOR: Mirvac Projects Pty Ltd, L26, 60 Margaret Street, Sydney, NSW 2000

In accordance with the Local Government (General) Regulation 2005 approval is hereby given to install a waste water treatment facility at the above premises subject to the following conditions.

1. The installation, construction or alteration of the sewage management facility must be implemented substantially in accordance with the information submitted in the approval application. This includes the document titled "Chifley Square 8 – 12 Chifley Square Mirvac Project – Recycled Water Scheme Section 68 Application" prepared by Michael Conciatore of Clearwater Technology Project no A0041, dated June 2008.

3. Until an "Application to Operate a System of Sewage Management" is submitted to and approved by the City of Sydney Council all recycled water must be disposed of to sewer in accordance with a trade waste agreement obtained from Sydney Water. *(in the case where documentation is provided supporting the position that a trade waste agreement is not required, and this includes the recycled water produced in the validation and verification period, this condition can be altered to remove the trade waste approval component*

3. Under the Water Industry Competition Act 2006 (WICA a licence must be obtained to construct, maintain or operate any water industry infrastructure, to supply potable or non-potable water or provide sewerage services by means of any water industry infrastructure. A proponent of any sewerage management system will be in breach of the Act if they construct, maintain or operate water industry infrastructure without first obtaining a WICA licence. Even if Council.

   There are however certain exemptions under WICA and as such further advice should be sought from the Independent Pricing and Regulatory Tribunal (IPART) who are the licensing authority whom may be contacted by telephoning (02) 9290 8400 or by writing to them at Utility Licensing, IPART, PO Box Q290, QVB Post Office NSW 1230.

4. The system must be located at the Chifley Square basement car park site as per the drawings and plans provided in the application documentation.

5. Wastewater is restricted to be collected from toilets, hand basins, showers, kitchen/canteen areas and cooling towers and supplemented by sewer mining and rainwater harvesting.

6. The recycled water is only approved for the following end use.

   Cooling towers, toilet flushing and sub surface irrigation of the limited landscape as per the information and drawings provided in the application documentation

7. All regulated systems defined in s 43 of the Public Health Act 1991 such as water cooling towers must be installed, commissioned, operated and maintained in accordance with all the requirements of the Public Health (Microbial Control) Regulation 2000 and AS/NZS 3666.1,2 and 3 2002.

   The owner or occupier of the building must register and provide particulars of any water cooling, and warm-water systems as required under the provisions of the *Public Health Act, 1991* and Regulation. Registration forms are available from the Council's Health Department.

8. The recycled water must not be permitted to discharge to any waterway or stormwater drain at any time.

9. All works are to be carried out by a licensed plumber and in accordance with the National Plumbing and Drainage Code AS3500:2003 and the NSW Code of Practice for Plumbing and Drainage 3rd edition 2006.

11. All work must comply with the supplier obligations under the Occupational Health and Safety Act 2000. This includes ensuring that there is adequate provision of information about the recycled water to the persons to whom it is supplied to ensure its safe use.

12. All work must comply with any requirements under the *Protection of Environmental Operations Act 1997*. There are to be no emissions or discharges from the recycled water scheme that give rise to a public health nuisance or would result in an offence under the *Protection of the Environment Operations Act 1997*.

13. The final water quality must comply with the "High Exposure "risk level for the parameters defined within Table 7.1 of the NSW Guidelines for Management of Private Recycled Water Schemes May 2008 which are copied below for your information.

Parameter	**Recycled Water Compliance Value**
E. Coli	< 1 cfu/100mL
BOD	< 10 mg/L
SS	< 10 mg/L
pH	6.5 - 8.5
Turbidity	<2 NTU (95%tile) <5NTU (Maximum)
Disinfection	Cl: 0.2m – 2.0 mg/l residual UV/ TBA
Coliphages	< 1 pfu/100 mL
Clostridia	< 1 cfu/100 mL

14. An alarm system must be implemented to notify responsible persons in the event of plant malfunction and if turbidity, pH or disinfection effluent

compliance values are not met. Recycled water must be diverted to sewer in these circumstances.

15. The system must have an emergency bypass to Sydney Water's sewer to protect human health and the environment in the event of critical failure. This back up connection must be maintained at all times.

16. The recycled water system must be designed, operated and maintained so as not to create environmental health or public nuisance.

Backflow prevention

17. Backflow prevention devices are to be installed where required by Sydney Water and in accordance with the National Plumbing and Drainage Code AS/NZS 3500:2003 and the NSW Code of Practice for Plumbing and Drainage 3rd edition 2006

18. A licensed plumber, who has accreditation in backflow prevention, must install all backflow prevention devices. Backflow devices are to be manufactured to comply with AS2845.1-1998 – Water Supply – Backflow Prevention Devices – Materials, design and performance requirements and installed in accordance with AS/NZS 3500: 2003 – National Plumbing and Drainage Code.

Preliminary advice - Application to Operate.

19. A separate application pursuant to S68 C (6) Local Government Act 1993 is to be made to Council for the operation of the subject sewage management facility, in accordance with the relevant guidelines and regulations. This must be submitted following validation and verification testing as outlined in this approval and before final commissioning of the system can occur. The relevant application form is attached for your information. This should be completed and returned to the City's Health Compliance Manager along with the supporting information as requested in the application form.

20. The treatment system, once installed must undergo Validation/Verification Monitoring over a minimum period of 12 weeks with continuous compliance with discharge limits over the influent / effluent monitoring frequencies for the "High Exposure" risk level given in Table 7.1 of the NSW Guidelines for Management of Private Recycled Water Schemes May 2008. Where the treatment system has been validated by the Department of Water and Energy (DWE) then the validation/verification period may be reduced to 4 weeks. Evidence to this effect must however be obtained from the DWE and forwarded to the Council with along with the "application to operate".

21. All validation and verification testing must be carried out by a NATA – accredited laboratory.

22. A Trade Waste Agreement is to be negotiated with Sydney Water for the discharge of treated effluent to the sewer main during the validation period. A copy of this agreement is to be forwarded to the City prior to the commencement of the validation period.

23. Recycled water from the treatment facility is to be discharged to Sydney Water's sewer main until the validation monitoring and verification testing has

been completed and an application for approval to operate has been submitted to and approved by the City.

24. All results of the validation and verification testing required under this approval shall be submitted to Council along with the Section 68 Application for Approval to Operate and further supporting documentation as required and stated in the application form.

25. The treated recycled water shall be irrigated by sub surface irrigation located at least 100mm below the land surface.

26. All treated recycled water distribution pipes, taps or outlets must be colour coded lilac and marked " WARNING – RECYCLED WATER/RECLAIMED WATER – NOT FOR DRINKING PURPOSES". Warning signage shall comply with AS 1319.

27. The location of the treated recycled water distribution pipes must not be closer than 300mm, if below ground, and 100mm, if above ground, of any potable mains water supply pipe work.

28. Appropriate warning signs shall be designed and erected in the irrigation area at the Approval to Operate stage to protect the public's health and to minimise damage to the irrigation system.

29. A System Management Plan shall be developed and submitted to Council with the s68 application for "Approval to Operate" in accordance with the requirements of the NSW Government Guideline for "Management of Private Recycled Water Schemes, May 2008". The plan shall include but not be limited to the following:

    - Detailed risk assessment and risk assessment plan
    - Operational and Maintenance Procedures
    - Operation awareness and training plan
    - Complaints handling
    - Incident and emergency response plan
    - On going monitoring and system auditing plan

30. The risk assessment and risk assessment plan shall include a thorough assessment of biological, chemical and physical hazards (including heavy metals, organic chemicals, pesticides and disinfection bi-products) for the end users of the recycled water, the general public and the environment. This should include analysis of typical contaminants in the influent to the waste water treatment facility, to the effectiveness of the treatment facility in removing contaminants, the potential for human exposure to contaminants for end users of recycled water at levels that would affect human health and the setting of biological, chemical and physical parameters and compliance values to be used for validation and verification monitoring and ongoing operational monitoring of the recycled water system. Chemical hazards such as the unauthorised dumping of chemical contaminants at levels that would affect human health should also be fully assessed in this process.

    Attention should also be given to:

- Any specific water quality criteria for cooling towers and the effects of recycling water containing biocides and algaecides from cooling towers, and

- Viability of using the source waters suggested (hand basins, kitchens toilets and showers) and supplementing it with sewer mining as opposed to simply sourcing the wastewater from sewer mining alone.

Notes

This approval does not abrogate Council's right to require abolition or modification of the installation if at any time the installation is considered to pose a risk to public health or the environment.

A public record of this approval will be kept by the City in accordance with the requirements of s113 of the Local Government Act 1993.

APPENDIX 3.5.1 PART III

SYDNEY WATER SEWER MINING - APPROVAL IN PRINCIPLE

Case Number: 123215

31 May 2011

MIRVAC PROJECT PTY LTD
c/- ROSE ATKINS RIMMER

Revised LETTER of APPROVAL
For
CONNECTION TO A SYDNEY WATER SEWER FOR SEWER MINING

Applicant:	**MIRVAC PROJECT PTY LTD**
Your reference:	**61/22180/SM**
Property location:	**8-12 Chifley Square, Sydney**
Your application date:	**10 February 2011**

Dear Applicant
Your application to connect to the sewer main at the above location is approved provided you do the following things:

1. Enter into the following agreements or contracts with Sydney Water:

   - **Sewer Mining Agreement** – a draft copy of this is available on our website http://www.sydneywater.com.au/SavingWater/RecyclingandReuse/RecyclingAndReuseInAction/SewerMining.cfm;
   - **Consent to Discharge Industrial Trade Wastewater**;
   - **Major Works Deed** – this is to be executed before construction of the connection; and
   - **Land Lease Agreements** (if they are needed).

2. Engage your current or another authorised Water Servicing Coordinator (Coordinator) to manage the design and construction of the required works to Sydney Water's standards, procedures and technical requirements as well as the Water Services Association of Australia standards.

   Note: The Coordinator must be fully authorised by us for the whole time of the Deed. Before you engage another Coordinator you must write and tell Sydney Water.

   For a list of authorised Coordinators either visit www.sydneywater.com.au > Building and Developing > Developing Your Land or call 13 20 92.

   When you construct these works you will need to pay project management, survey, design and construction costs **directly to your Coordinator and other suppliers. The Coordinator generally will be the single point of contact between you and**

Sydney Water. They can answer most questions you might have about our process and charges.

There are other fees and charges that need to be paid at certain times after you connect. These are detailed in Section 7 of the Sewer Mining Agreement.

3. Before any work is started, have your Coordinator submit detailed designs to Sydney Water for review that show all proposed modifications to Sydney Water's sewerage system. The documents must also include:

   - Work Methods Statement;
   - Flow Management Plan;
   - Safe Work Plan;
   - Odour Management Plan – Note that there are currently no sewage odour issues at this location. Therefore, if Sydney Water receives sewage odour complaints during the period of connection, they will be considered as resulting from that connection and Mirvac Project Pty Ltd will be responsible for any problems that result.
   - Inspection and Test Plans; and
   - Construction Commencement Notice.

   Notes:

   - The sewer mining connection must be designed so that it does not interfere with the normal operation of the sewerage system and does not cause sewage surcharges during dry or wet weather.
   - **Before you connect, if there is no activity on this project for a period of twelve months, your application must be re-investigated and you must pay another application fee.** Sydney Water may have extra requirements and charges may change.

4. Ensure that no work on the existing sewer main or the proposed connection is started until Sydney Water advises your Coordinator.

   If any work on our assets is carried out without that advice or final approval, Sydney Water will take action to have work on the site stopped. We will apply the provisions of Section 45 of the *Sydney Water Act 1994.*

5. Ensure that work on Sydney Water's sewerage system is carried out by Sydney Water accredited contractors in accordance with the Sydney Water Asset Creation – Developer Process. Temporary accreditation (with conditions) can be arranged upon application to Sydney Water.

6. Once the design has been reviewed by Sydney Water and the sewer mining connection point constructed, ensure that operation of the connection is in accordance with the terms and conditions of the:

   - Water Services Association of Australia (WSAA) standards and specifications;
   - Sewer Mining Agreement;
   - Consent to Discharge Industrial Trade Wastewater; and

- Land Lease Agreements (if they apply).

7. Apply the following specific conditions:
   1) The flows are to be extracted from the DN300 sewer main located in Hunter Street between Phillip Street and Elizabeth Street. A sewer main extension will need to be constructed across Hunter Street from the existing sewer main, to within the development site.
   2) The brine discharge from the sewer mining plant is to be returned to the sewer main system via the sewer house service for this property. The proposed development and the associated sewer house service, is to utilise the existing connection for this site and will be to the existing sewer main in Elizabeth Street (refer to Case No.122362).

Please contact me if you have any enquiries.

Yours faithfully,

Peter Mason
Asset Integrity Services
Sydney Water
Ph: 8849 4208 Fax: 8849 3063
Email: peter.mason@sydneywater.com.au

MAJOR WORKS DEED - EXTENSION

This Deed is made between

MIRVAC PROJECT PTY LTD ABN

(Applicant's Name)

of

(Applicant's Address)

And Sydney Water Corporation (Sydney Water) (ABN 49 776 225 038), a Corporation having its principal office at 1 Smith Street, Parramatta NSW 2150, in the State of New South Wales.

The Applicant made application to extend Sydney Water **sewer** works at and/ or adjacent to **8-12 Chifley Square, Sydney** and Sydney Water provided a Letter of Approval (the Letter) to the Applicant. A copy of the Letter (Case No. **123215**) is attached to this Deed.

This Deed witnesses that:

1. The Applicant will satisfy all the requirements of the Letter referred to above.

Sydney Water and the Applicant agree:

2. The Applicant must complete the construction of the Works as specified in the Letter within 12 months after the date of this Letter.

Method of Construction

3.1 Sydney Water will maintain and make available to the Applicant details of accredited Infrastructure Suppliers. In this Deed, authorised Water Servicing Coordinator, Designer, Constructor and Field Tester refer respectively to an Infrastructure Supplier who at the relevant time is accredited in one or more of the following four categories: Water Servicing Coordinator, Designer, Constructor and Field Tester.

3.2 For coordination, management and monitoring of the design and construction of the Works, the Applicant must engage and at all times use an authorised Water Servicing Coordinator who is required to follow Sydney Water's "Instructions to Water Servicing Coordinators". If at any time there is no Water Servicing Coordinator monitoring the Applicant's Works or the Water Servicing Coordinator monitoring the Applicant's Works is changed, the Applicant must immediately notify Sydney Water in writing.

Design of Works

4. A Designer must design the Works with the appropriate capability. The design must be such that the Works will comply in all respects with all laws and with Sydney Water Standards or requirements applicable as at the date of submission of the Design Package and be suitable in all respects for their intended purpose. Any possible impact which the Works or their construction may have on existing and proposed buildings and all precautions necessary for their protection must be noted in the designs.

Construction of Works

5. The construction of the Works must be by a Constructor with the appropriate capability. The Works must be constructed in a workmanlike manner in accordance with the design and Sydney Water standards and requirements.

Certificates Required

6. The Applicant must provide to Sydney Water:
   - Design Package Certificate
   - Certified Design Development Checklist
   - Certified Inspection and Test Plan
   - Construction Commencement Notice

- Project Validation Certificate

The documents, certificates and notices must satisfy the requirements set out in the "Instructions to Water Servicing Coordinators" and be in the form, if any, prescribed in those Instructions. They will indicate to whom documents, notices and certificates must be given.

No Representations Made

7.1 Sydney Water makes no representations whatsoever concerning the qualifications, ability or financial viability of any Water Servicing Coordinator, Designer, Constructor or Field Tester. The Applicant will be responsible for the acts or omissions of those persons as if they were the acts or omissions of the Applicant.

7.2 The Applicant shall ensure that all tasks falling within paragraphs 3, 4, 5 or 6 of this Deed are managed or performed as the case may be by an appropriately accredited Infrastructure Supplier. Where any Infrastructure Supplier retained by the Applicant ceases to hold appropriate accreditation the Applicant shall as promptly as circumstances permit retain an appropriately accredited replacement Infrastructure Supplier.

7.3 Sydney Water shall not be responsible to examine or approve any drawings or to inspect or test any work or materials or to give any advice to the Applicant. At any time, Sydney Water will have the right but not the obligation to inspect or test the Works or any part or any materials incorporated or intended to be incorporated therein. The Applicant must facilitate the inspection or testing and must not rely upon any inspection or testing by Sydney Water.

Creation of Easements

8. Where the development proposal and/or Works or part Works require the creation of easements and/or transfer of land or such other interests in land as are necessary to meet the requirements specified in Sydney Water's *Easement/Land Guidelines*, and/or as advised by Sydney Water, the Applicant must convey to Sydney Water such easements, land and/or interests in accordance with Sydney Water's requirements.

Variations

9.1 Variations in the construction of the Works or any part of the Works as designed may be requested in accordance with the "Instructions to Water Servicing Coordinators"

(a) by the Applicant to meet the Applicant's needs; or
(b) by Sydney Water to ensure completion in accordance with the Standards and/or its requirements; or
(c) by Sydney Water to meet Sydney Water's needs.

9.2 Sydney Water may grant or refuse to grant an application for variation under clause 9.1(a). A variation required by Sydney Water under clause 9.1(b) or (c) must be executed.

9.3 The Applicant acknowledges that the Water Servicing Coordinator may only make a claim for contribution from Sydney Water for or in respect of the cost of a variation notified under clause 9.1(c). A claim made under clause 9.1(c) must be supported by appropriate documentation and will be determined by negotiation between Sydney Water and the Water Servicing Coordinator.

Payment for Any Goods and Services Provided by Sydney Water

10.1 For any work done by Sydney Water for the Applicant and for goods or services provided to the Applicant by Sydney Water, the Applicant must pay Sydney Water the applicable fees or charges including any GST payable by Sydney Water. Without limiting any obligation to pay at an earlier time, all monies payable by the Applicant to Sydney Water, including any monies which become payable as a consequence of any Infrastructure Supplier's failure to fulfil any requirement of this Deed, must be paid to Sydney Water within 30 days of issue of an invoice by Sydney Water or prior to issue of the compliance certificate, whichever is earlier.

10.2 For any liabilities for Customer Redress under Sydney Water's Contract, charges must be paid to Sydney Water within 30 days of issue of an invoice by Sydney Water or prior to the release of the bank guarantee or cash bond.

Entry on to Land

11.1 The Applicant is responsible for obtaining entry to any land necessary to construct the Works and for paying any compensation payable. Where agreement on compensation cannot be reached between the parties, the Applicant will be responsible for obtaining professional valuation advice and obtaining mediation/arbitration assistance if necessary, from a nominee of the President of the Australian Institute of Valuers and Land Economists.

11.2 The Applicant or the Applicant's agents must not enter any private property without the written consent of the owner and tenant of the property on the Sydney Water "Permission to Enter" form(s) which must be used to negotiate entry.

11.3 The Applicant is required, if entry/ construction agreement for the preferred design cannot be obtained, to investigate alternative design options that avoid impacts on adjacent land and an alternative adopted, provided it is satisfactory to Sydney Water from an operational, maintenance and renewal point of view.

Representations and Indemnities

12.1 In performing the Deed, the Applicant is carrying out the Works on the Applicant's own behalf. If the Applicant fails to fulfil any requirement of this Deed, Sydney Water at its discretion may –

- require the Applicant to make good the failure at the Applicant's expense; or
- make good the failure and recover the cost.

12.2 This right is in addition to and not in substitution for any other right which Sydney Water may have. If a breach of this Deed causes Sydney Water to be in breach of its Customer Contract including Redress, damages payable by the Applicant will include but not be limited to the amounts payable by Sydney Water to its customers.

12.3 Sydney Water is not obliged to do anything to assist the Applicant to design or construct the Works. If at the request of the Applicant, Sydney Water provides any advice or assistance to the Applicant, it will be upon the condition that the Applicant releases Sydney Water from any liability which might arise from the advice or assistance and will indemnify Sydney Water against any claim by a third party arising out of the advice or assistance of Sydney Water.

12.4 If any payment by the Applicant to Sydney Water under this clause 12 in connection with a claim gives rise to a liability to pay GST, the Applicant must also pay to Sydney Water the amount of that GST. If Sydney Water must pay GST on a cost which is recoverable under this clause, then it may recover from the Applicant the cost plus all GST (except to the extent to which Sydney Water is entitled to an input tax credit).

Access to Site

13. On a request being made, the Applicant/ Water Servicing Coordinator must provide to Sydney Water, at any time during the working hours specified in the Quality Plan, access to the location of the Works and afford to Sydney Water any assistance it may reasonably request for the safe or convenient inspection, measurement, testing or sampling of any part of the Works.

Inspection of Works

14. Where an inspection by Sydney Water discloses that the Works have not been carried out in accordance with this Deed, the Applicant must pay to Sydney Water in accordance with any applicable determination made from time to time by Sydney Water the costs reasonably incurred by Sydney Water with respect to –
    (a) that inspection; and
    (b) any intensive audit which Sydney Water, in its opinion, decides should be carried out.

Dispute Resolution

15. Any dispute, except those relating to the Developer Charges section in the Letter, that may arise between the Applicant and Sydney Water with respect to any matter relating to this Deed will be resolved by negotiation between the parties. Any dispute not resolved by negotiation will

be determined on the decision of the appropriate Senior Manager of Sydney Water.

Notices

16. Any notice given by Sydney Water to the Applicant's representative will be regarded as notice given by Sydney Water to the Applicant.

Transfer of Works

17.1 Prior to the transfer of works to Sydney Water, the Applicant will provide to Sydney Water the total cost for Project Management, Design and Construction of the Works including Sydney Water costs referred to in clause 9.1(c) and excluding Sydney Water costs referred to in clause 10. In addition, upon request, the Applicant shall provide to Sydney Water evidence satisfactory to Sydney Water of the total GST-inclusive market value of the Works carried out by the Applicant other than Works carried out pursuant to clause 9.1(c) and shall also separately identify the cost claimed pursuant to clause 9.3.

17.2 Works or any part thereof will be transferred to Sydney Water at no cost, unless otherwise stipulated in this Deed or in the Letter, when Sydney Water gives the Applicant notice that the Works are transferred to Sydney Water. As between Sydney Water and the Applicant, that notice will effect the transfer. The Applicant must forthwith do everything necessary to ensure that the transfer is legally effective in all respects, including as regards any third party. Transfer of Works or any part to Sydney Water will not relieve the Applicant of the obligation to complete Works in accordance with the Deed.

17.3 If the Applicant appears to have satisfied all the requirements of the Letter under Section 74, then within 14 days thereafter Sydney Water will issue the compliance certificate. If Sydney Water has not already accepted transfer of the Works under 17.2, Sydney Water will then accept transfer. Issue of the compliance certificate or transfer of the Works will not relieve the Applicant from liability for any breach of this Deed.

Recipient Created Tax Invoice

18. Words used in this clause have the same meaning as in *A New Tax System (Goods and Services Tax) Act 1999.*
    (a) This clause only applies where the Applicant is registered for GST.
    (b) Unless the Applicant is notified otherwise by Sydney Water, Sydney Water shall issue a recipient created tax invoice in relation to any taxable supply by the Applicant and the Applicant shall not issue a tax invoice in relation to that supply.
    (c) Where Sydney Water is not permitted under the GST law to create a recipient created tax invoice in relation to a particular taxable supply, the Applicant must issue a tax invoice to Sydney Water within 14 days of a request by Sydney Water.
    (d) The Applicant hereby warrants that it is registered under the GST law and must immediately notify Sydney Water if it ceases to be so registered.
    (e) Sydney Water hereby warrants that it is registered under the GST law and must immediately notify the Applicant if it ceases to be so registered.
    (f) Sydney Water will immediately notify the Applicant if Sydney Water ceases to satisfy any of the requirements of the Commissioner of Taxation in relation to the issue by Sydney Water of recipient created tax invoices.

Australian Business Number

19. (a) The Developer warrants that its Australian Business Number is as shown on this Deed or as otherwise quoted to Sydney Water.
    (b) Notwithstanding clause 18.3 Sydney Water will not be required to issue a compliance certificate until the Developer has provided an Australian Business Number to Sydney Water and Sydney Water has no reasonable grounds to believe that the number given is not correct.

The nominated Water Servicing Coordinator for this Deed is:

Company Name: ROSE ATKINS RIMMER

Contact Name: Nikki Webster

EXECUTION

Notes: ***1. The Applicant(s) signature(s) must, on each of the two copies issued, be witnessed by any adult who is prepared to give their full name and address and who is not a parent of or child of or sibling to any signatory.***

2. Deed has no effect until executed for and on behalf of and dated by Sydney Water. One copy is then returned to the authorised Water Servicing Coordinator.

3. This Deed cannot be assigned.

Individual Partnership (As for individual, but all partners to sign. Please prepare your own execution page if necessary.)

Executed as an Deed by: _____ _____
Signature Print Name of Person Signing

_____ _____
Signature Print Name of Person Signing

In the presence of: _____ _____
Witness Signature Print Name of Person Signing

_____
Print Address

Company/Council/other Authority

2 Directors to sign **OR** 1 Director & Company Secretary **OR** 1 Director if company has only 1 Director who is also Company Secretary **OR** Any duly authorised Attorney under a Power of Attorney/ employee who must personally warrant possession of authority to bind the company/Council/other Authority.

Executed as an Deed by: _____ _____
Signature Print Name - Director &/Or Secretary
Or its duly appointed Attorney
Or _____
(insert senior position in company)
who warrants s/he is authorised to enter into this Deed
(strike out whichever is inapplicable)

_____ _____
Signature Director - Print Name

In the presence of: _____ _____
Witness Signature Print Name of Person Signing

_____
Print Address

****

Signed on behalf of
Sydney Water by: _____ _____
Signature Print Name of Person Signing

In the presence of
Witness: _____ _____
Signature Print Name of Person Signing

Date Deed Executed by Sydney Water: .....

APPENDIX 3.7.1 PART I

8 CHIFLEY SQUARE BLACKWATER SPECIFICATIONS

Mirvac Projects Pty Limited

8 Chifley Square

Blackwater Performance Specification

Rev 01 | May 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10
201 Kent Street
Sydney
NSW 2000
Australia
arup.com.au

Job number 220622

ARUP

Document Verification

ARUP

Job title		8 Chifley Square			**Job number** 220622
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			Prepared by	Checked by	Approved by
		Name	Mike Dodd	Thierry Melis	Andrew Johnson
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

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Appendices

Appendix A

Water Process Schematic

Appendix B

Basement 2 Layout

1

This performance specification forms part of the 8 Chifley Square Tender documentation it covers the requirements for a black water plant integrated into the basement of the new office development at 8 Chifley Square in Sydney's CBD.

1.1 Definitions and Interpretations

Within this specification and the related drawings the following words shall have the meanings described:

Principal	Mirvac Constructions Pty Ltd
The subcontractor	The entity specifically responsible for the works described in this package
Approve, To approval	Approval by the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works. This may be the Project Manager or Site Manager.
Building Trades	The entity specifically responsible for the construction of the building structure and fabric. Excludes the services trades such as electrical, air conditioning and plumbing.
Give notice, submit, supply, furnish, and similar expressions	Give notice, submit, supply, furnish and the like to the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works.

1.2 Tender Return

The Tender Return Documents and Form at the back of this document shall be completed and returned with the Tender.

The Subcontractor shall identify as shown, the various elements within the Tender. Elements should not be grouped together.

Incomplete or missing tender return forms shall not be accepted and, may render the submission as a non-compliant tender.

The Principal does not bind himself to accept the lowest or any tender and is not responsible for any cost incurred in the preparation of any tender.

1.3 Roles and Responsibilities

1.3.1 Specification Objectives

The intent of this specification and the associated documents is:

- To provide a clear statement of technical and performance requirements against which compliance can be assessed;

- To enable other interested parties to assess their obligations and to understand expectations of them;
- To define the Quality Assurance expectations of the Principal as they apply to the Subcontractor.

1.3.2 Design responsibilities

1.3.2.1 General

This specification and the referenced drawings describe the works sufficiently for a Subcontractor to understand the extent and nature of the works, the quality of the works required and to submit a tender.

1.3.2.2 Subcontractors Responsibilities

The Subcontractor is to possess specialist trade expertise necessary to complete the works in accordance with the documentation. The Subcontractor has the following additional obligations:

- To raise in good time, issues requiring design input or clarification, including;
- Interpretation and co-ordination of the specification and drawings;
- Problems in complying with the specification;
- Omissions from the specification and drawings;
- Suggested alternatives or substitutions;
- To certify compliance with the Subcontract documents, including all variation instructions, at Practical Completion;
- To certify compliance with Authority requirements;
- To pay all fees applicable to the works;
- To obtain all Authority permits and certificates to allow the progress of the work;
- To provide manufacturer's and construction drawings;
- To provide samples and prototypes where specified;
- It is the Subcontractors responsibility to ensure that all services are installed such as to meet the design intent indicated on the tender documentation. The Subcontractor shall undertake all necessary on site coordination, with other services and structure, such as to meet the design intent. The Subcontractor shall coordinate this detail with all other services and structure during preparation of shop drawings and prior to installation. The contract drawings do not indicate the presence of other services not included in this contract. Details of other services, supports for suspended ceilings, etc should be obtained from the Principal and the relevant Subcontractor. The Subcontractor may offer alternatives to both services reticulation routes and system configuration, however all offered alternatives shall be well considered, fully designed, and seek to improve the system function and/or cost. No alternatives shall be implemented until written approval is obtained from the Principal

- Access: Whether or not indicated on the documentation the Subcontractor shall provide suitable access to all plant equipment that will require to be maintained or serviced. Access provisions shall be in accordance with manufacturer's recommendations and in compliance with Occupational Health and Safety. Any areas where this cannot be achieved shall be notified to the superintendent;

  No extras of any kind will be allowed if work and equipment has to be removed and replaced.

1.4 Converged Network Option

1.4.1 Introduction

The Converged Network (CN) concept is to provide an integrated, open, expandable and flexible solution for the building's control and monitoring systems, whereby the nominated systems/equipment communicate over a common network and are fully interoperable.

The nominated systems/equipment relevant to this Specification are:

- Blackwater treatment.

An IP Network will be provided by the BMCS Contractor for the nominated communications, control and monitoring systems to utilise for communication.

The nominated communications, control and monitoring systems shall communicate using industry standard open protocols such that information can be freely passed between systems for improved monitoring and operational performance.

The Blackwater Sub-Contractor shall select products and solutions that complement the CN concept. Installation of any networks by the Services Contractor shall be highlighted and justified in the tender return. Any communication using proprietary protocols, or data that is not available for integration to a third party system via an open protocol, shall be highlighted and justified in the tender return.

The communications, control and monitoring requirements over the CN do not extend to systems which are not, by law, allowed to communicate via this digital medium.

In addition, there are several interfaces which are to remain low-level for critical control/monitoring and are the responsibility of their respective service. An example of such is the ATS control logic for the tenant distribution boards provided from the standby generator control panel (electrical services package).

The converged network is required to integrate all systems and applications onto a common, open platform with the user experience to be seen via a single graphical user interface (GUI) and replicated via a HTML/XML interface for control and monitoring.

The BMCS Contractor will provide a high level of coordination between all disciplines and shall ensure the systems are in place for installation, testing,

commissioning and ongoing operation and maintenance of the network. This also assists in achieving reliable demarcation between the various building systems.

The Blackwater Sub-Contractors shall provide pricing for the conventional standalone systems as detailed in this specification and associated drawings, and shall also provide an option pricing for the converged network solution.

An IP Network will be provided by the BMCS Contractor for the nominated communications, control and monitoring systems to utilise for communication.

The nominated communications, control and monitoring systems shall communicate using industry standard open protocols such that information can be freely passed between systems for improved monitoring and operational performance.

Refer to the CN schematic for further information regarding the proposed interfaces and demarcation of responsibilities. Please note, quantities are indicative only for pricing purposes and the final quantity is to be coordinated between the Blackwater Contractor and the BMCS Contractor.

1.4.2 Additional Scope of Works

The Blackwater Contractor shall:

- Provide information within their programme for when the network is required to be active, including the System Integration (SI), to ensure the network is available at this time. All services are to review these programmes and are to ensure the required services are in place for this to occur;
- Inform the BMCS Contractor the proposed location of all interface points required;
- Ensure all termination points are accessible externally to each panel/equipment with RJ-45 outlets. Outlets shall be provided with IP56 rated screw connectors in plant, carpark, in external areas or in locations which may be affected by particle or moisture ingress;
- Where a connection is to be made to a low-level signal, the Blackwater Contractor shall provide all terminals within a suitably mounted externally IP56 rated enclosure affixed to the associated equipment;
- Provide information within their programme for when the network is required to be active, including the SI, to ensure the network is available at this time. All services are to review these programmes and are to ensure the required services are in place for this to occur;
- Provide a list of all required points and functional requirements to the BMCS Contractor for inclusion in the common head-end logging and display and also the required layout of the points of network connectivity;
- Include software for each of the sub-systems which may access more detailed control and monitoring information;
- In the event that the Converged Network is unavailable during normal operation, ensure that the systems are capable of operation in a safe standalone manner or if this is not achievable, ensure that affected systems revert to a fail-safe mode of operation;

- Assist the BMCS Contractor in completing the interface office at the BMCS Contractors works;
- Attend offsite and onsite testing and demonstrations relevant to the interface to the BMCS.

1.4.3 Additional Hardware and Software Requirements

The Blackwater Contractor is to inform the SI Contractor as to the type and quantity of data which shall be interfaced and stored. The Services Contractor shall provide all relevant information to the SI to assist in the development of the GUI and to provide a consistent user experience.

1.4.4 Additional Tender Return Requirements

In addition to the tender return requirements detailed elsewhere in this document, the Blackwater Contractor shall provide the following information:

- Details of all connections to the converged network;
- Network architecture diagram;
- Details of all protocols proposed (open and proprietary).

1.5 Scope of Works

1.5.1 Project

This specification covers the Black water works associated with 8 Chifley Square, Sydney. The project involves the design and construction of a new multi-storey PCA Premium grade tower, which comprises 3 basement levels, 21 levels of office accommodation and multi level plant floors. Office accommodation will be configured as 1, 2 and 3 storey villages providing a total Net Lettable Area (NLA) of circa 19000m2. The existing building is to be demolished to allow the construction of the new site.

Systems within the building shall be installed to best practise standards to minimise energy consumption, reduce greenhouse gas emissions and to allow the building to achieve the targeted NABERS Energy and Green Star objectives. The services design has been developed to provide flexible and adaptable systems which will serve the requirements of the building and can be reconfigured to suit future re-planning of office areas.

1.6 Design responsibilities

1.6.1 General

The Subcontractor is to be aware that the Tender documentation for the Black water plant has not been prepared to a detailed design level. The level of detail provided, within the specification and referenced drawings, is sufficient for a Subcontractor to understand the extent and nature of the works, the quality of the works required to submit tender.

Following the award of this contract responsibility for the black water design is with the Subcontractor. During this period the Subcontractor will be expected to be available to attend design meetings and contribute to finalising the design, particularly with respect to assessing cost and buildability.

Additionally the Subcontractor shall carry out additional design processes as required to enable construction. Such processes include, but are not limited to, final detailed design of the black water plant, the preparation of drawings sufficient to allow construction of purpose made components, such as switchboards; and to allow for detailed co-ordination in specific locations.

1.7 Site Conditions

The climate at site shall be considered semi tropical, with mean site ambient temperatures ranging between 40°C and 0°C with a relative humidity up to 100%. All equipment and materials supplied shall be capable of withstanding these conditions.

2 Scope of Works

The Black water plant forms part of the integrated approach to sustainability undertaken for this project. Systems within the building shall be installed to best practice standards to minimise energy consumption, reduce carbon dioxide emissions and to allow the building to achieve the targeted 6 Star Green Star and to achieve a NABERS Energy rating for Base Building of 5 Star + 60% in design.

The services design has been developed to provide flexible and adaptable systems which will serve the requirements of the building and can be reconfigured to suit future re-planning of office areas.

The black water plant is an integral part of the sustainable objectives of the development. Potable water consumption is expected to be reduced considerably by an integrated water strategy.

Untreated waste from the building will be routed to the black water inlet screen BW-TS-01 within the black water plant room at basement 2 level by the Hydraulics contractor.

A motorised sewer diversion valve shall be installed by the hydraulic contractor at basement 2 level downstream of all building connections enabling the diversion of the building waste to either the black water plant or to the municipal sewer. The motorised diversion valve shall be normally open allowing the building waste water to enter the black water inlet screen but will shut diverting all building waste to sewer when level alarms on the buffer tank dictate or when the black water sump pump SP-01 operates.

The cooling tower blow down waste water will also be routed to this inlet screen via a separate motorised diversion valve by the hydraulics contractor. This shall allow the black water plant to be optimised with the ability to utilise the cooling tower blow down if suitable for use.

This building waste water will be supplemented with flow from a new sewer mining connection made to the existing sewer in Hunter Street. This sewer mining connection forms part of a separate scope of works delineation shall be at the inlet screen. The black water contractor is responsible for the BMS controls of the two building motorised valves and the sewer mining connection controls to manage the flow into the black water buffer tanks to optimise system performance.

Rainwater re-use has been integrated into the non-potable recycled water strategy for the building with the NPCW-T-01 located on level 33 being supplied with both treated black water and treated rainwater. (Rainwater treatment by others).

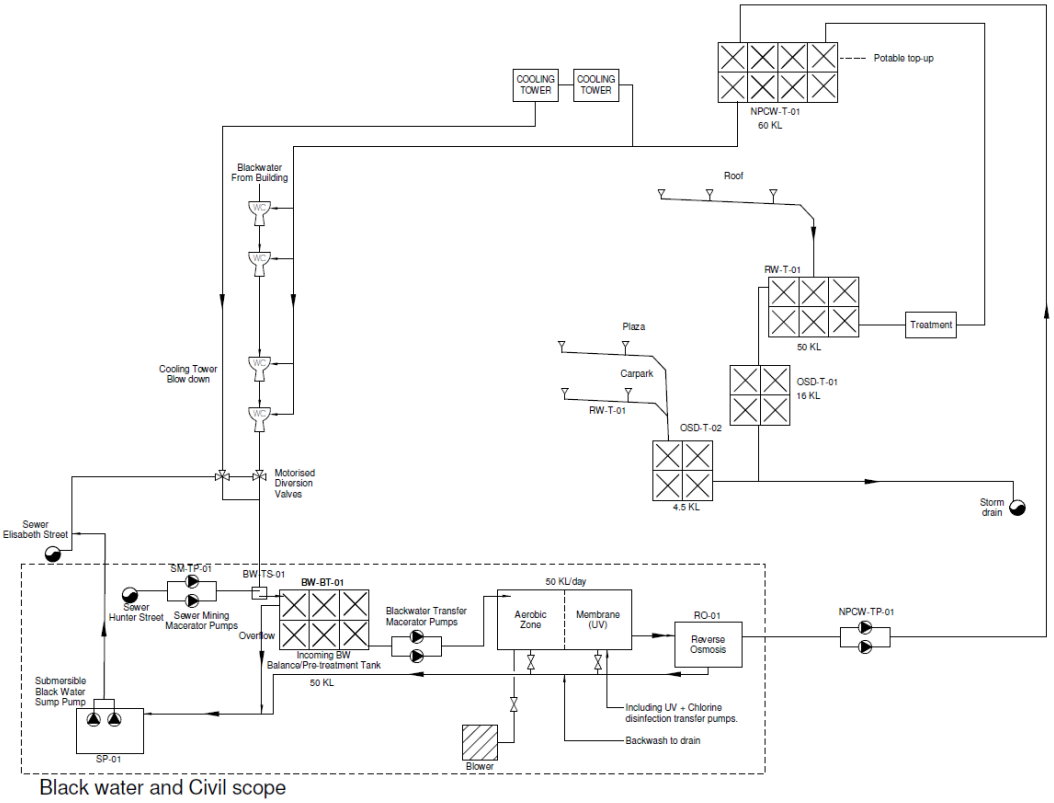
The black water plant is to treat the effluent to “High Exposure risk” in accordance with the New South Wales Department of Water and Energy (NSW DWE) guidelines.

The treated black water will be supplied to cooling towers, WC, Urinal flushing and for irrigation use.

The black water treatment plant is to be designed for an output operating capacity of 50m3/day for building NPCW use.

The black water contractor is responsible for all hydraulic works within the black water plant room extension of all hydraulic services penetrating the plant room and including provision of emergency showers and eye washes.

Appendix 1 contains a water process schematic for the plant and equipment. The diagram below shows the water flow principles.



Water flow principles diagram

3 Design Criteria

The plant will be designed in accordance with this specification and exact flow volumes are subject to final confirmation during detailed design development.

The plant will be designed and built to produce 50,000 litres per day of Class A water meeting the requirements of the NSW Management of Private water schemes.

The black water plant has been sized to meet 90% of the cooling tower water demand with non-potable water and to meet all irrigation, WC and urinal flushing needs within the building.

The breakdown of daily water consumption is expected to be as follows:

10,000 litres of treated water for building NPCW excluding cooling towers

40,000 litres of low salinity treated water per day for cooling tower use.

It is expected that the daily sources of waste water will be close to evenly split between building generated waste water with 28,500 litres expected to be available with a slightly larger component extracted from the sewer in Hunter Street.

The plant and treated water shall meet the quality standards outlined for 'High exposure risk level' in the NSW Management of Private Water schemes Health guidelines summarised in the table below:

Parameter	Effluent Compliance Value
E.Coli	< 1 cfu/100 ml
Biological Oxygen Demand (BOD)	< 10 mg/l
Suspended Solids	< 10mg/l
pH	6.5 – 8.0
Turbidity	< 2 NTU
Disinfection	0.2 – 2.0 mg/l Cl
Coliphages	< 1 pfu/100 ml
Clostridia	< 1 cfu/100 ml

The plant will be designed assuming the following inflowing water quality:

Parameter	Design Value
Biological Oxygen Demand (BOD)	< 500mg/l
Suspended Solids	< 600mg/l
Total Phosphous	< 20mg/l
Total Nitrogen	<100mg/l
pH	6.0 – 9.0
Fats, Oils and Grease	< 100mg/l
TDS	<1000mg/l

The black water contractor is to confirm the limits of operation of their proposed plant within their tender return.

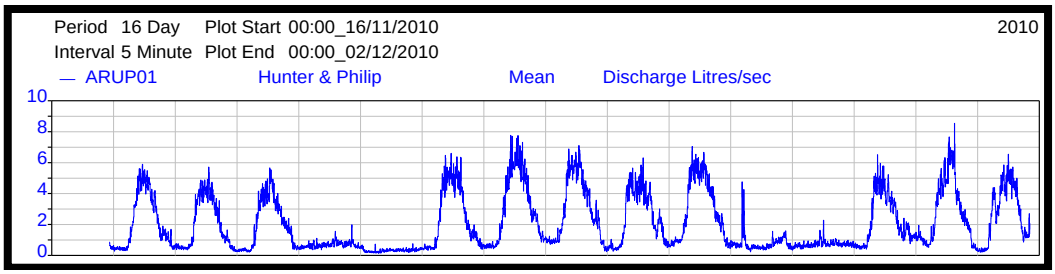
3.1 Flow Monitoring

Flow monitoring of the local 300mm sewer in Hunter Street has been completed in 2008 and in December 2010.

The manhole utilised for flow measurements is identified below. The depth is 6.2 m from the pipe invert to the road surface

The quantity of the sewer flows are as follows:

Flow data in litres/second



Volume of available flow

7am to 7pm Weekday (data 17/11/10) = 150,000 litres total
24 hour Weekday flow (data 17/11/10) = 189,000 litres total

7am to 7pm Weekend (data 20/11/10) = 30,000 litres total
24 hour Weekday flow (data 20/11/10) = 59,000 litres total

3.1.1 Water quality in external sewer

Parameter	Limit of Reporting (mg/L)	1/12/2010 Results
pH	0.01 pH units	6.59
Total Dissolved Solids (TDS)	1	516
Total Suspended Solids (TSS)	1	186
Alkalinity Total Alkalinity as CaCO3 Bicarbonate as CaCO3 Carbonate as CaCO3 Hydroxide as CaCO3	1	 157 157 <1 <1
Ammonia as N	0.01	27.4
Nitrite	0.01	<0.01
Nitrate	0.01	<0.01
Total Nitrogen as N (incl. NOx and TKN)	0.1	43.5
Total Phosphorus as P	0.01	5
Oil and Grease	5	74
Chemical Oxygen Demand (COD)	5	735
Biochemical Oxygen Demand (BOD)	2	419

This is a one time measurement and should be used as a guide only. The limits of the plant are to be stated in the event that the sewer water quality exceeds the measurements stated above. As part of the design process the contractor is to obtain new volume and flow analysis to verify the final plant selection.

4 Detailed Design Components

The minimum system requirements are for a fully operational black water treatment plant in compliance with this specification and all relevant Authority requirements. The black water treatment plant is to be located in one plant room at Basement level 2 the plant room refer to Appendix 2 (note there is restricted head room under the ramp). Refer to Architects drawings for detailed sections.

The items to be provided are, but not, limited to the following:

- All hydraulics pipework, defined as part of the black water plant throughout the plantroom and this specification including all necessary valves, fittings, fixings, supports and outlets. All pumps are to be a minimum Duty, Standby configuration.
- An automatic 'trash' screen BW-TS-01 on the incoming services before the buffer tank BW-BT-01 to remove inorganic matter into a storage bin for manual removal.
- Incoming buffer tanks BW-BT-01, this shall be provided for a sufficient volume of 24 hours storage at average building flow rate. This will take the form of 2No pre-cast concrete tanks each with min 25,000l capacity which shall be located below B2 slab. The tank shall be sealed with access hatches and level switches as identified in the controls section of this specification. The over flow level shall be set to drain by gravity to the black water sump pump SP-01. All controls, pipework, pumps are to be provided by the black water contractor and coordinated with the builder and other services.
- Macerating transfer pumps to transfer the effluent from the buffer tank to the aeration zone.
- An aerobic biological treatment zone and associated pumps, valves, controls and real time monitoring to efficiently operate the aeration requirements.
- An Ultra-filtration zone MBR process and associated controls and equipment.
- Second barrier disinfection
- On-line turbidity monitoring
- TDS, pH, Chlorine monitoring instruments
- Reverse Osmosis treatment (or similar) of treated black water to reduce the TDS level of the effluent for efficient usage in cooling towers.
- Supply to the NPCW transfer pumps NPCW-TP-01 (pumps by Hydraulic contractor) for transfer to the L33 NPCW tank.
- Automatic divert of treated stream to sump if any of the quality measurements are outside limits.
- Overflows and drains by gravity to the black water sump pump SP-01 in the event of system or power failure from black water plant.
- A sealed sump SP-01 to collect all overflows, screened trade waste, black water reject and all other reject to allow dilution before transferring to the gravity building drain. Including all level switches, pumps, valves, control and monitoring.
- All vent stack connections and odour controls.

- The black water plant shall be fully enclosed within the plant room to prevent the escape of odours with a mechanical extract system (by others).
- Remote monitoring and data logging of system at the Building Management System and critical control points
- Flow meters and energy consumption meters on all plant components
- Sewer wet well to collect the mined wastewater from the Hunter street Sydney Water sewer main complete with actuated knife gate inlet, macerating pumps (duty/standby), level switches, vent and outlet flow meter. (By others)
- All chemicals and equipment required for min 12 month operation achieving the specified water qualities.
- All materials and coatings used in the Black Water plant design shall be selected to provide a design life of at least 30 years.
- Controls and connection to the BMS of all components specified in the controls section of this specification, the black water contractor is responsible for the interface between the motorised diversion valves, level switches and sewer mining connection;
- Painting of all pipework as required by the colour code specification;
- Supports, signage and labelling of all hydraulic services;
- Provision and submission of all samples, equipment, fittings and fixtures specified;
- Submission of ITPs (inspection and test plans);
- Full testing, commissioning and demonstration of the works at completion and compliance with all authority regulations;
- The preparation of installation and construction documentation including shop drawings and installation and as installed drawings, essential services manuals, operating and maintenance manuals and quality assurance documentation;
- The provision of a full and comprehensive Maintenance Regime and Warranty during the 12 month Defects Liability Period;
- The contractor is to hand over the spare parts scheduled as part of this specification at the end of the defects period.
- A maintenance and tuning plan is required to be supplied by the black water subcontractor. This should be submitted to the Principal Contractor and the ESD Consultant a minimum of 6 weeks prior to commencement on site.

4.1.1 Obvious Work

The works under the contract include all those minor parts not necessarily explicitly specified and which are reasonably and obviously necessary as part of the works to be provide a fully working services system.

4.1.2 Notices and Fees

The contractor is to give all notices, obtain all licenses, pay all fees, charges, levies, tax and deposits and otherwise conform with the requirements of all properly constituted Authorities with respect to the Contract.

4.1.3 Design Responsibilities

The Specification and Drawings describe the scope, nature, quality and performance requirements of the Black water services installation. The contractor is to return a fully compliant bid with costs for the equipment specified within the schedules and data sheets. The contractor may make proposals for equipment of alternative supply however, these are to be itemised and costed separately to allow the design team and Principal to review. All equipment proposed by the contractor is to be equal in performance and quality to that originally specified. His proposal is to clearly identify the saving offered and a written confirmation that all costs are included within the saving. The contractor shall remain responsible for ensuring that he has included for any hidden costs associated with the proposal such as any alterations to pipework or power supplies etc. that the equipment change has brought about. The Principal shall accept no future claims for additional costs due to the contractor's omission to accurately address all additional costs associated with his proposal for alternative supply.

The Contractor shall develop the information contained on the Tender drawings into installation drawings incorporating all necessary co-ordination between other services and trades, including manufacturer specific dimensions and the access spaces for the operation and maintenance of the equipment. Where specific space is required for access, this shall be indicated on the installation drawings. The contractor shall produce builders work drawings in accordance with the Contract programme in order to allow slab penetrations, plinths, sleeves, etc. to be provided throughout the building in a timely manner consistent with the construction programme.

The contractor shall take all reasonable measures and care in the incorporation of the services into the building as a whole.

The Contractor shall carry out additional design development processes as required to enable construction. Such processes include, but are not limited to:

- The preparation of drawings sufficient to allow construction of black water systems;
- Allow for detailed co-ordination in specific locations e.g. plantrooms etc;
- Technical co-ordination of all the elements forming the black water services works and any suppliers;
- Co-ordination with the Architect, Engineer and other trades;
- Where the Contractor wishes to use alternative methods or equipment he is to fully evaluate and submit a detailed report on any proposals;
- Preparation of safety method statements particular to specific tasks;
- Preparation of method statements for plant installation and critical activities;
- Production of co-ordination drawings;

- Production of fully dimensioned installation drawings;
- Production of builders work drawings for the services installation including the determination of the size and location of penetrations in walls and floors;
- Production of installation wiring drawings for the works;
- Production of shop drawings of equipment and fabricated units;
- Production of manufacturer specific drawings certified as relating to the project;
- Production of record drawings for all services;
- Undertake detailed spatial co-ordination of the services with respect to all other works and trades including the detailing of interfaces, the contractor is responsible for ensuring all interfaces are covered and that there are no scope gaps;
- Confirm final calculations and sizing: pump duties, membrane size etc;
- Design and co-ordinate the supports for the services and equipment;
- Detail access ways and spaces for the services;
- Design of guide and expansion systems for all services including requirements at movement joints etc;
- Select valves for the services systems to meet requirements of the BMS specification;
- Select anti-vibration systems for the plant and equipment;
- Ensure the coordination across discipline for loads – for example, the electrical loading of equipment, the heat rejected by equipment, the need for water at a certain pressure and flow rate etc;
- Co-ordinate the construction works for the services installations;
- Develop the details of the electrical wiring and control diagrams for all equipment supplied showing all interconnections between equipment to enable the necessary wiring to be undertaken;
- Determine the settings for electrical protection equipment, time delays, time switches, balancing valves, flow regulating valves, dampers and the like;
- Detail the earthing and bonding requirements for all engineering services and architectural and structural elements requiring earthing and bonding.

4.1.4 Program

The works is governed by a program agreed between the contracting parties. Ensure that the works carried out under this package is in accordance with that program. Provide a separate program for this package of the works identifying specific milestones including:

- Commencement on site;
- Submission of Shop Drawings;
- Approval of Shop Drawings;
- Commissioning;

- Submission of first draft of as-built drawings and operating and maintenance manuals;
- Provision of Fire Safety Schedule and Compliance Certificates;
- Defects Inspection;
- Completion on site;
- Submission of final copies of as-built drawings and operating and maintenance manuals;
- Practical Completion;
- Defects Liability Period;
- Final inspection.

4.2 Sustainability Objectives

This section details the Green Star and National Australian Built Environment Rating System (NABERS) Energy targets of 8 Chifley Square. This specification includes clauses that are related to these targets; however the Subcontractor should refer to the ESD Specification for general requirements. The objectives of this section are written so that the Base Building achieves the following:

- Green Star – Office Design and As Built v2 minimum Overall Weighted Score of 75 points aiming at a minimum Green Star Office Design and Green Star Office As-Built rating of 6 Stars.
- A target to achieve a NABERS Energy rating for Base Building of 5 Star + 60% in design.

The Subcontractors shall be aware of environmental benchmarks and be involved in the project construction to deliver the environmental targets set by the design team and the Principal. The Principal and Subcontractors shall comply with all requirements included here and the ESD Specification.

Subcontractor Involvement in Green Star and NABERS Energy Compliance

The Subcontractor's role and involvement has implications in the design, construction, hand over and operation of the building. It is the Subcontractor's responsibility to actively request relevant documentation and instruction from the Principal during the different stages of the Green Star rating and review process. The Subcontractor, in accordance with the Principal, must collect and compile for submission all necessary information as outlined in this specification, the ESD Specification, and as required to achieve a 6 Star Green Star Office As Built rating.

It is the Subcontractor's responsibility to verify the requirements of the Green Star submission in terms of each credit according to the most recent Green Star As Built credit summary provided by the Principal.

The Principal must prepare and submit documentation required for the Green Building Council of Australia (GBCA) in a presentable and appropriately formatted "Green Star - Office As Built v2" as required for submission. The formatting of the submission should be in accordance with the requirements stated by the Green Building Council of Australia. Some of the requirements are listed below:

- All supporting Green Star related documents (copy of receipts, letters, reports, drawings etc.) shall be ordered according to the relevant Green Star Credit Category and filed in the above mentioned folder(s) in the appropriate section.
- All letters must be formally signed and dated letters on company letterhead nominating this specific job.
- Reports must be appropriately formatted and equipped with a title page, job information and table of contents.
- All supporting documents and receipts must be collected and filed in above mentioned folder and if not specifically mentioning this job, must be referred to in a letter which states relevant job and Principal information.
- All documents shall clearly highlight requested information

The final As Built certification shall be achieved prior to the end of the defects liability period.

The subcontractor is to provide broken down energy consumption and water efficiency information for their proposed system as part of the tender return.

5 Green Star Office As Built – ESD Requirements

- The Subcontractor submissions will be checked by the Principal Contractor. The Principal Contractor will approve or indicate required changes to ensure final documentation complies with Green Star requirements. Documentation is to be submitted no later than the dates indicated. The Subcontractor's documentation will be reviewed once prior to the submission of the Green Star Office As Built v2 documentation The final submission should ensure all documentation is complete and contains all correct information. The Subcontractor is expected to cover the cost of any additional revisions required due to missing or incorrect information supplied.
- The Principal Contractor's Green Star Office As Built v2 submission will be reviewed once by the ESD Consultant. The final submission should ensure all documentation is complete and contains all correct information. The Principal Contractor is expected to cover the cost of any additional revisions required due to missing or incorrect information supplied.

It is assumed that the Subcontractor will not make changes to the design and that the documentation submitted will be based on the building design developed by the Consultants. The Subcontractor must seek the approval of the Principal Contractor before making and proceeding with any changes to the design. Any changes proposed by the Subcontractor to the design may require additional computer modelling to verify compliance with Green Star requirements. The Subcontractor is responsible for covering the costs of any remodelling associated with changes to the proposed building design developed by the Consultants and the design team.

The following sections describe specific responsibilities and measures that shall be adopted in order to achieve a 6 Star Green Star – Office As built v2 rating.

The Subcontractor shall submit to the Principal Contractor and ESD Consultant for review the documentation as requested in each of the following sections no later than indicated.

5.1.1 Commissioning Clauses (Man-2)

The subcontractor shall provide all documentation and information required by the Principal Contractor in achieving the following.

The Principal Contractor shall comply with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required for all services and evidence must be provided to demonstrate that the appropriate Principal Contractor, Subcontractor and trades on site performed in accordance with the CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes).
- The Principal Contractor shall transfer information and documentation to building owner/manager regarding design intent, as installed details, commissioning report and training of building management staff.

The Principal Contractor shall submit the following documents before commencement on site:

- A commissioning plan (as prepared by the Independent Commissioning Agent) including a methodology statement of the commissioning process identifying commissioning dates, the tests to be carried out and proposed operational control strategy of each system component including Trigeneration, Ventilation, Heating Systems, Cooling Systems, Electrical Systems, Lighting, Domestic Hot Water and Blackwater. The commissioning plan needs to be signed off by Project Manager before commencement on site.

The Principal Contractor shall submit the following document prior to practical completion.

- Summary commissioning report (as prepared by the Independent Commissioning Agent) including commissioning dates, tests carried out and outcomes and changes made as a result of the commissioning process. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- A copy of the documentation and information transferred to building owner/manager.
- A copy of the transmittal of the commissioning report and to at information to the building owner showing the building owner/manager as the addressee or acknowledgement from the owner/manager that that information has been received.
- A signed statement from the building owner committing to the incorporation of the commissioning requirements.

The documentation submitted by the Principal Contractor to the Project Manager should provide comprehensive information on the following:

- Design Intent
- As Installed Details
- Commissioning Report
- Training

The following is a list of minimum inclusions for this document

5.1.1.1 Design Intent

Energy & Environmental Strategy

Information on energy efficient features and strategies in relation to the building, including an overview of the potential savings – stated for economic and environmental impact –must be provided.

Monitoring and Targeting

Documentation shall include information on energy targets and benchmarks for the building type and a strategy that addresses metering & sub-metering provision and how to record and present meter readings.

Building Services

Documentation providing description of basic functions, operations and descriptions of energy saving features of the following systems are to be provided:

- Trigeneration
- Ventilation
- Heating System
- Cooling System
- Electrical Systems
- Lighting
- Domestic Hot Water (DHW)
- Blackwater

Each system shall include, as a minimum, the following information:

- A simplified diagram of the system
- An explanation of how it operates
- A list of what the main components are (including Controls) and the importance of their efficient use
- Details of maintenance, including recommended frequency
- A list of likely and tell tale signs of system failure, system “do’s” and “do not’s” and notes of inefficient operation.

The Principal Contractor shall provide the following documentation no later than practical completion of works:

- An extract of service specification or short report detailing basic functions and operations of building services as requirement as stated above.

The Principal Contractor shall have access to the Green Star Office Design submission to reference work that has already been completed for this credit.

5.1.1.2 As Installed Details

The Principal Contractor shall submit the following documents no later than 2 weeks after commissioning has been completed in the building.

- A complete set of As Built drawings for all, mechanical, electrical and hydraulic systems and a comprehensive Operations and Maintenance (O&M) manual. The manual and drawing set is to include information on the Trigeneration and Blackwater systems.

5.1.1.3 Commissioning Report

The Principal Contractor shall submit the following document prior to practical completion

- A report which confirms that commissioning of each system or feature is in compliance with the contract documents. The report must also include a written list of outstanding commissioning issues, records of all functional/commissioning testing undertaken and list any seasonal testing required in the future. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- The report shall include the following as a minimum:
  - Demonstrate correct operation of the mechanical ventilation system.
  - Show the Trigeneration system operates correctly and in accordance with the energy modelling report.
  - Indicate the results of noise level testing outlining the conditions under which the tests were carried out.
  - Demonstrate that the building operates in the configuration described in the energy modelling report.
  - Show the water reuse system operates correctly.
  - Indicate water meter functions correctly.

5.1.1.4 Training

It is the Principal Contractor's responsibility to ensure that building managers or staff receives sufficient training to have all the information and understanding needed to operate and maintain the commissioned features and systems. The training issues are to include:

- Design Intent – including energy and environmental features
- Review of controls set-up, programming alarms and troubleshooting
- O&M manuals
- Building operation – including start up, normal operation, unoccupied operation, seasonal changeover and shutdown
- Interactions with other systems
- Optimising energy efficiency
- OH&S issues
- Maintenance requirements and sourcing replacements
- Occupant satisfaction feedback.
- Training certificate or letter stating that building manager and/or staff received training including all the issues mentioned above as a minimum. The letter should include the name of all staff that received training.

5.1.1.5 Commissioning Clauses

The blackwater Subcontractor shall comply with the following requirements.

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed by the Subcontractor and trades on site performed in accordance with the CIBSE Commissioning Code M: Commissioning Management in fulfilment of the Green Star requirements only. Additional commissioning requirements may apply.

Subcontractors shall refer to the Hydraulics Specifications for further requirements for Commissioning.

Note that the commissioning requirements listed above are required in fulfilment of the Green Star requirements only. Additional commissioning requirements, not listed may apply.

5.1.2 Commissioning – Building Tuning (Man-3)

All Subcontractors shall comply with the following requirements:

- Enter a maintenance agreement that includes a commitment to a 12-month commissioning tuning period after handover, including minimum quarterly reviews and a final recommissioning after 12 months of operation.

This will be achieved through on-site quarterly meetings involving all parties described below.

- Principal's Representative
- Principal Contractor's Representative
- Independent Commissioning Agent
- Architect and/or Consultant
- Mechanical and Controls Subcontractors
- Equipment Supplier

During the tuning period, the commissioning process will include:

- Review of BMS-generated trends.
- Monitoring the efficiency of the BMS, Trigeneration, blackwater, mechanical, electrical, lighting, domestic hot water, and IT systems during all seasonal variations for the occupied building.
- Tuning the BMS, Trigeneration, blackwater, mechanical, electrical, lighting, domestic hot water and IT systems to optimise control and time schedules to suit occupants' needs.
- On-going training of existing personnel and training of new personnel.
- Monitor complaints received from occupants/tenants and determine whether the problem lies in the discrepancy between the predicted performance measured against actual performance or whether the complaint indicates a need to re-evaluate the design intent.

- Documentation of the following:
    1. Maintenance records.
    2. Log of complaints, problems and corrective actions. Copies to be sent to the Principal Contractor and system designer, as well as the Mechanical and ESD Consultants.
    3. Log of system performance at different load periods.
    4. Modifications made based on tenant needs.

The Subcontractor shall agree to a scope of that will involve as a minimum the following roles and responsibilities during the building tuning period and as agreed between parties:

(Principal's Representative)

- Assign maintenance personnel and schedule participation in the building tuning commissioning events.
- Provide access to the building and any utilities required for the events.

(Independent Commissioning Agent)

- Review BMS generated trends, alarming and operator logs.
- Set quarterly energy targets based on monthly NABERS energy target profile set by the Independent Commissioning Agent and measure actual performance to ensure implementation of selected measures.
- Determine non-performance issues and direct rectification of the issues.
- Ongoing training of existing personnel and training of new personnel.
- Create a commissioning plan and direct the commissioning process that covers an air distribution system, boilers, automatic controls, lighting, refrigeration, domestic hot water, water distribution, system.
- Introduce standards and strategies early in the 12-month commissioning building tuning period.
- Coordinate with the Principal's Representative, Architect, Consultants, Principal Contractor, and relevant Subcontractors throughout the 12-month commissioning building tuning period.
- Observe all testing and review and approve contractor test results.
- Prepare a final commissioning report including recommendations to the Principal's Representative regarding the performance of commissioned building systems.

(Subcontractor)

- Include the cost for 12-month building tuning in the contract price.
- Ensure participation of major equipment manufacturers in building tuning commissioning events.
- Assist the Independent Commissioning Agent in verification and performance tests.
- Revise and re-submit the commissioning report to the ESD Consultant and Independent Commissioning Agent for review and acceptance.

(Principal Contractor)

- Ensure the 12-month building tuning requirements are included in the mechanical, electrical and control Subcontractor's contracts.
- Remedy deficiencies identified in verification and functional tests.

(Equipment Supplier)

- Include the cost for 12-month building tuning in the contract price.
- Demonstrate the performance of equipment as required.

The Subcontractor shall submit the following documents no later than two (2) weeks after signing of contract.

- Copies of the building tuning contract (prices may be deleted) showing the scope and timeframe of the building tuning process, demonstrating the above criteria and signed by all Subcontractors.

5.1.3 Building Users Guide (Man-5)

The Principal Contractor shall comply with the following requirements:

- Provide a simple Building User's Guide, which includes information relevant to the building users, occupants and tenants' representatives.

NOTE: The building User Guide is to be produced by Arup as part of design documentation and is available on request.

All Subcontractors shall comply with the following requirements:

- Provide information and documentation as required by the Principal Contractor in producing a Building Users Guide.

The Principal Contractor shall submit the following documents no later than practical completion of works

- Confirmation that the building user's guide has been issued to the owner through the provision of the official transmittal or through a letter from the owner confirming receipt of the document.
- Provide a copy of the guide to the GBCA

5.1.4 Environmental Management (Man-6)

The Principal Contractor will provide and implement a comprehensive Environmental Management Plan (EMP) for the works in accordance with Section 4 of the NSW Environmental Management System Guidelines (1998).

The Principal Contractor shall submit the following documents prior to commencement on site:

- An Environmental Management System (EMS) and an Environmental Management Plan (EMP).

The Principal Contractor shall submit the following documents no later than 2 weeks after practical completion of works:

- A copy of the EMP clearly demonstrating compliance with the requirements of Section 4 of the NSW Environmental Management System guidelines (1998).
- Copies of all reporting created through the use of the Environmental Management Plan (EMP) as evidence that the EMP was successfully implemented in accordance with Section 4 of the NSW Environmental Management System guidelines (1998).
- A copy of the ISO 14001 certification, its applicability and its restrictions.
- Statements with the EMS or Project EMP showing that any Sub Contractors relevant to the project will adhere to the ISO 14001 requirements.

All Subcontractors shall comply with the following requirements:

- Subcontractors will adhere to the Principal Contractors ISO 14001 requirements.

Refer to Appendix A of the ESD Specification for the requirements of the EMP and EMS.

5.1.5 Waste Management (Man-7)

The Subcontractor shall comply with the following requirements:

- Provide and implement a comprehensive Waste Management Plan.
- Reuse and/or recycle at least 80% of all waste by weight

As a minimum, this will include:

- Reuse and/or recycle at least 90% of waste metal by weight.

The collection of waste for recycling should come from all construction activities.

The Subcontractor shall provide the following documentation prior to commencement on site (All details must be forwarded to the Principal Contractor and ESD Consultant for review and approval):

- A catalogue listing the materials in the building, estimating the weights of materials to be removed and stating the proposed recycling facilities to be used, the proportion of waste to be reused or recycled by each recycling facility, and the total proportion of waste to be reused or recycled and advising on the percentage of each type of material to be recycled. This should be provided in spreadsheet format. The proposed methodology for the demolition must also be provided.
- Waste measurement methodology adopted.
- A list of appropriate recycling companies that will be employed for recycling, the costs for collection, and the timing of collection service. Any substitution of recycling companies at a later stage will require sign-off by the Principal Contractor and ESD Consultant. Substitution requests will need to include methodology documentation for the recycler in order to qualify for approval.
- Estimates of achievable rates of recycling by weight by recycling companies that will be employed.
- A copy of waste management plan used for this site.

The Subcontractor shall commit to and address in the waste management plan the following issues:

- Produce a methodology statement of the waste management process indicating the entire process from separation of waste to quantifying and recycling. The method should include recycling targets for each type of waste material.
- Establishment of an on-site waste management area for sorting and segregating waste.
- Provision for colour-coded and clearly marked waste skips or bins at the waste storage area for each of the following materials:

  ✓ Cardboard

  ✓ Timber

  ✓ Metal

  ✓ Soft Plastic

  ✓ Polystyrene

  ✓ Insulation

  ✓ Concrete

  ✓ Glass

  ✓ Bricks

Liabilities:

- The Subcontractor must ensure all care is taken during removal of items in order to ensure no surrounding materials are damaged.
- If under any circumstances any material becomes contaminated so as to deem it unfit for recycling due to the practice of the Subcontractor, the Subcontractor will be liable for the cost of landfill for this material plus an additional penalty to be outlined in the contract documents.
- The Subcontractors must provide notification of any asbestos or hazardous waste that is uncovered during the strip out works. A time frame for the removal of this waste should also be provided. See hazardous waste audit regarding air monitoring and clearance certificates.
- Any recycling Subcontractor used for recycling on this project must provide a facility/service license or similar certification within two weeks of tender and prior to proceeding with any site works.
- All certification, documents, reports, and records that relate to the mass, volume, relative amount, and type of recycled material must be collected during the works and submitted with claims for stage payments.
- The Subcontractors will be liable for any material that is unjustifiably ‘dumped’ or not dealt with as per the recycling schedule outlined in this report.
- Any penalties received from recyclers for the contamination of recycling bins or skips will be the responsibility of the Subcontractors. This charge will attract a penalty to be outlined in the contract documents.

5.1.6 Internal Noise Levels (IEQ-12)

The Subcontractors shall comply with following acoustic requirements as a Green Star requirement (as a minimum):

- Building services noise shall meet the recommended design sound levels provided in Table 1 of AS/NZS 2107:2000

Subcontractors are required to comply with either the above requirements **OR** the requirements found on the Acoustics specifications (whichever stricter)

The Subcontractors shall submit the following documents no later than two (2) weeks after completion of commissioning and prior to practical completion:

Extracts from the commissioning report showing the results of noise level testing and outlining the conditions under which the tests were carried out.

5.1.7 Volatile Organic Compounds (IEQ-13)

All Subcontractors shall comply with the following requirements:

- All adhesives and sealants are low-VOC.

The Subcontractor shall submit the following documents for adhesives and sealants no later than six (6) weeks prior to commencement of Installation/Application of materials on site:

- VOC data sheets for each product used which quote the VOC content of the product, provided by the supplier and signed by a suitably qualified representative showing that VOC levels are below those specified by Green Star compliance manual v2.

The Subcontractor shall submit the following documents no later than two (2) weeks prior to commencement of Installation/Application of materials on site:

- VOC data sheets for each product used which quote the VOC content of the product, provided by the supplier and signed by a suitably qualified representative.
- Supplier certification confirming the quantity of each product supplied.

The Subcontractor shall submit the following documents prior to practical completion:

- List of all adhesives and sealant quantities used on site.
- Subcontractor Certification which confirms that the products supplied were used in the development.

The following international standards are to be referenced for low-VOC:

Adhesives and Sealants

- Reference: South Coast Air Quality Management District (California, U.S.) – Rule 1168

Adhesives and sealants must respect VOC contents as per table below for latex based products:

ADHESIVES	
Product Type	**Maximum TVOC content* (g/litre of product)**
Multipurpose construction adhesive*	70
Maximum TVOC limits for Adhesives & Sealants *Sealants used to enhance the fire- and water-proofing properties are included.	

- VOC limits are less water and less exempt compounds.

Compliance testing: Refer South Coast Air Quality Management District Rule 1168 for testing methods and exempt compounds.

5.1.8 Energy (Ene-1, Ene-2)

All Subcontractors shall comply with the following requirements:

The base building As Built design achieves a minimum predicted rating of "5 Star + 60% CO2 reduction" using the National Australian Built Environment Rating System (NABERS) scheme simulation protocol.

Energy calculations have been provided for the Green Star Office Design submission, so the Subcontractor need only to demonstrate that the design and materials have not been significantly altered from those used for the original calculations. Alterations to the original design should be documented and it is the Subcontractors responsibility to demonstrate that any changes do not impact upon the building energy use.

The Subcontractor will receive a letter from the ESD Consultant indicating the calculations produced for the Office Design submission, provided that the Office Design specifications are still relevant.

If there have been significant changes, the As Built design should be remodelled and analysed. The Subcontractor is responsible for covering modelling costs arising from design changes.

The Subcontractor shall submit the following documents no later than two (2) weeks after commissioning has been completed in building.

- Extracts from the commissioning report demonstrating that the building operates in the configuration described in the energy modelling report.

The Subcontractor shall submit the following documents prior to practical completion;

- Exemptions report of all design variations between design documentation and as- built design for mechanical, electrical and façade design.
- Copies of as built drawings and performance schedules demonstrating that the blackwater systems are the same as described in the energy modelling report. This document shall clearly highlight part load efficiencies (at 20, 40, 60, 80, 100% load) for all plant items, including but not limited to:
    - Fans

- Pumps

The Subcontractor, as a result of design alterations, may be requested to provide an energy report by the Principal Contractor. The Subcontractor shall submit the following documents no later than two (2) weeks after completion of blackwater Construction Drawings:

- Energy modelling report for the as built office building which describes the energy modelling process as per the NABERS "Validation Protocol for the use of Computer Simulations to Estimate Building Energy Performance" (Version 2005-01).

5.1.9 Landscape Irrigation Water Efficiency (Wat-3)

The Subcontractors shall comply with the following requirements

- 90% of the water requirement for landscape irrigation is sourced from on-site rainwater collection or recycled site water.

The Hydraulics Subcontractor shall submit the following documents no later than two (2) weeks after completion of works. The blackwater Subcontractor shall provide all information and reports as required by the hydraulics Subcontractor in providing:

- A report describing the rainwater collection and black water recycling systems, with calculations showing tank sizes, showing the systems will provide at least 90% of the water requirements for landscape irrigation. The report should include:
- As-installed drawings of the system that show the tank size is the same as that calculated.
- Extracts from the commissioning report showing the system operates as outlined in the report.
- Documentation that indicates the system complies with the Environmental Protection Authority's requirements.
- Please note that this volume of water for irrigation must also be included in the Potable Water Credit Calculator referenced in Section 7.5.1.

5.1.10 Cooling Tower Water Consumption (Wat-4)

The Subcontractor shall comply with following requirements:

- The cooling tower system shall be designed to achieve six or more cycles of concentration.
- The cooling system uses 90% non-potable water

The Hydraulics Subcontractor shall submit the following documents prior to practical completion. The blackwater Subcontractor shall provide all information and reports as required by the hydraulics Subcontractor in providing:

- Document summarising the operation of the cooling towers, referring to extracts from the commissioning report and demonstrating that the cooling

towers and water treatment system achieve 6 cycles of concentration, or better, in operation; and

- Extracts from the commissioning report demonstrating the successful operation of the system; and
- A design drawing highlighting the location of the cooling towers and any supplementary equipment that may be required to achieve six cycles of concentration and equipment associated with supplying 90% recycled water to the cooling system; and
- Details of the water treatment system for the cooling towers, clearly showing the capacity to provide 90% of cooling tower water requirements referencing as-built drawings.

5.1.11 PVC Minimisation (Mat-7)

The Subcontractors shall comply with the following requirements:

- 60% of the common uses of PVC products in buildings (by cost) must meet the Best Practice Guidelines for PVC in the built environment.

The common use of PVC in building refers only to:

- Pipes, conduit and associated fittings;
- Wire and cable insulation; and
- Flooring (vinyl flooring or a carpet containing PVC backing) and resilient wall covering products that contain PVC.

Common uses of PVC products that are re-used are excluded. The 'total cost of PVC products' for the purpose of providing cost calculations shall be determined by the cost of the entire product (excluding installation costs).

Documenting compliance of a PVC product to the Best Practice Guidelines shall be demonstrated using any of the following pathways:

- ISO 14001 certified EMS that includes the requirements of the Best Practice Guidelines;
- Independently audited manufacturer's declaration of compliance to the Best Practice Guidelines; or
- Product third party certification of compliance to the guidelines (ISO type 5 certificate or eco label).

The Subcontractor shall submit the following documents:

- Short report describing how the Credit Criteria have been met by providing:
    - An as-installed PVC schedule prepared by a quantity surveyor, cost manager, cost planner, cost estimator, or architect showing cost calculations to demonstrate how the Credit Criteria is met. The PVC schedule must provide:
        - Type of common use PVC product ;
        - Product and supplier names;
        - Indication of compliance;
        - Reference to evidence of independent verification;
        - Quantities of installed products;

  - Total costs of compliant and non-compliant products; and
  - The percentage (by cost) of the total common use PVC products that are compliant with the Credit Criteria.
  - See Appendix B of the ESD Specification for a PVC schedule template example that must be included with the short report.
- Evidence of independent verification from the supplier demonstrating how PVC products comply with the Best Practice Guidelines for PVC in the Built Environment.
- Confirmation from the Principal Contractor or Supplier(s) confirming that the PVC products listed in the PVC schedule have been supplied and installed.

5.1.12 Insulant ODP (Emi-9)

The Subcontractor shall comply with following requirements:

- Demonstrated that the specification of thermal insulation avoids the use of ozone depleting substances in both its manufacture and composition.

The Subcontractor shall submit the following documents prior to practical completion.

- A copy of the sections of the specifications which refer to insulation where the requirements for that insulation are stipulated.
- Supplier certifications verifying that all insulants listed were supplied to the site. The supplier should certify that insulants did not use ozone depleting substances in manufacture or provide data sheets confirming this for all insulants.

Subcontractor certification that the insulants referenced by the supplier were the ones installed for this building. This certification should list all insulants installed.

6 Standards

All work shall meet the requirements of national and local authorities and shall be in accordance and fully comply with the following in so far as they apply to the work:

- Building Code of Australia;
- National Plumbing and Drainage Code AS 3500;
- NSW Code of Practice (Plumbing and Drainage);
- Sydney Water requirements;
- CIBSE commissioning codes:
- All applicable Australian Standards;
- Work Cover requirements;
- All Health Authority Requirements;
- All Sydney City Council regulations.
- NSW Health
- NSW Environment Protection Authority
- Department of Water and Energy
- IPART

Where this specification expressly requires standards higher than or different from those applicable under the relevant standard or code documents, this specification shall take precedence.

The contractor will be required to submit and make payment for any information requested by any of the above authorities for the successful approval of the scheme. All submitted information shall be additionally submitted to the consultant team.

7 Works for others – Interfacing and responsibilities

7.1 General

The black water systems interface with other trades and services within the building. All concrete cutting, Chasing, coring, cutting and making good for black water services are to be included;

7.2 Electrical Services

Actual demand information for all black water plant is to be provided by the Subcontractor and coordinated to enable the correct provision of sub mains supplying such equipment by the electrical Subcontractor.

Power is to be provided to black water equipment requiring such i.e. pumps, control panels, etc. by the electrical Subcontractor. The electrical Subcontractor will provide either GPOs or tails for final connection by the hydraulic Subcontractor.

7.3 Controls Services

The hydraulic services systems have various components that require controlling or monitoring by the BMS. Details of the controls can be found within the controls section of this specification and the BMS specification.

Water meters and flow meter with pulse outputs and valves are to be provided by the black water subcontractor, controls wiring, transducers and sensors are to be provided by the Controls Subcontractor.

7.4 Hydraulic services

The black water contractor is to extend incoming hydraulic services provided by the Hydraulic contractor from within 1m of the black water plant room with final connections to be made by the black water contractor. These include cold water services, incoming sewer mains.

8 Works by Others

8.1 General

This section details those works required to enable the black water services to be installed.

8.2 Building Trades

Sewer mining connection and pumps set – By others

8.3 Mechanical Services

Ventilation for the black water plant room is to be provided by the mechanical contractor.

8.4 Electrical Services

Sub-mains to black water plant Control Panels and/or switchboards including sufficient tails to allow final termination are to be provided by the electrical contractor.

8.5 Fire Services

Fire subcontractor is to provide all fire services within the black water plant rooms.

8.5.1 Hydraulic services

Hydraulics Subcontractor to provide incoming water service. Hydraulic Subcontractor to provide pipework into the black water plant room terminating with a valve and flange. Final connection by black water plant supplier.

All hydraulic services requiring extension from the Black water plant including vents and sewer rising mains shall be provided by the Hydraulic contractor to within 1m of the black water plant room with final connections to be made by the black water contractor. This includes the extension of the 100mm garbage room waste which is to be reticulated by the back water contractor to SP-01.

Recycled water transfer pumps NPCW-TP-01 – By Hydraulics contractor

9 Controls

This section summarises the controls of the black water system to assist the tenderer in understanding the design intent.

9.1.1 Black Water Balance Tank

Ref: BW-BT-01

The Black water system incorporates a raw effluent balance tank prior to the treatment plant. The inflow to this tank is via both the sanitary system in the building and harvested black water from the sewer mining system.

This capacity tank is split between two tanks to enable routine maintenance and for security.

These tanks are emptied by sewage transfer pumps Ref: BW-ST-01 and 02 sitting within the tanks arranged as duty and standby. The transfer pumps run continuously to provide a constant steady flow through the black water treatment plant however safety interlocks exist on the pumps to stop them running dry

Each section of the black water balance tank has low level pump cutouts within them to suppress the pumps operation. The pumps are linked to the BMCS and controlled to alternate their lead each pumping cycle.

The Black Water Treatment plant is a packaged system working under the dictates of its own controls. The BW plant is to have a common fault signal linked to the BMS Ref: BW-FLT-01 which when operated raises an alarm on the BMCS (Black Water Treatment System Failed) and suppresses the BW transfer pumps Ref: BW-ST-01 and 02.

The Black water balance tank is provided with level switches to control the operation of the sewer mining pumps BW-SMP-01 and 02. The BW-SMP-01 and 02 are controlled by the BMCS to transfer mined sewage into the black water balance tank. The BMCS is to rotate the lead pump each operation.

The sewer motorised diversion valves are to be normally open but closed on signal from the BMS when the HL alarm is activated in the buffer tanks or under the dictates of the black water system. This enables the full control of where the incoming sewage to the black water plant and the ability to divert all waste from the black water plant when required.

The sewer mining pumps are controlled as follows.

Alarm Reference	Description	Operation
A-BW-OF-01	Overflow alarm section 1.	Alarm on BMCS.
A-BW-OF-02	Overflow alarm section 2.	Alarm on BMCS.
A-BW-HL-01	High level alarm section 1.	Alarm on BMCS Suppress operation of pumps Ref: BW-SMP-01 and 02. Close motorised valves.

Alarm Reference	Description	Operation
A-BW-HL-02	High level alarm section 2.	Alarm on BMCS Suppress operation of pumps Ref: BW-SMP-01 and 02. Close motorised valves.
A-BW-PS-01	70% capacity alarm section 1	Pumps Ref: BW-SMP-01 and 02 stop
A-BW-PS-02	70% capacity alarm section 1	Pumps Ref: BW-SMP-01 and 02 stop
A-BW-LL-01	50% capacity alarm section 1	Pumps Ref: BW-SMP-01 or 02 start
A-BW-LL-02	50% capacity alarm section 2	Pumps Ref: BW-SMP-01 or 02 start

Each section also contains low level pump cutout switches supplied and installed by the pump suppliers. The pump cut outs are designed to suppress the operation of the black water transfer pumps ref: BW-ST-01 and 02 when the tanks are empty.

All level switches and cut outs are to be configured to allow continued operation in the event of one compartment being isolated and drained down.

The controls strategy is to be developed by the black water contractor to enable optimal performance of the plant. This includes the strategy to potentially utilise the cooling tower blow down of quality allows. The controls are to interface with the levels within NPCW-T-01 such that if this tank is nearing capacity the black water plant will reduce capacity optimising operation.

9.1.2 Sanitary Waste Water Pump Out Units

Ref: SP-01

The project incorporates a sewer water pump out units. These are provided with their own packaged controllers. The control panels are arranged to operate the pumps when the sumps are full and stop pumping when the sumps are empty. The units incorporate volt free contacts for signalling to the BMS a fault condition. The contacts are to be rated at 240Vac 5A.

10 Schedule

10.1 Pipework Schedule

Item Pipework Materials	Location	Type/Duty
Aerial sewer drainage (suspended)	Internal	HDPE. Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm).
Sanitary plumbing branch lines and vents	Internal	HDPE. Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm).
Trade Waste plumbing branch lines and vents	Internal	HDPE. Electro fusion sockets are to be used throughout, but fusion will not be allowed. Fully insulated against sound transmission (25mm).
Non-Potable water	Internal	Polypropylene with electrofusion couplings. But fusion will not be allowed. Stainless steel 316 “Blucher” Mapress.
Acoustic insulation	All drainage services	Pyrotek Soundlag 4525C or approved equal. As documented within specification and as required to meet acoustic engineers requirements

11 Construction Drawings

11.1 Black Water Services

11.1.1 Work-As-Executed/Installed Drawings

Include correct and accurate services diagrams involving Layout Plans, Schematic Diagrams, Circuit Diagrams including all labelling references for valves, pumps, pits and the like. Include accurate locations of in-ground, under-suspended-floor and in-ceiling systems.

Review of construction/shop drawings by the design consultant relates to the general principle of design only. Review of drawings will not in any way relieve the black water plant contractor from responsibility for the completion of the works in accordance with the requirements specified herein or any other contract documents.

Where drawings are returned for amendment, they shall be amended and resubmitted until such time as the drawings are marked as satisfactory.

The drawings produced by the contractor for this project shall include:

- Process flow diagrams
- Full detailed layout of all systems (1:100)(1:50);
- Plantroom layouts and sections (1:20);
- Schematics of each system (NTS);
- Relevant control schematics;
- Double line representation for all pipework 65mm diameter and over on 1:50 scaled layouts;
- Relevant panel layout drawings;
- Manufacturers drawings for all items of plant;
- Labelling in sequence of all valves, pumps and pits and the like on plan layouts and schematics.

The Contractor shall submit the following documents no later than 2 weeks after commissioning has been completed in the building.

A complete set of as built drawings for all, hydraulic systems and a comprehensive Operations and Maintenance (O&M) manual.

- Submit one copy of the draft O&M manual 4 weeks before date for practical completion. Include provisional record drawings, preliminary performance data and temporary insertions for items that are not yet finalised;
- Submit three sets of final volumes within 2 weeks of practical completion. Incorporate all feedback, corrections and notes as applicable.

12 Commissioning

The Contractor shall submit the following documents prior to practical completion:

- A report which confirms that commissioning of each system or feature is in compliance with the contract documents. The report must also include a written list of outstanding commissioning issues, records of all functional/commissioning testing undertaken and list any seasonal testing required in the future. This summary report must demonstrate compliance with the CIBSE Commissioning Codes and BSRIA document. The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period. The black water plant shall be commissioned in accordance with all statutory authority requirements.

The report shall include the following as a minimum:

- Sterilisation record sheets.
- Pressure testing record sheets
- Show the correct operation of all system components.

12.1.1 Commissioning

The Sub Contractor shall provide the Contractor with the following requirements:

Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required and evidence must be provided to demonstrate that the appropriate Contractor, sub-Contractor and trades on site performed in accordance with the ASHRAE Guideline 1 or the CIBSE Commissioning Codes.

Provide a commissioning sheet for item of plant or other equipment to include the following items and any additional items required by the Installers ITP. Carry out all pre-testing and testing inspections and tests as specified elsewhere.

Commissioning shall include, but not be limited to the testing, balancing, sterilisation, tagging, certifying and bringing into full working operation the hydraulic systems on this project.

The systems are to be pre-cleaned, tested and commissioned in accordance with the following:

- CIBSE- Commissioning Code M;
- CIBSE- Commissioning code W;
- BSRIA- Guide AG1/2001.1.

The following commissioning procedures shall include, but not be limited to the following:

- For each item of equipment such as pumps, carry out full commissioning tests in accordance with the manufacturer's specification. Otherwise carry out tests to establish that the equipment controls operate correctly, that all remote indications operate correctly and that the equipment is capable of performing

in accordance with the specification. Incorporate into the record any factory test results as applicable;

- Correct rotation of all motors;
- Correct operation of all controls, indicators and instrumentation;
- Verification of existence of all required safety notices and signage;
- Painting and labelling of all services and equipment;
- Cleaning of all appliances and equipment of dust, soot, cement/concrete droppings and alike;
- Provision of isolation and balancing valve tagging which shall identify valves numerically, service type and area/s served which correspond to As Built Drawings;
- Correct operation of interfaced shut off and warning systems with other services;
- Noise transmissions from services and equipment complies with specification requirements;
- Electrical isolation or continuity testing as applicable;
- Pressure testing of the service;
- Full chlorination and subsequent flushing of all water services pipework regardless of size prior to putting into service, chlorination is to be undertaken by a specialist commissioning and pipe cleansing company;
- Prior to commissioning starting the contractor is to provide a fully detailed proposal for review of the works he is to undertake and the methods to be employed.
- The blackwater subcontractor will enter a maintenance agreement that includes a commitment to a 12-month commissioning tuning period after handover, including minimum quarterly reviews and a final recommissioning after 12 months of operation.

12.1.2 Maintenance

The maintenance period is the defects liability period under the contract, starting from the date of Practical Completion for the Works.

During the maintenance period the contractor is to carry out periodic inspections and maintenance work as required by statutory regulations and recommended by manufacturers of supplied equipment, and promptly rectifies faults.

The contractor shall attend emergency calls within 2 hours.

The contractor shall submit details of maintenance procedures and program, relating to installed plant and equipment 6 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

The contractor shall report to the designated representative of the Principal on arriving and before leaving the site. Comply with all security procedures established on the site of the works.

Maintenance shall be carried out at times and in a manner that shall have the least impact on the tenants.

Submit in binders which match for all services the Operating and Maintenance Manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures. Such information shall include materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed logbook pages recording the operational and maintenance activities performed up to the time of practical completion.

Include test and approval certificates.

At each service visit record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. Obtain the signature of the designated representative.

Reports unsigned won't be recognised and the Principal can either have additional services carried out to the required number or deduct the cost of disputed visits.

If referenced documents require that logbooks or records be submitted, include this material in the Maintenance records.

During the defects liability period, the Contractor shall complete all maintenance items requested of them.

At least 4 weeks before the date for practical completion submit a schedule of spare parts necessary for maintenance of the installation.

12.1.3 Training

It is the sub Contractor's responsibility to ensure that building managers or staff receive sufficient training to have all the information and understanding needed to operate and maintain the commissioned features and systems. The training issues are to include:

- Design Intent – including energy and environmental features
- Review of controls set-up, programming alarms and troubleshooting
- O&M manuals
- Building operation – including start up, normal operation, unoccupied operation, seasonal changeover and shutdown
- Interactions with other systems
- Optimizing energy efficiency
- OH&S issues
- Maintenance requirements and sourcing replacements
- Occupant satisfaction feedback.
- Training certificate or letter stating that building manager and/or staff received training including all the issues mentioned above as a minimum. The letter should include the name of all staff that received training.

13 Plant Monitoring, testing and reporting

Continuous automatic monitoring shall be provided for pH, turbidity and chlorine residual (disinfection efficiency) at the outlet of the plant, prior to entry to the recycled water distribution system. A central alarm shall be provided that can be triggered to pH, turbidity and chlorine residual being outside the corresponding acceptable ranges, or by a mechanical failure or overflow.

It is imperative that appropriate measures are in place to manage the environmental and health risks of the recycled water scheme are managed.

The validation and verification monitoring shall be in compliance with the NSW Guidelines for the management of private recycled water schemes for a 'High Risk exposure Level' as summarised below:

Parameter	Effluent Compliance Value	Inflow Monitoring Frequency	Effluent Monitoring Frequency
E.Coli	< 1 cfu/100 ml	Weekly	2 times/week
Biological Oxygen Demand (BOD)	< 10 mg/l	Not required	2 times/week
Suspended Solids	< 10mg/l	Not required	2 times/week
pH	6.5 – 8.0	Continuous on-line	Continuous on-line
Turbidity	< 2 NTU	Continuous on-line	Continuous on-line
Disinfection	0.2 – 2.0 mg/l Cl	NA	Continuous on-line
Coliphages	< 1 pfu/100 ml	Fortnightly	Weekly
Clostridia	< 1 cfu/100 ml	Fortnightly	Weekly

Sampling frequency for on-going monitoring shall be in compliance with the NSW Guidelines for the management of private recycled water schemes for a 'High Risk exposure Level'.

The black water plant will also instrumentation to monitor and record the recycled water quality and operation in addition to those required under the NSW guidelines and as described in Controls section of this specification.

These include Status/condition of black water plant components such as:

- Level sensors
- Pumps
- Flow
- Blowers
- Aeration cycle
- Secondary disinfection status

14 Documents to be provided

The Tender Return Documents and Form at the back of this document shall be completed and returned with the Tender.

The Sub Contractor shall identify as shown, the various elements within the Tender. Elements should not be grouped together.

Incomplete or missing tender return forms shall not be accepted and, may render the submission as a non-compliant tender.

The Principal does not bind himself / herself to accept the lowest or any tender and is not responsible for any cost incurred in the preparation of any tender.

The tenderer is to additionally supply the following information:

- Energy consumption of all items of plant
- Expected discharge volumes from MBR plant
- Expected efficiency of secondary water treatment including RO (or similar) plant
- Limits of plant operation for every relevant incoming effluent parameter.
- Design sludge retention time in black water plant
- Warranties and Guarantees
- Demonstrate Buildability and plant replacement strategy within the tight confines of the plant room.

Item	**Price**
Preliminaries and General Conditions	$
Production of Workshop Drawings/Installation drawings	$
Approvals including fees	$
Site delivery and installation	$
Inlet screen	$
Black water precast buffer tanks	$
Black water transfer pumps	$
Hydraulic pipework and valves etc	$
MBR Plant	$
Aeration Plant	$
Process transfer pumps	$
Secondary treatment (excluding RO)	$
Reverse Osmosis plant (or similar)	$
Pressure testing	$
Sterilisation	$
Controls	$
Signage	$
Testing and Commissioning	$

Item	Price
O & M Manuals (including Work as executed drawings)	$
Training	$
Total:	$

Appendix A

Water Process Schematic

A1

Notes

1. This drawing is to be read in conjunction with all relevant structural, mechanical, electrical, fire and architectural drawings.
2. For details of materials and markmanship refer to the hydraulic services specification.

14/04/2011 2:46:07 PM

Civil Contractors Scope

Black Water Contractors Scope

Issue	Date	By	Chkd	Appd
02	14/04/11	CL	MD	CD
	Revised AFC Issue			
01	06/04/11	CL	MD	CD
	AFC Issue			

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Client

Mirvac

Job Title

No. 8 Chifley Square
Sydney

Drawing Title

Sanitary Drainage Schematic

Scale at A1 N.T.S.

Discipline **Hydraulics**

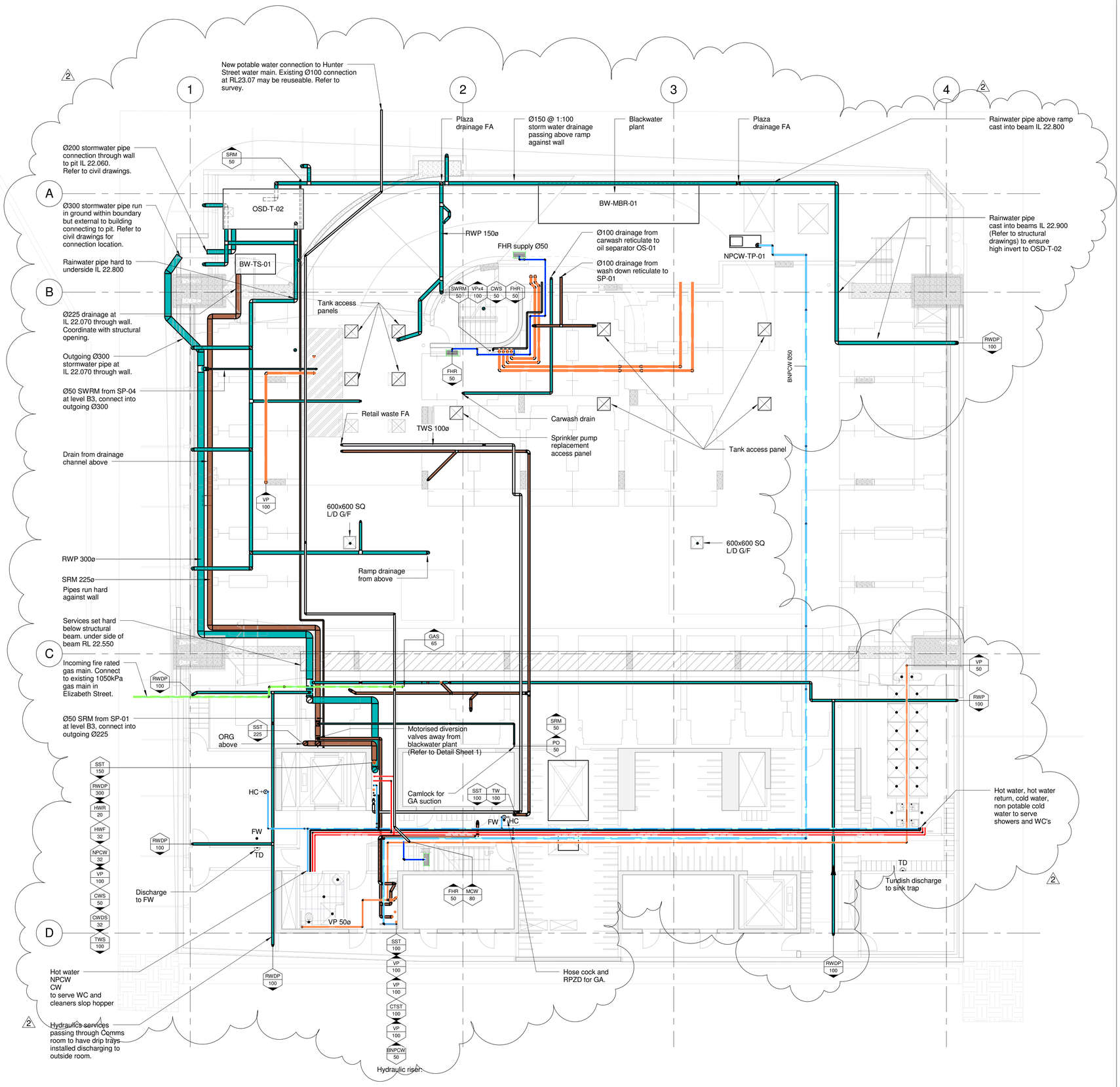
Drawing Status **Revised AFC Issue**

Job No	Drawing No	Issue
220622	H5001	02

Do not scale

Appendix B

Basement 2 Layout



Notes

1. This drawing is to be read in conjunction with all relevant structural, mechanical, electrical, fire and architectural drawings.
2. For details of materials and markmanship refer to the hydraulic services specification.

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Issue	Date	By	Chkd	Appd
02	14/04/11	CL	MD	CD
	Revised AFC Issue			
01	06/04/11	CL	MD	CD
	AFC Issue			

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Job Title
No. 8 Chifley Square
Sydney

Drawing Title
Basement 2

Scale at A1
1 : 100

Discipline
Hydraulics

Drawing Status
Revised AFC Issue

Job No	Drawing No	Issue
220622	H5198	02

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APPENDIX 3.7.1 PART II

8 CHIFLEY SQUARE - BUILDING MANAGEMENT CONTROL SYSTEM

Mirvac Projects Pty Limited

8 Chifley Square

Tender Issue - Building Management & Controls System (BMCS) Specification

Rev D | February 2011

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Job number 220622

ARUP

Document Verification

ARUP

Job title		8 Chifley Square			**Job number** 220622
Document title		Building Management & Controls System (BMCS) Specification			**File reference**
Document ref		Building Management & Controls System (BMCS) Specification			
Revision	**Date**	**Filename**	BMCS Specification Preliminary Tender.docx		
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			Prepared by	Checked by	Approved by
		Name	David Stidolph	Cameron Dymond	Andrew Johnson
		Signature			
Rev B	15/12/10	**Filename**	BMCS Specification Preliminary Tender.docx		
		Description	Preliminary Tender Issue		
			Prepared by	Checked by	Approved by
		Name	David Stidolph	Cameron Dymond	Andrew Johnson
		Signature			
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		Name	David Stidolph	Cameron Dymond	Andrew Johnson
		Signature			
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		Name	David Stidolph	Cameron Dymond	Andrew Johnson
		Signature			
			Issue Document Verification with Document		✓

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Mirvac

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Appendices

Appendix A

Glossary of Terms Used

1 Preliminaries

This specification is to be read in conjunction with Mirvac's trade specific scope of works document and Mirvac's Building Information Modelling Brief.

The construction programme will be determined by Mirvac (not between parties)

1.1 Definitions and Interpretations

Within this specification and the related drawings the following words shall have the meanings described:

Principal	Mirvac Constructions Pty Ltd
The subcontractor	The entity specifically responsible for the works described in this package
Approve, To approval	Approval by the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works. This may be the Project Manager or Site Manager.
Building Trades	The entity specifically responsible for the construction of the building structure and fabric. Excludes the services trades such as electrical, air conditioning and plumbing.
Give notice, submit, supply, furnish, and similar expressions	Give notice, submit, supply, furnish and the like to the entity specifically responsible as the Principal's representative for the purposes of the contract governing the works.

2 Introduction

2.1 General

2.1.1 Project

This specification covers the BMCS works associated with 8 Chifley Square, Sydney. The project involves the design and construction of a new multi-storey tower PCA Premium Grade, which comprises 3 basement levels, 21 levels of office accommodation and multi level plant floors. Office accommodation will be configured as 1, 2 and 3 storey villages providing a total Net Lettable Area (NLA) of circa 19000m2. The existing building is to be demolished to allow the construction of the new site.

Systems within the building shall be installed to best practise standards to minimise energy consumption, reduce carbon dioxide emissions and to allow the building to achieve the targeted NABERS Energy and Green Star objectives. The services design has been developed to provide flexible and adaptable systems which will serve the requirements of the building and can be reconfigured to suit future re-planning of office areas.

The commercial office spaces are split into a combination of double (2) or triple (3) level interconnected villages and single contiguous floor plates. Villages are connected by stairs through an internal atrium and the design allows for villages to be subdivided in the future into single floors or into three (3) sub tenancies per single contiguous floor.

The BMCS Specification is to be read in association with the Mechanical Services Specification and drawings. All Preliminaries detailed within the Mechanical Services Specification also apply to the BMCS Specification.

2.1.2 Converged Network (CN) Tender Option

The BMCS subcontractor is invited to provide a tender option for a CN solution. The CN concept is to provide an integrated, open, expandable and flexible solution for the building's control and monitoring systems, whereby the nominated systems/equipment communicate over a common network and are fully interoperable. In general, it shall be the responsibility of the BMCS Contractor to carry out the detailed design of the system and coordinate all interfaces with others to deliver a complete and operational solution.

The CN concept is that the BMCS has full read and write access to all associated systems, providing the facility to display any point on a graphic or share points between systems to enhance operational performance. However, configuration and interrogation of each third party system shall remain available from the system specific software supplied by the associated vendor.

The purpose of the CN component of this BMCS Tender Specification is to establish a GMP and ascertain the technical solutions and capabilities of the BMCS subcontractor. Any additional technical requirements or scope specific to the CN option are detailed throughout this specification.

Following the return of tenders from all trades being considered for inclusion in the CN concept, it is the intention that the preferred BMCS subcontractor(s) assist Arup and Mirvac in the design development of the CN solution, resulting in the production of a 'Functionality and Interface Requirements Document'(FIRD). The FIRD will be used for Tender negotiations following which a BMCS Contractor will be appointed.

The following systems/equipment have been nominated for consideration as part of the CN solution and as such, CN requirements clauses have been included in the appropriate Tender Specifications for option pricing:

Electrical Services:-

- Private utility metering;
- Lighting control and monitoring systems;
- Emergency lighting monitoring and testing;
- Load Shedding monitoring and control;
- Standby Power System monitoring and control;
- UPS monitoring;
- MATV head-end monitoring;
- Lightning and surge protection system monitoring.

Mechanical Services:-

- Private utility metering;
- DDC monitoring and controls;
- Tri-generation monitoring and control;
- Wind and outside temperature sensing.

Hydraulic Systems:-

- Water and gas monitoring;
- Hydraulic control panel, tank and pump status monitoring and control;
- Blackwater treatment.

Fire Systems:-

- Fire panel, tank and pump status information.

Security Services:-

- Intruder Detection Status Monitoring;
- Access Control System Monitoring;
- CCTV information display.

Vertical Transportation

- Vertical transportation management;
- Lift-car/lobby information displays.

ESD

- Greenstar/NABERS logging and trending.

Architectural Systems:-

- Blinds, Shading and other façade details.

Refer to the Converged Network Schematic for indicative network architecture, interface numbers and locations.

2.1.3 Related Documents

The BMCS Specification shall be read in conjunction with all other relevant project documentation, including:

- Mechanical Services Specification and Drawings;
- Electrical Services Specification and Drawings;
- Security Services Specification and Drawings
- Hydraulic Services Specification and drawings;
- Black Water Specification
- Fire Services Specification and drawings;
- Vertical Transportation Specification
- Architectural Specification and drawings

The BMCS specification shall also be read in conjunction with all other relevant Contract Documents.

2.2 Interpretation of the BMCS Specification

This specification has been written using simple, direct language wherever possible. Imperative terms such as 'provide' and 'submit' mean that the Subcontractor shall 'provide' or 'submit' the relevant samples, documentation or information.

2.2.1 ESD Requirements

The objectives of this document are written so that the Base Building achieves the following:

- Green Star – Office Design and As Built v2 minimum Overall Weighted Score of 75 points aiming at a minimum Green Star Office Design and Green Star Office As built rating of 6 Stars.
- A target to achieve a NABERS Energy Base Building rating of 5 Star + 60% NABERS rating in design.
- The Subcontractors shall be aware of environmental benchmarks and be involved in the project construction to deliver the environmental targets set by the design team and the Principal. The Principal Contractor and

Subcontractors shall comply with all requirements included here and the ESD Specification.

In the event of any contradiction with any of the other specifications, or if there isn't a clear disembarkation of the Subcontractors responsibilities, it is the responsibility of the Subcontractor to seek further clarification of their scope.

2.3 Green Star Rating Standard

A certified assessment of the environmental standard of this project will been made, utilising the Green Star – Office Design V2. A minimum of 6 Star Green Star will be achieved for base building, and the completed design will achieve the same overall weighted score. The Principal Contractor, Subcontractors and other Consultants will supply all required data for this purpose in answer to the Green Star criteria summary. Reference shall be made to "Green Star – Office Design v2" Technical Manual 2004. The Principal Contractor shall make all Subcontractors aware of the design requirements and ensure that the measures implemented in the design stage get implemented throughout the construction of this project. The Principal Contractor's Representative and Subcontractors are responsible to supply the documentation necessary for the Principal to apply for a Green Star Office As built rating of 6 Stars.

2.4 National Australian Built Environment Rating System (NABERS) Standard

The construction work shall be completed to assure that the building systems operate and is commissioned in accordance with the design and has the potential to achieve a National Australian Built Environment Rating System (NABERS) Base Building rating of 5 Star + 60% improvement.

2.4.1 NABERS Responsibilities

- All Subcontractors are to ensure that the final selection of equipment and installation is conducted in a manner which enhances energy efficiency and the ability to achieve this target in operation. All relevant requested part load and operational performance data will be provided to Principal Contractor's Representative for approval prior to final selection. Proposed selections cannot have an adverse effect on the NABERS rating.
- All Subcontractors are responsible for raising with the Principal Contractor as early as possible any observed inefficiencies in equipment selection or final detailed design of systems which may adversely affect the ability of the installation to achieve Five (5) Star + 60% NABERS. It is the Principal Contractors responsibility to report these to the Principal and ESD consultant.
- The Principal Contractor's Representative is responsible for liaising with the ESD Consultant by submitting all information relating to final selected equipment in a prompt manner;
- BMCS Subcontractors in conjunction with the Mechanical, Electrical, Hydraulic, Blackwater, Fire and Trigeneration Subcontractors shall demonstrate that the onsite installed and commissioned BMCS/Controls system functions and operates in full accordance with the Design Specification. The commissioning of systems shall give due regard to the

proposed Trigeneration and Blackwater systems and address this in reported BMCS/Controls functionality. Once commissioned and with the entire plant running in automatic control, an Independent Commissioning Agent, employed by the Principal, shall submit to the ESD Consultant all commissioned setpoint values, trend log data and graphs for every sensor on the project, the metering data of common area lighting, carpark lighting, exterior lighting, cooling energy consumption, Trigeneration electrical output, Trigeneration thermal output, heat rejection energy consumption, lift energy consumption and supplementary cooling energy consumption and building operational profile all taken from a period of seven (7) consecutive days. This is to occur at least one month before handover to ensure that the building operates in the configuration described in the energy modelling report. To this end all services Subcontractors shall ensure that all systems are installed and commissioned with sufficient time to ensure this operational profile can be gathered by the nominated date.

- The Principal Contractor shall conduct any pre-commissioning tests prior to commencing commissioning including confirming that static tests are complete, inspecting the whole installation, completing pre-start-up checklists and rectifying outstanding items in accordance with the commissioning section within this document;
- The Principal Contractor shall co-operate and be involved with the commissioning process and the independent commissioning agent for a 12-month period. This requires, at a minimum, quarterly reviews and a final re-commissioning by the Principal Contractor after 12 months of operation, in addition to fulfilling the requirements of Green Star for commissioning and building tuning.
- The Principal Contractor is responsible for involvement in the study of operational performance of all systems controlled and monitored by the BMCS and to converse with the facilities manager and ESD Consultant to identify any areas of inefficiency.

3 Scope of Works

3.1 General

The scope of works includes all detailed design and coordination between all systems and subsystems. Engineer, supply, install, program, configure, test and commission all system hardware, software, field devices, hardware and virtual points, field panels, cabling, power supplies and all other items required for a complete fully integrated direct digital control (DDC) Building Management and Control System (BMCS) to automatically control, monitor and provide alarm management for the nominated building services.

3.2 Package Works

The works contained in the BMCS include, but are not limited to:

- Building Management & Control System (BMCS)
- Terminal Unit Controllers (TUCs)
- BMCS Communications Network
- Energy and Water Monitoring System
- Touch Panel Displays
- Remote Web Access
- Interface to other systems
- Control Panels (CPs)
- Uninterruptable Power Supplies (UPS)
- Controls/Power Wiring Installation
- Equipment Selection and Installation
- Commissioning
- Green Star Requirements
- Labelling
- Consumables
- Demonstration
- Documentation
- Works in Association with other Subcontractors and Subcontractors
- Operator Training
- Warranty & Maintenance
- 12 Month Building Tuning Period

3.3 Description Of Work Items

3.3.1 Building Management & Control System (BMCS)

The supply, installation, commissioning and handover of all the microprocessor based hardware, servers, network devices, power supplies, uninterruptible power supplies, filters and suppressors.

The supply, installation unless detailed elsewhere, commissioning and handover of all sensing devices, control valves and actuators, damper actuators and interfaces to form a complete and fully operational system.

The supply, testing, installation, commissioning and handover of the operator's station(s), printer(s), graphics and controller software.

The following management level BMCS related hardware shall be supplied in the following locations:

Equipment	Location
Operator WorkStation No.1	TBA
Operator Work Station No.2	TBA
Servers	TBA

Converged Network Option

In addition to above:

- Install third party software provided by others on servers. All Servers are to interface with an SQL database which shall store all logging and status information within an XML format with the exception of Digital Video Recorders for CCTV Systems. This data shall be made capable of interface to all servers, with encryption and permission control;
- Provide a single graphic user interface (GUI) that links together all third party systems in an intuitive and logical manner including schematics, layouts, alarms, time scheduling and reporting. For advanced data manipulation, the GUI shall link into the systems software package with the appropriate user permissions;

3.3.2 Terminal Unit Controllers (TUCs)

The supply, installation, commissioning and handover of TUCs, associated network gateways and power supplies including transformers, primary and secondary fuses.

The supply, testing, installation, commissioning and handover of the TUC software and associated operator's station graphics.

The connection of TUCs to local area networks which in turn shall be connected to the BMCS network, via gateways, to enable full interrogation and adjustment of TUC parameters/setpoints from the operator's station.

3.3.3 BMCS Communications Network

The design, supply, install and commissioning of a 1Gb TIA standard communications Ethernet network to the location of all DDC controllers and head end operator stations.

Provide all racks, cabinets and containment.

The network shall have a fibre backbone spanning the height of the building to provide a connection to each floor.

Hirschmann industrial "Compact Rail" MS30 Gbe switches (or approved equivalent) complete with dual fibre uplinks shall be installed with associated patch panels, patch leads located within an enclosure with cable management where required within areas without suitable environmental conditioning spaces (eg risers).

All network devices shall be powered from base building UPS supplies.

An outlet shall be provided for each DDC controller. A spare outlet shall be provided at each DDC controller location. All outlets shall be CAT 6A Class EA RJ45 type.

The network shall provide a centralised/peer-to-peer IP control network to the location of all DDC controllers; including all network components and power supplies. The network shall be designed to meet all performance requirements detailed in this Specification.

TUC controllers shall be connected via an MSTP network which shall be connected to the Ethernet network. MSTP networks shall not span across multiple office floors.

Converged Network Option

In addition to the above:

The design, supply, install and commissioning of a 10Gb TIA standard communications Ethernet network backbone to the location of all building systems and head end operator stations.

The network shall have diverse fibre backbones spanning the height of the building to provide a primary and secondary connection to each floor for redundancy.

An outlet shall be provided at the location of each physical interface to the converged network. Refer to Converged Network schematic for indicative interfaces and locations.

The technical requirements for the converged network are detailed in section 7 of this specification.

3.3.4 Energy and Water Monitoring System

Design, supply, install and commission a fully automated energy and water monitoring system that provides an effective mechanism for monitoring energy and water consumption data.

Provide all necessary pulse counters, interfaces, power supplies, cabling, network devices, servers, visual displays and software to collect data from all electrical, gas and water meters and store in a central location.

The software package provided shall be specifically developed for this purpose i.e. separate to the standard BMS supervisory software.

Coordinate with the Mechanical subcontractor to ensure that the meters selected have the correct interface requirements.

Coordinate with the Hydraulic subcontractor to ensure that the meters selected have the correct interface requirements.

Coordinate with the Electrical subcontractor to ensure that the meters selected have the correct interface requirements.

3.3.5 Touch Panel Displays

The supply, installation, commissioning and handover of an all in one Touch Screen Panel PC in the following locations:

Equipment	Location
BMCS touch panel screen	Located in roof plantroom

3.3.6 Remote Web Access

The Subcontractor shall supply, install and commission all necessary hardware and software required for the BMCS to be accessible remotely for up to five (5) concurrent users via a standard web browser on the LAN, WAN and internet.

The Subcontractor shall arrange for the supply and installation of an ADSL 2+ high speed connection with a static IP address and all necessary network components to enable remote access via the internet.

3.3.7 Interface to Other Systems

The BMCS Subcontractor shall:

Supply, install and commission the required high and low level interfaces to all third party systems/equipment, including electrical, fire, lifts, blind control, hydraulic services, blackwater and tri-generation, as detailed within this specification.

Liaise as necessary with other Subcontractors and suppliers to ensure compatibility of all high and low level interfaces.

Converged Network Option

In addition to the above:

Create an interface requirements document detailing details of every interface to the converged network. Coordinate and assign network addresses for all third party systems connecting to the converged network e.g. IP address range, BACnet device address range.

3.3.8 Control Panels (CPs)

The BMCS/Controls Subcontractor shall:

- Provide control panels to house all BMCS controllers and associated controls equipment e.g relays, transformers etc;
- Design, select, manufacture, works test, supply and deliver to site, unload, store as necessary, take from store, hoist to required position, install and site test field control panels;
- Provide all necessary protection to the CPs so as to prevent damage during delivery, storage, positioning and throughout the execution of the works up until completion of the contract. All forms of protection provided, once the FCPs are on site, shall be in accordance with the contract requirements, shall be of a flame retardant material certified to LPS 1207 and shall allow safe working access to the CPs;

The following drawings shall be provided for each CP:

- Schematic and external wiring diagrams;
- General arrangement drawings detailing internal and external equipment layouts.

In addition to those required to house controls equipment in plantroom locations, field control panels shall be provided on each floor, located within the accessible electrical riser, for connection to the BMCS to house all controls equipment associated with on floor controls.

Power for CPs shall be from MCCs by the Mechanical Subcontractor.

3.3.9 Uninterruptable Power Supplies (UPS)

The supply and installation of UPS for the following equipment:

Equipment	Location
All DDC controllers and network devices.	Various
Operator WorkStation No.1	TBC
Operator Work Station No.2	TBC
Servers	TBC

3.3.10 Controls/Power Wiring Installation

The BMCS subcontractor shall:

- Provide and install an electrical containment system for the controls wiring (consisting of tray, trunking and conduit and including all necessary fixings and support systems)
- Provide all power wiring for damper and valve actuators
- Provide and install flexible conduit for the final cable length run to all detecting devices, actuators etc. of such a length (up to 1000mm) as to permit removal of all devices without deformation or disconnection.

- Provide detailed drawings for all BMCS/control wiring routes, tray, trunking and conduit installation and cable details of their supply.
- Co-ordinate the controls wiring installation with all other specialist's work.
- Test all BMCS wiring as described under Wiring Installation in this Specification and AS/NZS 1660.3;
- Test all BMCS wiring as described in the Electrical Services Specification and AS/NZS 1660.3;
- Provide documentary evidence of all cable test results associated with BMCS wiring installation;
- Report the extent of any failures identified during testing which may affect the installation programme;
- Correct any wiring faults discovered during the testing and commissioning at no additional cost to the contract.

All power wiring and its containment is to be provided by the respective Subcontractor responsible for each component. The BMCS Subcontractor shall coordinate all control wiring requirements with all Subcontractors to ensure systems are installed complete and operational.

3.3.11 Equipment Selection and Installation

The BMCS Subcontractor shall:

- Fit and mount all detecting devices into pipe work pockets, ducts or on walls;
- Supply free issue to the Mechanical Subcontractor all valve bodies for installation.
- Supply valve actuators with the necessary cranks, linkages and mountings for the specified motorised valves;
- Supply damper actuators with the necessary cranks, linkages and mountings for the specified motorised dampers;
- Mount all valve actuators to valve bodies and connect the linkages;
- Mount damper actuators to damper assemblies, including the supply and mounting of all necessary universal joints, actuator cranks, linkages etc;
- Ensure that all control equipment is installed such that there is adequate clearance for removal of any such item without dismantling any other item of equipment, and that all wiring connections can be visually inspected without removing the items;
- Ensure that all control equipment installed in association with other Subcontractors and Subcontractors shall be so mounted that there is adequate clearance for removal of such equipment and also for normal testing, maintenance and inspection;
- Ensure that all control equipment supplied free issue to site is installed in accordance with the manufacturer's instructions;
- With respect to any specified differential pressure transmitter, electromagnetic, or ultrasonic flow measuring stations, provide manufacturer's application data including pressure drop versus flow rate through the complete

scale range, accuracy, turn down ratio and maximum permissible static pressure for approval by the Construction Manager;

- Install all averaging element temperature sensors and include for supplying and fitting all necessary clips, hangers and supports for serpentining the elements across the ducts. The elements shall be clipped every 200mm and the supports and hangers shall be adequate to prevent vibration of the element.

In engineering the BMCS system, all control valves/actuators and damper actuators shall be sized by the BMCS Subcontractor in accordance with the manufacturer's recommendations and system flow rates, coil pressure drops, system pressures and any other relevant data.

The BMCS Subcontractor shall complete a control valve schedule detailing:-

Valve flow rates, valve pressure drops, valve flow coefficients (Kv), coil pressure drops, valve authorities, maximum valve pressures, maximum valve pressure drops, actuator types and plantroom system pressures. This shall be submitted for comment prior to ordering any equipment.

Where high level interfaces are required interface data sheets shall be produced for each item of equipment for the equipment manufacturer to complete. This data sheet shall include all information required for the successful interface with the third party equipment such as location, network number, interface number, data communications protocol, network connection type, speed. Any interfaces that have not been completed successfully on previous projects shall be demonstrated at the third party equipment manufacturer’s factory prior to installation on site.

3.3.12 Commissioning

The BMCS shall be commissioned in accordance with the Independent Commissioning Agents requirements, CIBSE Code C:2001 and this specification. Where there is a discrepancy between these documents the Independent Commissioning Agent requirements shall take precedence.

The BMCS Subcontractor shall:

- Fully commission the installed BMCS system once the software and operator's station graphics have been installed on site;
- Arrange for all flow measurement devices to be commissioned/calibrated by the equipment manufacturer and provide documentary evidence of such testing;
- Provide any temporary air conditioning units required for the BMCS servers and network equipment to be fully operational during commissioning without any reliance on the buildings CHW or condenser water systems.

The commissioning process is defined as the activity where the complete BMCS system is moved from a condition of static completion to a state of dynamic operation to provide functional and environmental control of the process within the design parameters. The commissioning process shall be undertaken systematically through the following principle stages to meet the requirements of the contract programme:

- Pre-commissioning and setting to work;

- Point to point testing;
- System functional operation;
- Setting and adjustment of system variables or control loop values.

The installation shall be thoroughly tested in the course of commissioning by the BMCS Subcontractor to ensure every point, control device and item of plant is being controlled and/or monitored correctly.

It is a requirement that the system is tested and commissioned by personnel who have gained an intimate understanding of the project throughout its design stages. These personnel must also have had at least three years experience in the DDC controls field and have full product training. Should any commissioning personnel not meet these requirements the BMCS Subcontractor must apply to the Construction Manager for approval prior to allowing the said commissioning person(s) on site. The Construction Manager reserves the right to refuse such commissioning personnel from working on site.

All testing and commissioning shall be preplanned and scheduled in order that it is fully co-ordinated with other relevant trades and shall be carried out in a safe and efficient manner with a minimum of inconvenience to all concerned.

A method statement and programme shall be prepared and agreed with the Construction Manager and submitted for comment prior to commencing commissioning.

The installation shall be tested progressively as construction progresses and then finally on completion to ensure that the installation complies with the requirements and operates correctly under normal, emergency power, fire, fireman's override and fault conditions. Control, protection and operative devices shall be checked for correct adjustment and rating. Throughout the commissioning period detailed records of all testing undertaken shall be kept and maintained on site and periodically submitted to the Construction Manager for their information. The detailed records shall include calibration certificates of any instrumentation used during the commissioning process.

All equipment or materials found to be faulty during testing shall either be replaced or repaired free of charge.

Pre-commissioning and setting to work shall include:

- Ensuring that field devices have been correctly located for the application;
- Ensuring that control devices are correctly installed in accordance with the manufacturer's instructions and are so mounted that there is adequate clearance for their removal and for normal testing, maintenance and inspection;
- Verification that the control device has the correct range for the application, that the range is correctly entered in the controller and is correctly engineered on the operator's station;
- Attendance during the initial start up of prime movers and the checking of direction of rotation, hard wired safety interlocks and the suitability and settings of protective devices;
- The functionality and operation of all hard wired safety interlocks.

Point to point testing shall include:

- Correct operation of a controls device/interface, including any associated status and alarm text;
- Correct installation of each valve/damper actuator, and that each valve/damper actuator is stroked correctly when checked against the BMCS output;
- Calibration check of the control device;
- Labels provided on the control devices and mechanical equipment are correct.

Point to point checks shall be proven from the field device/interface operation to the controller and from the controller to the presentation of the point on the graphics in a single continuous operation. The results from the point to point tests shall be submitted on pre-defined schedules.

System functional operation shall include:

- Functional testing of the software in relation to detailed controls sequences on a clause by clause basis to check system normal, emergency power, fire, fireman's override and fault conditions as applicable;
- The functional testing of hard wired interlocks by simulation of their respective fault conditions and the subsequent operation of the system in accordance with the system narrative;
- Functional testing of the synchronisation between hard wired interlocks and system software to suppress alarm conditions.
- End to end testing of all high level interfaces with third party systems and equipment e.g. from an occupancy sensor end device to the BMCS graphic.

Setting and adjustment of system variables and control loop values shall include:

- Setting the correct operational value for delay on/off timers to provide the correct cascade control or dissipation functions;
- Setting the correct operational value for delay timers associated with alarm inhibit functions;
- Checking the correct temperature value for out of limit alarms that provide either a high, low or differential alarm function;
- Setting the correct proportional, integral, or derivative values in control loops to maintain stable control at the required design conditions.

The graphics shall be verified as part of the commissioning process to ensure that they give a true representation of the installed plant layout, e.g. if heating and cooling coils are swapped or a damper has been omitted. Sensors should be located in the correct positions with relation to other plant e.g. is the sensor before or after the pump?

Converged Network Option

In addition to the above:

Coordinate with all subcontractors that have systems or equipment interfacing to the converged network to determine their reliance on the converged network for commissioning. Create a commissioning program including all relevant

subcontractors and their connection, commissioning and interface demonstration times.

3.3.13 Green Star Requirements

The following section describes specific responsibilities and measures related to the mechanical services that shall be adopted in order to achieve a 6 star Green Star – Office As-Built rating. The requirements nominated are to be read in conjunction with this specification. Importantly, the Subcontractor shall note that the Green Star Design Documentation will be available to the Subcontractor. Any changes to the scheme will require the an update of documentation, at the Subcontractor's expense.

3.3.14 Commissioning Clauses (Man-2)

The Principal Contractor shall comply with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required for all services and evidence must be provided to demonstrate that the appropriate Principal Contractor, Subcontractor and trades on site performed in accordance with the CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes).
- The Principal Contractor shall transfer information and documentation to building owner/manager regarding design intent, as installed details, commissioning report and training of building management staff.

The Principal Contractor shall submit the following documents before commencement on site:

- A commissioning plan (as prepared by the Independent Commissioning Agent) including a methodology statement of the commissioning process identifying commissioning dates, the tests to be carried out and proposed operational control strategy of each system component including Trigeneration, Ventilation, Heating Systems, Cooling Systems, Electrical Systems, Lighting, Domestic Hot Water and Blackwater. The commissioning plan needs to be signed off by Project Manager before commencement on site.

The Principal Contractor shall submit the following document prior to practical completion.

- Summary commissioning report (as prepared by the Independent Commissioning Agent) including commissioning dates, tests carried out and outcomes and changes made as a result of the commissioning process. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- A copy of the documentation and information transferred to building owner/manager.
- A copy of the transmittal of the commissioning report and to at information to the building owner showing the building owner/manager as the addressee or

acknowledgement from the owner/manager that that information has been received.

- A signed statement from the building owner committing to the incorporation of the commissioning requirements.

The documentation submitted by the Principal Contractor to the Project Manager should provide comprehensive information on the following:

- Design Intent
- As Installed Details
- Commissioning Report
- Training

The following is a list of minimum inclusions for this document

3.3.14.1 Design Intent

Energy & Environmental Strategy

Information on energy efficient features and strategies in relation to the building, including an overview of the potential savings – stated for economic and environmental impact –must be provided.

Monitoring and Targeting

Documentation shall include information on energy targets and benchmarks for the building type and a strategy that addresses metering & sub-metering provision and how to record and present meter readings.

Building Services

Documentation providing description of basic functions, operations and descriptions of energy saving features of the following systems are to be provided:

- Trigeneration
- Ventilation
- Heating System
- Cooling System
- Electrical Systems
- Lighting
- Domestic Hot Water (DHW)
- Blackwater

Each system shall include, as a minimum, the following information:

- A simplified diagram of the system
- An explanation of how it operates
- A list of what the main components are (including Controls) and the importance of their efficient use
- Details of maintenance, including recommended frequency

- A list of likely and tell tale signs of system failure, system “do’s” and “do not’s” and notes of inefficient operation.

The Principal Contractor shall provide the following documentation no later than practical completion of works:

- An extract of service specification or short report detailing basic functions and operations of building services as requirement as stated above.

The Principal Contractor shall have access to the Green Star Office Design submission to reference work that has already been completed for this credit.

3.3.14.2 As Installed Details

The Principal Contractor shall submit the following documents no later than 2 weeks after commissioning has been completed in the building.

- A complete set of As Built drawings for all, mechanical, electrical and hydraulic systems and a comprehensive Operations and Maintenance (O&M) manual. The manual and drawing set is to include information on the Trigeneration and Blackwater systems.

3.3.14.3 Commissioning Report

The Principal Contractor shall submit the following document prior to practical completion

- A report which confirms that commissioning of each system or feature is in compliance with the contract documents. The report must also include a written list of outstanding commissioning issues, records of all functional/commissioning testing undertaken and list any seasonal testing required in the future. This summary report must demonstrate compliance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes). The commissioning report shall detail the commissioning guidelines used, the processes and the outcomes of the commissioning period.
- The report shall include the following as a minimum:
    - Demonstrate correct operation of the mechanical ventilation system.
    - Show the Trigeneration system operates correctly and in accordance with the energy modelling report.
    - Indicate the results of noise level testing outlining the conditions under which the tests were carried out.
    - Demonstrate that the building operates in the configuration described in the energy modelling report.
    - Show the water reuse system operates correctly.
    - Indicate water meter functions correctly.

3.3.14.4 Training

It is the Principal Contractor's responsibility to ensure that building managers or staff receives sufficient training to have all the information and understanding needed to operate and maintain the commissioned features and systems. The training issues are to include:

- Design Intent – including energy and environmental features
- Review of controls set-up, programming alarms and troubleshooting
- O&M manuals
- Building operation – including start up, normal operation, unoccupied operation, seasonal changeover and shutdown
- Interactions with other systems
- Optimising energy efficiency
- OH&S issues
- Maintenance requirements and sourcing replacements
- Occupant satisfaction feedback.

Training certificate or letter stating that building manager and/or staff received training including all the issues mentioned above as a minimum. The letter should include the name of all staff that received training.

3.3.14.5 Commissioning Clauses

Mechanical and Trigeneration Subcontractors shall comply with the following requirements:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed for mechanical services by the appropriate Subcontractors and trades on site performed in accordance with the following commissioning codes:
- ASHRAE Guideline 1-1996 – The HVAC Commissioning Process
- Commissioning Code A: Air Distributions Systems 1996
- Commissioning Code B: Boilers 2002
- Commissioning Code C: Automatic Controls 2001
- Commissioning Code M: Commissioning Management 2003
- Commissioning Code R: Refrigerating Systems 2002
- Commissioning Code W: Water Distribution Systems 2003
- BSRIA - AG 2/89.3 Commissioning Water Systems
- BSRIA - AG 1/2001.1 Pre-commissioning Cleaning of Pipe Work Systems
- BSRIA – AG 1/91 Commissioning of VAV Systems in Buildings
- BSRIA - AG 3/89.3 Commissioning of Air Systems
- Water Conservation, Best Practice Guidelines for Cooling Towers in Commercial Buildings (Sydney Water)

- Indoor Air Quality Commissioning Plan as Developed for this Project

Subcontractors shall refer to the Mechanical Specification for further requirements for Commissioning.

Note that the commissioning requirements listed above are required in fulfilment of the Green Star requirements only. Additional commissioning requirements, not listed here may apply.

3.3.15 Commissioning – Building Tuning (Man-3)

All Subcontractors shall comply with the following requirements:

- Enter a maintenance agreement that includes a commitment to a 12-month commissioning tuning period after handover, including minimum quarterly reviews and a final recommissioning after 12 months of operation.

This will be achieved through on-site quarterly meetings involving all parties described below.

- Principal's Representative
- Principal Contractor's Representative
- Independent Commissioning Agent
- Architect and/or Consultant
- Mechanical and Controls Subcontractors
- Equipment Supplier

During the tuning period, the commissioning process will include:

- Review of BMCS-generated trends.
- Monitoring the efficiency of the BMCS, Trigeneration, mechanical, electrical, lighting, domestic hot water, and IT systems during all seasonal variations for the occupied building.
- Tuning the BMCS, Trigeneration, mechanical, electrical, lighting, domestic hot water and IT systems to optimise control and time schedules to suit occupants' needs.
- On-going training of existing personnel and training of new personnel.
- Monitor complaints received from occupants/tenants and determine whether the problem lies in the discrepancy between the predicted performance measured against actual performance or whether the complaint indicates a need to re-evaluate the design intent.
- Documentation of the following:
    1. Maintenance records.
    2. Log of complaints, problems and corrective actions. Copies to be sent to the Mechanical Subcontractor and system designer, as well as the Mechanical and ESD Consultants.
    3. Log of system performance at different load periods.
    4. Modifications made based on tenant needs.

The Subcontractor shall agree to a scope of that will involve as a minimum the following roles and responsibilities during the building tuning period and as agreed between parties:

(Principal's Representative)

- Assign maintenance personnel and schedule participation in the building tuning commissioning events.
- Provide access to the building and any utilities required for the events.

(Independent Commissioning Agent)

- Review BMCS generated trends, alarming and operator logs.
- Set quarterly energy targets based on monthly NABERS energy target profile set by the Independent Commissioning Agent and measure actual performance to ensure implementation of selected measures.
- Determine non-performance issues and direct rectification of the issues.
- Ongoing training of existing personnel and training of new personnel.
- Create a commissioning plan and direct the commissioning process that covers an air distribution system, boilers, automatic controls, lighting, refrigeration, domestic hot water, water distribution, system.
- Introduce standards and strategies early in the 12-month commissioning building tuning period.
- Coordinate with the Principal's Representative, Architect, Consultants, Principal Contractor, and relevant Subcontractors throughout the 12-month commissioning building tuning period.
- Observe all testing and review and approve contractor test results.
- Prepare a final commissioning report including recommendations to the Principal's Representative regarding the performance of commissioned building systems.

(Subcontractor)

- Include the cost for 12-month building tuning in the contract price.
- Ensure participation of major equipment manufacturers in building tuning commissioning events.
- Assist the Independent Commissioning Agent in verification and performance tests.
- Revise and re-submit the commissioning report to the ESD Consultant and Independent Commissioning Agent for review and acceptance.

(Principal Contractor)

- Ensure the 12-month building tuning requirements are included in the mechanical, electrical and control Subcontractor's contracts.
- Remedy deficiencies identified in verification and functional tests.

(Equipment Supplier)

- Include the cost for 12-month building tuning in the contract price.

- Demonstrate the performance of equipment as required.

The Subcontractor shall submit the following documents no later than two (2) weeks after signing of contract.

- Copies of the building tuning contract (prices may be deleted) showing the scope and timeframe of the building tuning process, demonstrating the above criteria and signed by all Subcontractors.

3.3.16 Commissioning – Commissioning Agent (Man-4)

The Principal Contractor and all Subcontractors shall comply with the following requirements:

- The Principal Contractor and Subcontractors shall liaise with the Independent Commissioning Agent (ICA).

The commissioning agent must report directly to the Principal's representatives and is the person, company or agency that will plan and carry out the overall commissioning process. The primary goal of the commissioning agent is to independently identify system deficiencies as early in the project as possible and track their status until they are corrected.

NOTE: The Independent Commissioning Agent (ICA) is engaged by the Principal's representatives.

The Principal Contractor shall submit the following documents as indicated below:

2 weeks after signing of contract:

- Obtain a copy of commissioning agent CV provided to the Principal in preparation for Green Star submission.

3 weeks prior the commissioning process is initiated:

- Evidence of the independent agent's involvement during the commissioning process EITHER through the demonstration of the agent's involvement in meetings through the provision of copies of meeting minutes and attendees OR through a list of correspondence and reporting provided by the Independent Commissioning Agent (ICA) to the design team. The assessor may also ask for copies of this correspondence to be provided.

2 weeks after commissioning has been completed in building:

- Commissioning agent report with information on the major findings and recommendations on the commissioning process summarised into one section.

The nominated commissioning agent shall comply with the following requirements:

- Review the basis of design and the design intent as well as preliminary working drawings and ensure design and documentation is commissionable. Ensure control strategies are well understood and have useful information.
- Create a commissioning plan and direct the commissioning process that covers air distribution systems, boilers, automatic controls, lighting refrigeration

systems and water distribution systems in accordance with CIBSE Commissioning Codes (ASHRAE Guideline 1 may be employed for mechanical services only, all other services are to be in accordance with the CIBSE Commissioning Codes).

- Set target requirements in the contract documents to ensure implementation of selected measures
- Coordinate with the Principal, design team, Principal Contractor and Subcontractors throughout the commissioning, testing, and a 12-month tuning process.
- Observe all testing, review and approve Subcontractor test results. Witness off site testing of equipment during construction phase. Witness equipment testing and integrated functional testing prior to practical completion.
- Review and document performance of systems during the first 12 months of operation. Provide feedback and assist fine tuning of systems. The tuning will be as a minimum quarterly reviews and a final recommissioning after 12 months of operation.
- Provide meeting minutes and attendees of commissioning process or list of correspondence and reporting provided by the Independent Commissioning Agent (ICA) to the design team.
- Ensure proper operation and maintenance (O&M) documentation for the building owner. Ensure operator training is adequate. Operator can be trained by a Subcontractor if applicable.
- Prepare a final commissioning report including alarm log, trend log data and graphs for all meters and sensing devices, recommendations to the Principal regarding the performance of commissioned building systems.
- Submit a report of building performance to the ESD consultant, including alarm log, trend log data and graphs for all meters and sensing devices.
- If any plant is operating in manual control i.e. out of automatic, investigate the reason why and include in the report to the ESD consultant.

3.3.17 Building Users Guide (Man-5)

The Principal Contractor shall comply with the following requirements:

- Provide a simple Building User's Guide, which includes information relevant to the building users, occupants and tenants' representatives.

NOTE: The building User Guide is to be produced by Arup as part of design documentation and is available on request.

All Subcontractors shall comply with the following requirements:

- Provide information and documentation as required by the Principal Contractor in producing a Building Users Guide.

The Principal Contractor shall submit the following documents no later than practical completion of works

- Confirmation that the building user's guide has been issued to the owner through the provision of the official transmittal or through a letter from the owner confirming receipt of the document.
- Provide a copy of the guide to the GBCA

3.3.18 Environmental Management (Man-6)

The Principal Contractor will provide and implement a comprehensive Environmental Management Plan (EMP) for the works in accordance with Section 4 of the NSW Environmental Management System Guidelines (1998).

The Principal Contractor shall submit the following documents prior to commencement on site:

- An Environmental Management System (EMS) and an Environmental Management Plan (EMP).

The Principal Contractor shall submit the following documents no later than 2 weeks after practical completion of works:

- A copy of the EMP clearly demonstrating compliance with the requirements of Section 4 of the NSW Environmental Management System guidelines (1998).
- Copies of all reporting created through the use of the Environmental Management Plan (EMP) as evidence that the EMP was successfully implemented in accordance with Section 4 of the NSW Environmental Management System guidelines (1998).
- A copy of the ISO 14001 certification, its applicability and its restrictions.
- Statements with the EMS or Project EMP showing that any Sub Contractors relevant to the project will adhere to the ISO 14001 requirements.

All Subcontractors shall comply with the following requirements:

- Subcontractors will adhere to the Principal Contractors ISO 14001 requirements.

Refer to Appendix A of the ESD Specification for the requirements of the EMP and EMS.

3.3.19 Waste Management (Man-7)

All Subcontractors shall comply with the following requirements:

- Provide and implement a comprehensive Waste Management Plan.
- Reuse and/or recycle at least 80% of all waste by weight (including concrete and steel).

As a minimum, this will include:

- Reuse and/or recycle at least 90% of waste concrete by weight.
- Reuse and/or recycle at least 90% of waste metal by weight.

The collection of waste for recycling should come from all construction, demolition and land clearing activities.

The Subcontractor shall provide the following documentation prior to commencement on site (All details must be forwarded to the Principal Contractor and ESD Consultant for review and approval):

- A catalogue listing the materials in the building, estimating the weights of materials to be removed and stating the proposed recycling facilities to be used, the proportion of waste to be reused or recycled by each recycling facility, and the total proportion of waste to be reused or recycled and advising on the percentage of each type of material to be recycled. This should be provided in spreadsheet format. The proposed methodology for the demolition must also be provided.
- Waste measurement methodology adopted.
- A list of appropriate recycling companies that will be employed for recycling, the costs for collection, and the timing of collection service. Any substitution of recycling companies at a later stage will require sign-off by the Principal Contractor and ESD Consultant. Substitution requests will need to include methodology documentation for the recycler in order to qualify for approval.
- Estimates of achievable rates of recycling by weight by recycling companies that will be employed.
- A copy of waste management plan used for this site.

The Subcontractor shall commit to and address in the waste management plan the following issues:

- Produce a methodology statement of the waste management process indicating the entire process from separation of waste to quantifying and recycling. The method should include recycling targets for each type of waste material.
- Establishment of an on-site waste management area for sorting and segregating waste.
- Provision for colour-coded and clearly marked waste skips or bins at the waste storage area for each of the following materials:

  ✓ Cardboard

  ✓ Timber

  ✓ Metal

  ✓ Soft Plastic

  ✓ Polystyrene

  ✓ Insulation

  ✓ Concrete

  ✓ Glass

  ✓ Bricks

The Principal Contractor and Subcontractors shall commit to and address the following issues in the waste management plan:

- At a minimum, all demolition and construction waste is to be separated into the previously delineated categories and be dealt with according to the process outlined in this section (some of the materials may be in combined skips, provided that evidence is given to demonstrate that the waste Subcontractor will separate these materials off-site).
- All waste is to be collected by appropriate recycling facilities
- All waste removed must be documented. Keep records to demonstrate actual percentage of waste recycled, including weight and volume of all wastes leaving the site and the destination and/or name of recycler/waste hauler. All receipts recording weights of material recycled are to be collected and submitted. If there is no receipt produced stating the weight of material recycled, the recycling facility will need to provide a letter indicating typical weights and percentages of each material recycled. At completion of works all receipts and associated data will be issued in a spreadsheet and summary document by the Subcontractor for review by the Principal Contractor and ESD Consultant and for submission to the GBCA.
- The Subcontractor shall issue waste reports to the Principal Contractor and ESD Consultant at quarterly intervals showing percentage of waste recycled or reused by weight.
- Ensure participation in waste minimisation training for all Subcontractors.
- Publish a waste minimisation plan for all Subcontractors to reduce on-site waste to landfill.

NOTE:

Asbestos or other hazardous materials that legally must be withheld from the general construction waste do not have to be included in the calculation for the total waste by mass.

The Principal Contractor and Subcontractor shall submit the following documents no later than practical completion of works:

- A copy of the waste disposal report that details the quantity (by weight) of waste generated by the refurbishment works and the fraction of waste re-used or recycled (by weight).
- Information that confirms that the waste re-use/recycling target was achieved for the site.
- Obtain certification from all Subcontractors confirming that the waste reuse/recycling target was achieved for this site upon completion of works.

Liabilities:

- The Principal Contractor and Subcontractor must ensure all care is taken during removal of items in order to ensure no surrounding materials are damaged.
- If under any circumstances any material becomes contaminated so as to deem it unfit for recycling due to the practice of the Principal Contractor or Subcontractor, the Principal Contractor or Subcontractor will be liable for the cost of landfill for this material plus an additional penalty to be outlined in the contract documents.

- The Principal Contractor and Subcontractors must provide notification of any asbestos or hazardous waste that is uncovered during the strip out works. A time frame for the removal of this waste should also be provided. See hazardous waste audit regarding air monitoring and clearance certificates.
- Any recycling Subcontractor used for recycling on this project must provide a facility/service license or similar certification within two weeks of tender and prior to proceeding with any site works.
- All certification, documents, reports, and records that relate to the mass, volume, relative amount, and type of recycled material must be collected during the works and submitted with claims for stage payments.
- The Principal Contractor and Subcontractors will be liable for any material that is unjustifiably 'dumped' or not dealt with as per the recycling schedule outlined in this report.
- Any penalties received from recyclers for the contamination of recycling bins or skips will be the responsibility of the Principal Contractor and Subcontractors. This charge will attract a penalty to be outlined in the contract documents.

3.3.20 Ventilation Rates (IEQ-1)

The mechanical Subcontractor shall comply with the following requirements:

- Ensure that a minimum of 18.75 l/s/per person of outside air rate is provided, which is 150% improvement on AS 1668.2-1991.

The Subcontractor shall submit the following documents on award of mechanical subcontract and prior to commencing mechanical installation:

- Commissioning plan showing minimum fresh air rates served by each AHU

The Subcontractor shall submit the following documents no before practical completion of works:

- As built drawings indicating the NLA served by each AHU.
- Table showing design fresh air rates for each space demonstrating compliance with credit.
- Commissioning report showing minimum fresh air rates served by each AHU.
- Summary table showing that for each space served by an AHU, the requirements of the credit for the points claimed are met. Note that improvements must be measured against AS1668.2 (1991).

3.3.21 Air Change Effectiveness (IEQ-2)

The mechanical Subcontractor shall comply with the following requirements:

- The ventilation systems are designed to achieve an Air Change Effectiveness (ACE) of >0.95 when measured in accordance with ASHRAE F25-1997 for at least 90% of the NLA. The ACE is to be measured in the breathing zone (normally 1m from the finished floor level).

- Demonstrate a distribution and laminar flow pattern for at least 90% of each space in the direction of air flow for not less than 95% of hours of predicted natural ventilation operation.

The Subcontractor shall submit the following documents before practical completion of works:

- A summary report summarising the CFD analysis and modelling results clearly demonstrating that the as-built design provides and Air Change Effectiveness of >.95 calculated in accordance with the ASHRAE F25-1997 for 90% of the NLA with minimum turndown rates.
- Copies of as built drawings for all typical areas, in addition to relevant excerpts from the commissioning report demonstrating modelling is valid for the as-built design.

The Subcontractor shall have access to the Green Star Office Design submission to reference work that has already been completed for this credit.

3.3.22 Carbon Dioxide Monitoring and Control (IEQ-3)

The mechanical Subcontractor shall comply with the following requirements:

- Ensure that a CO2 monitoring system with a minimum of one CO2 sensor per each return air duct on every floor (i.e. two RA ducts per floor equates to two CO2 sensors per floor) is provided in order to facilitate the continuous monitoring and adjustment of outside air ventilation rates to at least 95% of the NLA.

The Subcontractor shall submit the following draft documents no later than 6 weeks prior to commencement of mechanical works on site:

- A draft list of BMCS as built point schedules showing the connection between the CO2 sensors and the BMCS.
- A draft extract from the O&M manual for the building showing how the ongoing operation of the CO2 sensors will be maintained.

The Subcontractor shall submit the following document prior to practical completion:

- As part of mechanical control and commissioning plan, provide a brief description of the system and its method of operation, referring to the following attached documentation.
- As built drawings showing the locations of all CO2 sensors and the areas served by those sensors.
- A list of BMCS as built point schedules showing the connection between the CO2 sensors and the BMCS.
- An extract from the O&M manual for the building showing how the ongoing operation of the CO2 sensors will be maintained.

3.3.23 Mould Prevention (IEQ-15)

The mechanical Subcontractor shall comply with the following requirements:

- The mechanical ventilation system is designed to actively control humidity to be no more than 60% relative humidity in the space and no more than 80% relative humidity in the supply duct work.

The Subcontractor shall submit the following documents no later than two (2) weeks prior to mechanical installation:

- HVAC Controls operations statement clearly stating how humidity control will be achieved and how humidity sensors will be commissioned, calibrated and tested.

The Subcontractor shall submit the following documents prior to practical completion:

- As installed drawings and BMCS points schedules showing humidity sensors installed in the ductwork.
- Clearly marked extracts from the commissioning report showing the humidity levels in the ducts and in the office space for heating and cooling modes of operation.

The Subcontractor shall have access to the Green Star Office Design submission to reference work that has already been completed for this credit.

3.3.24 Energy (Ene-1, Ene-2)

All Subcontractors shall comply with the following requirements:

The base building As Built design achieves a minimum predicted rating of “5 Star + 60% CO2 reduction” using the National Australian Built Environment Rating System (NABERS) scheme simulation protocol.

Energy calculations have been provided for the Green Star Office Design submission, so the Subcontractor need only to demonstrate that the design and materials have not been significantly altered from those used for the original calculations. Alterations to the original design should be documented and it is the Subcontractors responsibility to demonstrate that any changes do not impact upon the building energy use.

The Subcontractor will receive a letter from the ESD Consultant indicating the thermal calculations produced for the Office Design submission, provided that the Office Design specifications are still relevant.

If there have been significant changes, the As Built design should be remodelled and analysed for thermal comfort. The Subcontractor is responsible for covering modelling costs arising from design changes.

The Subcontractor shall submit the following documents no later than two (2) weeks after commissioning has been completed in building.

- Extracts from the commissioning report demonstrating that the building operates in the configuration described in the energy modelling report.

The Subcontractor shall submit the following documents prior to practical completion;

- Exemptions report of all design variations between design documentation and as- built design for mechanical, electrical and façade design.
- Copies of as built drawings and performance schedules demonstrating that the mechanical, electrical and facade details and materials are the same as described in the energy modelling report. This document shall clearly highlight part load efficiency (at 20, 40, 60, 80, 100% load at 4 different condenser water temperatures and chilled water temperatures) for the selected chillers (including absorption chillers) and part load efficiencies (at 20, 40, 60, 80, 100% load) for all other plant items, including but not limited to:
    - Chiller plant
    - Boilers
    - Fans
    - Pumps
    - Trigeneration equipment
    - Blackwater equipment

The document will also specify façade glazing performance and the installed capacity of any PV system including calculations for annual hourly electrical output from the PV.

The Subcontractor, as a result of design alterations, may be requested to provide an energy report by the Principal Contractor. The Subcontractor shall submit the following documents no later than two (2) weeks after completion of Façade and Mechanical Construction Drawings:

- Energy modelling report for the as built office building which describes the energy modelling process as per the NABERS “Validation Protocol for the use of Computer Simulations to Estimate Building Energy Performance” (Version 2005-01).

3.3.25 Electrical Sub-metering (Ene-3)

The electrical and BMCS Subcontractor shall comply with following requirements:

- Sub metering shall be provided for substantive energy uses within the building (greater than 100kVa). Computer rooms and catering facilities must also be sub-metered if present.

The Subcontractor shall submit the following documents prior to practical completion.

- As-installed schematics with location of all sub meters clearly marked and showing maximum load for each meter
- As-installed drawings to be submitted clearly showing the location of all energy sub meters in the building confirming whether meters are read directly or via a Building Management System (BMCS) and demonstrate that for meters read via a BMCS that these meters are connected appropriately. This should include as minimum separate metering for:
    - Chillers

- Air Handling Fans
- Lifts
- Common area light and power
- Kitchen
- Domestic Hot Water Boilers (if electric)
- External lighting
- Any additional item which carries an energy use greater than 100 kVA

3.3.26 Tenancy Sub-metering (Ene-4)

The electrical and BMCS Subcontractors shall comply with following requirements:

- Sub metering shall be provided for each floor and tenancy

The Subcontractor shall submit the following documents 2 weeks prior to commencement of electrical works on site

- Summary sheet showing the breakdown of separately tenanted spaces in the building, where those tenancies are and how big they are
- The BMCS points schedule showing inputs from meters must also be provided if the meters are read via the BMCS

The Subcontractor shall submit the following document no later than 2 weeks after completion of Electrical installation:

As-installed schematics with the location of all sub meters clearly marked.

3.3.27 Peak Energy Demand Reduction (Ene-7)

The Subcontractors shall comply with following requirements:

- Energy demand reduction systems are installed to reduce peak demand on electricity infrastructure by 25%;
- The reduction shall be measured against base building peak energy demand calculated without the benefit of the installed reduction systems which may be achieved by on-site generation or by thermal/energy storage systems, but not by load lopping using the Building Management System (BMCS).

The Subcontractors shall submit the following documents no later than six (6) months following practical completion:

- A report that details the operation and capacity of the tri-generation and photovoltaic systems. The report should refer to the as built drawings and commissioning reports to clearly demonstrate that energy demand has been reduced by 25%.
- As built drawings of the tri-generation and photovoltaic systems.
- Extracts from the commissioning report that would confirm the correct operation of the tri-generation and photovoltaic systems.

3.3.28 Water Meter (Wat-2)

The Subcontractor shall comply with the following requirements:

- Water sub-meters shall be installed on all major water uses in the building including as a minimum cooling towers, irrigation & wash-down, recycled water and/or rainwater systems (where installed) and hot water services
- Sub-water meters shall be linked to a Building Management System (BMCS) to provide a leak detection system.

The Subcontractor shall submit the following documents prior to practical completion.

- A list of all major water uses in the building referenced to As Built drawings or As Built schematics clearly showing the locations of all water meters and the associated water use
- The as-installed point schedule for the BMCS showing that all water meters are correctly installed and extracts from the commissioning report showing that the meters function correctly.

3.3.29 Refrigerant Leak Detection (Emi-3)

The Subcontractor shall comply with following requirements:

- Demonstrate that systems containing refrigerants are contained in a moderately air-tight enclosure and where a refrigerant leak detection system is specified/installed covering high-risk parts of the plant (evaporator or condenser coils can be omitted)

The Subcontractor shall submit the following draft documents no later than 6 weeks prior to commencement of Mechanical works on site:

- A draft list of BMCS as built point schedules showing the connection between the refrigerant leak detection sensors and the BMCS
- A draft extract from the O&M manual for the building showing how the ongoing operation of the refrigerant leak detection sensors will be maintained.

The Subcontractor shall submit the following document prior to practical completion.

- Short document describing the type of system installed and how it works with reference to:
- Attached as-installed drawings showing how the system has been built;
- Attached extracts from the commissioning report demonstrating that the system operates correctly;
- Attached extracts from the O&M manual explaining the correct operation of the leak detection system.

3.3.30 Refrigerant Recovery (Emi-4)

The Subcontractor shall comply with following requirements:

- That either provision of automatic refrigerant pump-down is made to the heat exchanger or dedicated storage tanks with isolation valves.

The Subcontractor shall submit the following documentation no later than 2 weeks after completion of Commissioning

- Short document describing the type of system installed and how it works with references to:
  - Attached as-installed drawings showing how the system has been built.
  - Attached extracts from the commissioning report demonstrating that the system operates correctly
  - Attached extracts from the O&M manual explaining the correct operation of the leak detection system.

3.3.31 Labelling

The BMCS Subcontractor shall supply and fix engraved Formica laminate labels for all items of controls equipment.

Labels shall be fitted to a flat surface next to the controls device using self tapping screws or an epoxy based resin. Where no flat surfaces are available e.g. on valves, the labels shall be hung from brass chains. Control items in occupied areas other than plantrooms shall be marked with their tag reference on concealed surfaces i.e. on the inside of a room temperature sensor cover.

3.3.32 Consumables

The BMCS Subcontractor shall provide printer paper up to Practical Completion at which point the Client shall be issued with one box of spare paper per printer as part of the handover procedure.

The BMCS Subcontractor shall provide ink cassettes up to Practical Completion at which point the Client shall be issued with two ink cassettes (colour and black) per printer as part of the handover procedure.

The BMCS Subcontractor shall provide all the necessary disposable batteries for all equipment supplied under the Contract e.g. wireless sensors, until Practical Completion at which point the Client shall be issued with a complete set of replacement batteries as part of the handover procedure. This excludes equipment containing rechargeable batteries.

3.3.33 Demonstration

The BMCS shall fully demonstrate to the principle, principle's representative and the Independent Commissioning Agent that the BMCS system operates to the requirements.

The BMCS Subcontractor shall, prior to loading software into controllers on site, demonstrate all software and head end graphics at works, by simulation of plant operating conditions using switches, potentiometers, volt meters and lamps etc. The BMCS Subcontractor shall give the Construction Manager seven working days notice of software test dates. The Construction Manager may decline to test software off-site.

Demonstrate in detail and prove all aspects of BMCS high level interfacing, control, monitoring and alarm generation required from building subsystems including UPS units, Generators, Main Switchboards, Variable Speed Drives, Sun Blinds, Lifts and Fire Indicating Panel. This testing shall be carried out at both off site testing facilities and on site.

Demonstrate in detail and prove all aspects of BMCS low level (hard wired) interfacing, control, monitoring and alarm generation required from building subsystems including UPS units, Generators, Main Switchboards, Variable Speed Drives, Lifts, Sun Blinds and Fire Indicating Panel. This testing shall be carried out at both off site testing facilities and on site.

On site the graphics shall be utilised as a means to carry out point to point checking in a single operation from field terminal device through controller to operator's station prior to demonstrating the system functionality.

The BMCS Subcontractor shall then demonstrate that the installed and commissioned BMCS system functions and operates in full accordance with the requirements and the testing and commissioning procedures described elsewhere in the Contract Documents

Before any demonstration, the BMCS Subcontractor shall issue a signed document stating that the system has been fully tested and commissioned and complies fully with the requirements.

The following shall be demonstrated as a minimum:

- Each and every point on the system including calibration checks and the stroking of actuators;
- All dynamic graphics comply with the Specification;
- All system programs comply with the Specification.

The BMCS shall make available a minimum of three hand held radio transmitters (complete with chargers, etc.) to be used during the demonstration period.

Calibration of all devices will be demonstrated using only a currently NATA certified instrument. It will be the responsibility of the BMCS Subcontractor to ensure all instruments and their calibration certification are available for inspection prior to the demonstration. These shall remain the property of the BMCS Subcontractor.

Acceptance of the system does not absolve the BMCS Subcontractor from his responsibility, to provide a fully operational system, should any defects appear during the warranty period, not withstanding that a fault was not apparent at the time of commissioning.

3.3.34 Documentation

The BMCS Subcontractor shall collate, prepare, submit, alter and subsequently re-submit controls O&M documentation and drawings in accordance with the Contract Documents as described under 'Project Documentation'.

As some items described in 'Project Documentation' cannot be completed until the project is partially or fully completed the documentation shall be formally

submitted at 3 stages in the project. These stages, their timing and their contents are described as follows:

- Stage 1 (Preliminary) - This documentation shall consist of a file which contains dividers for all sections;
- Any sections of the document not submitted shall be marked as such with the date by which that section will be supplied;
- This stage of the documentation shall contain sections i, ii, iii, iv, viii and ix as described in 'Project Documentation' and shall be submitted within 3 months of the commencement of the contract.
- Stage 2 (Construction) - This shall be as per the stage 1 document set, except it shall include the latest revisions of the sections for stage 1 plus sections v and vi. Proposed operator graphic displays shall be submitted with this document issue. This documentation stage must gain approval from the design team before programming shall commence;
- Stage 3 (As-installed) - This document set shall contain the latest revisions of all sections. It shall be submitted in an A4 size vinyl hard back folder with no less than three spine fixing clips. This bound document shall open flat, be appropriately labelled and shall be submitted at the completion of the commissioning period. Note that Practical Completion will not be awarded until all three copies of the three volumes of documentation have been submitted and accepted.

A soft copy of the entire O&M manual shall be supplied.

In addition to the above documentation a disc shall be supplied complete with all DDC programs, configuration details and graphics, stored upon it. All documentation submission stages shall be done in accordance with the building schedule.

The BMCS Subcontractor shall provide any significant residual risk information to the Construction Manager for compiling the Health and Safety File at least two weeks prior to Practical Completion.

3.3.34.1 Document Management

Document are to be issued via EDC using drawing numbers conforming to those set out in Mirvac's EC manual. Document will be produced at the following sizes:

- Reports A4;
- Drawings full size, A3 and A4.

The principal requires all project related correspondence and documents to be exchanged via EDC (Electronic Document Control).

All sub-contractors will be given access to EDC through an internet web page. Each user will be issued with a logon username and password. All sub-contractors will receive user manuals and a guide for changing Internet Explorer settings as part of the EDC setup process. The principal will supply additional support for training and setup upon request.

Sub-contractors must use the appropriate software systems required to complete its works. The following software is required for using the EDC program:

- Browser Software - Microsoft Internet Explorer 6.0 or later
- Registered documents viewer: Adobe Acrobat 6

3.3.35 Works In Association with Other Contractors and Subcontractors

Other Subcontractor and Subcontractors' works will be associated with and related to the BMCS Subcontractor's work.

The BMCS Subcontractor shall:

- Before commencement of installation drawings, acquaint themself with the spatial, setting out and installation requirements of other Subcontractors and Subcontractors works described in the Contract Documents;
- Make themself fully aware of the interfaces between the requirements of their works and the works of others.

The BMCS Subcontractor's work related to the work of others shall include but not be limited to the following:

Mechanical

Liaison necessary to ensure that all interfaces are compatible and attendance of off-site interface testing as required.

Liaison necessary to agree suitable locations for all sensors, valves, actuators etc. Provide mechanical installation drawings for submission showing agreed locations of sensing devices, valve and damper actuators etc. complete with their tag references. ACAD files of, the flow rate, pressure drop, flow coefficient (Kv), coil pressure drop, authority, maximum differential mechanical installation drawings to be provided by the Mechanical Subcontractor.

Liaison necessary, for the purpose of obtaining information for the completion of a control valve schedule, detailing for each valve pressure, actuator type and system pressure.

The submission of the completed control valve schedule for information/comment prior to ordering any equipment.

The supply free issue to site of all valve bodies, flow measurement devices, sensor pockets, hydraulic tube connections, brackets, clamping bushes, couplings, lock-nuts, gaskets, orifice plates/carrier rings and any special fittings for fitting to pipework.

Liaison necessary, for the purpose of obtaining suitable differential pressure measuring signal values across orifice plates and static pressure values for the selection of differential pressure switches in flow proving applications.

The supply free issue to site of all float switches, level controllers and contents transmitters for fitting into storage tanks when required for BMCS monitoring.

The supply free issue to site of all duct mounting air flow measurement sensor arrays, flanges, brackets, clamping bushes, couplings, lock-nuts, gaskets and any special fittings for fitting to air handling units and air ducts.

Liaison necessary to ensure all required BMCS signals from plant are provided and are compatible with the BMCS.

Obtaining certified electrical information/wiring diagrams of equipment interfaced with the BMCS system enabling the production of wiring diagrams in accordance with an agreed programme.

Attendance at site to suit the Contract Programme, for the purpose of positioning control valves and damper actuators during water and air system balancing/commissioning.

Liaison necessary to determine values required for schedules to be written into the BMCS software e.g. minimum fresh air reset.

Electrical

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Liaison necessary to ensure that suitable essential power supplies are provided to all field control panels at the required locations.

Provide BMCS monitoring points including meters and all wiring work

Security

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Hydraulic

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Provide wiring of water and gas meters via BMCS

Tri-generation

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Black Water

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Vertical Transportation

Liaison necessary to ensure all interfaces to the BMCS (high and low level) are provided and are compatible with the BMCS.

Fire Detection and Alarm

Liaison necessary to ensure that all interfaces are compatible and attendance of off-site interface testing as required.

Liaison necessary to ensure that all building fire detected and fireman's override switch signals required for BMCS Control/monitoring are provided in the correct locations. The fire signals shall be in the form of volt free contacts.

Converged Network Option

For each subcontractor that has a system or equipment connected to the converged network:

Liaison necessary to understand the interface technical requirements and locations for connection to the converged network and create an interface requirements document.

Provide network addresses for the subcontractor to use on the converged network.

Liaison necessary to understand each subcontractors reliance on the converged network for commissioning and coordinate programs.

3.3.36 Operator Training

The BMCS Subcontractor shall provide training for the Employer and his nominated representative(s) starting at the end of the Contract Period not later than two weeks after Practical Completion. This shall comprise ten days onsite training for four people and two days off-site for two people.

Five days further training shall be provided within the defect liability period at a time requested by the client with a minimum of three weeks notice.

3.3.37 Warranty & Maintenance

The BMCS Subcontractor shall warrant and maintain the entire installation (including all BMCS hardware and software, valves, etc.) for 12 months following the issuing of the certificate of Practical Completion.

The BMCS Subcontractor shall attend any call by the end of the next working day as part of the warranty requirements.

Maintenance shall include regular visits to site during the warranty period. As a minimum requirement the BMCS Subcontractor shall visit the site for two full day (16 hours) per month, to conduct maintenance and fine tuning of the BMCS. Note that the rectification of defects is not to be included in this 16 hour period.

During these visits the operation of the system shall be checked and any maintenance required shall be performed.

Fine tuning of the system shall be carried out.

Following each site visit a report detailing maintenance carried out, fine tuning adjustment made and problems encountered shall be submitted.

3.4 Associated Works

3.4.1 Mechanical Subcontractor

The Mechanical Subcontractor will:

- Liaise with the BMCS Subcontractor to agree suitable locations for sensors, valves, actuators, flow measuring devices, etc;

- Provide the BMCS Subcontractor with ACAD files of the mechanical installation drawings;
- Provide the BMCS Subcontractor with information for the purpose of sizing control valves including medium, system static pressure, pump head, flow rates, coil pressure drops, and any other relevant data;
- Where orifice plates are installed in pipework for flow proving, provide the BMCS Subcontractor with information for the purpose of selecting differential pressure switches including medium, system static pressure and the measuring signal differential pressure value at the maximum design flow rate;
- Fit all valve bodies, pockets, hydraulic tube connections, duct mounting flanges, brackets, clamping bushes, couplings, lock-nuts, gaskets, orifice plates/carrier rings and any special fittings for pipework and air handling units supplied by the BMCS Subcontractor;
- Fit all flow measuring devices into pipework/ductwork in accordance with the manufacturer's installation instructions provided by the BMCS;
- Supply and fit binder type test points adjacent to all pipework thermostats, temperature sensors and each port of the two-port and three-port control valves; isolating valves and binder type test points either side of differential pressure switches across pump sets; access panels where control and sensing devices are not withdrawable from ductwork; welded bosses or screwed tees for water flow switches, with an oversize branch connection bushed down;
- Provide independent means of validating the calibration of all flow measurement devices e.g. orifice plates and binder type test points in pipework, test holes in ductwork for a pitot traverse;
- Fit all storage tank float switches, level controllers and contents transmitters in accordance with the manufacturer's installation instructions provided by the BMCS Subcontractor. Provide and fit any stool pieces, isolation valves etc. required for calibration purposes;
- Mount and fit universal joints, actuator cranks and damper actuators, supplied by the BMCS Subcontractor, and supply, fit and connect linkages between actuators and dampers. Mount and fix all dampers and their frames into prescribed openings;
- Liaise with the BMCS Subcontractor to ensure all BMCS/control interface requirements/signals associated with mechanical plant are provided and are compatible;
- Provide the BMCS Subcontractor with electrical information/wiring diagrams for mechanical plant that is controlled from or monitored by the BMCS system;
- Commission complete air conditioning and ventilation system in conjunction with the BMCS Subcontractor. Advise BMCS Subcontractor of all set points determined during commissioning for fan static pressure, damper positions required to maintain required outside air rates at various supply fan speeds, chilled and hot water system pressures etc.
- Provide attendance during commissioning of the control system;
- Give four weeks prior written notice to the BMCS Subcontractor for site attendance for commencement of the supervisory service and for testing and commissioning;

- Provide and install all power wiring between mechanical distribution boards and plant drives and include the provision of stop locks or local switch disconnectors.
- Provide and install an electrical containment system in the plantrooms, risers and floors and designate a section of the tray/trunking along the main routes for BMCS cabling. Also include for sizing the designated tray/trunking

3.4.2 Electrical Subcontractor

The Electrical Subcontractor will:

- Liase with the BMCS Subcontractor, via the principle, to ensure all BMCS control interface requirements/signals associated with electrical equipment are provided and are compatible;
- Provide the BMCS Subcontractor with electrical information/wiring diagrams of electrical equipment that is to be controlled or monitored by the BMCS system;
- Commission all high level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the BMCS system.

3.4.3 Fire Detection Subcontractor

The Fire Detection Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

3.4.4 Security Services Subcontractor

The Security Services Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

3.4.5 Hydraulic Services Subcontractor

The Hydraulic Services Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

3.4.6 Tri-Generation Subcontractor

The Tri-Generation Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

3.4.7 Black Water Subcontractor

The Black Water Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

3.4.8 Vertical Transportation Subcontractor

The Vertical Transportation Subcontractor will:

- Commission all high/low level interfaces in conjunction with the BMCS Subcontractor;
- Provide attendance during commissioning of the interface to the BMCS system.

Converged Network Option

Subcontractors that have a system or equipment that interfaces with the converged network will:

- Provide information within their programme for when the network is required to be active, including the BMCS, to ensure the network is available at this time.
- Inform the BMCS subcontractor the proposed location of all interface points required;
- Ensure all termination points are accessible externally to each panel/equipment with RJ-45 outlets. Outlets shall be provided with IP56 rated screw connectors in plant, carpark, in external areas or in locations which may be affected by particle or moisture ingress;
- Where a connection is to be made to a low-level signal, the subcontractor shall provide all terminals within a suitably mounted externally IP56 rated enclosure affixed to the associated equipment;
- Provide a list of all required points and functional requirements to the BMCS Contractor for inclusion in the common head-end logging and display and also the required layout of the points of network connectivity;
- Include software for each of the sub-systems which may access more detailed control and monitoring information;

- In the event that the Converged Network is unavailable during normal operation, ensure that the systems are capable of operation in a safe standalone manner or if this is not achievable, ensure that affected systems revert to a fail-safe mode of operation;
- Assist the BMCS subcontractor in completing the interface offsite at the BMCS subcontractors works;
- Attend offsite and onsite testing and demonstrations relevant to the interface to the BMCS.

4 Design Responsibilities

4.1 General

This Specification describes the Works to be carried out by the BMCS Subcontractor. It does not relieve the BMCS Subcontractor of his responsibility for the design and implementation of the works to provide a fully working BMCS of the highest quality.

Where requirements more onerous than the industry standards are specified within this document, the conditions of this Specification shall take precedence.

4.2 Acceptance Of Work By Others

The BMCS Subcontractor shall:

- Ensure that before commencing and during the carrying out of works the position, dimensions and suitability of any work executed or to be executed by others which might in any way affect the effective execution of his own works is correct and shall immediately report in writing if any work is out of position, wrongly dimensioned or in any other way unsuitable;
- Have no claim or right of action arising from work executed or to be executed by others unless he has properly reported in accordance with the above paragraph any discrepancy in position or dimension or other unsatisfactory conditions.

5 Tender Requirements

5.1 Tender Information

5.1.1 Information To Be Returned With The Tender

The BMCS tenderer shall:

- Return the completed Pricing Schedule and Schedule of Rates with the Tender;
- Include within the Tender a clause by clause statement highlighting any discrepancies between the Tenderer's standard system and the requirements of this specification. If the Tenderer does not highlight these discrepancies then it shall be deemed that the Tender complies fully with the Contract documents;
- Details of completed projects in Sydney of similar size and complexity.
- CVs of key personnel proposed to undertake this project.
- With respect to any specified differential pressure transmitter, electromagnetic, or ultrasonic flow measuring stations, include in the Tender for positioning the flow measurement device in accordance with the manufacturer's installation instructions;
- With respect to any water or air flow measurement device, include in the Tender for the manufacturer to commission/calibrate the flow measurement device on site and for the provision of the manufacturer's documentary evidence of such testing;
- Clearly specify within the Tender the methods by which the BMCS Subcontractor intends to eliminate any interference with signal and data transmissions;
- State in the tender how many spare points are actually available on each controller or at each controller location and the expansion capability of each controller;
- Provide with the Tender a communications network diagram appertaining to the devices included in the Tender, complete with engineering specifications for all the different items of intelligent equipment;
- Provide with the Tender an example ‘Commissioning Method Statement’ document which details the steps that are taken to ensure that the plant is operating as specified in the functional description, for an AHU and chilled water system of similar complexity.
- Provide with the Tender an example ‘Inspection and Test Report (ITR)’ document which details the commissioning results and associated sign off sheets.
- Provide as a Tender option a proposal for an Energy Monitoring & Targeting software package.

- Unless the BMCS Subcontractor specifically states to the contrary in the Tender, it shall be deemed that the BMCS Subcontractor has given the following undertakings:

  a) Ownership of application software shall be retained by the Client who requires unrestricted access to carry out modifications and adjustment to programmes as necessary.

  b) The Tender price is deemed to include all royalties and other ownership fees payable for software.

  c) There shall be no agreements of any kind preventing the Client's staff from modifying programs themselves, after Practical Completion.

- Include in the Tender all costs associated with the warranty requirements of attending any call by the end of the same day;
- Include in the Tender all costs associated with warranty visits to maintain particular items (e.g. batteries) that are more frequent than monthly;

5.1.2 Description Of Excluded Work

The BMCS Subcontractor shall, with his Tender, clearly describe any work necessary for the proper completion of the Subcontractor and Subcontractor works not included for in his Tender and which he may require to be executed and paid for by others; any such work not specifically stated and described shall be deemed to have been included in his Tender.

5.1.3 Post-Contract Maintenance

The BMCS Subcontractor shall submit an offer at time of tender for three levels of maintenance contract for the system offered i.e. preventative maintenance, intermediate and comprehensive for periods of one, three or five years as detailed in the appendix of this Specification.

The quotation for each level of maintenance contract shall be based on a fixed price contract, which is paid monthly and indexed (as per a formula supplied by the BMCS Subcontractor) annually.

Variations throughout the contract period will increase the maintenance contract price on a pro rata basis that is dependent upon the ratio of variations to the original contract price.

The maintenance prices quoted will be based on costs at the time of Tender. The Tender date maintenance price will then be indexed until the system is out of warranty, at which time the first year's maintenance costs will be calculated

Normal working hours are defined as 9.00am to 5.00pm, Monday to Friday, excluding public holidays.

5.2 Tender Assessment

Tender assessment will pay particular attention to the following aspects for which all the necessary information shall be submitted with the Tender.

- The Tenderer's conditions, if any, associated with a Software Licence or similar agreement. Note that if the Tenderer requires the Client to enter into a Software Licence Agreement then all conditions associated with the said agreement shall be clearly detailed in the Tender. Should a condition not be detailed clearly in the Tender then it shall be deemed "not applicable";
- It must be noted that conditions within a Software Licence Agreement which limit the present or future client's usage of the BMCS, may cause the Tender to be rejected;
- The additional functions offered, the spare capacity of the system and its future expansion capability;
- The simplicity of the day to day operation of the installation (i.e. user friendliness);
- Maintenance in terms of costs per annum, speed of response to call out, long term availability of spares, supply of spares to the Client or the Client's appointed Maintenance Subcontractor and commercial conditions associated with the maintenance contract;
- The time between requesting information and its display on the operator's station;
- What key Health and Safety issues have been identified and the proposals to manage them.

6 Project Documentation

The following outlines the minimum requirements for subcontractors Operation and Maintenance Manuals. Refer to Mirvac's Building Information Modelling Brief for supplementary requirements.

The project documentation forms a major part of the contract and consequently only the most professionally prepared and presented documentation will be accepted.

Documentation shall be in accordance with the Preliminaries and the requirements detailed in this section.

Documentation shall consist of three volumes of which 3 copies of each shall be submitted. The three volumes are:

- BMCS Project Documentation
- BMCS Operator's Manual
- BMCS Programmer's Manual

Each volume may be submitted in more than one file if its large size will limit its ease of use. The BMCS project documentation volume will be job specific and therefore is the most important volume of documentation. The following details the sections which must be included in this part of the documentation.

Index

i. Schematic Diagrams - This includes schematic diagrams of the BMCS network complete with system numbering and controller locations. It provides a quick understanding of the network architecture. Also included in this section is a plan view (and elevation view, if required) of the site which combine to give a reader a quick understanding of the site's/building's layout.

ii. Functional Description - This section describes in detail, the program and hard-wired control sequences associated with the systems. It shall reflect any changes made during the Contract. It shall be written in an easy to understand format and include the following:

   - Set points values, time schedules etc.
   - Mnemonic tag references as detailed in the Specification schedules.
   - Input/output point addresses.
   - Software addresses where appropriate e.g. calculation points, global points, etc.
   - Detail of required operator action in acknowledging and resetting alarms, etc.

iii. Input/Output Listings - A complete list of all BMCS inputs and outputs including device type connected, location, point number and terminal numbers shall be provided in this section.

iv. Strategy Diagrams/Program Listing - Strategy diagrams or a program listing shall be provided, dependent on the manufacturer's standard software production method, for each controller and unitary controller. The program listing shall include English Language descriptions of how the routines work. Both methods shall include the values of all setpoints, proportional bands, integral reset times, timers etc.

v. Configuration Data - This section shall include a printout of all English language point and alarm descriptors and other information as described under 'Configuration' in this Specification. Configuration of all components including MODBUS drivers etc to be recorded and provided.

vi. Maintenance Instructions - This section shall include any specific items of maintenance which are necessary to ensure the safe and reliable operation of the BMCS and the plant it control.

vii. Data Sheets - A data sheet for each item of equipment in the BMCS including all field devices.

viii. Drawings - A complete set of drawings shall be supplied in separate plastic drawing covers and clipped into the volume. Drawings as a minimum shall include the following:

- Schematic diagrams of all systems, detailing the locations of each item of plant in the system and the control actuators and sensors, complete with cross-reference point and item numbers.
- Equipment schedules (including all field equipment).
- Field wiring diagrams.

If a deviation to the above is required it must first be agreed with the Construction Manager. However, any such deviation would be in format or presentation only. That is, all information described above must be included.

7 Converged Network

7.1 Standards and Regulations

The following standards\regulations\governmental legislations and acts apply to all sections of installation – the most recent revision of these standards is to be applied in all cases:

Australian Telecommunications Act 1997

All Standards appearing on the ACMA Telecommunications Standards Listing at the time of contract award.

Foxtel Standards for Campus Distribution & TDM.

All relevant AS/ACIF/ACA standards notably:

AS/ACIF S008	Requirements for Customer Cabling Products
AS/ACIF S009	Installation Requirements for Customer Cabling (Wiring Rules)
AS/NZS 1367:	Coaxial cable and optical fibre systems for the RF distribution of analogue and digital television and sound signals in single and multiple dwelling installations
AS/NZS 1768	Lightning Protection
AS 2834:	Computer Accommodation
AS/NZS 3000:	Electrical Installations (also known as the Australian/New Zealand Wiring Rules)
AS/NZS 3080:	Telecommunications installations – Generic cabling for commercial premises
AS/NZS 3084:	Telecommunications installations – Telecommunications pathways and spaces for commercial buildings
AS/NZS 3085:	Telecommunications Installations – Administration of Communications Cabling systems – basic requirements
AS/NZS ISO/IEC 15018:	Information technology - Generic cabling for homes
AS/NZS IEC 61935.1:	Testing of balanced communication cabling in accordance with ISO/IEC 11801 - Installed cabling
AS/NZS IEC 61935.2:	Testing of balanced communication cabling in accordance with ISO/IEC 11801 - Patch cords and work area cords
AS 4154	General Access Floors (Elevated Floors)
AS/NZS ISO/IEC 24702:	Telecommunications Installations – Generic Cabling – Industrial Premises
HB 243:	Communications Cabling Manual – Module 1: Australian Regulatory Arrangements
HB 29:	Communications Cabling Manual – Module 2: Communications Cabling Handbook

Where a conflict of standards occurs the decision shall be referred to the Principal for resolution.

7.2 Data Network

7.2.1 Introduction

The Converged Data Network is responsible for transport of building system communication information throughout the building. It is envisaged that the Converged Data Network shall connect into a WAN for future remote monitoring and control.

The data network topology will be based on a two layer model. A primary access layer will consolidate all Edge Network devices, connecting onto a single, common service Core Layer.

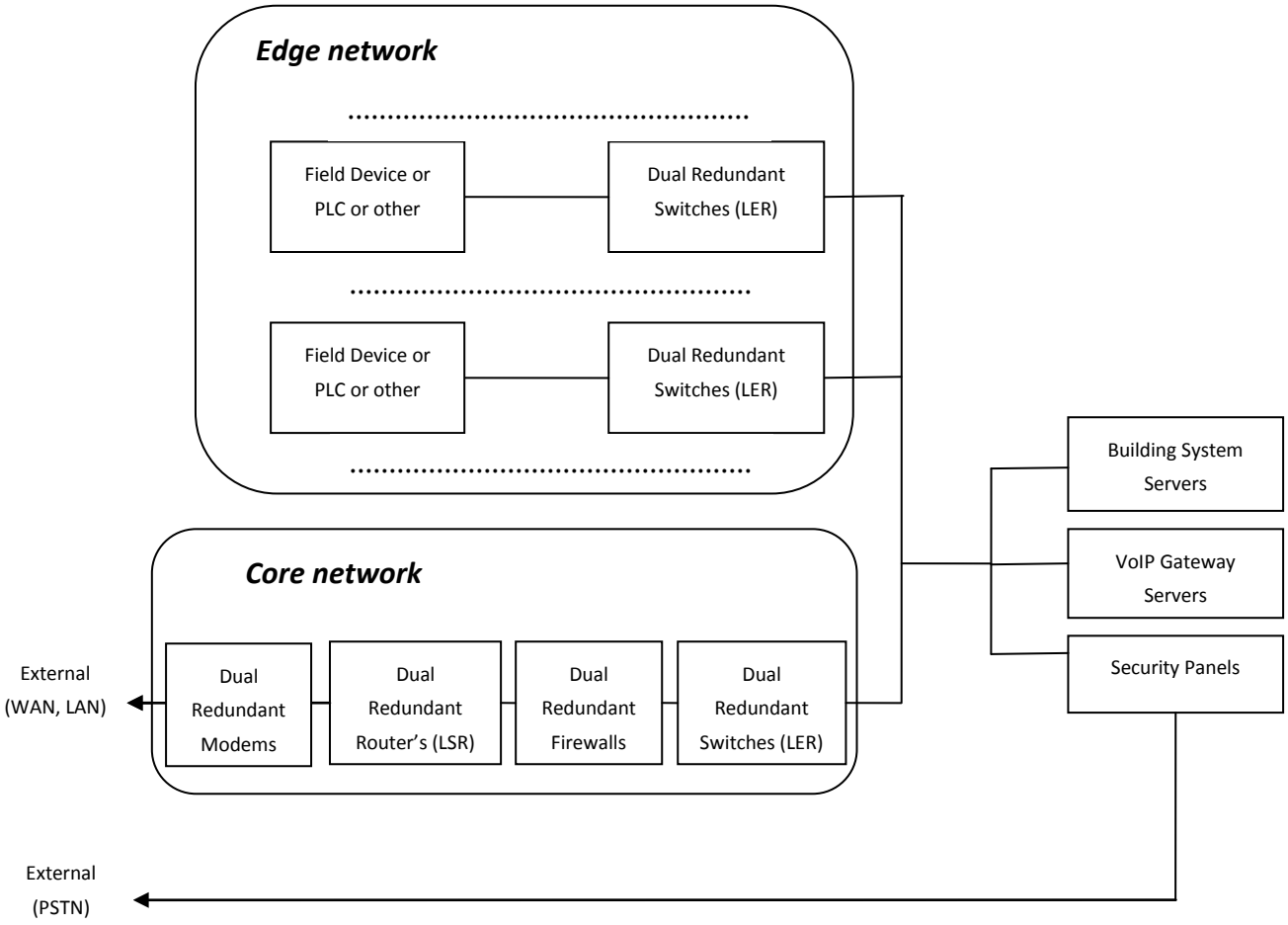
The data network shall implement MPLS layer-3 VPN's. MPLS will allow the Principal to provide carrier class network services, increase security and lower operational overheads throughout the precinct.

Quality of service shall be utilised across the network to ensure timely and accurate delivery of information.

The network shall be monitored for faults and performance issues by a network management tool.

7.2.2 Architecture

A logical representation of the data network topology is shown below. It highlights the components of each of the layers of the data network. The requirements around each of these components are captured in the following sections of this document.



7.2.3 Functional Requirements

7.2.3.1 Network Topology

The communication system topology will be broken up into two distinct layers; the Core and Edge networks.

Core Network

The core network is responsible for two major functions within the common data network; high speed switching and connecting various Edge networks.

The Core network shall:

- Be resilient and fault tolerant;
- Operate MPLS as the primary forwarding mechanism;
- Operate using open standard protocols;
- Be implemented on a number of a chassis based switch allowing for future expansion.

The Core network infrastructure shall include the following equipment:

- Core network routers (WAN/CAN equipment);
- Core network switches (WAN/CAN equipment).
- Firewall appliances
- ADSL modems

The following interfaces will be required at the Core network:

- An interface to the Edge networks;
- An interface to server and backend related equipment;
- Interface to a Carrier Network(s).

Core network equipment will be located within the Central Equipment Room.

Edge Network

The Edge network shall provide the interface between equipment in the field and the Core network.

The Edge network shall be:

- Resilient and fault tolerant;
- Operate open standard protocols;
- Be stackable a switch allowing for future expansion;
- Provide power-over-Ethernet (PoE), IEEE 802.3af.

The Edge network infrastructure shall include the following equipment:

- Edge network switches (LAN equipment);

The following interfaces will be required at the Edge Level:

- An interface to the Core network;
- Interfaces to field equipment such as: Intercom, CCTV, PLC's, UPS's, Blackwater plant etc.

7.2.3.2 MPLS Topology

In addition to the two layer data network approach described above, the Converged Data Network shall also implement a MPLS topology overlay. The MPLS topology will be broken into three distinct functions.

1. Core network routers will functions as Label Switches Routers, commonly referred to Provider routers.
2. The Core network switches will function as Label Edge Routers, commonly referred to Provider Edge Routers.
3. The Edge network switches will function as Customer Edge Routing functions, commonly referred to as Customer Edge Routers.

MPLS Label Switch Routers (LSR)

The MPLS LSR's shall:

- Not contain any customer routing information;
- Permit the traversal of Label Switched Paths;
- Permit Multicast;
- Be capable of supporting traffic engineering functions.

MPLS Label Edge Routers (LER)

The MPLS LER's shall:

- Contain customer routing information;
- Permit the traversal of Label Switched Paths;
- Permit Multicast;
- Be capable of supporting traffic engineering functions.

7.2.3.3 Availability

The BMCS Subcontractor shall provide an analysis of the network to demonstrate that a high availability is achieved. The contractor shall provide scenarios of failure modes and demonstrate that failures, or sequences of failures, do not affect the availability of the common network.

Core Layer

There shall be resiliency built into the Core network such that no single point of failure will cause a loss of connectivity to any network switch or router after a period of reconvergence.

Resilient, diverse path links shall be utilised within the Core and Distribution Layers to ensure the availability of the Common Network.

All routing and switching functions within the Core network shall be resilient; all nodes within the Core network shall operate in a hot standby system.

All layer 3 interfaces shall be shared across active/standby pairs. In the event of failure, the layer 3 function shall pass from one node to the other; for example: Virtual Router Redundancy Protocol.

Where possible, routing protocols shall load balance between nodes.

Wherever possible, routing protocols shall facilitate rapid re-convergence between nodes by leveraging on second best route selection.

Edge Layer

The Edge layer shall consist of stackable based switches. Stacks of switches shall select a primary master for coordination of the stack. The stack shall also select a secondary master; the secondary master shall coordinate the stack in the event of a master failure.

Edge stacks shall uplink to the distribution layer via resilient, diverse paths to separate distribution layer network devices.

7.2.3.4 Scalability

The Converged Data Network shall be designed to be easily scale to accommodate an increase in network traffic and an increase in capacity between devices to meet future demands.

All links within the network shall be designed to be capable of easily increasing capacity by leveraging such functions as IEEE 802.3ad Link Aggregation protocol.

The BMCS Subcontractor shall demonstrate that the addition of switches, routers or field devices can be accomplished without disruption to the Converged Data Network.

The Core network shall be designed with sufficient capacity to include such networks in the future.

7.2.3.5 Capacity

The Converged Data Network shall have the capacity required in order for the network to operate effectively in each area including provision for expansion and spare capacity.

Supervisor engines and router/switch CPU capacity shall be sufficient to support full utilisation of links at nominal operating packet sizes.

Spare capacity of at least 50% shall be provided on all ports, equipment and cables within the Converged Data Network. The minimum capacity of nodes within the Converged Data Network is stated in the table below:

Layer	**Element(s)**	**Minimum Capacity Requirement**
Core	Routers Switches Firewalls	10Gbps between Core/Distribution nodes. 1Gbps all other fibre. 10/100/1000 BaseT on CAT6A ports. 10Gbps
Edge	Switches Field Devices	10/100/1000BaseT on CAT6A ports. 10/100/1000BaseT on Cat6A ports

7.2.3.6 Performance

The BMCS Subcontractor shall provide a network of sufficient performance to cater for applications utilising the Converged Data Network.

The Converged Data Network shall support at least 4 classes of traffic performance levels; Real Time, Gold, Silver and Best Effort.

Real Time Class

The real time traffic class shall be utilised for delay and delay variation sensitive traffic.

It must exhibit the following:

- Strict priority queuing;
- Queuing mechanism to permit priority levels;
- Highest level of priority;
- Admission controlled;
- Bandwidth controlled: limited to 10% of link capacity on customer facing interfaces;
- Violation of bandwidth controls shall be reclassified to Best Effort;
- One-way end-to-end transmission delay of less than 50ms;
- One-way end-to-end transmission variation (jitter) of less than 20ms,
- The Common Network shall shape customer traffic before policing.

Example use: Voice over IP.

Gold Class

The Gold traffic class shall be utilised for high priority traffic.

It shall exhibit the following:

- Queuing mechanism to permit priority levels;
- Second Highest level of priority;
- Admission controlled;
- Bandwidth Controlled (In order to not impede on higher priority traffic);
- Violation of bandwidth controls shall be reclassified to best effort;
- One-way end-to-end transmission delay of less than 100ms;
- The Common Network shall shape customer traffic before policing.

- Example use: CCTV, Video and Video Teleconference.

Silver Class

The Silver traffic class shall be utilised for transactional and interactive traffic.

It shall exhibit the following:

- Queuing mechanism to permit priority levels;
- Third highest level of priority;
- Admission controlled;

- Bandwidth controlled (In order to not impede on higher priority traffic);
- Violation of bandwidth controls shall be reclassified to best effort;
- The common network shall shape customer traffic before policing.

- Example use: User interactive data and business process data.

Best Effort Class

The Best Effort class shall be utilised for all other remaining traffic or traffic which has been reclassified.

It shall exhibit the following:

- Queuing mechanism to permit priority levels,
- Lowest level of priority,
- Bandwidth controlled (In order to not impede on higher priority traffic).

Example use: Bulk transfer, reclassified traffic, etc.

7.2.3.7 Network Security

Network security shall be implemented in line with the Principals security policy and all specifications detailed within this document.

All network devices shall provide secure access control to system administration. All networks nodes shall implement RADIUS based authentication for system administration. There shall be a facility for administering the network in the event the RADIUS server is not available.

The BMCS Subcontractor shall provide redundant configuration Firewalls to facilitate inter-VRF traffic.

The Firewalls shall exhibit the following;

- Comply with all Core network specifications as defined within this document,
- By default deny all traffic between VRF's.
- Explicit rules shall be used to classify traffic which may traverse the Firewall.

7.2.3.8 Open Standards

The Converged Data Network design shall ensure that all devices are compliant with CISCO open standards.

All protocols utilised throughout the Converged Data Network shall not be based on proprietary protocols without the written consent of the Principal.

7.2.4 System Components and Technical Requirements

7.2.4.1 Core switches

Dual network switches shall be provided in the Core network.

The core switch shall meet, but shall not be limited to, the following requirements:

Functionality

- Provide switching at the Core network to the required network segments.
- Shall support Layer 2 and Layer 3 switching/routing.
- Sufficient port capacity shall be provided to interface with the systems above,
- Sufficient bandwidth and switching/CPU capacity shall be provided to interface with the systems above,

Interfaces

- Optical interfaces shall be provided to the interface with the following:
  - Core switches;
  - Core routers;
  - Edge switches;
  - Firewalls Appliances;
  - Modem Appliances.
- Suitable interfaces (optical, copper or otherwise) shall be provided to interface with the following:
  - Building System Servers;
  - VoIP Gateways / Servers
- Sufficient capacity shall be allowed for connectivity to be maintained in the event of a single device or path failure.

Physical Media

- X2 pluggable modules shall be provided for 10Gbps links, connectors shall be standardised throughout the network,
- Small form pluggable (SFP) modules shall be provided for all other optical fibre ports, connectors shall be standardised throughout the network,
- All optical ports shall be suitable for single mode fibre,
- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.

Layer 2 Functions

- Sufficient capacity shall be provided on each network switch/router for the Core network,
- The switch/router shall be capable of handling sufficient MAC addresses for the Core network,
- The switch/router shall support flow control (IEEE 802.3x),
- The switch/router shall support link aggregation protocol (IEEE 802.3ad),
- The switch/router shall support the ARP protocol,
- The switch/router shall support VRRP.

VLAN Functions

- The switch shall support Virtual LANs (IEEE 802.1q),

- The switch shall support VLAN management protocols (GARP, GVRP),
- Sufficient VLAN IDs shall be supported on the switch for the Core Layer.

Spanning Tree

- The switch/router shall support STP, RSTP and MSTP.

Layer 3 Functions

- The switch/router shall support static and dynamic routing protocols; at a minimum: RIPv2, OSPF, IS-IS and BGP,
- The switch/router shall support DHCP forwarding.

Multicast

- The switch/router shall support IGMP,
- The switch/router shall support Protocol Independent multicast (PIM),
- The switch/router shall support Multicast over the network.
- The switch/router shall support Network Address Translation,

Traffic Control and Quality of Service

- The switch/router shall support a strict protocol queuing,
- The switch/router shall support traffic Shaping (rate limiting),
- The switch/router shall support Scheduling Algorithms (WFQ, Class Based Queuing, WRR, DWRR),
- The switch/router shall support congestion avoidance algorithms (RED, WRED, traffic policing).

Network Management Features

- The switch/router shall support remote administration and diagnostics (Telnet, SSH HTTP/HTTPS/FTP),
- A separate VLAN (Edge) shall be provided for network management,
- The switch/router shall support SNMP,
- The switch/router shall support an additional, local, out of band administration port for local diagnostics via serial or Ethernet.

Security Features

- The switch/router shall support IEEE 802.1x,
- The switch/router shall support the use of ACLs.
- The switch/router shall support the binding of any combination of IP address, MAC address, ports or VLANs,

Environmental Requirements

- The switch/router must be effective at operating temperatures of 16° to 26°C (AS2834, Type 1),
- The switch/router must be effective at operating relative humidity of 40% to 70% (AS2834 Type 1),
- The physical dimension shall be suitable for installation into a standard 19 inch equipment enclosure or rack,

- The switch/router shall operate more than one cooling fan,
- The switch/router shall provide front to back air flow; or,
- If the switch/router supports side to side air flow, suitable air ducting shall be provided to extract exhaust air to the rear of the equipment enclosure.

Power Requirements

- The switch/router shall have redundant power modules, each power module shall be capable of supporting the full load of the switch/router,
- The power module shall be hot swappable,
- Independent power isolation switches shall be provided for each power module,

Redundancy

- 1:1 redundancy in processor modules shall be provided,
- 1:1 redundancy of switch modules and line cards shall be provided,
- Processor modules shall support graceful handover for servicing,
- Processor modules shall support state synchronisation.

Other Requirements

- All switch modules including processor modules and interface line cards shall be hot swappable,

Installation Requirements

- The Contractor shall install all equipment in accordance with AS3080,
- All optical fibre patch cords connected to the switch interfaces shall be terminated on a fibre patch panel,
- All copper patch cords connected to the switch interfaces shall be terminated on a copper patch panel,
- All cabling to the switch shall be clearly labelled,
- Routing of patch cords into the switch shall not impede the removal of individual modules and line cards for the purpose of servicing.
- All equipment shall be mounted in a 19 inch equipment enclosure,
- All chassis shall be permanently attached and marked tag with the name of the unit, model number, manufactures name and address, part number and serial number,
- Chassis mount units shall be removable with no risk of damage to other units during replacement,
- All connections and connectors to the unit shall be provided on the front panel,
- All Ethernet 10/100/1000 BaseT connections shall be with RJ45 jacks,
- All fibre connections at switches shall be standard connectors, the same connector shall be used throughout the network.
- For fibre connectors, LC connecters are preferred.

Testing Requirements

- The Contractor shall submit testing plans to demonstrate that all features detailed in this specification are in correct operation,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,
- All equipment shall be tested in the manufacturers test facility to demonstrate that all individual modules interface correctly. The factory test shall certify that the equipment complies with specification IEEE802,

The following test shall be performed on all equipment upon installation;

- Power up the equipment and ensure all components pass the system POST test;
- Ensure all components have been installed correctly and recognised by the system;
- Upon connection to other switches, routers or equipment, ensure all interfaces and protocols are performing to specification;
- Verify that all LEDs and Alarm indicators are operational;
- Verify that all Alarms are properly recognised by the NMS.

The following shall be conducted after the network has been configured with all IP address parameters, routing protocols, forwarding protocols, layer 2 switching protocols to the various network nodes.

- Verify that no single point of failure of the core layer shall affect the performance of the network;
- Verify that all protocols operate as expected;
- Verify that all protocols operate as expected under fault conditions;
- For each data interface on the network, perform a performance test;
- For each data interface on the network, perform an error test;

7.2.4.2 Edge Switches

Edge network switches shall be provided in stack configurations in the Distribution Layer and Access layer when located within a dedicated communications room.

Edge network switches shall be provided in wall-mounted configurations in the Access Layer when located within a riser or non-conditioned space. These shall be Hirschmann MS30 switches **(or equivalent),** with backplane and fibre/copper patch panel modules (MM22POE for copper and MM4-2TX for fibre), within a Rack Technologies enclosure **(or equivalent)** Provide all required power supplies.

The Edge switch shall meet, but shall not be limited to, the following requirements:

Functionality

- Provide switching at the Access layer to the required network segments;
- Shall support Layer 2 switching;
- Switches shall support PoE/PoE+;

- Provide an interface with the following:
  - Core network switches;
  - Field Terminated devices (Power meters, network gateways, PLC's etc).
- Sufficient port capacity (+25% spare) shall be provided to interface with the systems above including,
- Sufficient bandwidth and switching/CPU capacity shall be provided to interface with the systems above.

Interfaces

- Optical interfaces shall be provided to the interface with the following:
  - Core Switches;
- Suitable interfaces (optical, copper or otherwise) shall be provided to interface with the following:
  - Field Terminated devices (Power meters, network gateways, PLC's etc).
- Sufficient capacity to the Distribution layer shall be allowed for connectivity to be maintained in the event of a single device or path failure.

Physical Media

- Small form pluggable (SFP) modules shall be provided for all other optical fibre ports, connectors shall be standardised throughout the network,
- All optical ports shall be suitable for multi-mode fibre,
- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.

Layer 2 Functions

- Sufficient capacity shall be provided on each network switch for the Access network,
- The switch shall be capable of handling sufficient MAC addresses for the Access network,
- The switch shall support flow control (IEEE 802.3x),
- The switch shall support link aggregation protocol (IEEE 802.3ad),
- The switch shall support the ARP protocol.

VLAN Functions

- The switch shall support Virtual LANs (IEEE 802.1q),
- The switch shall support VLAN management protocols (GARP, GVRP),
- Sufficient VLAN IDs shall be supported on the switch for the Distribution Layer.

Spanning Tree

- The switch shall support STP, RSTP and MSTP.

Multicast

- The switch shall support IGMP,
- The switch shall support Multicast.

Traffic Control and Quality of Service

- The switch shall support a IEEE 802.1p,
- The switch shall priority queuing.

Network Management Features

- The switch shall support remote administration and diagnostics (Telnet, SSH HTTP/HTTPS/FTP),
- A separate VLAN (Edge) shall be provided for network management,
- The switch shall support SNMP,
- The switch shall support an additional, local, out of band administration port for local diagnostics via serial or Ethernet.

Security Features

- The switch shall support IEEE 802.1x,
- The switch shall support the use of ACLs.
- The switch shall support the binding of any combination of IP address, MAC address, ports or VLANs,

Environmental Requirements

- The switch must be effective at operating temperatures of 16° to 26°C (AS2834, Type 1) for Distribution Layer Switches,
- The switch must be effective at operating temperatures of -5° to 45°C for Access Layer Switches mounted within non-conditioned spaces (eg. Risers).
- The switch must be effective at operating relative humidity of 0% to 95%,
- The physical dimension shall be suitable for installation in a wall mounted enclosure,
- The switch shall operate more than one cooling fan.

Power Requirements

- The switch shall have redundant power modules, each power module shall be capable of supporting the full load of the switch,
- The power module shall be hot swappable,
- Independent power isolation switches shall be provided for each power module.

Redundancy

- 1:1 redundancy in processor modules shall be provided,
- 1:1 redundancy in fibre uplinks shall be provided.

Other Requirements

- All switch modules including processor modules and interface line cards shall be hot swappable.

Installation Requirements

- The Contractor shall install all equipment in accordance with AS3080,

- All optical fibre patch cords connected to the switch interfaces shall be terminated on a fibre patch panel,
- All copper patch cords connected to the switch interfaces shall be terminated on a copper patch panel,
- All cabling to the switch shall be clearly labelled,
- Routing of patch cords into the switch shall not impede the removal of individual modules and line cards for the purpose of servicing.
- All equipment shall be mounting in a 19 inch equipment enclosure,
- All chassis shall be permanently attached and marked tag with the name of the unit, model number, manufactures name and address, part number and serial number,
- Chassis mount units shall be removable with no risk of damage to other units during replacement,
- All connections and connectors to the unit shall be provided on the front panel,
- All Ethernet 10/100/1000 BaseT connections shall be with RJ45 jacks,
- All fibre connections at switches shall be standard connectors, the same connector shall be used throughout the network.
- For fibre connectors, LC connecters are preferred.

Testing Requirements

- The Contractor shall submit testing plans to demonstrate that all features detailed in this specification are in correct operation,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,
- All equipment shall be tested in the manufacturers test facility to demonstrate that all individual modules interface correctly. The factory test shall certify that the equipment complies with specification IEEE802,
- The following test shall be performed on all equipment upon installation;
    - Power up the equipment and ensure all components pass the system POST test;
    - Ensure all components have been installed correctly and recognised by the system;
    - Upon connection to other switches, routers or equipment, ensure all interfaces and protocols are performing to specification;
    - Verify that all LEDs and Alarm indicators are operational;
    - Verify that all Alarms are properly recognised by the NMS.

The following shall be conducted after the network has been configured with all IP address parameters, routing protocols, forwarding protocols, layer 2 switching protocols to the various network nodes:

- Verify that all protocols operate as expected;

- Verify that all protocols operate as expected under fault conditions;
- For each data interface on the network, perform a performance test;
- For each data interface on the network, perform an error test;

7.2.4.3 Firewall Appliances

Dual Firewall appliances shall be provided in the Core network.

The Firewall shall meet, but shall not be limited to, the following requirements:

Functionality

- Provide inter-VRF traffic at the Distribution layer.
- Shall support Layer 2 and Layer 3 switching/routing.
- Provide an interface to the Core network nodes.
- Sufficient port capacity shall be provided to interface with the systems above.
- Sufficient bandwidth and switching/CPU capacity shall be provided to interface with the systems above.

Interfaces

- Suitable interfaces (optical, copper or otherwise) shall be provided to interface with the following:
- Core nodes.
- Sufficient capacity shall be allowed for connectivity to be maintained in the event of a single device or path failure.

Physical Media

- X2 pluggable modules shall be provided for 10Gbps links, connectors shall be standardised throughout the network,
- Small form pluggable (SFP) modules shall be provided for all other optical fibre ports, connectors shall be standardised throughout the network,
- All optical ports shall be suitable for single mode fibre,
- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.

Layer 2 Functions

- The Firewall shall be capable of handling sufficient MAC addresses for the Core network,
- The Firewall shall support the ARP protocol.

VLAN Functions

- The Firewall shall support Virtual LANs (IEEE 802.1q),
- The Firewall shall support VLAN management protocols (GARP, GVRP),
- Sufficient VLAN IDs shall be supported on the Firewall for the Core network.

Layer 3 Functions

- The Firewall shall support static and dynamic routing protocols; at a minimum: RIPv2, OSPF, IS-IS and BGP,
- The Firewall shall support Network Address Translation.

Network Management Features

- The Firewall shall support remote administration and diagnostics (Telnet, SSH HTTP/HTTPS/FTP),
- A separate VLAN shall be provided for network management,
- The Firewall shall support SNMP,
- The Firewall shall support an additional, local, out of band administration port for local diagnostics via serial or Ethernet.

Security Features

- The Firewall shall support IEEE 802.1x,
- The Firewall shall support the use of ACLs.
- The Firewall shall support the binding of any combination of IP address, MAC address, ports or VLANs,
- The Firewall shall support firewall polices to be built with IP address, MAC address, protocol, port number as either a destination or source attribute.
- The Firewall shall support both dropping and denying network traffic.

Environmental Requirements

- The Firewall must be effective at operating temperatures of 16° to 26°C (AS2834, Type 1),
- The Firewall must be effective at operating relative humidity of 40% to 70% (AS2834 Type 1),
- The physical dimension shall be suitable for installation into a standard 19 inch equipment enclosure or rack,
- The Firewall shall operate more than one cooling fan,
- The Firewall shall provide front to back air flow; or,
- If the Firewall supports side to side air flow, suitable air ducting shall be provided to extract exhaust air to the rear of the equipment enclosure.

Power Requirements

- The Firewall shall have redundant power modules, each power module shall be capable of supporting the full load of the switch,
- The power module shall be hot swappable,
- Independent power isolation switches shall be provided for each power module.

Redundancy

- There shall be two Firewalls connected to the two redundant routers.
- Configuration of the Firewall shall be synchronised.

<u>Installation Requirements</u>

- The Contractor shall install all equipment in accordance with AS3080,
- All optical fibre patch cords connected to the Firewall interfaces shall be terminated on a fibre patch panel,

- All copper patch cords connected to the Firewall interfaces shall be terminated on a copper patch panel,
- All cabling to the Firewall shall be clearly labelled,
- Routing of patch cords into the Firewall shall not impede the removal of individual modules and line cards for the purpose of servicing.
- All equipment shall be mounting in a 19 inch equipment enclosure,
- All chassis shall be permanently attached and marked tag with the name of the unit, model number, manufactures name and address, part number and serial number,
- Chassis mount units shall be removable with no risk of damage to other units during replacement,
- All connections and connectors to the unit shall be provided on the front panel,
- All Ethernet 10/100/1000 BaseT connections shall be with RJ45 jacks,
- All fibre connections at the Firewall shall be standard connectors, the same connector shall be used throughout the network.
- For fibre connectors, LC connecters are preferred.

Testing Requirements

- The Contractor shall submit testing plans to demonstrate that all features detailed in this specification are in correct operation,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,
- All equipment shall be tested in the manufacturers test facility to demonstrate that all individual modules interface correctly. The factory test shall certify that the equipment complies with specification IEEE802.

The following test shall be performed on all equipment upon installation;

- Power up the equipment and ensure all components pass the system POST test;
- Ensure all components have been installed correctly and recognised by the system;
- Upon connection to other switches, routers or equipment, ensure all interfaces and protocols are performing to specification;
- Verify that all LEDs and Alarm indicators are operational;
- Verify that all Alarms are properly recognised by the NMS.

The following shall be conducted after the network has been configured with all IP address parameters, routing protocols, forwarding protocols, layer 2 switching protocols to the various network nodes.

- Verify that no single point of failure of the core layer shall affect the performance of the network;
- Verify that all protocols operate as expected;
- Verify that all protocols operate as expected under fault conditions;

- For each data interface on the network, perform a performance test;
- For each data interface on the network, perform an error test.

7.2.4.4 ADSL2/2+ and Fibre Modem

Dual modems shall be provided in the Core network.

The modems shall meet, but shall not be limited to, the following requirements:

Functionality

- Shall provide access to the internet.
- Sufficient port capacity shall be provided to interface with the Core router.
- Sufficient bandwidth and CPU capacity shall be provided to interface with the systems above.

Interfaces

- Suitable interfaces (optical, copper or otherwise) shall be provided to interface with the following:
  - Core routers;
  - Sufficient capacity shall be allowed for connectivity to be maintained in the event of a single device or path failure.

Physical Media

- X2 pluggable modules shall be provided for 10Gbps links, connectors shall be standardised throughout the network,
- Small form pluggable (SFP) modules shall be provided for all other optical fibre ports, connectors shall be standardised throughout the network,
- All optical ports shall be suitable for single mode fibre,
- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.

Network Management Features

- The modem shall support remote administration and diagnostics (Telnet, SSH HTTP/HTTPS/FTP),
- The modem shall support SNMP,
- The modem shall support an additional, local, out of band administration port for local diagnostics via serial or Ethernet.

Environmental Requirements

- The modem must be effective at operating temperatures of 16° to 26°C (AS2834, Type 1),
- The modem must be effective at operating relative humidity of 40% to 70% (AS2834 Type 1),
- The physical dimension shall be suitable for installation into a standard 19 inch equipment enclosure or rack,
- The modem shall operate more than one cooling fan,
- The modem shall provide front to back air flow; or,

- If the modem supports side to side air flow, suitable air ducting shall be provided to extract exhaust air to the rear of the equipment enclosure.

Installation Requirements

- The Contractor shall install all equipment in accordance with AS3080,
- All copper patch cords connected to the modem interfaces shall be terminated on a copper patch panel,
- All cabling to the modem shall be clearly labelled,
- All equipment shall be mounted in a 19 inch equipment enclosure,
- All chassis shall be permanently attached and marked tag with the name of the unit, model number, manufactures name and address, part number and serial number,
- Chassis mount units shall be removable with no risk of damage to other units during replacement,
- All connections and connectors to the unit shall be provided on the front panel,
- All Ethernet 10/100/1000/10Gb BaseT connections shall be with RJ45 jacks.
- All fibre connections shall be by 10GbBaseFX to server equipment.

Testing Requirements

- The Contractor shall submit testing plans to demonstrate that all features detailed in this specification are in correct operation,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,
- All equipment shall be tested in the manufacturers test facility to demonstrate that all individual modules interface correctly. The factory test shall certify that the equipment complies with specification IEEE802,
- The following test shall be performed on all equipment upon installation;
- Power up the equipment and ensure all components pass the system POST test;
- Ensure all components have been installed correctly and recognised by the system;
- Upon connection to other switches, routers or equipment, ensure all interfaces and protocols are performing to specification;
- Verify that all LEDs and Alarm indicators are operational;
- Verify that all Alarms are properly recognised by the NMS.

The following shall be conducted after the network has been configured with all IP address parameters, routing protocols, MPLS forwarding protocols, layer 2 switching protocols to the various network nodes.

- Verify that no single point of failure of the core layer shall affect the performance of the network;
- Verify that all protocols operate as expected;
- Verify that all protocols operate as expected under fault conditions;

- For each data interface on the network, perform a performance test;
- For each data interface on the network, perform an error test;

7.2.4.5 Programmable Logic Controllers (PLC's)

The PLC's shall be provided to integrate digital I/O signals onto the Common Network and provide control and monitoring functionality.

The PLC's shall meet, but shall not be limited to, the following requirements:

Functionality

- Provide digital input and output interfaces to the required services equipment;
- Provide pulse counters for water and gas meters;
- Provide RS232/485 IP gateways as required;
- Internal non-volatile storage sufficient to retain 60 days of measured values;
- Interface to NTP to time-stamp events;
- Provide an interface with the following:
  - Edge switches;
  - RS-232/485 field equipment;
  - Field Terminated devices.
  - Chassis' are to be sized for additional 20% increase in modules.

Interfaces

- Copper interfaces shall be provided to the interface with the following:
  - Edge Switches;
- Suitable interfaces (copper) shall be provided to interface with the following:
  - RS-232/485 field equipment;
  - Field Terminated devices.
- Sufficient capacity to the Access layer shall be allowed for connectivity to be maintained in the event of a single device or path failure.
- Communications to be performed by Ethernet/IP adaptors between controllers and servers.

Physical Media

- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.
- Modules are to be installed as required with 25% spare I/O capacity and are to come complete with a removable terminal block (RTB) – screw type. Key all RTB's using a unique pattern to ensure inadvertent mismatch in module replacement type.
- Provide suitable terminal blocks for control cabling field cabling terminations.

Environmental Requirements

- The switch must be effective at operating temperatures of -5° to 45°C

- The switch must be effective at operating relative humidity of 0% to 95%,
- The physical dimension shall be suitable for installation in a wall-mounted enclosure,
- The switch shall operate more than one cooling fan.

Power Requirements

- The switch shall have redundant power modules, each power module shall be capable of supporting the full load of the switch,
- The power module shall be hot swappable,
- Independent power isolation switches shall be provided for each power module,
- Power supplies are to be provided with 20% additional capacity and supplied at 24VDC to the control section of all services boards to ensure isolation of all parts from dangerous voltages.
- All PLC's to be served by an uninterruptible power supply (UPS)/battery back-up system for a period of no less than 24 hours. Refer to electrical services specifications for requirement and coordinate with electrical contractor.

Redundancy

- 1:1 redundancy in processor modules shall be provided,
- 1:1 redundancy in fibre uplinks shall be provided.

Other Requirements

- All switch modules including processor modules and interface line cards shall be hot swappable.

Testing Requirements

- The Contractor shall submit testing plans to demonstrate that all features detailed in this specification are in correct operation,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,
- All equipment shall be tested in the manufacturers test facility to demonstrate that all individual modules interface correctly. The factory test shall certify that the equipment complies with specification IEEE802.

The following test shall be performed on all equipment upon installation;

- Power up the equipment and ensure all components pass the system POST test;
- Ensure all components have been installed correctly and recognised by the system;
- Upon connection to other switches, routers or equipment, ensure all interfaces and protocols are performing to specification;
- Verify that all LEDs and Alarm indicators are operational;
- Verify that all Alarms are properly recognised by the NMS.

The following shall be conducted after the network has been configured with all IP and RS232/485 address parameters, routing protocols, forwarding protocols, switching protocols to all nodes.

- Verify that all protocols operate as expected;
- Verify that all protocols operate as expected under fault conditions;
- For each data interface on the network, perform a performance test;
- For each data interface on the network, perform an error test.

7.2.4.6 RS-485 Control Cabling

All control cabling to be a minimum of 1.5mm² with grey colouring for control conductors and black colouring for neutral conductors. All cabling to have low-smoke zero halogen.

All connections to be of a screw-type terminal, with terminal covers.

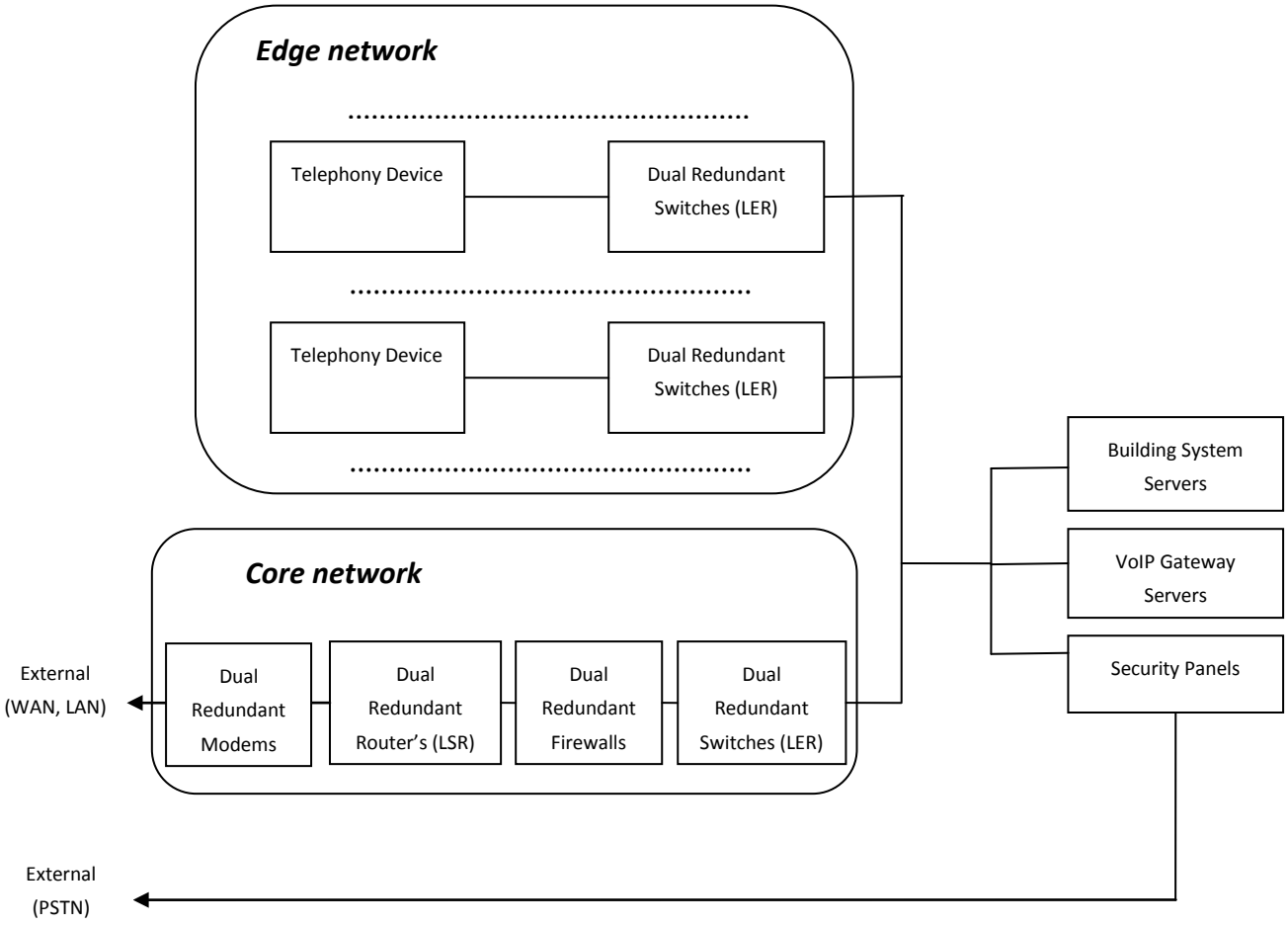
Control cabling shall be run in cable pairs to allow a redundant control path for each device on the system. Utilise communications controllers equipped to cater for

7.3 IP Telephony

7.3.1 Introduction

The Voice Communications System will provide a minimum of two-party full duplex voice communications among the telephone handsets based within the building. The voice communication system, and associated handsets, provides the intercom functionality.

7.3.2 Architecture



7.3.3 Functional Requirements

The system will fulfil the following functional and performance requirements:

- The system will be a robust, simple and easy-to-use system,
- It will be of high quality in audio performance in providing clear and audible two-way voice communications among the telephone handsets,
- It will be a reliable and safe system and will be built with resilience in system architecture to increase system reliability,
- It will be modular in design, scalable and expandable,
- It will be designed based on common standards in communication protocols, voice compression standards, encoding/decoding standards, etc,
- It will be designed based on leading access technology e.g. Voice over Internet Protocol (VoIP),
- It will make use of the Converged Data Network,
- Telephone handsets will be provided for tenants requesting a service from the base-building,

- A selected number of models will be selected from the product range based on tenant requirements. Different models of telephone handset will be provided to different users based on their needs.

7.3.4 System Components and Technical Requirements

The system consists of the core telephone gateways/servers with power supplies (backed up by UPS), Operator Workstations, telephone handsets of various models and interface modules required to interface with other systems such as the Intercom System. Users shall be able to leave voice messages to the telephone handsets when they are unable reach the called party.

The core telephone equipment in communications rooms will be built with dual central processing units, memory and switching back planes so that the failure of any major unit in the core equipment does not affect the normal operation of the system.

7.3.4.1 IP Telephones

The IP Telephones shall meet, but not limited to, the following requirements:

- Provide telephony access to internal and external extensions,
- Provide LCD display or similar,
- Display digits or extension numbers when calls are received or initiated,
- Provide shortcut keys for ease of dialling,
- Sufficient display, shortcut keys and user interfaces for the particular work function where the telephone shall be installed,
- Suitable to be installed on walls and desks,
- Suitable to be installed in desk-based work environments,
- Suitable interface(s) (optical, copper or otherwise) shall be provided to interface with the Common Data Network,
- Shall be capable of adjusting ring and ear piece volume control,
- Shall be capable of hands free operation,
- Shall be capable of muting the microphone,
- Shall utilise Power-over-Ethernet (POE) technology.

7.3.4.2 Gateways and Servers

The voice gateways and/or voice servers shall meet, but not limited to, the following requirements:

- Shall provide an Interface with the common data network,
- Suitable interfaces (optical, copper or otherwise) shall be provided to interface with the following:
    - Converged Data Network,
    - Sufficient capacity to handle the volume of handsets and simultaneous calls expected throughout the domestic terminal,

- The gateway/server shall support SNMP,
- Small form pluggable (SFP) modules shall be provided for all other optical fibre ports, connectors shall be standardised throughout the network,
- All optical ports shall be suitable for single mode fibre,
- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.
- The gateway/server shall be effective at operating temperatures of 16° to 26°C (AS2834, Type 1),
- The gateway/server shall be effective at operating relative humidity of 40% to 70% (AS2834 Type 1),
- The physical dimension shall be suitable for installation into a standard 19 inch equipment enclosure or rack,
- The gateway/server shall operate more than one cooling fan,
- The gateway/server shall provide front to back air flow; or,
- If the gateway/server supports side to side air flow, suitable air ducting shall be provided to extract exhaust air to the rear of the equipment enclosure.
- The gateway/server shall have Redundant power modules, each power module shall be capable of supporting the full load of the switch,
- The power module shall be hot swappable,
- Independent power isolation switches shall be provided for each power module,
- 1:1 redundancy in processor modules shall be provided,
- 1:1 redundancy of switch modules and line cards shall be provided,
- Redundant processors and modules/line cards shall be located in physically separate rooms,
- All switch modules including processor modules and interface line cards shall be hot swappable,
- The Contractor shall install all equipment in accordance with AS3080,
- The Contractor shall propose relevant tests to be performed at FAT, POP and SIT,

The following test shall be performed on all equipment upon installation:

- Power up the equipment and ensure all components pass the system POST test,
- Ensure all components have been installed correctly and recognised by the system,
- Verify that all LEDs and Alarm indicators are operational.

The following shall be conducted after the network has been configured with all IP address parameters, routing protocols, MPLS forwarding protocols, layer 2 switching protocols to the various network nodes:

- Verify that no single point of failure of the core layer shall affect the performance of the network,
- Verify that all protocols operate as expected,
- Verify that all protocols operate as expected under fault conditions,
- For each data interface on the network, perform a performance test,
- For each data interface on the network, perform an error test,

7.4 Building Systems Server Equipment

7.4.1 Introduction

The building systems servers provide the Virtual Machine Hosts, Virtual Machine Client, SQL Databases that collect, process, store and analyse the operational information and building system controls. It shall provide resource management tools needed by building operators.

The system shall converge disparate system information from the Virtual Clients and provided a unified front-end, complete with Building system

The scope of works for the Servers includes the following:

- Provide dual redundant server equipment to accommodate the building systems processing and interfaces,
- Provide software to enable a virtual machine

7.4.2 Architecture

The building system will have a virtual server configuration. The server configuration will consist of a minimum of four (4) servers providing a dual redundant system. The serves and associated storage devices will be located in the Central Equipment Room.

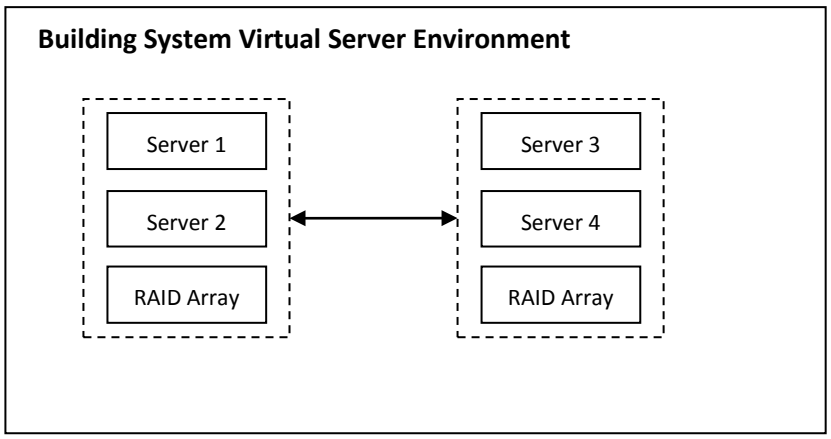
The system shall comprise of the two servers located within the Central Comms Room with the future capability for an additional server to be located in an off-site location (eg. A data centre).

The network architecture shall be as follows:

- Dual servers with dual network attachment to provide resilience due to the critical nature of the system.
- Storage Area Network (SAN) equipment to provide storage for up to 10 years of full back-up of in a RAID 5/6 configuration.
- Option of private Gigabit and Serial Heartbeat over fibre.

An interface to the existing FIDS network will need to be provided to enable transport from the proposed workstations to the existing AIMS servers. The existing AIMS devices including servers and displays can be migrated onto the common network platform in the future.

The physical configuration is described below.



Each of the services that are included in the Converged Data Network are fed into the building systems virtual server. The majority of the services consist of a client-server configuration, with the server software located in their individual virtual machine. These virtual machines will pass on the relevant indication data to the SCADA virtual machine. The interfacing systems

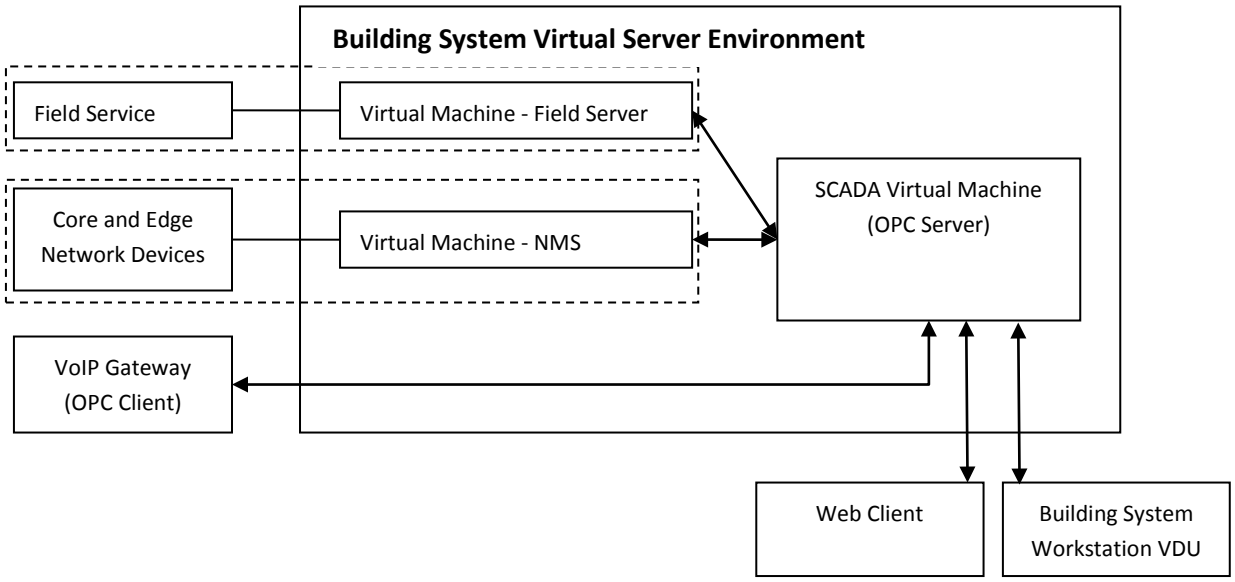
The following is an indicative outline of the virtual machines that will exist on the server environment.

1. Virtual Machine – Lighting Control System
2. Virtual Machine – SCADA (Gas, Water, Hydraulic Metering, Electrical Control and Indications)
3. Virtual Machine – Intercom
4. Virtual Machine – Security (CCTV)
5. Virtual Machine – Emergency and Exit Lighting
6. Virtual Machine – Mechanical DCC Outlets
7. Virtual Machine – Fire Panel Indications
8. Virtual Machine – Network Management System
9. Virtual Machine - Lift interface

The following is an indicative list of the systems that do not require a virtual machine but will instead be directly accessed by the SCADA virtual machine for indications and controls (where applicable) or monitored directly by a BMCS DDC controller.

1. Gas Metering
2. Water Metering
3. Electrical Control and Indications
4. VoIP Gateway
5. UPS’s

Logically, the architecture of the building systems virtual server environment is shown below.



7.4.3 System Components and Technical Requirements

7.4.3.1 Servers

Provide dual-redundant configuration servers and include all programs and licenses installed to mirror these units.

All server minimum performance specifications shall be as per the software manufacturers recommended specifications. Hard drive configurations to be provided with RAID controllers and drives.

Indicative server min. specification requirements are as follow:-

- CPU - Quad-core 3.0 GHz Xeon (with virtualization technology)
- RAM - 8 GB +
- Hard drives > 3 x 500 GB in RAID 5 formatted using NTFS
- Ethernet - 10 Gigabit Fibre;
- 19” Rack –mounted unit;

Major disk space requirements include:

- 20 GB for Windows, front-end system components, and 100,000 online events;
- Event Archiving;
- History Archiving;

- Typical custom displays, which require between 30 and 120 KB (However, if they include imported bitmaps or other graphic files, their size may increase dramatically, to the order of 500 KB.)

Interfaces

- Single-mode fibre interfaces shall be provided to interface with the following:
  - SAN via SONET/SDH;
  - Core network.
  - Sufficient capacity to the Core network shall be allowed for connectivity to be maintained in the event of a single device or path failure.
  - Communications to be performed by Ethernet/IP adaptors between controllers and servers.

Physical Media

- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.
- Modules are to be installed as required with 25% spare I/O capacity and are to come complete with a removable terminal block (RTB) – screw type. Key all RTB's using a unique pattern to ensure inadvertent mismatch in module replacement type.
- Provide suitable terminal blocks for control cabling field cabling terminations.

7.4.3.2 Storage Area Network

Provide dual-redundant configuration SAN's including all licenses.

Minimum performance specifications shall be as per the software manufacturers recommended specifications. Hard drive configurations to be provided with RAID controllers and drives.

The Virtual Host Operating System shall be currently Windows Server 2008 R2.

Indicative server specification requirements are as follow:-

- The RAM requirements increase by 256 MB if the computer has multiple displays.
- CPU - Quad 3.0 GHz Xeon
- RAM - 8 GB +
- Hard drive > 2 x 500 GB in RAID 1 formatted using NTFS
- Ethernet - 10 Gigabit
- Rack –mounted;

Major disk space requirements include:

- 10 GB for Windows, SCADA system components, and 100,000 online events
- 10 GB per
- Event Archiving
- History Archiving

- Typical custom displays, which require between 30 and 120 KB (However, if they include imported bitmaps or other graphic files, their size may increase dramatically, to the order of 500 KB.)

Interfaces

- Single-mode fibre (fabric) interfaces shall be provided to interface with the following:
  - Server Equipment;
  - Sufficient capacity to the Access layer shall be allowed for connectivity to be maintained in the event of a single device or path failure.
  - Communications to be performed by Ethernet/IP adaptors between controllers and servers.

Physical Media

- Registered Jack (RJ) 45 interfaces shall be provided for all non-optical ports.
- Modules are to be installed as required with 25% spare I/O capacity and are to come complete with a removable terminal block (RTB) – screw type. Key all RTB's using a unique pattern to ensure inadvertent mismatch in module replacement type.
- Provide suitable terminal blocks for control cabling field cabling terminations.

7.4.3.3 Network Management

The BMCS Subcontractor shall provide a Network Management System (NMS). All nodes on the Common Network shall report alarms or state changes to the NMS.

The NMS shall exhibit the following:

- Comply with all Distribution Layer specifications as defined within this document
- Automated remote download and backup of network equipment configuration,
- Automated backup of the NMS configuration and device information,
- Centralised reporting of alarms and traps advertised by the network,
- Automated batch configuration for updating of equipment configuration,
- Bandwidth monitoring of all Core and Distribution interfaces: The NMS shall alarm with any interface incurs a breach of 70% average utilisation,
- Quality of Service monitoring on all Core and Distribution devices: The NMS shall alarm when delay between any two nodes exceeds 70ms average or 150ms peak.
- Quality of Service monitoring on all Core and Distribution devices: The NMS shall alarm when delay variation between any two nodes exceeds 20ms average or 40ms peak,
- An external interface for Alarm monitoring, for example: Email notification, visual and/or audible notification, pager or SMS notification.

The NMS shall meet, but shall not be limited to, the following requirements:

Functionality

- Provide a means for monitoring the status of the network,
- Provide a means for automated backup of device configuration,
- Provide a means for batch configuration changes,
- Provide alarm information in the event of failure,
- Provide a network map view for ease of management,
- Provide an interface with the following:
  - Core network nodes,
  - Sufficient port capacity shall be provided to interface with the systems above,
  - Sufficient bandwidth and switching/CPU capacity shall be provided to interface with the systems above,

Network Management Features

- The NMS shall support remote administration and diagnostics (Telnet, SSH HTTP/HTTPS/FTP),
- A separate VLAN shall be provided for network management,
- The NMS shall support SNMP,

Security Features

- The NMS shall support the use of ACLs.

7.4.3.4 Server Software and Applications

The BMCS Subcontractor shall provide the following installed software on each of the dual redundant servers:-

- The Virtual Host Operating System shall be Windows Server 2008 R2;
- Microsoft SQL Server 2008 R2;
- VMWare vCentre Server/vSphere;
- Symantec Enterprise AntiVirus;
- Symantec Backup Exec;
- Adobe Reader (current);
- Crystal Reports.

Alternative software packages shall be considered and shall be included in the tender return documentation.

Provide all software licenses for the system, allowing networked licenses for 10-simultaneous users. All licenses are to be not to be locked to individual users.

7.4.3.5 Uninterruptible Power Supplies (UPS)

Operation of an uninterruptible power supply shall be such that in the event of mains failure the equipment supported shall power down in an orderly manner.

An uninterruptible power supply shall be capable of maintaining, in a fully functional mode, its associated devices for a period of 15 mins.

The uninterruptible power supply shall have sealed batteries and include a data connection to the Converged Data Network for monitoring of the following conditions:

- Battery low level.
- Charger fault.
- Mains power status

7.4.3.6 Transient/Spike Protection

All microprocessor based controllers and other electronic equipment such as unitary controllers, personal computers and peripheral equipment and communications equipment, must be capable of withstanding transient disturbances from the input power supply.

Suppressors shall be fitted to all controller input and output points for protection against voltage transients, spikes etc.

The controllers' communication network(s) shall be isolated against transient disturbances via optical couplers or other approved means. Where running between buildings, lightning protection devices shall be installed on the communications network at the point of entry to each building.

7.4.3.7 Electromagnetic Compatibility

All components of and the complete system shall comply with the requirements of BS EN 50 081-1 Generic Emission Standard, BS EN 50 082-1 & 2 Generic Immunity Standard and C-Tick.

In order to avoid corruption of the equipment operation by electrical interference, all wiring shall be installed to minimise coupling of electromagnetic and electrostatic interference on low voltage signals and data wiring. The preferred method of achieving this shall be by ensuring a physical separation of greater than 50mm between the power supply cables and the signal and data cables. Where mixed wiring is unavoidable braided screen mains cable, dressed close to metalwork, is preferred.

The equipment shall be protected from interference by the operation of hand held radio transmitters, radio pagers, etc, within 1 metre of the equipment.

7.4.3.8 Power Supply Tolerances

The equipment supplied shall be suitable for operation on site power supply and the supply voltage and frequency tolerances permitted by the Electricity Supply.

7.5 General Cabling Installation Requirements

Cable pathways shall be independent of any other service and/or support;

Ensure all fixings and support hardware used will support the system when loaded to the full extent of the system rating;

Adhesive-based fastening systems shall not be accepted;

Suspended support systems shall make use of a single central hanger system;

Wall-mounted systems should be installed as close to the wall as possible, but a minimum 25-mm gap shall be left to allow cables to exit the support between the support and the wall;

For backbone systems, a minimum of 600mm clear space for personnel access shall be provided along one side of at 60% of the length of the support system;

For horizontal systems, a minimum of 600mm clear space for personnel access shall be provided along one side of at least 80% of the length of the support system;

Cable support systems shall only be installed over easily accessible areas;

Pathways at risk of vehicular or other impact risk shall be provided with impact protection and reflective striping to minimise risk of damage;

Exposed metallic pathways shall be painted Harbour Blue or such other colour as may be instructed. Powder coating or other alternative protective systems may be submitted for approval;

Within enclosed ceiling spaces and shared risers, provide an adhesive strip of reflective material to each side of the support system, ensuring that it is clear visible. The strip shall be a minimum dimension of 300mm x 40mm. Application shall be repeated every 2m minimum;

All equipment used in the channel shall be from the same supplier and adhere to their warranty requirements;

The maximum fill of a cable tray shall not exceed 50%;

Cable on wire ways and cable trays/ladders should only be tied to these supports using Velcro type ties throughout (unless more onerous requirements are recommended by the manufacturer for that particular System);

- The following securing\routing methodologies are not permitted:
  - Nylon cable ties;
  - Cable stapling;
  - Resting of cables on the underside of roofing tiles;
  - The routing of cables in inaccessible\hazardous areas.

Cable slack of approximately 300mm shall be provided at the user outlet, and shall be in the form of a goose neck;

Cable slack of 3m shall be provided at the CER/FD, and shall be in the form of a goose neck;

Minimum untwist at termination shall not exceed the Manufacturer’s specification;

The minimum bend radius, under no load conditions, shall not be less than four times the cable diameter or the manufacturers recommended, whichever is the greater;

The required minimum bend radius for fibre and copper patch cords shall be followed to the manufacturer’s specification;

There shall be no exposed shielded pairs after termination and only the overall foil shall protrude over the jacket by no more than 10mm;

There shall be a maximum of 4 connections in the full Category 6A channel. This maximum would include two connections in the patching rack, one connection in a consolidation point, and one connection to the end device;

The maximum conduit fill shall not exceed 50%;

The foil of the F/UTP cabling, if applicable, shall be grounded to the telecommunications ground bar in the respective BD and FD

All cables shall be low smoke zero halogen;

Riser cabling shall be secured at least a minimum of once every floor;

Installation of connecting hardware shall comply with the EMI separation requirements for cables described in CIBSE AM7;

Separation between communications LV cabling and light fixtures shall exceed 300mm. If a crossing is required, this shall be at right angles. This minimum separation shall also be maintained from other EMI sources;

The following length requirements apply:

- Maximum horizontal cable length is 90m;
- Minimum horizontal cable length is 15m;
- Maximum total cord length (including work area, equipment and cross-connect cords, if applicable) is 10m;
- Minimum cord length is 1m; and
- The minimum and maximum distance requirements for a cable length between a Consolidation point and Telecommunications outlet shall be to the Manufacturer's specification.

The following minimum distance requirements apply:

- Hot water pipes and other hydraulic services – 300mm;
- Boilers or furnaces (including pipe-work) – 2000mm;
- Fluorescent light fittings and other ballasts – 300mm; and
- Adjacent walls – 25mm.

7.5.1 Applications Supported

Voice grade cabling

The Tenderer shall confirm support for each application using balanced cabling as contained within AS/NZS 3080.

Voice-grade cabling shall support the following applications:

- Digital PBX telephony.
- Analogue Telco Public exchange lines.
- Digital Telco Public exchange lines (e.g. copper based ISDN PRA and BRA).

Category 6A F/UTP

The Tenderer shall confirm support for each application using balanced cabling as contained within AS/NZS 3080 (defined up to 1000 MHz).

Category 7A F/STP shall support the following applications:

- IEEE 802.3 suite of protocols designed to operate using a Category 6A F/UTP end-to-end channel at 10Mbps, 100Mbps, 1Gbps and 10Gbps.
- Serial digital video, using baluns.
- PoE and PoE+
- Digital PBX telephony.
- Analogue Telco Public exchange lines.
- Digital Telco Public exchange lines (e.g. ISDN PRA and BRA).

Multi Mode OM4 Optical Fibre Cabling

Multi-mode OM4 optical fibre cables shall:

- Support all protocols defined in the IEEE 802.3 suite of standards, designed for transmission over multi-mode optical fibre cables to OM4 standard, for the following transmission rates:
  - 10 Mbps.
  - 100 Mbps.
  - 1000 Mbps (1 Gbps).
  - 10Gbps
  - 40Gbps for a fibre channel of total length 125m.
  - 100Gbps for a fibre channel of total length 125m.
- Utilise an MPO connection with LC presentations.

Single Mode OS2 Optical Fibre Cabling

Single mode OS2 (if ratified) optical fibre cables shall support:

- all protocols defined in the IEEE 802.3 suite of standards, designed for transmission over single-mode optical fibre cables to OS1/OS2 standard, for the following transmission rates:
  - 10 Mbps.
  - 100 Mbps.
  - 1000 Mbps (1 Gbps).
  - 10Gbps
  - 40Gbe/100Gbe over 125m

7.5.2 Copper Cables

Category-6A Foil/Shielded Twisted Pair (F/UTP)

Category-6A F/UTP cables shall conform to AS/NZS 3080

Internal grade Category-6A F/UTP or above cables shall be Low Smoke Zero Halogen (LS0H).

7.5.3 Fibre Optic Cables

Multi-Mode Optical Fibre

Multi-mode fibre optic cable shall conform to AS/NZS 3080 for:

- OM4 Fibre (50µm/125µm), 4700 MHz.km @ 850nm. EMB (min.)

Internal grade multi-mode fibre cables shall be LS0H.

Single-Mode Optical Fibre

Single-mode fibre optic cable shall conform to AS/NZS 3080 for OS2 fibre if ratified.

Single-mode fibre optic cable shall conform to AS/NZS 3080 for OS1 fibre if not ratified.

Internal grade multi-mode fibre cables shall be LS0H.

7.5.4 Patch Panels and Consolidation Points

Category 6A F/UTP or above Patch Panels

Category 6A F/UTP or above RJ45 patch panels shall have the following characteristics:

- Suitable for mounting in 19" frames within termination cabinets.
- Fixed using securing bolts and captive nuts at either side.
- With sufficient finger space around connectors to allow patch cables to be connected and disconnected and to allow individual connectors to be mounted and dismounted without disturbing other adjacent connectors.
- Able to accommodate full labelling of every connector.
- With cable support at the rear for dressing individual cables with due consideration for minimum bending radii of cables to avoid permanent indentation of the cable sheath.
- With appropriate protective glands or grommets to provide strain relief for cables entering at the rear.
- Panels shall be front mount only, no more than 400mm front to back, and shall contain return flanges to increase rigidity.
- RJ45 connectors shall be installed with plug locking mechanisms at the top.
- Snap in connectors shall be firmly fixed to the connector cut-out in the panel. Connector layout shall follow consistent pattern to the maximum possible density consistent with ease of installation and maintenance.
- The termination sequence shall be consistent on all racks with the lowest number at the first available termination at the top left of the frame or panel, or allocated portion of the panel.

- Sufficient cable reserve shall be installed such that re-termination of connectors can occur in addition to an allowance for removal and inspection of the complete panels.
- Strain relief shall be provided at each termination such that any strain on the cabinet is not transferred to the electrical contacts in the connector

Optical Fibre Patch Panels and Fibre Termination Blocks

Fibre optic patch panels shall have the following characteristics:

- Suitable for mounting in 19" frames within termination cabinets.
- Fixed using securing bolts and captive nuts at either side.
- Enclosed units, sealed to IP54, front mount only and with no more than 400mm front to back.
- Outlets can be installed complete with housing, adaptors, nuts, strain relief, dust cover, ferrule assemblies and crimp rings.
- Suitable bulkhead adaptors installed where required complete with tight polymer caps to prevent ingress of dust and moisture, suitable location keys and nuts.
- With sufficient finger space around connectors to allow patch cables to be connected and disconnected and to allow individual connectors to be mounted and dismounted without disturbing other adjacent connectors.
- Able to accommodate full labelling of every connector.
- With an internal area for cable management, splicing and cable support, fully accessible for installation and maintenance purposes.
- Cables entering enclosed panels can be protected by appropriate protective glands or grommets and dressable with due consideration for minimum bending radii.
- With strain relief provided at each connector with compression glands or internal clips and entrapment of yarn based impact resistance on each fibre optic cable.
- Any strain on the cable or element shall not be transferred to the connector.
- In the case of panels housing terminations with maintenance access to rear, using sliding, tilting or other mechanism that does not strain the terminated cables or terminations.

7.5.5 Core and Building Distribution Equipment Racks

Equipment cabinets shall have the following characteristics:

- Fabricated from steel or aluminium.
- Minimum useable frame height of 45U (1U=44.45mm) unless otherwise nominated.
- Minimum dimensions of 800mm (width) x 900mm (depth).
- Cable entry supported through the base of the cabinet.
- Cable entry supported through the top of the cabinet.

- A modular plinth kit provided.
- Lockable front and rear doors, with all cabinet keys identical.
- Smoked glass front door and perforated rear door (with documentation wallet).
- Removable side panels.
- 1 No. 150mm tray up each side of the cabinet between the front and rear mounting frames.
- 19” mounting frames adjusted to accommodate the installation of 550mm deep shelves.
- 4No. 550mm deep equipment shelves with front and back supports supplied for each cabinet.
- 1No. 10 way un-switched power strip, mounted vertically at the rear.
- 1No. 300mm tray up each side of the cabinet between the front and rear mounting frames.
- Fitted with a minimum of 4 heat extract fans in the top of the cabinet.
- Vertical cable management to be provided at the front of each cabinet providing 90mm deep patch cord jumper rings at not more than 300mm intervals.
- A minimum of 2 heat extract fans in the top of the cabinet.
- 4 mounting feet provided per cabinet.
- Earth bonding between cabinet components.

7.5.6 Riser Distribution Equipment Cabinets

Edge network switches shall be provided in wall-mounted configurations in the Access Layer when located within a riser or non-conditioned space.

These shall house the Compact Industrial Switches (Hirschmann MS30 switches or equivalent), with backplane and fibre/copper patch panel modules (MM22POE for copper and MM4-2TX for fibre), within a Rack Technologies enclosure (or equivalent). Provide all required power supplies.

7.5.7 Cable Terminations

Category-6A F/UTP Cabling

Category 6A F/UTP cable shall be directly terminated at each end on a Category RJ45, 8 pin, un-keyed sockets as defined in TIA568A.

Optical Fibre Connectors

Optical fibre cables shall be terminated in connectors that conform to AS/NZS 3080. There shall be the following types of optical fibre connector:

- MPO connectors
- LC connectors

The average loss for all connector pairs shall be less than 0.3dB, including the loss due to splicing. The Contractor shall confirm all required fibre connections with the Client before procurement and installation.

7.5.8 Outlet Enclosures

Faceplates

Faceplates shall typically be white PVC with standard cut-outs to accommodate the installation of RJ45 sockets. The Contractor shall coordinate with the Architect, Interior Designer and the Room Data Sheets to confirm colour and wall elevation position. The Contractor shall work with the Services Contractors to confirm location, elevation and types of connection enclosure throughout each Floor.

7.5.9 Cable Testing

Method

The Cabling Contractor shall issue the following information to the Contractor prior to commencing cable testing, in accordance with the agreed installation programme:

- Fully detailed method statements, identifying the manufacturer of test equipment and procedures to be followed for all tests.
- Details of cable testing documentation procedures and samples of the test documentation.
- Sample signatures of all personnel authorised to carry out cable tests.
- Provide proof that all testing equipment has been calibrated by manufacturer within manufacturer dictated timeframes.

Notice

The Cabling Contractor shall provide at least fourteen days notice of the date of commencement of the first cable tests. Additionally, this notice shall be given again if the tests are separated such as to give a week with no testing carried out.

Test Equipment

The model and serial numbers of test equipment used for testing shall be recorded for each relevant test.

Testing

Tests shall be carried out and recorded on every cable installed unless otherwise specified.

Records

Test results shall be recorded electronically and copied to CD-ROM, in their original electronic format, for review by The Client or The Clients Representative. The Cabling Contractor shall free-issue any software necessary to read the test results.

Failures

Failures detected during testing shall be duly noted. All faults shall be rectified and any damaged cables shall be replaced with new cables in complete runs.

Witness Tests

The Client, or The Client's representative, reserves the right to attend site to witness cable tests and complete random sample testing upon completion of tests. Witness testing and random sample testing shall be agreed with The Cabling Contractor prior to commencement

7.5.10 Testing

Objectives

The purpose of testing is to demonstrate that the installed cables meet the appropriate standards of performance.

Category 6A F/UTP

Every Category 6A F/UTP cable shall be tested over the permanent link to confirm performance characteristics as stated in AS/NZS 3080.

Computed test results that indicate that some part of the result is closer to the limit than the tolerance of the test equipment may be noted as 'PASS*' or 'FAIL*'. A 'PASS*' test result shall not be accepted and shall be treated in the same way as a 'FAIL".

The following field parameters shall be tested on 100% of the telecommunications links:

- Wire map, as well as shield continuity
- DC Loop resistance
- Characteristic Impedance
- Attenuation to Cross-talk ratio (ACR)
- Power sum ACR
- Length
- Insertion loss
- Near-End Cross-talk (NEXT) (Both directions)
- Power sum Near-end Cross-talk (PS NEXT) (Both directions)
- Far-End Cross-talk (FEXT) (Both directions)
- Equal Level Far-End Cross-Talk (ELFEXT) (Both directions)
- Power sum Equal Level Far-End Cross-Talk (PSELFEXT) (Both directions)
- Power sum Far-End Cross-Talk (PSFEXT) (Both directions)
- Alien Cross-talk (AXT)
- Return loss (Both directions)
- Propagation delay (Both directions)

- Delay skew

The preceding test parameters shall be measured with a Fluke Networks DTX-1800 or Agilent Technologies WireScope Pro, with current firmware and calibrated to within the factory time frames. Other test units may be considered but must be equivalent to the above equipment and must be approved by the Client or the Clients representative, as well as being compliant with the System Suppliers recommended equipment.

Optical Fibre Cable

Each optical fibre channel shall be tested to confirm (as a minimum) that it meets the insertion loss requirements, as detailed AS/NZS 3080, for the applications detailed in this Specification.

- Multi-mode fibre optic cables shall be tested at 850nm and 1300nm wavelength.
- Tests shall be made in both directions of the installed cable.

For each optical fibre channel the following test results shall be recorded:

- Power Meter Measurements:
  - Overall attenuation (insertion loss) to the nearest 0.1dB in both directions.
  - Confirmation of mapping of fibre cores onto patch panel terminations.
- OTDR Measurements
  - The length of the channel in meters.
  - The loss of each connector and splice in the channel.

Failures

Cables that continually fail tests shall be pulled out and replaced by complete runs of new cable. Cable jointing or running of part segments shall not be accepted.

Test Records

Test results shall be recorded in electronic form on one or more CD ROMs. The Cable Contractor shall free issue any software required to read test results.

Test records shall identify cables under test using the equivalent cable identity to that installed. Alternatively, the Cable Contractor shall provide an electronic schedule of the mnemonics used during tests and cross reference these to the actual (installed) cable identity.

Electronic copies of OTDR test results shall be scaled to allow measurements of insertion loss across all splices and connectors on the link to the nearest 0.1dB. The location of all splices and connectors shall be clearly indicated, along with the measured insertion loss. (These requirements may be generated by the OTDR tester in the form of an event table.)

7.5.11 Labelling and Records

7.5.11.1 General

The general requirements for labelling shall be as defined in AS/NZ 3085.1:1995. Where an existing installation labelling system is established the new system shall be an extension of the existing system.

7.5.11.2 Cable Labels

Place labels on cables during installation to incorporate:

- Identification markers at each end.
- A minimum of three markers at either cable end and labelled on the jackets at intervals of one meter such that the cable can be identified at least three meters beyond the termination points.
- Identification markers at five meter intervals for outdoor cables.

7.5.11.3 Telecommunications Outlet Labels

Label each faceplate using traffolyte labels with black text on a white background with 3.5mm high “Arial” style font. The labels shall identify the originating equipment room and outlet jack number.

Coloured icons provided with the outlets are to be installed to indicate services. Outlet A will be Blue, Outlet B will be Red and Outlet C (where provided) will be left blank. Blue = Voice, Red = data, Blank = spare.

The faceplate will be labelled AA BBBB CC where:

AA - refers to the equipment room that the work area is cabled from.

BBBB - refers to the room number were the work area is located.

CC - refers to the outlet number where there are more than one outlet in a work area.

In addition, the individual sockets in each faceplate shall be identified as alphabetically, i.e. A, B, C.

7.5.11.4 Equipment Room Labels

The FD patch frame shall conform to the following wall frame example:

	B12-539-07-A	B12-539-07-B	B12-539-07-C	B12-539-08-A	B12-539-08-B	B12-539-08-C
	Horizontal UTP Cat-6A Telecommunication Outlets to Building 2 Room 539					
	B12-539-05-A	B12-539-05-B	B12-539-05-C	B12-539-06-A	B12-539-06-B	B12-539-06-C

Where the following are represented:

B12 - refers to the FD.

539 - refers to the space number

07 - refers to the outlet number in this work area

A - refers to socket A in the faceplate

The designation strips for wall mounted termination strips are to be colour coded as follows:

Horizontal F/UTP - Light Blue

Active Data - Purple

Active Voice - Red

Termination information is to be printed in Black onto coloured paper.

7.5.11.5 Records

Provide cable records in both hard copy and soft copy form to an agreed format. Record all details of the cabling system components installed, patching records and test results as part of these works.

The records shall be in accordance with AS/NZ 3085.1, including Appendix D and Appendix E.

Provide hard copy records in each cross connect location and in the Operating and Maintenance Manuals. Provide record holders in each equipment room adjacent to the cross connect frame.

7.6 Cable Containment and Support Systems

7.6.1 Application

The various available cable containment and support systems shall be utilised as shown in the following table unless required otherwise on the drawings or within this specification.

7.6.2 Catenary Cable Support Systems

Not to be utilised unless given prior approval.

Use stranded steel wire of suitable gauge for the proposed load.

Terminate ends using proprietary thimbles and secure cut strands in workmanlike manner.

Fix to structure using approved method. Install a turnbuckle in each length to facilitate tensioning.

Fix cables to catenary using approved nylon wire ties or bright steel ties. Remove fly ends of nylon cable ties. The use of insulating tape as a securing or fixing method is not permitted.

Ensure that the total weight of the suspended cable is borne by the catenary and that the cable at each end and at any dropper has sufficient slack to allow for normal movement, termination of cables and the like.

7.6.3 Conduits

7.6.3.1 Type

uPVC conduit to AS 2053.

7.6.3.2 Size

A minimum 20mm diameter shall be used for any conduit or as required by the application.

Maximum 50% cable-fill conduit.

Provide draw wires for all conduits.

Provide accessible draw-in boxes along conduit runs.

Where spare conduits may be subject to dust and moisture ingress, provide suitable plugs.

Ensure conduits are free from dirt and loose material before cables are drawn in.

Seal openings around conduits or penetrations with fire retardant/water resistant sealant as required to the standards or to regulatory requirements.

7.6.4 Cable Tray

Painted, galvabond, steel perforated tray sized to accept the cables required over the nominated route. Install with punching burrs away from cable mounting surface.

Loading weight and capacity < 50% of the capacity given in the manufacturer’s data.

Supported at intervals as advised in the manufacturer’s data.

Supply and install all hangers, splices, bends, brackets, screws, nuts, etc. for a complete working system.

Differing voltage cables shall be on separate cable trays.

Co-ordinate routes with other Trades.

Secure all cables using approved ties appropriate to the duty.

7.6.5 Fibre Management System

Fibre raceway shall be utilised for all horizontal fibre reticulation.

ADCKrone FibreGuide or equivalent;

Loading weight and capacity < 50% of the capacity given in the manufacturer's data.

Supported at intervals as advised in the manufacturer's data.

Supply and install all hangers, splices, bends, elbows, crosses, exits, covers, trumpets, adapters, brackets, screws, nuts, etc. for a complete working system.

Co-ordinate routes with other Trades.

7.6.6 Skirting and Wall Duct

Use only where shown on the drawings.

Unless otherwise specified, duct shall be 150 mm high extruded aluminium, black powder coated finish. Provide at least two completely segregated channels; one for power cables and one for telecommunications cables and data cables. Splay top edge. Surface mount onto blockwork, semi-recess into plasterboard.

Provide access to each channel of the skirting duct from accessible ceiling space, dropping down in separate conduits into the rear of the skirting duct.

Provide conduits to maintain circuit/cable continuity through stud partition walls, over doors and the like. Provide at least 2 conduits at each location to support power, communications and data.

Provide all end plates, mounting plates, accessories, splice plates, etc. to provide a complete working system.

Submit sample for approval prior to installation.

7.6.7 Cable Ladder

Galvanised steel or aluminium sized to accept the cables required over the nominated route, unless otherwise specified.

Loading weight and capacity < 50% of the capacity given in the manufacturer's data.

Capable of accepting a load of 100kg at the midpoint between two supports without any non-elastic deflection.

Supported at intervals not exceeding those advised in the manufacturer's data.

Supply and install all hangers, splices, bends, brackets, screws, nuts, etc. for a complete working system.

Differing voltage cables shall be on separate cable ladders.

Co-ordinate routes with other Trades.

Secure all cables using approved ties appropriate to the duty.

7.6.8 In-floor Duct

Liaise to ensure proposed system is coordinated with structural and finished floor systems.

Provide at least two completely segregated channels, with at least one for power cables, and the other suitable for telecommunications cables and data cables.

Install either between the layers of reinforcing steel in the floor slab or within the topping, to approval in locations shown on the drawings.

In the locations shown, provide flush outlet boxes with hinged covers with recesses for the installation of matching floor surfaces and a separate hinged section to facilitate entry of cables without pinching.

Install systems to manufacturer's specifications.

7.6.9 Containment Support Systems

7.6.9.1 General

Prior to installing support systems, liaise with other trades to facilitate co-ordinated distribution routes.

Use proprietary galvanised steel section systems, clamps, and brackets and related accessories.

Secure to building structure only, to manufacturers' specifications.

7.6.9.2 Sizing

Use a system of suitable size and strength to allow for the required load and for expansion and contraction of cable containment systems.

7.6.9.3 Materials

Remove sharp edges from cut ends and touch-up with a cold application galvanising paint. Finish or cap as necessary.

7.7 Schedule of Rates

Item	Rate	$	¢
Cat 6 UTP cable installed and terminated	M		
Cat 6a S/FTP cable installed and terminated	M		
Single UTP Data Outlet	Ea		
Double UTP Data Outlet	Ea		
Triple UTP Data Outlet	Ea		
Single Cat6a S/UTP Data Outlet	Ea		
Double Cat6a S/UTP Data Outlet	Ea		

Item	Rate	$	¢
Triple Cat6a S/UTP Data Outlet	Ea		
6-core OM3 optical fibre cable - LSZH	M		
12-core OM3 optical fibre cable – LSZH	M		
6-core OM3 optical fibre cable – gel filled – LSZH	M		
12-core OM3 optical fibre cable – gel filled – LSZH	M		
6-core OM4 optical fibre cable - LSZH	M		
12-core OM4 optical fibre cable – LSZH	M		
6-core OM4 optical fibre cable – gel filled – LSZH	M		
12-core OM4 optical fibre cable – gel filled – LSZH	M		
6-core OS1 optical fibre cable – LSZH	M		
12-core OS1 optical fibre cable – LSZH	M		
6-core OS1 optical fibre cable – gel filled – LSZH	M		
12-core OS1 optical fibre cable – gel filled – LSZH	M		
6-core OS2 optical fibre cable – LSZH	M		
12-core OS2 optical fibre cable – LSZH	M		
6-core OS2 optical fibre cable – gel filled – LSZH	M		
12-core OS2 optical fibre cable – gel filled – LSZH	M		
OM3 fibre core termination	Ea		
OM4 fibre core termination	Ea		
OS1 fibre core termination	Ea		
OS2 fibre core termination	Ea		
Fibre Raceway			
100 x 50 Fibre Raceway Section	M		
100 x 50 Fibre Raceway Bend	Ea		
100 x 50 Fibre Raceway Elbow	Ea		
100 x 50 Fibre Raceway Cross	Ea		
100 x 50 Fibre Raceway Trumpet	Ea		
100 x 50 Fibre Raceway Exit	Ea		
100 x 50 Fibre Raceway Adapter	Ea		
150 x 100 Fibre Raceway Section	M		
150 x 100 Fibre Raceway Bend	Ea		
150 x 100 Fibre Raceway Elbow	Ea		
150 x 100 Fibre Raceway Cross	Ea		
150 x 100 Fibre Raceway Trumpet	Ea		

Fibre Raceway			
150 x 100 Fibre Raceway Exit	Ea		
150 x 100 Fibre Raceway Adapter	Ea		
Other			
Cable tray			
300mm Medium duty cable tray – Horizontal reticulation	M		
300mm Medium duty cable tray – Vertical reticulation	M		
300mm Medium duty cable tray bend	Ea		
300mm Medium duty cable tray Tee	Ea		
450mm Medium duty cable tray – Horizontal reticulation	M		
450mm Medium duty cable tray – Vertical reticulation	M		
450mm Medium duty cable tray bend	Ea		
450mm Medium duty cable tray Tee	Ea		
450mm Medium duty cable tray Tee	Ea		
600mm Medium duty cable tray – Horizontal reticulation	M		
600mm Medium duty cable tray – Vertical reticulation	M		
600mm Medium duty cable tray bend	Ea		
600mm Medium duty cable tray Tee	Ea		
750mm Medium duty cable tray – Horizontal reticulation	M		
750mm Medium duty cable tray – Vertical reticulation	M		
750mm Medium duty cable tray bend	Ea		
750mm Medium duty cable tray Tee	Ea		
ICT Equipment			
Core Switches (Type)	Ea		
24-port Edge Switches (Type)	Ea		
Routers	Ea		
Modem	Ea		
Firewall Appliance	Ea		
Server	Ea		
Software list: -			
Operating System	Ea/Lic.		
NMS Server (software or appliance)	Ea/Lic.		
SCADA package	Ea/Lic.		
Virtual Machine Host package	Ea/Lic.		
Virus Scanner	Ea/Lic.		
SQL Database	Ea/Lic.		

Cable tray			
Report Generation	Ea/Lic.		
Backup software	Ea/Lic.		
	Ea/Lic.		
	Ea/Lic.		
	Ea/Lic.		
	Ea/Lic.		
Middleware	Total		
Converged Points	Total		
Additional Points	Ea.		
Small Form Edge Switches (Type)	Ea		
Small Form Edge Switches Backplanes	Ea		
Small Form Edge Switches Power Supply	Ea		
Small Form Edge Switch Enclosure	Ea		
45RU 19” Rack approx. 800x900mm (specify dimensions)	Ea		
24-port Cat6A patch-panel	Ea		
24-port OM3 FOBOT	Ea		
24-port OM4 FOBOT	Ea		
24-port OS1 FOBOT	Ea		
48-port OM3 FOBOT	Ea		
48-port OM4 FOBOT	Ea		
48-port OS1 FOBOT	Ea		
Vertical cable manager (Copper)	Ea		
Horizontal cable manager (Copper)	Ea		
Vertical cable manager (Fibre)	Ea		
Horizontal cable manager (Fibre)	Ea		
Small Form Cat6A Patch Panels	Ea		
Small Form OM3 Patch Panels	Ea		
Cat6A patch leads (1.5m nominal)	Ea		
OM3 patch leads (1.5m nominal)	Ea		
OM4 patch leads (1.5m nominal)	Ea		
OS1 patch leads (1.5m nominal)	Ea		
Others not listed	Ea		

8 BMCS and Controls

8.1 Electronic Controls

8.1.1 General

All controls shall be capable of operating in ambient conditions varying between 0°C to 40°C and 0-95% RH non-condensing. Controls for external applications shall be capable of operating in ambient conditions varying between -15°C to 50°C and in rain and snow.

All wall mounting sensors and thermostats shall be suitable for mounting on Australian Standard conduit boxes.

All control devices shall, unless provided with a flying lead, have a 20mm conduit knockout. Alternatively they shall be supplied with adaptors for 20mm conduit.

All control equipment shall be installed such that there is adequate clearance for removal of any such item without dismantling any other item of equipment and also for normal testing, maintenance and inspection.

When items of equipment are installed in the situations listed below the following ancillary items shall be included:

- External Mounting: All devices mounted externally, or which due to their location are exposed to the elements, are to be suitably weatherproofed to IP 65;
- Pipework Immersion: Corrosion resisting pockets of a length suitable for the complete active length of the device, screwed ½" or ¾" BSPT suitable for the temperature, pressure and medium;
- Duct Mounting: Mounting flanges, clamping bushes, couplings, lock-nuts, gaskets, brackets, sealing glands and any special fittings necessitated by the device;

Two position switching devices shall:

- Have concealed adjustment unless detailed otherwise in the Contract documents;
- Be capable of switching voltages up to 230V ac and all accessible live parts shall be shrouded to IP 2X as a minimum. Devices with metallic cases or exposed metal parts shall be supplied complete with an earth terminal;
- Temperature, humidity and pressure sensors shall operate on extra low voltage.

8.1.2 Sensors & Switching Devices

The following types of measuring device shall be selected so that the total combined limits of accuracy of the sensor and its associated BMCS controller/IUC are (unless stated elsewhere):

Sensor	Range	Accuracy *
Temperature		
- discharge air	-10 to +50 °C	± 0.3°C
- space	0 to +50 °C	± 0.3°C
- Space (Wireless)	0 to +50 °C	± 0.5°C
- chilled water	-10 to +30 °C	± 0.25°C
- condenser water	0 to +50 °C	± 0.25°C
Humidity		
Space/Discharge	10 to 90% RH	± 3%
Space Wireless	10 to 90% RH	± 5%
Duct and Water Pressure	-	± 3%
Water flow meter	> 5:1	± 2%

*To ensure accuracy, all temperature measuring devices in wells or pockets shall be installed using a suitable heat transfer medium.

8.1.2.1 Pressure Switches For Pipework

- Shall be bellows operated;
- Suitable for the medium and the working temperatures and pressures;
- Capable of withstanding a hydraulic test pressure of 1.5 times the working pressure;
- Connections shall be suitable for 8mm (¼") o.d. copper tube;
- Supplied suitable for pipe or wall mounting;
- The setpoint shall fall within 30%-80% of the scale range;
- Static pressure switches shall have differentials adjustable over 10%-30% of the scale range;
- Differential pressure switches shall have a differential of no more than 0.2 bar (20 kPa);
- Shall include calibration scales for both setpoint and differential adjustments;
- Differential pressure switches installed across orifice plates for flow proving applications shall be by the preferred manufacturer listed in the Particular Specification.

8.1.2.2 Pressure Switches For Air Systems

- Shall be diaphragm operated;

- Switches shall be supplied with air connections permitting their use as either static or differential pressure switches;
- Shall be supplied complete with brackets suitable for wall mounting or mounting on ducts in any plane;
- The setpoint shall fall within 30%-80% of the scale range;
- Shall have a switching differential of not more than 10% of the scale range;
- Shall include a calibration scale for the setpoint.

8.1.2.3 Air Flow Switches

- Shall be selected for the correct air velocity, duct size and mounting attitude;
- Exposed parts of the switches shall be suitably coated or made to withstand any special atmospheric conditions in which they operate.

8.1.2.4 Water Flow Switches

- Shall be electromagnetic or magnetic flow type
- Shall be selected for the correct water velocity, pipe size and mounting attitude.

8.1.2.5 Level Switches

- Shall be selected for the fluid type, system pressure and have adjustable differentials;
- May be conventional float type, capacitance type or conductivity type;
- Where conductivity types are offered they shall include all probes (including earth).

8.1.2.6 Condensation Sensors

- Shall be installed on the chilled beam

8.1.2.7 Room Temperature/Humidity Sensors

- Shall have the conduit entry points sealed to prevent draughts blowing through the conduit and affecting the sensor reading.
- Wireless room sensors shall utilise a frequency within a legal range as approved by ACMA.
- Wireless room sensors shall have a normal battery life greater than 5 years.

8.1.2.8 Averaging Element Duct Temperature Sensors

- Shall be used where a probe type Duct Sensor cannot penetrate more than ¼ of the way across a duct or where noted;
- Shall have a minimum capillary length of between 3m and 5m to suit the application;
- The averaging element shall be serpentined across the whole duct;

- Where the span of the element is less than 1m then it shall be fixed with purpose-made clips and may be unsupported across the duct;
- Where the span of the element is above 1m then it shall be supported on Unistrut or similar rigid support.

Averaging elements composed of multiple thermistor beads are not acceptable.

8.1.2.9 Room Humidity Sensors

- Shall not require regular maintenance, re-calibration or regeneration;
- Shall have the conduit entry points sealed to prevent draughts blowing through the conduit and affecting the sensor reading.

8.1.2.10 Duct Mounted Humidity Sensors

- Shall not require regular maintenance, re-calibration or regeneration.

8.1.2.11 Pressure Sensors

- Shall be suitable for the medium and the working temperatures and pressures;
- Shall be capable of withstanding a hydraulic test pressure of 1.5 times the working pressure;
- Connections shall be suitable for 8mm (¼") o.d. copper tube;
- Ductwork versions shall be supplied with air connections permitting their use as static or differential pressure sensors;
- The setpoint shall fall within 30%-70% of the sensing range of the sensor.

8.1.3 Weather station

8.1.3.1 General

Shall consist of at least two (2) measurement sensors contained within a single multi sensing device. Measurement sensors include:

- Dry bulb temperature
- Relative Humidity
- Wet bulb temperature
- Wind Direction
- Wind Strength
- Rain Sensor

Shall be capable of connection to the BMCS for all sensed measurement points;

Technical performance shall be equivalent to Vaisala weather transmitter model WXT 520;

8.1.4 Actuators

8.1.4.1 General

- Shall have a sufficient torque to open and close valves and dampers against the maximum out of balance pressure across them;
- Shall be supplied complete with the necessary universal joints, cranks, linkages and mountings for the specified motorised valve or motorised damper;
- Shall have position indicators unless fitted to terminal units. The fully open and closed positions shall be unambiguously marked;
- Shall have a manual override facility unless fitted to terminal units;
- Shall have a linear stroke/control signal characteristic.

Control Damper Actuators shall be of the type where the damper spindle passes through the actuator and is secured by a U clamp.

Additional features required shall include:

- Fail Safe: Shall have an auxiliary spring for fail safe conditions. The spring shall be rated for a minimum of 1000 operations. The spring shall have sufficient torque to open or close valves and dampers against the maximum out of balance pressure across them.

8.2 Valves

8.2.1 General

- All valves with the exception of unit valves shall be fitted with valve position indicators clearly marked to show the fully open and fully closed positions;
- All valves shall be tested to a pressure of at least 150% of their standard rated working pressure;
- All valves shall be manufactured to comply with the relevant Australian standard;
- All valves shall be suitable for the system pressure in which they operate;
- Valve bodies Up to and including 50mm shall be screw fit and above 50mm they shall be flanged. The body construction and flanges shall be suitable for the medium, temperature and pressure of the systems in which they operate.

With the exception of butterfly valves, valves shall be of the single seated plug or rotating ball types. No plugs or trims shall be constructed of materials liable to corrode or cause sticking.

8.2.2 Valve Selection

8.2.2.1 Characteristics

- Two-port valves shall have an equal percentage or modified parabolic characteristic and their rangeability shall be not less than 100:1;

- Actual valve Kvs values shall not deviate from the quoted Kvs value by more than ±10%;
- The Kv of the valve shall not deviate from the stated characteristic curve by more than ±10%;
- Three-port and four-port valves shall give an installed constant total flow characteristic, within ±10%, for all valve positions.

8.2.2.2 Authority

- All two-port modulating valves shall be selected to have an authority between 0.45 and 0.7;

8.2.2.3 Let-By

On liquid applications let-by shall not exceed 0.05% of full duty.

8.2.2.4 Two-Port Valves

Shall be selected to ensure that each valve is capable of opening and closing against the maximum differential head which may be applied across the valve in its circuit.

8.2.2.5 Butterfly valves

Butterfly valves and actuators shall be supplied by Keystone or approved equivalent.

Modulating butterfly valves shall be selected so that full flow rate is achieved at the 60% open position unless a "fishtail" pattern butterfly is used when the valve shall be 90% open for full flow rate. The actuator stroke shall be set accordingly.

8.3 Labels

Engraved Formica laminate labels shall be fitted to all items of controls equipment and the labels shall be in accordance with the reference numbers.

Where field mounted local isolators/switch disconnectors and emergency stoplocks are provided they shall be fitted with engraved Formica laminate labels.

Labels shall be fitted to a flat surface next to the controls device using self-tapping screws or an epoxy based resin. Where no flat surfaces are available e.g. on valves, the labels shall be hung from brass chains. Control items in occupied areas other than plant rooms shall be marked with their tag reference on concealed surfaces i.e. on the inside of a room temperature sensor cover.

8.4 Control Panels (CPs)

8.4.1 Index Of Protection

All CPs shall have a minimum protection of IP 54.

8.4.2 Finger Protection

All components shall be IP 2X finger protected such that live parts cannot be accidentally touched.

8.4.3 Fabrication & Assembly

FCP shells shall be manufactured in best quality pickled and oiled mild steel plate to a minimum thickness of 2mm, in all folded and welded construction.

Doors shall be 700mm maximum width, mild steel with folded edges and welded corners suitable for eliminating distortion and whip, to a minimum thickness of 2mm. They shall have hinges of a type which permit removal of the door and door stays which prevent them opening more than 90 degrees.

CPs shall be constructed in sections no wider than 1580mm. Each section shall have fully numbered interconnecting terminals.

Mounting plates within CPs, for fitting internally mounted equipment, shall be in galvanised mild steel to a minimum thickness of 2mm. Equipment shall be fitted to Avdel Nutserts or similar to eliminate back nuts. Alternatively, the mounting plate may be tapped and the equipment fixed with screws. Self-tapping screws will not be permitted. The mounting plates shall be suitable for supporting all equipment within any section without visible distortion.

No equipment shall be mounted less than 300mm from the base of the CP.

All framework associated with doors shall be fitted with foamed plastic dust protective strip or neoprene tube sealing gaskets.

CP construction shall be such that adequate ventilation shall be provided for internal heat dissipation. Under no circumstances shall the internal temperature rise above 40°C. Where required, louvred sections and/or ventilation fans shall be provided.

8.4.4 Finishes & Labelling

All surfaces shall be smooth and free from burrs, weld marks and sharp edges.

Paint finishes shall be in stoved enamel.

Internal mounting plates shall be galvanised.

External labels shall be in 'Formica' engraving laminate coloured white with black engraving. All labels shall be fixed with bright finish instrument head screws or plastic flat headed push-in rivets of the same colour as the label. Labels for switch plates shall cover the entire area taken up by a switch and its associated lamps and be drilled and engraved for each group of items.

Internal labels shall be either of the following:

- 'Formica' engraving laminate coloured white with black engraving fixed with bright finish instrument head screws or plastic flat headed push-in rivets of the same colour as the label;

- Engraved cable trunking lids (white engraving on grey coloured cable trunking);
- Non-embossed, plasticised labelling tape, black on white background. Embossed 'Dymo' type labels will not be accepted.

Trunking lids shall be provided with suitable labelled code, i.e. AA, BB, etc. to ensure lids can be removed and re-fitted in the correct positions.

8.4.5 Wiring & Terminations

All low voltage wiring shall use Tri-Rated cable. The minimum conductor cross sectional area for power, control and extra low voltage wiring shall be follows:

- Power wiring - 2.5mm2;
- Control wiring (230V ac) - 1.0mm2;
- Extra low voltage wiring associated with BMCS digital inputs and outputs - 0.5mm2;
- All other extra low voltage wiring - 0.75mm2.

All control wiring shall be identified with colour coded and numbered ferrules. These numbers shall be shown on the schematic wiring diagrams.

All control wiring shall be fitted with crimped terminal ends.

Twenty spare terminals shall be fitted to each CP. Each terminal rail shall have sufficient length for 10% additional terminals.

All wiring for BMCS control devices shall be via hinged 'link' type terminals.

Entry to the CP terminals shall be via detachable, undrilled gland plates. Gland plates shall cover the length of the terminal strip, be constructed from non-ferrous metal and be of sufficient thickness to support the incoming and outgoing cables.

All CP-mounted equipment shall be wired out to terminal strips.

8.5 Building Management Control Systems (BMCS)

8.5.1 General

A 'Glossary of Terms Used' for the BMCS in this Specification is included in the Appendices.

This section details the hardware and software requirements of the BMCS. The functions described serve to define the functional requirements of an acceptable system.

All BMCS equipment shall be capable of operation in the following conditions without detriment to the equipment:-

- 0 - 45°C;
- 0 - 95% RH (non-condensing).

The system shall be logically structured into distinctive sub systems based on the functions, performance, modularity and autonomy required within each subsystem. Based on these requirements the most appropriate technology shall be used.

Each subsystem shall be autonomous from the other.

The levels are defined as Management Level and Automation Level.

Peer to peer communication shall be possible within the sub systems.

The system design shall be modular in structure to allow straight forward extensions.

Use of communication standards:

Where a standard is used, it shall have a recognised method of ensuring compatibility between devices from different manufacturers.

Where standard protocols are used, only the following are appropriate to be used at the two levels:

- Management level BACnet; OPC
- Automation level BACnet; LONMARK, Modbus, J Bus

Where a configuration software tool is used to set-up the network and devices from a number of manufactures and are connected to the same network, only one tool from one manufacturer shall be used to configure the whole project to ensure consistence and interoperability.

If the standard creates a project specific database in order to configure the network, the client shall have ownership of the operation. The BMCS supplier will provide all software tools and applications necessary for the development and operation of all aspects of the BMCS including graphics (creating and viewing) network set-up, database creation, configuration tools and all operating software

8.5.2 Integration of Third Party Systems

Third party software shall run concurrent with the BMCS application program without affecting its ability to monitor the system and advise that an alarm has occurred via a pop-up window.

The third party management system shall provide the information in a commercially available open protocol format and using off the shelf mechanisms.

Where a physical connection is required between a 3rd party device and the system, the third party supplier shall provide the necessary line drivers and cables, documentation and support to make the connection into the device that will provide the protocol conversion.

8.5.3 Operator's Station & Server

The BMCS server shall be based around the Microsoft Windows 2008 Server multi-tasking environment. The networking software shall use the industry standard TCP/IP LAN protocol. All LAN connected Operator Workstations shall be able to view operator displays from the server.

Server hardware shall meet the requirements of the software to be run on the server and the following minimum requirements, whichever is the most onerous:

- Rack mountable (maximum 2U)
- Processor shall be Intel quad core Xeon 2.4 Ghz (or equivalent performance)
- Random Access Memory (RAM) 4Gb, 1066Mhz.
- 2 off 250 GB hard drives hot pluggable
- RAID 1 Controller
- Communications ports: One serial port and two USB port in addition to any ports required for the keyboard and mouse.
- CD-RW and DVD-RW
- Gigabit Ethernet NIC

The operator interface provided by the system shall allow for efficient communication of operational data and abnormal conditions. It shall provide a consistent framework for viewing of information. Critical areas (such as alarm icons) shall be visible at all times.

The operator interface shall also be compatible with Windows Terminal Services allowing remote PDA devices to be used as mobile operator interfaces.

The operator interface shall employ standard Windowing conventions so as to reduce required Operator training. In particular, standard tool bar icons and drop-down menus shall be available on all standard and custom displays to allow easy access to common functions.

The system shall provide flexible trending allowing real-time, historical or archived data to be trended in a variety of formats. In addition, trend data types shall be able to be combined to allow for comparisons between data e.g. current real-time data versus archived data.

Alarms shall be able to be viewed in a consolidated alarm summary which shows all current or pending alarms on the system. This summary may be sorted by time and date, database partition or source of the alarm.

The system shall support a flexible reporting package to allow easy generation of report data. The reports provided shall include pre-configured standard reports for common requirements such as Alarm Event reports and custom report generation facilities that are configurable by the user.

The system shall support archiving of historical data to allow a continuous record of history to be built up over a period of time. Archived data may be stored on the hard disk of the system or a remote network drive or moved off-line to removable media such as DAT tape, or optical disk.

Any of the following Open Protocol Standards shall be used for high level interfacing of third party devices or systems:

- MODBUS
- BACNET (ANSI / ASHRAE 135)
- OLE for PROCESS CONTROL (OPC)

- ADVANCEDDE
- LONWORKS

All system peripherals shall be capable of being connected to the server computers via the LAN.

The BMCS system shall have the capability to interface to the point database of other similar BMCS systems on a TCP/IP network. This shall enable both the acquiring of point data and issuing control outputs to other BMCS systems.

The system must be capable of exporting bulk data to Microsoft Excel and the capability of writing of values from Excel back to the BMCS.

The operator's station shall comprise a personal computer incorporating the most up to-date micro-processor technology complete with monitor, keyboard and mouse. The operator's station basic purpose is to display and format data and enable manual control functions (e.g. setpoint and program changes) to be performed in a user friendly manner. Operator's stations shall take no part in any plant or global control functions and shall not be used to transfer data between controllers on the communications network.

The software for carrying out the various requirements for system control shall be backed up at the operator's station irrespective of whether the routines are normally held and operated from a controller or unitary controller. The operator's station shall have the ability to upload and download controller configuration data via the communications network.

When a controller suffers a loss of memory which is then detected by the operator's station, the operator's station shall have the ability to automatically download all relevant stored configuration data to that controller. This feature shall be selectable on a controller by controller basis.

Each operator's station shall have a real time clock which shall not be affected by power failure and which shall be synchronised with all other real time clocks on other operator's stations, controllers and unitary controllers, whenever a controller is brought back on line. All real time clocks shall also be synchronised on a daily basis. Real time clocks shall contain the necessary firmware to operate unaided until January 2060.

The operator's station shall be provided with a removable media backup facility of sufficient size or capability to store the entire contents of the hard disk. The backup facility shall be fully automatic, on a specified time basis, with the ability to manually backup the system. It shall be possible to load selected files from this storage facility on to the operator's station.

Each server shall contain sufficient hard disk capacity for all database and software requirements described plus sufficient hard disk capacity for all graphic displays, historical records and trends as described below:

- Graphic Displays 1,000 screens;
- Historical Records 500,000 events;
- Trends 5,000,000 samples.

All programming such as alarm inhibition, sequence interlocking, addition and deletion of points, etc, shall be through the operator's station or touch screen panels.

Each operator's station shall be supplied with a high resolution colour graphic LCD flat panel monitor with a minimum resolution of 1280 x 1024 pixels. The monitor shall conform to the latest international standards for electromagnetic emissions. The diagonal dimension of the screen shall not be less than 24.5".

8.5.4 Touch Screen Panels

Touch screen panels shall be provided in nominated plant rooms. These panels shall be capable of full BMCS monitoring and control (under password access control) but additionally have facility for a simplified mimic of a defined set of equipment status and alarms.

8.5.5 Printers

8.5.5.1 Ink Jet

Each operator's station on the BMCS shall be capable of supporting a colour ink jet printer. Where specified, ink jet printers shall be used to copy any required graphic screens together with all dynamic data, graphical trend log displays and support "Print Only" functions as required.

The printer shall:

- Have both black and coloured ink cassettes;
- Have a minimum printing speed of 4 full black and white graphic pages per minute;
- Have a minimum printing speed of 1 full colour graphic page per minute;
- Have a cassette ink system, so that ink renewal is a simple operation;
- Produce a true copy of the graphic display i.e. have a true to life aspect ratio.

8.5.6 Direct Digital Controllers (DDCs)

Controllers shall be complete with power supplies, a real time clock, input and output modules, memory, processors and all other items necessary for proper and correct interfacing and operation of the control functions.

All controllers shall have peer to peer communications. All controllers shall have a ‘stand-alone’ capability such that a failure of the operator's station shall still permit the plant and controls associated with the controllers, to continue to operate normally with the controllers continuing to communicate with one another.

In the event of transmission failure in the controller network the controllers shall continue to operate with all sequence interlocks and control strategies operating normally excepting those which require global information. Either user adjustable default values or the last sensed value (user selectable) shall then be assumed for

these global parameters. An alarm shall be raised at the operator's station for each 'off-line' controller.

All necessary interfacing equipment shall be provided so that the controllers are fully compatible with all items of plant and equipment.

All controllers shall be installed inside MCPs.

The controllers shall be constructed so that the cabinets and internal terminal strips can be mounted, and electrical terminations made, with all electronics being added at a later date during the testing and commissioning phases.

The controller shall be capable of accepting digital, analogue, pulsed inputs and providing digital and analogue outputs.

- Digital Input: Shall monitor the change of state of a volt free contact;
- Pulsed Input: Pulses (voltage-free contact closures, i.e. digital type input) originating typically from flow meters, electrical kWh or kVA meters, etc. and shall be accumulated into registers. A register shall be resettable to zero either by software or operator command. The input must be able to accept pulses up to a frequency of 10Hz with a minimum duration of 50ms. All counts must be stored in a non-volatile register so the count value is not affected by a power failure;
- Digital Output: The output signal, a voltage free contact which shall close upon energisation of the output. Should digital outputs be used to drive modulating actuators, other than for terminal unit applications, a potentiometer shall be fitted to the actuator and connected to the BMCS to provide actuator position feedback. The controller shall use this feedback to ensure the accuracy of positioning of the actuator;
- Analogue Inputs: Analogue to digital conversion (ADC) with a minimum resolution of 1024 counts (10 Bit) over the input range (i.e. 0-10V, 2-10V, 0-20mA, 4-20mA etc.) of the sensor. The sensor range shall match the process control range. Any equipment necessary for the conversion of an input signal to the required input level shall be provided;
- Analogue Outputs: Digital to analogue conversion (DAC) shall be performed by the controllers with a minimum resolution of 256 counts (8 Bit) over the output range which shall also match the control range of the device and/or system being controlled. Any equipment necessary for the conversion of the output signal to the required process level (i.e. 0-10V, 2-10V, 0-20mA, 4-20mA etc.) shall be provided. Analogue outputs driving damper and valve actuators shall not be used to drive raise/lower actuators through interface devices;
- Universal Inputs: Shall be configurable to either digital or analogue input and shall have the features defined above.

Each controller or controller location shall be provided with spare hardware capacity for future additions of at least 25% of each type of point. Universal inputs may be counted as either a spare digital or analogue point, but not both. Note that this spare capacity may be accomplished by the addition of input/output modules but all components necessary shall be provided. Memory shall also be sufficient to allow all programs associated with these points to be run in the controller.

Multiplexing boards to convert analogue inputs to multiple digital inputs and analogue outputs to multiple digital outputs shall not be used.

The controllers shall be provided with their own internal battery or capacitor back up power supply, capable of maintaining all memory including the real time clock for not less than 72 hours. The battery shall be easily replaceable i.e. not soldered to the PCB.

Each analogue input shall be calibrated (to compensate for non-linear characteristics of input devices, line resistance and similar items) to achieve an accuracy, of the displayed value on the operator's station, as required for each sensing device. Calibration and scaling data shall be retained in the controller memory. Open or closed circuits on sensor inputs shall be recognised by the controller and annunciated as alarms on the system operator's station(s). If a sensor fails (open or closed circuit or out of range) then its associated control loop shall default to a safe condition.

It shall be possible to characterise each analogue output to an actuator in order to obtain a near-linear response from the device the actuator is controlling. This may take the form of a look up table with a minimum of 6 co-ordinates, such that the linear output from a control loop is converted into a non-linear control signal to the actuator.

8.5.7 Uninterruptible Power Supplies (UPS)

Operation of an uninterruptible power supply shall be such that in the event of mains failure the equipment supported shall not power down and reboot.

An uninterruptible power supply shall be capable of maintaining, in a fully functional mode, its associated devices for a period of 20 minutes.

The uninterruptible power supply shall have sealed batteries and include volt free contacts for connection to the BMCS for monitoring of the following conditions:

- Battery low level.
- Charger fault.
- Mains power status

8.5.8 Controller Software

- All software relating to plant control and monitoring shall reside at controller or unitary controller level. Only management software shall reside at the operator station;
- All programs shall be scanned as a minimum every one second;
- Software shall include diagnostic routines which check hardware for correct operation. All hardware faults shall be annunciated on the operator's station(s).

8.5.9 Password Access

- Operators shall gain access to the system by logging on which shall be achieved by entry of a unique operator name and password combination;

- Each operator shall be assigned a system access level which shall enable that operator, once logged on, to access only those command, monitoring and program functions which have an equal or lower access level. A minimum of eight access levels shall be provided;
- Only the highest access level shall enable assignment or reading of operator passwords. The system shall support a minimum of twenty separate operators;
- The system shall record (to the operator's station's hard disk and optionally on a selected printer) logging on/off activity. Terminals shall automatically log off after a pre-set time if no keyboard activity has occurred. In addition, operators shall be able to manually log off when leaving the terminal;
- The configuration of system access levels shall be submitted for approval before commissioning commences.

8.5.10 Alarm Processing

Alarms shall be classified by their alarm type and priority. The facility shall be provided for enabling and disabling each individual alarm on the system.

Once generated, the alarm shall be processed by its associated alarm type and priority as required. The alarm types and priorities shall be as follows:

Type	Description	Priority
1	Digital or Analogue	Critical
1a	Mismatch	
2	Digital or Analogue	General
2a	Mismatch	
3	Digital or Analogue	Low level

Digital, analogue and mismatch alarm are defined as follows:

Digital: The alarm is associated directly with an external volt free contact (i.e. a digital input). The alarm may be generated by transitions from either open to closed status, closed to open status, or any change of state. A time delay shall be associated with the alarm such that the alarm does not occur until the required alarm state has existed for longer than the delay period.

Analogue: The alarm is associated directly with an analogue input. The alarm is generated by the BMCS due to a measured variable exceeding specified limits. It shall be possible to define the limits in two ways:

- Fixed limits. The point has fixed upper and lower alarm limits. If the measured variable rises above the upper limit, or falls below the lower limit, then an alarm is generated. e.g. high alarm limit = 30°C, low alarm limit = 8°C;
- Floating limits. The point has an associated setpoint, and an alarm is generated when the measured variable deviates either above or below the setpoint by more than a given alarm limit value. If the setpoint is changed, the alarm

limits are automatically moved to suit. e.g. setpoint = 21°C, alarm limits = Setpoint ±2K.

The above alarm limits shall have associated hysteresis bands to avoid nuisance alarming. A time delay shall be associated with the alarm such that the alarm does not occur until the required alarm state has existed for longer than the delay period.

Mismatch: The alarm is associated with an output command point and an input giving status feedback of the output command. The alarm is generated when the status feedback does not correspond with the output command status for longer than a defined time delay period.

Alarm priorities are defined as follows:

- Critical: Includes life safety alarms i.e. fire detected, gas detected, etc;
- General: Includes plant failure, high temperature, low pressure, etc.;
- Low level: Includes advisory and maintenance alarms i.e. filter dirty, etc.

On occurrence, the alarm shall be displayed on the operator's station screen, the alarm shall be put in the alarm list and the relevant alarm message, including time and date, printed out on the operator's station(s) alarm printer(s). Time and date stamping shall take place in the controller, not the operator's station. In addition, the following actions shall be taken dependant upon the alarm type.

Critical Alarms:

- The alarm printout shall be in bold text to clearly differentiate it from general or maintenance alarms;
- Shall generate an audible alarm at the operator's station;
- Shall have the ability to bring up an associated alarm graphic or text screen at the operator's station.

General Alarms:

- Shall generate an audible alarm at the operator's station;
- Shall have the ability to bring up an associated alarm graphic or text screen at the operator's station.

It shall be possible, at the highest operator password level, to enable and disable the audible alarm feature of the operator's station. In addition the keyboard facility to mute the audible alarm shall be provided.

Alarms shall remain active until acknowledged by an operator logged on with the appropriate password level, even if the alarm has physically cleared. Upon acknowledgement, the alarm shall be moved to the appropriate place in the alarm list and an alarm acknowledgement message sent to the printer(s) which shall include the time, date and operator's identity. An acknowledgement message at a given printer shall be in the language/characters selected for that printer.

When an alarm is acknowledged, the audible alarm, if enabled, shall be muted unless another unacknowledged critical or general alarm exists on the system.

It shall be possible to acknowledge alarms on both an individual and group basis.

Upon clearance of an alarm, a clearance message shall be sent to the printer, which shall include the time and date. If the alarm has been previously acknowledged, it shall be removed from the alarm list.

All alarm events shall be included in the historical data program.

It shall be possible to view or print the contents of the alarm list in historical order, using the following selection criteria:

- All alarms in the alarm list;
- Critical alarms only;
- General alarms only;
- Acknowledged alarms only;
- Selection of alarms associated with an individual drive or plant only.

8.5.11 Alarm Inhibition

Consequential alarm suppression algorithms shall be provided to limit the alarms annunciated on the BMCS to those associated with the source of the initial alarm condition e.g. chiller lockout shall not initiate flow and return water temperature alarms, fire alarms shall not initiate mismatch alarms, restoration of power following a power failure shall not initiate mismatch alarms etc.

Analogue alarms associated with plant shall be inhibited when the plant is commanded off by the BMCS unless otherwise stated.

8.5.12 Configuration

Configuration data shall be stored in the controllers or the unitary controllers. Configuration data shall include but not be limited to the following:

- The engineering unit applicable (°C, kPa, m3/s etc);
- The point identifier (minimum of 12 characters);
- The point alarm message if applicable (minimum of 80 characters);
- The point descriptor (minimum of 32 characters);
- Other miscellaneous information necessary for the correct operation of the entire BMCS (e.g. trending run hours, accumulation, access levels etc).

All configuration data shall be displayed in alphanumeric characters. Configuration shall include but not be limited to the following points:

- All system peripherals and remote controllers;
- System inputs and outputs (binary and analogue);
- System alarms;
- System calculation results (e.g. efficiency values);
- System parameters and timers;
- System programs (e.g. event initiated program);

- System points received via a data interface.

Once configured, points shall then be assigned to colour graphic displays and/or logical groups.

8.5.13 Colour Graphic Displays

The colour graphics shall incorporate automatic updating of real time field data. Full alphanumerics shall spell out in plain English any current condition, value, or action.

Each graphic shall incorporate up to 40 freely assigned connected or calculated points and shall be stored on the operator's station's hard disk ready to be displayed.

All plant symbols shall be drawn in a fashion so as to represent plant items and control devices as opposed to DIN standard type and shall be of a similar format to those shown under ‘Sample Graphics’. Standard symbols libraries shall be augmented by user defined symbols. Editing features for adding, deleting and modifying data, shall be provided. Access to the colour graphics features shall be controlled so that only designated operators can display or modify files.

Each and every input, output and calculated BMCS point shall be placed on an associated graphic display. Each and every system shall be provided with a separate graphic display comprising a system overview screen, and engineering screens. For large systems several engineering screens shall be required to display all relevant information and setpoints. These displays shall be linked as described below.

It shall be possible to interrogate each item of plant or system by graphic penetration. That is, all graphics shall be constructed in levels as follows:

- Level 1 - Graphic detailing site overview;
- Level 2 - Graphic detailing building/block overview;
- Level 3 - Graphic detailing systems on each floor/within each plant room;
- Level 4 - Graphic detailing a 2D system schematic;
- Level 5 - Graphic(s) detailing system engineering parameters and setpoints;
- Level 6a - Graphic detailing system description of operation (or a link to a read only file containing the description of operation);
- Level 6b - Graphic displaying system strategy diagram or flow chart (or link to a read only file containing the system strategy diagram or flow chart);
- Level 7 - Empty user definable graphic screen.

The system software shall accept up to 10 levels of graphics. Changing from one graphic to another graphic shall be by the use of 'click' boxes on the graphics. It shall be possible for a system operator to navigate from any level 4 Graphic to any other level 4 graphic in no more than four 'click' box operations.

Graphical representation of all plant and plant symbols (i.e. schematics) shall be two-dimensional in representation. Refer to ‘Sample Graphics’.

Level 4 graphics shall be the system operators 'window' to the system. They shall show the main functionality of the system, whether the system is 'required to run' and whether the system is 'available to run'. If a system is required to run but is not available then the operator would interrogate the system via the level 5 and 6 graphics which would contain the detailed operational information.

Primary system setpoints (such as supply air temperature) shall be displayed and accessible from the level 4 graphics. All other setpoints shall be accessed via level 5 graphics only. Where setpoints are calculated or scheduled within software, then the calculated value can be displayed on level 4 graphics, but shall be 'greyed out', so as to indicate to the operator that it is non accessible.

Where fans/pumps are variable speed, the drive enable, run and BMCS speed outputs only shall be displayed on the level 4 graphic. All other drive related information shall be displayed on level 5 graphics.

All level 4 graphic screens shall comprise as a minimum the following:

- Date, time, outside air temperature and humidity. Outside air enthalpy (where required);
- Primary system setpoints (e.g. supply air temperature);
- Safety Interlock status;
- Plant command (on/off);
- Plant status (e.g. fan, pump, boiler, etc);
- Measured values (e.g. temperature, humidity, static pressure, etc);
- Output values (e.g. valve and damper position etc);
- Alarms;
- Critical/safety overrides (e.g. fire shutdown);
- Associated graphic 'click' boxes;
- Facility to link to trend logs for all displayed plant values and status;
- Facility to link to system description of operation.

Level 5 graphic screen shall comprise as a minimum the following:

- Date, time, outside air temperature and humidity. Outside air enthalpy (where required);
- All setpoints/schedules;
- Optimum start/fixed time program settings;
- Plant command status (e.g. optimum start, fixed time start, boost, night low temperature cycle, manual, etc);
- System demand signals;
- Control loop parameters;
- Plant run time status and associated hours run resets;
- Normal overrides (e.g. primary heating loop temperature, enthalpy, standby power shutdown);
- System fault reset button(s);

- Associated graphic 'click' boxes;
- Facility to link to trend logs for all displayed plant values and status;
- Facility to link to system description of operation.

Should a graphic be too large to place on a single display, it shall be segmented and each portion placed on separate graphics joined by 'click' boxes.

All setpoints shall be able to be modified via the graphic displays.

It shall be possible to manually override (force) on/off each system and individual points via the applicable graphic screen. Indication shall be provided on a graphic when a system has been manually overridden and for each and every individual point overridden. The manual overrides shall be configured such that a competent operator with sufficient access rights shall have the ability to override system and individual points. An operator with lesser access rights shall have the ability to override complete systems only.

The colour of each point/symbol on a graphic display shall represent a different condition associated with the point/symbol. Symbol colours shall be in compliance with the basic guide below and as represented in the typical graphic samples.

The conditions of each point as described below are the minimum requirements.

Off	White
On/Enabled	Green
Overridden Off	White with 'hand' symbol
Overridden On	Green with 'hand' symbol
Alarm/Mismatch Alarm	Red
Loss of communication	Display to product manufacturer's standard default

Based upon the above representations the following examples can be cited for a pump or fan:

- If a pump or fan is enabled and a running status has been received by the BMCS then the outer section of the symbol (enable output) would be green and the inner section of the symbol (run status) would be green;
- If a pump or fan were switched off by the BMCS but overridden via the BMCS/graphics by the operator then the outer section of the symbol would be green and the inner run status of the symbol would be green. Additionally a 'hand' symbol would be adjacent to the pump or fan symbol and a plant override alarm would be present on the BMCS system;
- If a pump or fan is disabled and a running status has been received by the BMCS (but has not been overridden via the graphics by the operator) then the outer section of the symbol would be white and the inner run status of the symbol would be green. Additionally a plant mismatch alarm would be present on the BMCS system and a red flashing 'mismatch alarm' banner would be present on the graphics adjacent to the pump or fan symbol;
- If a pump or fan is enabled and a running status has not been received after the flow proving period then the outer section of the symbol would be green and

the inner run status of the symbol would be red. Additionally a plant mismatch alarm would be present on the BMCS system and a red flashing 'mismatch alarm' banner would be present on the graphics adjacent to the pump or fan symbol.

Positions of all items such as modulating dampers and control valves shall be shown as a percentage open figure adjacent to the symbol. Dynamic representation of damper positions shall be accepted in addition to the percentage figure where this is available.

Where dampers and control valves are open/close types, then the controlling output and input status shall be represented in words. Where required mismatch alarms shall be adjacent to the word banners.

All ductwork shall be drawn to the same width as the symbols for plant items within that ductwork or AHU.

All sensors shall have 'failure' and 'out of limits' alarms displayed on level 4 graphics. If either condition occurs the device symbol shall turn from white to red and flash. A red flashing banner with white text adjacent to the sensor shall indicate which state has caused the alarm. Stem and capillary temperature sensors shall be represented by different symbols.

Plant and field equipment references (tags) shall be included on all graphic screens. Where available, tag references shall normally be hidden, to be highlighted when the cursor is placed over the device, or shall have the facility to be turned on and off via a button on the graphic.

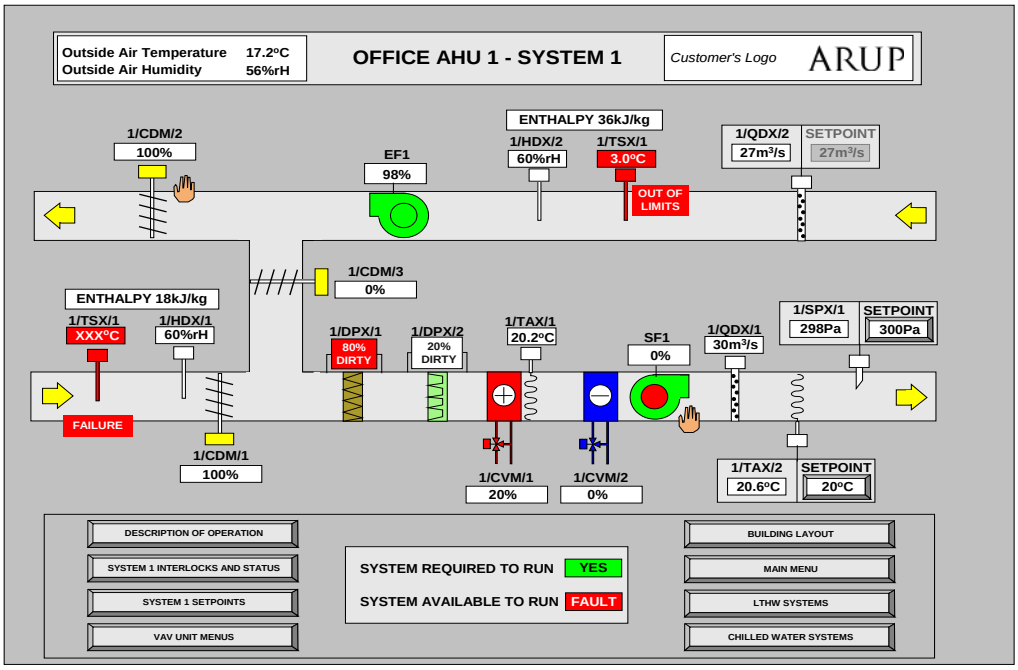
The background colour for the entire graphic shall be light grey. The specific shade chosen shall enhance the graphic display and not obscure any on-screen data.

In addition to those graphics mentioned previously the following shall also be provided on separate graphics:

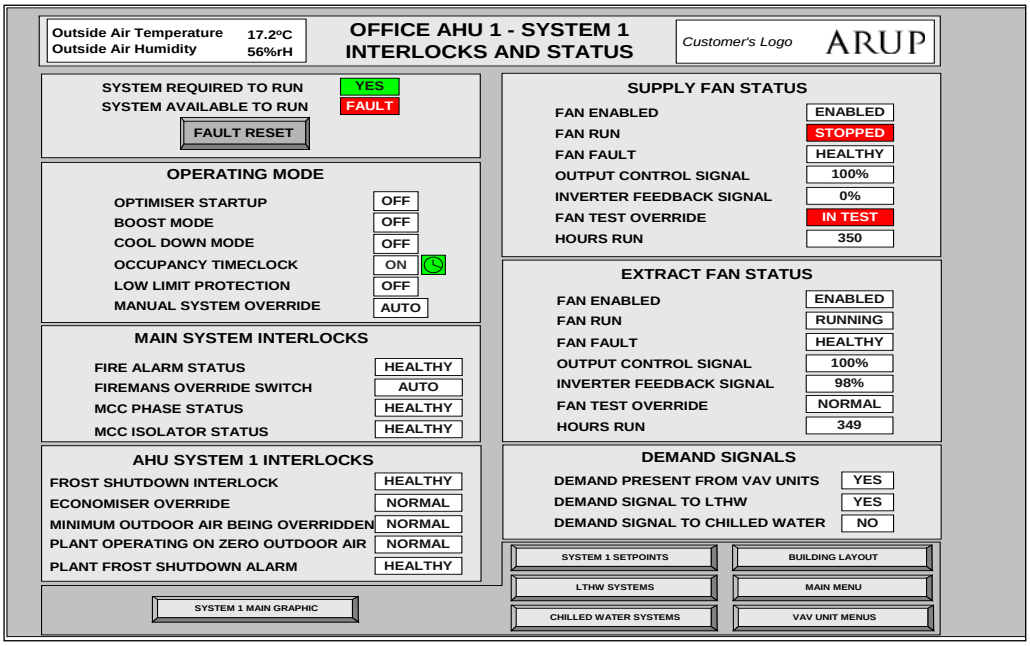
- All MDBs and BMCS control panels detailing their number and location;
- The BMCS network and all items of intelligent BMCS equipment complete with addresses and locations.

The following sample graphics are not project specific.

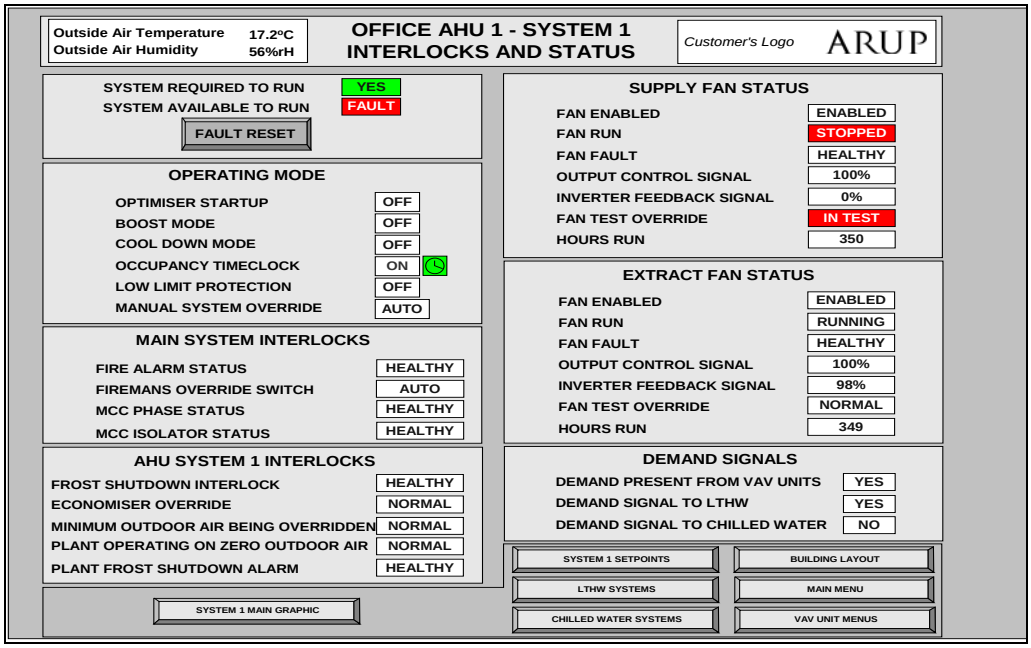
8.5.13.1 Sample of a Typical Level 4 Graphic Office (Office AHU1-System 1)



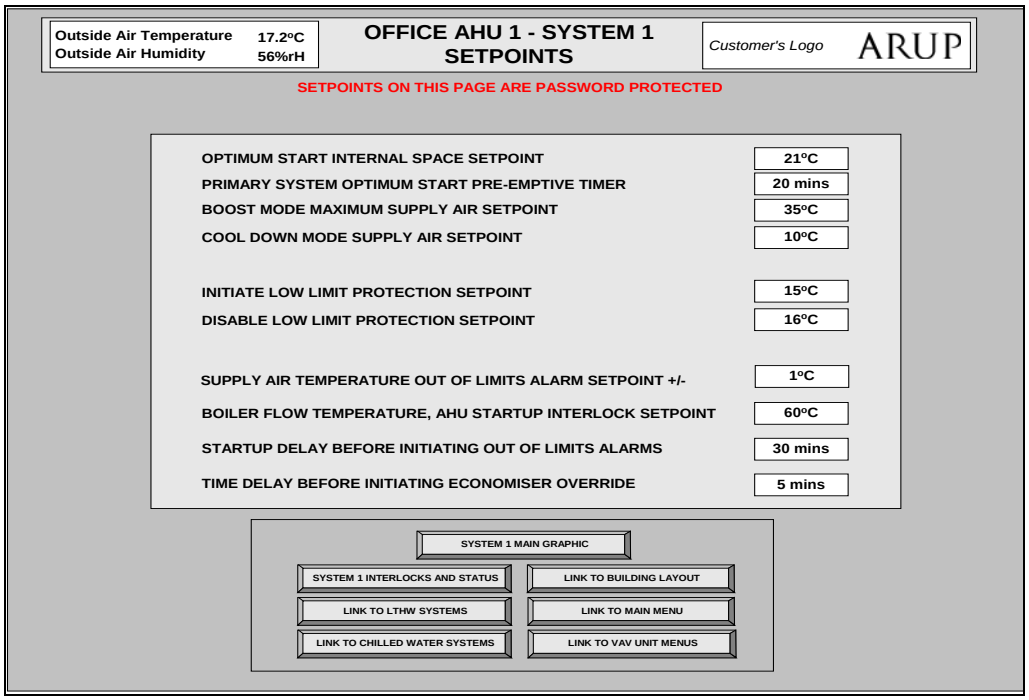
8.5.13.2 Sample of a Typical Level 5 Graphic (Office AHU1 – System 1, 'Interlocks and Status')



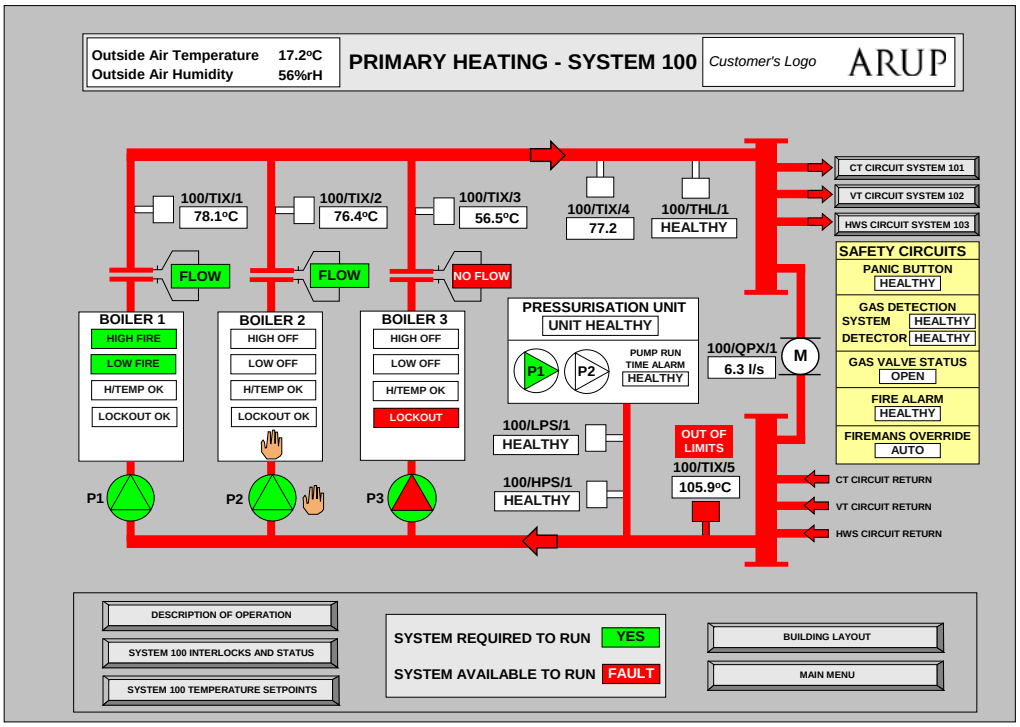
8.5.13.3 Sample of a Typical Level 5 Graphic (Office AHU1 – System 1, 'Interlocks and Status')



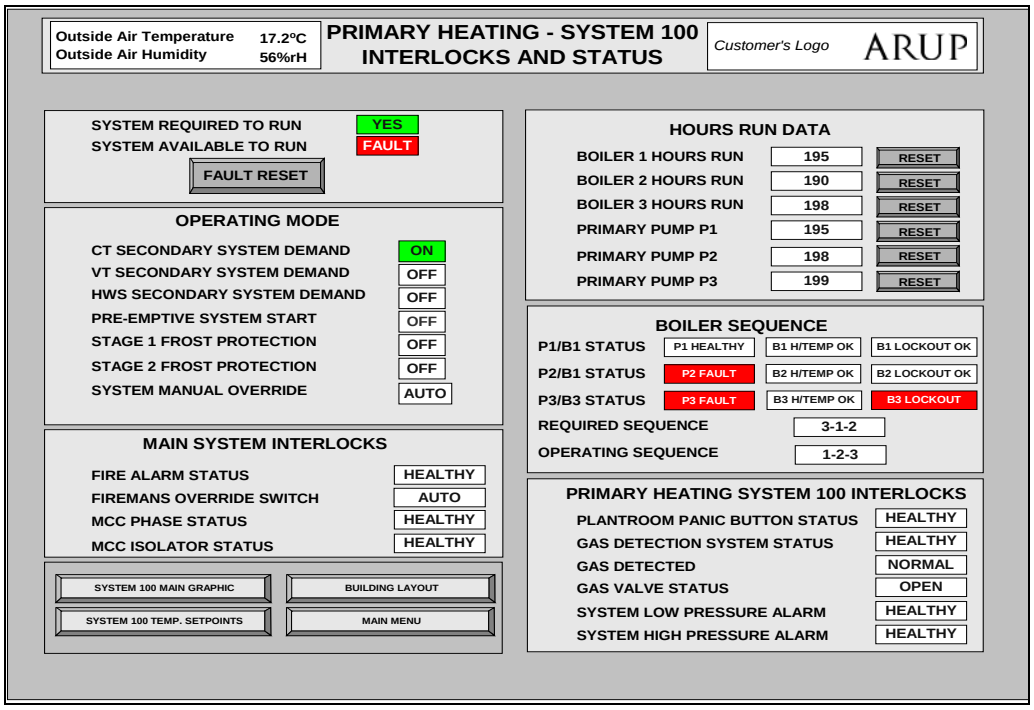
8.5.13.4 Sample of a Typical Level 5 Graphic (Office AHU1 – System 1, 'Setpoints')



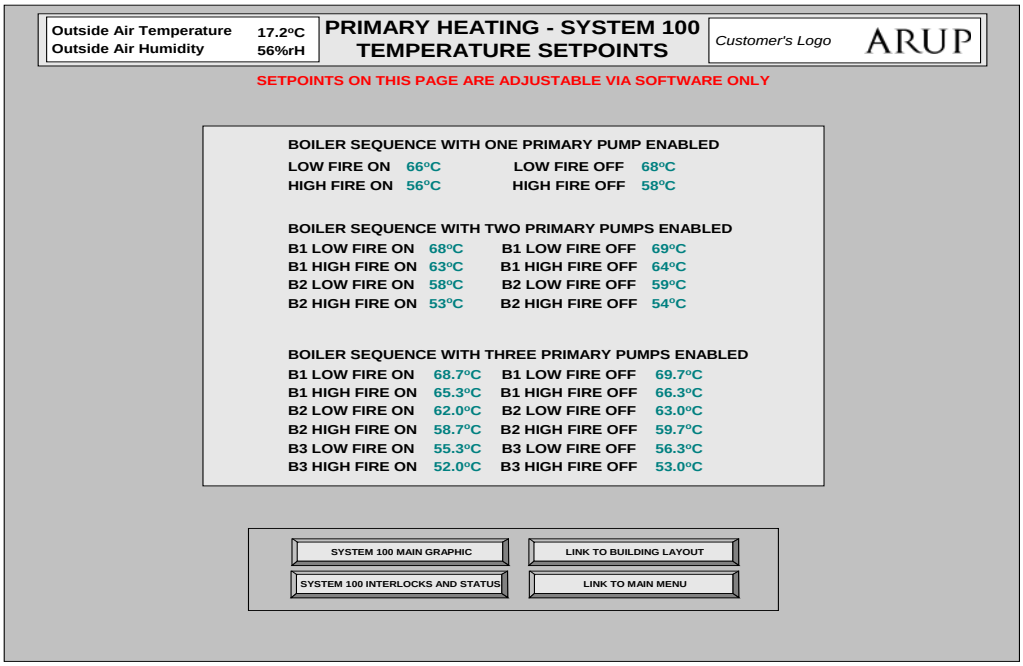
8.5.13.5 Sample of a Typical Level 4 Graphic (Primary Heating – System 100)



8.5.13.6 Sample of Typical Level 5 Graphic (Primary Heating – System 100 'Interlocks and Status)



8.5.13.7 Sample of a Typical Level 5 Graphic (Primary Heating – System 100 'Temperature Setpoints')



8.5.14 Systems Logs & Reports

An operator shall be able to display system logs on any operator's station or print logs on any BMCS printer. Logs as a minimum shall include:

- Critical alarm summary log;
- Critical and general alarm summary log;
- Summary of all current alarms;
- Status logs which include a review of selected system points (e.g. a graphic display or logical group);
- Time schedules logs, which print all or selected time schedules;
- Hours run values for selected or all equipment;
- Accumulated register values for selected or all equipment;
- Change of state conditions for selected or all equipment.

In addition, an operator must be able to record, format, display and/or print out information, as detailed above, on a building controller or point ID basis.

The point ID basis allows an operator to enter in all or any part of a point identifier complete with wild cards. The system will then perform the required function (i.e. search, record, print etc.) on all points which have common identifier characters to that entered.

A print screen function shall also be available.

The BMCS shall be able to arrange all data in a format compatible with Microsoft Excel software or an approved equivalent, which shall also be supplied with the system.

When an operator's station is being used for spreadsheet purposes and other similar programming functions, which may not be directly related to the monitoring and control aspects of the system, it shall continue to monitor, display and annunciate alarms upon their occurrence.

Once the hard disk unit of an operator's station is 90% full it shall raise an alarm to indicate this.

8.5.15 Trending

The system shall provide flexible trending allowing real-time, historical or archived data to be trended in a variety of formats. In addition, trend data types shall be able to be combined to allow for comparisons between data e.g. current real-time data versus archived data.

The system shall provide trending capability with the following functions:

- Real time trending
- Historical trending
- Archived History trending
- Trend Scrolling
- Trend Zoom
- Engineering Unit or Percent
- Cursor readout of trend data

Trend comparisons between archived, real-time and historical data (for example, this year vs. last year). Comparisons between the same point offset in time, or different points must be possible.

Trend De-cluttering via per-pen enable/disable on multi-plot style trends

Independent Y-axis per point on multi-plot style trends. It must be possible to display the Y-axis for any point on the trend by simply selecting the point using the mouse or keyboard

Copying the currently displayed trend data to the clipboard for pasting into spreadsheet or document

Trend Types

The system shall be able to present real-time, historical or archived data in a variety of formats, including single, dual and multiple value trends of up to 8 points. For each trend set display it shall be possible for operators to configure the number of historical samples and ranges displayed. Points configured in trend sets shall be changeable on-line.

Operators shall be able to zoom in on information displayed on trend sets for closer inspection by dragging out an area of interest with the mouse or other pointing device. From such a selection, it shall be possible to copy the underlying data to the Windows clipboard for subsequent pasting into a spreadsheet application such as Microsoft Excel.

Scroll bars shall be available to move the Trend set backwards and forwards across the historical records. The trend sets shall automatically access archived history files without 0perator configuration.

It shall be possible to embed trend objects as part of custom displays. The following formats shall be available:

- Bar Trend
- Line Trend
- Numeric Trend
- Tuning Trend
- Pie Trend
- X-Y Plot

8.5.16 Information Redirection

It shall be possible for the system to redirect information to other (future) operator's stations and/or printers on a time schedule basis (including holiday programming) or manual command basis. For example, all alarms may be re-directed from the BMCS alarm printer to the security room alarm printer, after hours.

8.5.17 Programming

- The system shall have the facility for the user to write his own programs. Programming shall be performed via an operator's station or portable computer;
- Programming shall be user friendly and not require the services of a specialist software programmer;
- The BMCS shall be programmed to achieve all functions for a complete operational system;
- Adjustable software parameters for each process loop, including the setting of the proportional bands, integral times and derivative rates, shall be set up and tuned on site and the values recorded in the appropriate engineering units. All settings shall be such that each process loop performs within the required tolerances and that there is no hunting (cycling) of final control elements.

8.5.18 Response Times

The response times detailed below are the maximum acceptable response times.

- Alarms: The time from activation of an alarm (at the source) to annunciation on an operator's station shall not exceed 3 seconds;
- Graphic Displays: A graphic display shall be displayed complete with updated information from the field for all points, within 3 seconds of the operator request;
- Once displayed all point information will be updated from the field and displayed at intervals not exceeding 30 seconds;

- Logical Groups: A logical group shall be displayed complete with updated information from the field for all points within 10 seconds of the operator's request. Once displayed the value shall be refreshed every 10 seconds;
- Selected Points: The field value of a single input, output or virtual point shall be displayed on the operator's station screen within 3 seconds of a request;
- Global Program: The time from occurrence of an event from one controller or unitary controller to the activation of the output of another controller or unitary controller shall not exceed 5 seconds.

8.5.19 Transient / Spike Protection

All microprocessor based controllers and other electronic equipment such as unitary controllers, personal computers and peripheral equipment and communications equipment, must be capable of withstanding transient disturbances from the input power supply.

Suppressors shall be fitted to all controller input and output points for protection against voltage transients, spikes etc.

The controllers' communication network(s) shall be isolated against transient disturbances via optical couplers or other approved means. Where running between buildings, lightning protection devices shall be installed on the communications network at the point of entry to each building.

8.5.20 Electromagnetic Compatibility

All components of and the complete BMCS system shall comply with the requirements of BS EN 50 081-1 Generic Emission Standard, BS EN 50 082-1 & 2 Generic Immunity Standard and C-Tick.

In order to avoid corruption of the BMCS equipment operation by electrical interference, all wiring shall be installed to minimise coupling of electromagnetic and electrostatic interference on low voltage signals and data wiring. The preferred method of achieving this shall be by ensuring a physical separation of greater than 50mm between the power supply cables and the signal and data cables. Where mixed wiring is unavoidable braided screen mains cable, dressed close to metalwork, is preferred.

The BMCS shall be protected from interference by the operation of hand held radio transmitters, radio pagers, etc, within 1 metre of the equipment.

8.5.21 Power Supply Tolerances

The equipment supplied shall be suitable for operation on site power supply and the supply voltage and frequency tolerances permitted by the Electricity Supply.

8.5.22 BMCS Functions/Standard Programs

8.5.22.1 Point Override

It shall be possible to override all input and output points by use of the BMCS manufacturer's standard software engineering pages or graphics.

8.5.22.2 Manual Start/Stop

- Manual start/stop shall be provided for each system and individual item of plant e.g. pump, fan, etc;
- When the manual command can be overridden by other signals e.g. fire, the system or item of plant selected for manual start/stop control shall be manually controlled without 'forcing' the output point(s) directly.

8.5.22.3 Fixed Time Program

- The time program shall enable and disable the item(s) of plant at specific times for each day of the week. It shall be possible to specify a minimum of four switching times per day;
- It shall be possible to program for up to twelve months in advance including holidays and to make temporary time adjustments which automatically reset once operated;
- At the request of the operator, a system summary of all or selected time schedules may be displayed on the operator's station and/or printed out.

8.5.22.4 Rotational Point

This program shall initiate the altering of the control point designation (such as duty/standby and lead/lag) under any one of the following circumstances:

- On a calendar basis (e.g. weekly, monthly);
- Once a predefined hours run total has been reached;
- Once a predefined time is reached;
- Major plant items (boiler, chillers etc.) affected by the automatic changeover of other items of plant (pumps, fans etc.) which are running when the rotational point is required to operate shall be shut down in a controlled manner before point rotation occurs. Following point rotation, the main plant shall be restarted as required;
- The parameter which defines which item of plant is which (i.e. lead or lag; duty or standby) shall be configured to allow its display. Upon failure of the lead or duty machine the lag or standby machine will run in its place and become the duty/lead machine;
- Once the rotational point has operated to place the failed lead/duty machine in the lag/standby position or the lag machine has failed the rotational point shall be inhibited until the failed machine is reset from the operator's station.

8.5.22.5 Run Time Totalization

- A run time totalization program shall be provided for each drive or plant enable output. The system shall initiate an identifiable alarm output whenever the preset limit has been exceeded for the particular item;
- The run time total shall be accessible by command from the operator, who shall also be able to reset the limits or zero the count for each item.

8.5.22.6 VSD Energy Monitoring

- The energy consumption for each VSD shall be monitored by the BMCS, refer to equipment schedule for details of points required.
- The totals shall be accessible by command from the operator, who shall also be able to reset the limits or zero the count for each VSD.

9 Control Sequences & Monitoring

9.1 General

This section provides a functional description of the manner in which plant or systems shall be controlled. In general, all control shall be performed by the BMCS, however, hardwired control is also described.

Where setpoints, time delays, deadbands, high and low values, proportional bands and similar have been nominated these are indicative only. All these items shall be adjustable and shall be adjusted as required during commissioning.

All items identified within square brackets thus, [20]°C, shall be operator adjustable via the graphics. All items identified within curly brackets thus, {10} secs, shall be adjustable during commissioning and be protected with a high system access level. These items need not be accessed via graphics but can be accessed via system configuration tools i.e. be part of a configuration strategy.

9.2 Weather Stations

9.2.1 General

The weather station shall consist of the following:

- Outside air dry bulb temperature
- Wet bulb temperature sensor
- Relative humidity sensor
- Rain sensor
- Wind speed
- Wind direction

The temperature and humidity sensors shall be shielded from direct sunlight, shall be located away from any exhaust louvers or other sources of heat, and a cover shall shield the sensors from contact with rain. In addition, the temperature and relative humidity values shall be used to calculate the outside air enthalpy value in kJ/kg.

9.3 Office AHUs

9.3.1 General

The low rise office floors are served by the following AHUs:

- AHU-L19-1 serving east internal zone
- AHU-L19-2 serving west internal zone
- AHU-L20-1 serving east villages
- AHU-L20-2 serving west villages

- AHU-L20-3 serving east perimeter zone
- AHU-L20-4 serving west perimeter zone

The high rise office floors are served by the following AHUs:

- AHU-L30-1 serving east villages
- AHU-L30-2 serving west villages
- AHU-L30-3 serving east perimeter zone
- AHU-L30-4 serving west perimeter zone
- AHU-L31-1 serving east internal zone
- AHU-L31-2 serving west internal zone

Each AHU comprises the following:

- Outside air damper (modulating)
- Minimum outside air damper (modulating)
- Return air damper (modulating)
- Panel filter
- Bag filter
- Cooling coil
- Heating coil
- Supply air fan with associated VSD

AHU-L19-1 and AHU-L19-2 each have a dedicated variable speed return air fan and associated exhaust air dampers.

AHU-L20-1 and AHU-L20-3 have a common return air fan and associated exhaust air damper.

AHU-L20-2 and AHU-L20-4 have a common return air fan and associated exhaust air dampers.

High rise AHUs have associated smoke spill fans that are used as relief air fans in normal operation. SSF-R-1 relives air from the east side and SSF-R-2 from the west.

The internal zone AHUs serve pressure independent variable air volume (VAV) boxes.

The perimeter zone AHUs serve pressure independent constant air volume (CAV) boxes.

Each village has an associated high level exhaust air fan, RAF-20-3 exhausts air from the villages in the low rise and RAF-31-3 exhausts air from the villages in the high rise.

Each village has an associated pressure independent CAV box.

Each AHU shall have a dedicated DDC controller located within a field control panel adjacent to the AHU.

The following control sequences are common for each low rise AHU.

Refer to Mechanical Services Schematics and Layout Drawings for numbers and location of equipment.

9.3.2 Automatic Operation

9.3.2.1 System Enable/Disable

The AHU shall be enabled upon any of the following:

- Request from any office floor controller (as described under ‘Office Floor Controls) for warm-up, cool down, normal start, after hours or night purge mode;
- Via a ‘Manual Override’ command on the BMCS graphic.

Upon no enable commands being active, or upon a manual command via the system graphic, the AHU shall be configured as described under plant shutdown.

9.3.2.2 Occupancy Time Schedule

Each tenancy (half floor) shall have an associated occupancy time schedule which shall be adjustable via the BMCS operator station.

The time schedule for each AHU shall be accessible via both the associated AHU graphic and a dedicated AHU time schedule graphic showing all AHUs.

9.3.2.3 After Hours Demand

After hours demand shall be on a half floor basis and shall be derived from:

Local pushbutton key switch

Via web access (configured for dedicated user names for each tenancy)

Voice activated phone system

Upon a request from after hours the AHU shall be configured as described under normal start.

9.3.2.4 Optimum Start Program

The office floor controllers shall determine the most appropriate start time and start mode for each AHU (as described under ‘Office Floor Controls) to ensure that the associated space temperature condition reaches the required comfort level by the start of the occupancy time period.

The start mode sent to the AHU DDC shall be either ‘Warm-Up’, ‘Cool Down’ or ‘Normal Start’.

In a conflict situation where an optimum start program for one floor starts the AHU in Warm-Up and another optimum start program on a different floor requires Cool Down or vice versa, the AHU shall be configured to run as described under Normal Start.

Warm-Up

On receipt of a warm-up mode start signal the plant shall be configured as follows:

- Outside air and minimum outside air dampers shall remain fully closed
- Return air damper shall remain fully open
- Cooling coil valve fully closed
- Supply air fan shall be enabled
- Upon receipt of the supply air fan running status, the AHU shall operate under normal temperature control with the exception that the supply air temperature setpoint shall be fixed at [30]°C.
- Dew point control loop shall be enabled

Warm-Up mode shall be terminated upon any of the following being true:

- There are no warm up requests from any office floor;
- There is a cool down request from any office floor;
- There is a normal start request from any office floor.

On termination of warm-up the AHU shall run under normal control with the exception that the minimum outside air damper shall remain closed until the start of occupancy. The supply air temperature setpoint shall be set to [18]°C.

Cool Down

On receipt of a Cool down mode start signal the system shall be configured as follows:

- Heating coil shall remain fully closed;
- Supply air fan shall be enabled
- Upon receipt of the supply air fan running status, the AHU shall operate under normal temperature control with the exception that the supply air temperature setpoint shall be fixed at [12]°C.
- Dew point control loop shall be enabled
- Economy cycle shall be available but the minimum outside air damper shall remain closed.

Cool Down mode shall be terminated upon any of the following being true:

- There are no Cool Down requests from any office floor;
- There is a Warm Up request from any office floor;
- There is a normal start request from any office floor.

On termination of cool down the AHU shall run under normal control with the exception that the minimum outside air damper shall remain closed until the start of occupancy. The supply air temperature setpoint shall be set to [13]°C.

Normal Start

On receipt of a Normal start signal the system shall be configured as follows:

- The supply air fan shall be enabled

Upon receipt of the supply air fan running status, all control loops shall be enabled under normal control.

- The supply air temperature setpoint shall be set to [15]°C.

9.3.2.5 Plant Shutdown

Upon a request for plant shutdown the AHU shall be configured as follows:

- The supply air fan shall be disabled.
- Following a suitable time delay for the fan to stop, the outside air dampers and exhaust air dampers (where applicable) shall be driven fully closed and the return air damper fully open.
- Cooling coil and heating coil valves shall be driven fully closed.
- All control loops associated with the AHU shall be disabled
- Return air and exhaust air fans associated with AHUs shall be disabled upon all associated AHUs being shutdown.

9.3.2.6 Manual Override

An operator shall have the facility to manually enable/disable the AHU via the system graphic.

Upon a manual enable command, the AHU shall be enabled under Normal Start.

9.3.2.1 Floor Isolation Damper Interlock

The AHU shall be inhibited from starting unless at least two floor's supply isolation dampers associated with the AHU are open, indication shall be displayed on the system graphic that insufficient floor supply air isolation dampers are open in this scenario. Note: if only one floor only is occupied, dampers associated with another floor shall be overridden open as described in "Low occupancy - Floor Isolation damper Operation".

9.3.2.2 Night Purge

The DDC controllers on each floor shall determine if night purge is beneficial and send a request to the associated AHUs. Upon receipt of a night purge request from [5] or more floors (refer to office floor controls for details), the AHU shall be configured as follows:

- Supply air fan shall be enabled and run under normal pressure control with the exception that the static pressure setpoint shall be [70]% of the normal operating setpoint;
- Return air fans/exhaust air fans shall operate under normal control;
- Outside air, minimum outside air and exhaust air (where applicable) dampers fully open;
- Return air damper fully closed;

- Heating and cooling valves shall remain fully closed.

Night purge shall be disabled upon either a request for the AHU to run in another mode or upon less than [5] requests for night purge from the office floors.

An operator shall have the facility to disable night purge for the AHU via the system graphic.

Details of night purge requests and times when the AHU has run in night purge mode shall be displayed on a system graphic.

9.3.2.3 Supply Air Temperature Control

The dampers (when economy cycle is available), cooling coil valve and heating coil valve shall be modulated in sequence via a P+I control loop to maintain the internal zone supply air temperature at setpoint ± 0.5K.

The position of the cooling coil control valve shall be the greater (most open position) of the dew point temperature, relative humidity and supply air temperature control loops.

The position of the heating coil control valve shall be the greater (most open position) of the relative humidity and supply air temperature control loops.

When the cooling coil is modulating as part of the dew point or relative humidity control loop it shall be removed from the temperature control loop. The dampers and heating coil shall continue to modulate to the dictates of the temperature control loop.

An alarm shall be raised in the event that the supply air temperature is greater than {2}K above or below setpoint for {15} minutes. The alarm shall be inhibited for {30} minutes after plant start, and whenever the AHU is shut down.

9.3.2.4 Supply Air Temperature Setpoint Reset (Internal Zone)

The average cooling and heating demand for each AHU zone (internal, perimeter and village) on each floor shall be calculated as a percentage i.e. 0 – 100% (as described under ‘Office Floor Controls’).

The supply air temperature setpoint for the **internal** zone AHUs shall be reset between the limits of [12]°C and [18]°C according to the **highest** average floor cooling demand (limits shall be adjustable for each AHU).

If the demand is greater than {90}%, the supply air temperature setpoint shall be reduced at a rate of {0.5}K/minute until either the demand reduces below {90}%, or any zone has a heating demand, when resetting shall stop.

If the demand is less than {80}%, the supply air temperature setpoint shall be increased at a rate of {0.5}K/minute until either the demand rises above {80}%, when resetting shall stop.

Resetting shall be inhibited in the event that the supply air temperature is greater than {0.5}K above or below the supply air temperature setpoint.

9.3.2.5 Supply Air Temperature Setpoint Reset (Perimeter Zone)

The average cooling and heating demand for each AHU zone (internal, perimeter and village) on each floor shall be calculated as a percentage i.e. 0 – 100% (as described under 'Office Floor Controls').

The supply air temperature setpoint for the **perimeter** zone AHUs shall be reset between the limits of [12]°C and [18]°C according to the **lowest** average floor cooling demand (limits shall be adjustable for each AHU).

If the demand is greater than {20}%, the supply air temperature setpoint shall be reduced at a rate of {0.5}K/minute until the demand reduces below {20}%, when resetting shall stop.

If the demand is less than {10}%, the supply air temperature setpoint shall be increased at a rate of {0.5}K/minute until either the demand rises above {10}%, when resetting shall stop.

Resetting shall be inhibited in the event that the supply air temperature is greater than {0.5}K above or below the supply air temperature setpoint.

9.3.2.6 Dew Point Control

The supply air temperature and relative humidity sensors shall be used to calculate the supply air dew point temperature.

The cooling coil control valve shall modulate via a P+I control loop to maintain the supply air dew point at setpoint ± 0.2K.

The cooling coil valve position shall be dictated by either the temperature, dew point temperature or relative humidity control loops, whichever calls for the most open position.

Indication shall be displayed on the system graphic whenever dehumidification is active, i.e. the dew point control loop requires a more open valve position than the supply air temperature control loop.

In the event that the heating hot water flow temperature is below [50]°C, dew point control shall be inhibited.

An alarm shall be raised in the event that the supply air dew point temperature is greater than {1}K above or below setpoint for {15} minutes. The alarm shall be inhibited for {30} minutes after plant start, and whenever the AHU is shut down.

9.3.2.7 Supply Air Dew Point Setpoint Reset

At start-up the supply air dew point temperature setpoint shall be [12.5]°C.

The average dew point temperature for each AHU zone (internal, perimeter and village) on each floor shall be calculated (as described under 'Office Floor Controls').

The supply air dew point temperature setpoint shall be reset between the limits of [9.0]°C and [14]°C according to the highest average floor dew point temperature (limits shall be adjustable for each AHU).

If the highest average dew point temperature is greater than {14}°C, the supply air dew point temperature setpoint shall be reduced at a rate of {0.5}K/minute until either the highest average dew point temperature reduces below {13.5}°C, when resetting shall stop.

If the highest average dew point temperature is less than {13}°C, the supply air temperature setpoint shall be increased at a rate of {0.2}K/minute until either the highest average dew point temperature rises above {13.5}°C, when resetting shall stop.

Resetting shall be inhibited in the event that the supply air temperature is greater than {0.2}K above or below the supply air temperature dew point setpoint.

9.3.2.8 Supply Air Relative Humidity Control

The cooling coil control valve and the heating coil control valve shall modulate in sequence via a P+I control loop to maintain the supply air relative humidity below [78]%rH ± 1%.

The cooling coil valve position shall be dictated by either the temperature, dew point temperature, or relative humidity control loops, whichever calls for the most open position.

The heating coil valve position shall be dictated by either the temperature or relative humidity control loops, whichever calls for the most open position

Indication shall be displayed on the system graphic whenever %rH control is active i.e. the relative humidity control loop requires a more open cooling/heating coil valve position than the temperature or dew point temperature control loop.

A software interlock with the heating water valve shall ensure that the relative humidity control does not raise the supply air temperature above {15.0}°C.

In the event that the AHU has a heating demand and the heating hot water flow temperature is below [50]°C, relative humidity control shall be inhibited.

The supply air relative humidity sensor shall raise an alarm in the event that the relative humidity rises above [80]%rH for {15} minutes. The alarm shall be inhibited for [30] minutes after plant start-up or whenever the AHU is shutdown.

9.3.2.9 Cooling Call Signal

A cooling call signal shall be derived from the BMCS output signal to the air handling unit cooling coil control valve. When the cooling valve reaches the {40}% open position a cooling call shall be sent to the low temperature chilled water system.

The cooling call signal shall remain active until the valve closes and remains closed for a period of {10} minutes, at which point the cooling call signal shall be de-activated. When the valve reaches the {10}% open position again, the cycle shall repeat.

Cooling calls shall not be generated when the plant is in a shutdown state.

9.3.2.10 Heating Call Signal

A heating call signal shall be derived from the BMCS output signal to the air handling unit heating coil control valve. When the heating valve reaches the {40}% open position a heating call shall be sent to the heating hot water system.

The heating call signal shall remain active until the valve closes and remains closed for a period of {10} minutes, at which point the heating call signal shall be de-activated. When the valve reaches the {10}% open position again, the cycle shall repeat.

Heating calls shall not be generated when the plant is in a shutdown.

9.3.2.11 Economy Cycle

The decision on whether the plant operates in economy cycle shall be based on a comparison of return air conditions and the conditions in the outside air plantroom plenum.

An operator shall have the facility to select whether the economy cycle decision is based on a comparison of ‘enthalpy and dry bulb temperature’ or ‘dry bulb temperature’ alone.

Enthalpy and Dry Bulb Temperature

In the event that the outside air enthalpy is lower than the return air enthalpy and the outside air dry bulb temperature is less than the return air dry bulb temperature, economy cycle shall be available.

Dry Bulb Temperature

In the event that the outside air dry bulb temperature is lower than the return air dry bulb temperature, economy cycle shall be available.

When economy cycle is enabled the outside air damper shall modulate as the first stage of cooling in the temperature control loop.

The outside air and return air dampers shall modulate in opposition. The outside air and exhaust air damper (where applicable) shall modulate in unison.

Each damper shall have a dedicated analogue output to characterise the damper output during commissioning.

Indication shall be displayed on the system graphic whenever economy cycle is active.

9.3.2.12 Supply Fan Static Pressure Control

A static pressure sensor located in the distribution ductwork shall be used as the measured input into the fan speed control loop.

The sensor shall have an associated static pressure setpoint. The static pressure setpoint shall be determined during commissioning.

The BMCS shall modulate the supply fan speed via a Proportional plus Integral action control loop to maintain static pressure sensor at setpoint. The static pressure sensor shall be installed approximately 2/3 the way down the distribution

ductwork and wired directly to the AHU DDC. The location of the sensor shall be detailed on the system graphic.

9.3.2.13 Supply Air Static Pressure Setpoint Reset

The average VAV/CAV damper position for each AHU zone (internal, perimeter and village) on each floor shall be calculated as a percentage i.e. 0 – 100% (as described under 'Office Floor Controls').

The supply static pressure setpoint shall be reset between {100}% and {60}% according to the highest average damper position.

If the damper position is less than {70}%, the supply static pressure setpoint shall be reduced at a rate of {10}Pa/minute until either the damper position increases above {80}%, when resetting shall stop.

If the damper position is greater than {90}%, the supply static pressure setpoint shall be increased at a rate of {10}Pa/minute until the damper position reduces below {80}%, when resetting shall stop.

Resetting shall be inhibited in the event that the supply static pressure is greater than {10}Pa above or below setpoint.

An operator shall have the facility to inhibit the suppy air static pressure reset strategy via the system graphic.

9.3.2.14 Pressure Control Alarm Limits

The static pressure control sensor shall provide out of limits alarms on the BMCS when the sensed pressure rises [30]Pa or more above or below setpoint. The alarms shall be inhibited for [5] minutes after plant start, and whenever the AHU is shut down.

9.3.2.15 Minimum Outside Air Damper Control

A thermal dispersion type air flow measuring device shall be located in the minimum outside air duct.

The minimum outside air damper shall modulate via a P+I control loop to maintain the air flow at setpoint.

The minimum outside air setpoint shall be reset according to the CO_2 control described below.

9.3.2.16 Carbon Dioxide (CO_2) Monitoring and Control

The minimum outside air volume setpoint shall be reset between upper and lower limits according to the highest CO_2 level measured on the occupied floors.

For each number of floors occupied the air volume that correlates to the following shall be determined:

- Upper limit - Full occupancy (18.75l/s per person)
- Lower limit - Minimum BCA requirement for associated floor area

The CO_2 level on each floor shall be monitored by the BMCS.

At start-up the minimum outside air damper position shall assume full occupancy.

Resetting shall only commence once the AHU has been operational for [30] minutes.

If the highest CO_2 level is less than {600}ppm, the minimum outside air damper volume setpoint shall be reduced at a rate of {1}% per minute until either the highest CO_2 level rises above {620}ppm or the lower limit volume is reached, when resetting shall stop.

If the highest CO_2 level is greater than {640}ppm, the minimum outside air damper volume setpoint shall be increased at a rate of {5}% per minute until either the highest CO_2 level falls below {620}ppm or the upper limit volume is reached, when resetting shall stop.

9.3.2.17 Return Air Fan Speed Control

AHU-19-1 and AHU-19-2

The return air fan speed shall track the associated supply air fan speed such that {90}% of the total supply air volume is exhausted from the space. A look-up table shall be populated during commissioning in conjunction with the air balancer that relates the return air volume to the following supply air volumes - 100%, 80%, 60% and 40%. Supply air volumes shall be achieved under normal pressure control through modulation of VAV/CAV boxes.

AHU-20-1/3 and AHU-20-2/4

A static pressure sensor shall be installed in the return air duct between the two AHU take offs.

The speed of the return air fan shall modulate via a P+I control loop to maintain the static pressure at setpoint [10]Pa +/- 5pa.

9.3.2.18 Exhaust Air Fan Speed Control (High Rise)

Smoke spill fans SSF-R-1 and SSF-R-2 shall be used in normal operation for relief air control.

Each smoke spill fan shall have an associated static pressure sensor located approximately 2/3 down the relief air riser wired directly back to the DDC controlling the fan speed.

The speed of the return air fan shall modulate via a P+I control loop to maintain the static pressure at setpoint +/- 5pa. The setpoint shall be determined during commissioning in conjunction with the air balancer such that with the AHUs on 100% outside air, 90% of the supply air volume is being relieved.

The fans shall be disabled when less than {5} floors in the associated zone are occupied.

9.3.2.19 Village High Level Exhaust Fan Speed Control

Each village exhaust air fan shall have an associated static pressure sensor located approximately 2/3 down the riser wired directly back to the DDC controlling the fan speed.

The speed of the fan shall modulate via a P+I control loop to maintain the static pressure at setpoint +/- 5pa.

9.3.2.20 Valve Exercising Routine

Every [7] days at a time when the plant is shutdown, the chilled and heating valves shall be exercised. Each valve shall be driven to the fully open position, then to the fully closed position, then to the required plant shutdown position. Heating and cooling calls shall be inhibited when the valves are exercising.

9.3.2.21 Filter Monitoring

Each AHU has an associated panel filter and bag filter.

A separate differential pressure switch shall be provided to measure the pressure drop across each filter. In the event that the pressure drop across the filter becomes indicative of a dirty filter condition, an alarm shall be raised on the BMCS operator's station.

9.3.2.22 Fan VSD Monitoring

Enable command, speed control and fault status shall be via low level interfaces. All other monitoring and control shall be via a high level interface.

Each fan shall be monitored for running status via the VSD running status.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan status, an alarm shall be raised on the BMCS operator's station and the fan shall be commanded off. The AHU shall be deemed to have failed and shall be configured as described under plant shutdown.

In the event of a fault being reported from the fan VSD an alarm shall be raised at the BMCS operator's station and the fan shall be commanded off. The AHU shall be deemed to have failed and shall be configured as described under plant shutdown.

In either condition the air handling unit shall not re-enter the normal automatic control sequence until the BMCS operator acknowledges that the fan fault alarm has been cleared, and operates the fault reset at the BMCS operator's station.

The underload/time parameters shall be set up on the VSD such that if the motor torque/current drops below the selected load curve parameter for the set time, indicating a malfunction e.g. a broken belt, the variable speed motor shall be stopped and a fault alarm raised at the BMCS operator’s station.

9.3.2.23 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.3.2.24 BMCS Communications Network Integrity

If communication with a floor controller is lost and the AHU was running in Warm Up, Cool Down, Normal or After Hours modes of operation prior to failure, the AHU shall default to run in a Normal mode. The supply air temperature setpoint shall default to [13.0]°C and the supply air dew point setpoint shall default to [9.5]°C.

If communication with a floor controller is lost and the AHU was running in Night Purge modes of operation prior to failure, the AHU shall be shutdown.

9.3.3 Graphical Requirements

An AHU summary graphic shall be developed that displays the following information for each AHU in a single table:

- AHU operation mode
- Supply air temperature
- Supply air temperature setpoint
- Supply air relative humidity
- Supply air relative humidity setpoint
- Supply air dew point temperature
- Supply air dew point temperature setpoint
- Supply air static pressure
- Supply air static pressure setpoint
- Economy cycle status

An office floor summary graphic shall be developed for each AHU that displays the following information specific to the zones served:

- Number of floors occupied
- Highest space temperature
- Lowest space temperature
- Average space temperature
- Highest dew point temperature
- Lowest dew point temperature
- Average dew point temperature

A VAV/CAV box summary page shall be developed for each AHU that displays the following information for each box:

- Space temperature (+ setpoint)

- Volume measured (+ setpoint)
- Damper position

9.4 Office Floor Controls

9.4.1 General

Low rise office floors are located in levels 6 to 17 inclusive, high rise office floors are located on levels 21 to 29 inclusive.

Where multiple floors (two or three) are interconnected by a central staircase, this is referred to as a village. There are also a number of levels that are not associated with a village.

For the purpose of occupancy time schedules, each level shall be split into two zones.

Each office level is served by the following AHUs:

- East perimeter zone via CAV boxes
- East Internal zone via VAV boxes
- West perimeter via CAV boxes
- West internal via VAV boxes

The lowest level in each village is also served by an east and west village AHU via VAV boxes.

Air is exhausted from the highest level in each village by RAF-20-3 for the low rise and RAF-31-3 for the high rise, via CAV boxes.

The lowest level in each village has trench heating located on the north and south façade. Each trench heater has an associated fan.

Office floors not associated with a village have trench heating located on the south façade only. Each trench heater has an associated fan.

Active chilled beams are located around the perimeter of each office level.

Each office floor shall have a dedicated floor controller that shall connect directly to the Ethernet backbone. All terminal unit controllers (TUC) on an office floor shall be networked back to the associated floor controller (networking between floors is not acceptable).

Chilled beams shall be controlled by distributed TUCs located local to the beams i.e. not from a central controller within the riser.

Refer to Mechanical Services Schematics and Layout Drawings for numbers and location of equipment.

9.4.2 Automatic Operation

9.4.2.1 Occupancy Time Schedules

Occupancy time schedules and the associated optimum start program shall be located within the DDC controller located on the office floor.

The optimum start programs shall ensure that the associated space temperature condition reaches the required comfort level by the start of the occupancy time period. The average of the space temperature sensors on the floor and the global outside air temperature shall be used to determine the most appropriate start time and start mode for the associated AHUs. An operator shall have the facility to remove temperature sensors from the optimum start program via the system graphic.

The start time shall be limited to a maximum of [120] minutes before occupancy.

The request to the associated AHUs shall either be Cool Down, Warm Up or Normal Start, depending on whether the office floor average space temperature is less than the floor global heating setpoint, greater than the floor global cooling setpoint or between the heating and cooling setpoints respectively.

Upon a call for Cool Down mode the associated chilled beams and CAV and VAV boxes shall be enabled and operate under normal temperature control.

Upon a call for Warm Up mode the associated trench heaters and CAV boxes shall be enabled and operate under normal temperature control. The VAV boxes shall operate in heating mode i.e. increase the volume upon a greater demand for heating.

The trench heaters shall remain disabled in Cool Down mode.

The chilled beams shall be disabled in warm-up mode.

Warm-Up mode shall be terminated upon any of the following being true:

- occupancy time for the zone is reached;
- upon all space sensors rising above the floor global heating setpoint;
- upon any space sensor rising above the floor global cooling setpoint;

Cool Down mode shall be terminated upon any of the following being true:

- occupancy time for the zone is reached;
- upon all space sensors falling below the floor global cooling setpoint;
- upon any space sensor falling below the floor global heating setpoint.

Upon termination of Warm Up or Cool Down mode a Normal Start signal shall be sent to the associated AHUs.

Warm-Up mode shall be inhibited if night purge mode has been active any time in the previous 12 hours.

9.4.2.2 After Hours Air Conditioning

Each occupancy zone shall have a dedicated after hours air conditioning request. After hours requests shall be via a tenant web interface or via the head end operator's station (i.e. both methods shall be provided).

Upon a call for after hours the 1 of 3 floor zone shall operate under normal control for a time period of [60] minutes (note: all other zones on the floor shall remain shutdown) and a Normal Start request shall be sent to the associated AHUs.

The BMCS shall be configured to also have facility for additional, further subdivided, after hours zones to be added as part of tenant fitout works. These zones shall involve operation of certain chilled beam control valves and AHUs in response to the afterhours zone activated.

9.4.2.3 Tenant Outside Air System

Upon any tenancy zone on a floor being occupied (normal or after hours) a request shall be sent for the associated tenant outside air fan.

Upon the floor being unoccupied the request shall be removed.

9.4.2.4 Tenant General Exhaust System

Upon any tenancy zone on a floor being occupied (normal or after hours) a request shall be sent for the associated tenant outside air fan.

Upon the floor being unoccupied the request shall be removed.

9.4.2.5 Floor Isolation Dampers

Upon a request for air conditioning from either the occupancy time schedule, optimum start, after hours request or night purge the associated supply and return floor isolation dampers shall be driven open.

Each floor isolation damper shall have an associated open and closed end switch that feedback the position of the damper blade (not the actuator position).

In the event that neither status is received the damper shall be deemed to be driving.

In the event of a mismatch between the damper command and damper status following a suitable drive time, an alarm shall be raised on the BMCS.

A request for an AHU to start shall not be sent until the associated floor isolation dampers have been proven open via their end switches.

When a supply isolation damper is required to close, the request for the associated AHU shall be removed, the isolation damper shall be driven closed following a time period of [3] minutes to allow for the AHU to shutdown.

An operator shall have the facility to manually open/close all supply air isolation dampers and/or all return air isolation dampers via separate commands on the system graphic. The dampers shall reset back to their auto position at midnight.

Floor isolation dampers are hardwired with the fire alarm system to override the BMCS command in the event of a fire. The BMCS commands shall be wired to terminals in a smoke damper interface panel provided by the Mechanical Services Subcontractor. The BMCS Subcontractor shall coordinate final interface requirements with the Mechanical Services Subcontractor.

9.4.2.6 Space Temperature Sensors

All office space temperature sensors shall be located at 1.5m above FFL. The BMCS Subcontractor shall coordinate all sensor locations with the builder to ensure conduit is cast into the concrete where required.

Refer to mechanical services floor layout drawings for locations of temperature sensors.

9.4.2.7 Floor Temperature Control

Each space temperature sensor shall have an associated temperature setpoint and deadband. The cooling setpoint shall be calculated as the temperature setpoint plus half the deadband and the heating setpoint shall be calculated as the temperature setpoint minus half the deadband. The heating and cooling setpoints shall be used to control the associated chilled beams, VAV boxes, CAV boxes and trench heaters (as described under the relavent section below).

An operator shall have the facility to adjust the temperature setpoint and deadband for all sensors on a floor by adjusting the global floor parameters via a one shot operation. The global floor setpoint shall initially be set to [22.5]°C and the deadband [3.0]K, giving a cooling setpoint of 24°C and a heating setpoint of 21°C.

An operator shall also have the facility to remove each sensor from using the global parameters and input a temperature setpoint and deadband. Indication shall be displayed on the floor layout graphic in the event that a sensor has been removed from using the global floor parameters e.g. sensor temperature value changes colour.

In the event that a sensor is {0.5}K above the cooling setpoint or {0.5}K below the heating setpoint, visual indication shall be displayed on the floor layout graphic e.g. value coloured red.

The space temperature sensors shall raise an out of limits alarm in the event that the sensed temperature is greater than [3]K above or below setpoint. The alarms shall be inhibited when the floor is not occupied.

9.4.2.8 Chilled Beam Temperature Control

Each chilled beam zone shall have a dedicated space temperature sensor.

Chilled beam temperature control shall be enabled during cool down mode and whenever the associated tenancy is occupied (normal or after hours), at all other times the chilled beam 2-port valve shall be driven closed.

The two port control valve shall modulate via a P+I control loop to maintain the associated temperature sensor at the cooling setpoint.

Upon a Cool Down command the chilled beams shall operate under normal temperature control.

9.4.2.9 Trench Heating Control

Trench heater control shall be enabled during warm up mode and whenever the associated tenancy is occupied (normal or after hours), at all other times the chilled beam 2-port valve shall be driven closed.

Each trench heater has an associated 2-port control valve, fan and space temperature sensor. Fans serving the same zone shall be enabled via a common output.

The two port control valve shall be modulated via a P+I control loop to maintain the associated space temperature sensor at the global floor heating setpoint ± 0.5K.

The trench heater fans shall be enabled/disabled according to the trench heater temperature P+I loop. Upon the loop output reaching {100}% the fan shall be enabled. The fan shall then be disabled upon the fan output falling below {70}%.

Upon request for a Cool Down or Night Purge the two port control valve shall remain fully closed.

Upon the zone being unoccupied the two port control valve shall be driven fully closed.

9.4.2.10 Trench Heater Fan monitoring

Each trench heater fan shall be monitored for a trip via an aux. contact on the associated fan starter. An alarm shall be raised on the BMCS in the event of a trip condition.

9.4.2.11 Dew Point Control

Each internal zone shall have 2 no. associated space humidity sensors located adjacent to a nominated space temperature sensor.

Each perimeter zone shall have 1 no. associated space humidity sensor located adjacent to a nominated space temperature sensor.

The space dew point temperature shall be calculated by the floor controller at the location of each humidity sensor. The highest dew point temperature on each floor shall be available to use for the secondary/tertiary CHW reset control strategy. The average dew point temperature for each zone shall be available to use for the AHU dew point control strategy.

An operator shall have the facility to remove rogue sensors from the calculation.

The space temperature/humidity sensors shall raise an out of limits alarm in the event that the sensed dewpoint is [1]K above setpoint. The alarms shall be inhibited when the floor is not occupied.

9.4.2.12 Chilled Beam Condensation Override

Each chilled beam zone shall have a dedicated condensation sensor installed on exposed pipework (i.e. no lagging 50mm either side of the sensor) on the flow pipe to the chilled beams on the system side of the zone two port valve.

In the event that condensation is detected, the associated two port valve shall be overridden closed and an alarm shall be raised.

Upon the condensation sensor no longer detecting condensation, the valve shall return to automatic control i.e. no reset is required.

9.4.2.13 VAV Box Control

VAV box control shall be enabled during warm up mode, cool down mode and whenever the associated tenancy is occupied (normal or after hours). When the zone is unoccupied the VAV box shall be driven open.

Each VAV box shall have a dedicated space temperature sensor(s). Where a VAV box served two zones, each with a space temperature sensor the values shall be averaged.

Refer to ‘CAV/VAV Boxes’ Section for further details of VAV Box control requirements.

9.4.2.14 CAV Box Control

CAV box control shall be enabled during warm up mode, cool down mode and whenever the associated tenancy is occupied (normal or after hours). When the zone is unoccupied the CAV boxes shall be driven open.

Refer to ‘CAV/VAV Boxes’ Section for further details of VAV Box control requirements.

9.4.2.15 AHU Heating and Cooling Demand

A heating/cooling demand shall be sent to the associated AHU for each zone on each floor served.

The space temperature sensors associated with the zone shall be averaged on each floor and compared to the floor global cooling and heating setpoints to determine a cooling/heating demand (%). The heating/cooling demand shall be sent to the associated AHU DDC controller.

9.4.2.16 Night Purge

The floor controller shall determine if Night purge mode would be beneficial. Upon all of the following criteria being true a night purge request shall be sent to the associated AHU:

- There are no other AHU requests active;
- The outside air temperature is between [15]°C and [22]°C;
- The outside air dew point temperature is less than [13]°C;

- The average space temperature for the zone is greater than [24]°C;
- The next occupancy time scheduled is within [10] hours.

A Night purge request shall be removed upon any of the following criteria being true:

- The average space temperature for the zone is ≤ [22.5]°C;
- Any space temperature sensor in the zone falls below [19] °C;
- There is another AHU request active;
- The outside air temperature is not between [15]°C and [22]°C;
- The outside air dew point temperature > [13]°C;
- The next scheduled occupancy start time is within [2] hours.

The following night purge information shall be displayed and logged for each floor:

- Times when night purge mode is active (AHU is also running in night purge mode);
- Average temperature at start of night purge;
- Average temperature at end of night purge.

Note: night purge parameter setpoints shall be common for all floors and adjusted via a common graphic.

9.4.2.17 Carbon Dioxide (CO_2) Monitoring

The CO_2 level in each ½ floor's return air path shall be monitored on the BMCS and used for AHU outside air volume control (refer to Office Floor AHUs for further details).

9.4.3 Graphical Requirements

A floor layout graphic shall be provided for each floor using an architectural background. The following information shall be displayed on the floor layout as a minimum:

- HTCHW flow temperature
- Chilled beam locations and zoning
- Trench heaters and valve position
- VAV Boxes and % volume of Vmax
- CAV boxes
- AHU supply air temperatures
- Space temperature sensor readings
- Space relative humidity sensor readings
- Calculated dew point temperatures
- Condensation sensor activated

An office floor summary graphic shall be developed that displays the following information specific to the zones served:

- Number of floors occupied
- Highest space temperature for each floor
- Lowest space temperature for each floor
- Average space temperature for each floor
- Highest dew point temperature for each floor
- Lowest dew point temperature for each floor
- Average dew point temperature for each floor

9.5 CAV/VAV Boxes

9.5.1 General

All CAV/VAV boxes shall be pressure independent type.

Each CAV/VAV box shall be supplied with the following equipment:

- Electronic volume controller, velocity sensor, space temperature sensor (not required for CAV boxes), modulating damper actuator and all associated wiring.
- CAV/VAV box control shall be carried out by terminal unit controllers (TUC) installed on each CAV/VAV box.
- Space temperature sensors shall be wired directly to the associated TUC.

Refer to Mechanical Services Specification and drawings for numbers and location of CAV/VAV boxes.

9.5.1.1 CAV/VAV Box Volume Control

The motorised damper shall modulate via a P+I control loop to maintain the supply air volume at setpoint.

For VAV boxes, the volume setpoint shall be reset according to the space temperature control.

For CAV boxes, the volume setpoint shall be constant.

9.5.1.2 VAV Box Temperature Control

Each VAV box shall have an associated space temperature setpoint [22.5]°C and deadband [3.0]K.

A cooling setpoint shall be calculated as the setpoint plus half the deadband [24.0]°C and a heating setpoint shall be calculated as the setpoint minus half the deadband [21.0]°C.

Each VAV box shall have an associated maximum (V_{max}) and minimum (V_{min}) volume setpoint.

On increasing demand for cooling, the supply air flow shall modulate from V_{min} to V_{max} via a P+I control loop to maintain the space temperature cooling setpoint.

On increasing demand for heating (warm-up mode only), the conditioned supply air flow shall modulate from V_{min} to V_{max} via a P+I control loop to maintain the heating setpoint.

9.5.1.3 Terminal Unit Controller (TUC)

TUCs shall be fully networked with each other and with the BMCS for optimum start program and manual override control and to facilitate full viewing/adjustment of all settings and control parameters from the operator's station.

9.5.1.4 TUC Communications Network Integrity

If communication with a VAV box TUC is lost then the failed VAV box/TUC shall be removed from the AHU supply air temperature setpoint reset routine.

The failure of a VAV box TUC shall not inhibit communications with the remaining VAV box TUCs on a floor LAN. Failure of a VAV box TUC shall raise an alarm at the BMCS operator's station.

9.5.1.5 Graphical Requirements

The measured variables and status conditions for each CAV/VAV box listed below shall be monitored and displayed on graphics at the BMCS operator's station and also displayed on the plug-in portable hand held terminal:

- Space air temperature (°C)
- Space air temperature setpoint (°C) (adjustable)
- Volume flow (l/s)
- Active volume flow setpoint (l/s) (adjustable)
- Volume flow limits V_{min} and V_{max} (l/s) (adjustable)
- Damper Position (%)
- Cooling demand (%)
- Heating demand (%)

A VAV box summary table shall be provided for each AHU showing the above parameters. An operator shall have the facility to deselect each VAV box from inclusion in the AHU supply air temperature and pressure setpoint reset strategies.

9.6 Ground Floor Glass Lobby Natural Ventilation

9.6.1 General

The design for this system has not been finalised, the following shall be allowed for tender purposes.

There are 4 No. automatic louvers located in the Glass Lobby, 2 No. at high level and 2 No. at low level.

All actuators and wiring to the louvers will be carried out by others. The BMCS Subcontractor shall interface with the louvers via terminals in a panel for the purpose of control.

9.6.2 Automatic Operation

9.6.2.1 Temperature Control

Upon the average temperature in the atrium rising above [24]°C, all four louvers shall be commanded open by the BMCS.

Upon the average temperature in the atrium falling below [21]°C, all four louvers shall be commanded closed by the BMCS.

9.6.2.2 Manual Override via Graphic

An operator shall have the facility to individually override louvers open or closed via the operator's station system graphic.

9.6.2.3 Local Switch Override

An Open/Auto/Closed switch located in the atrium (final location and finish to be approved by architect) shall override all 4 No. louvers to the desired position.

9.7 Office Toilet Exhaust

9.7.1 General

There are two office toilet exhaust systems:

- TEF-R-1 serves the low rise east and west zones and the high rise east zone.
- TEF-R-2 serves the high rise west zone.

Each system comprises a toilet exhaust fan and associated isolation damper.

9.7.2 Automatic Operation

9.7.2.1 Enable/Disable

Each toilet exhaust system shall be enabled upon any of the associated floors served being occupied (normal or after hours).

When all of the associated floors are unoccupied the system shall be shutdown.

9.7.2.2 System Start-up

When enabled the system shall be configured as follows:

- Exhaust isolation damper driven open
- Following a suitable time delay for the damper to open, the exhaust fan shall be enabled.

9.7.2.3 System Shutdown

When disabled the system shall be configured as follows:

- The exhaust fan shall be disabled.
- Exhaust isolation damper driven closed

9.7.2.4 Fan Monitoring

Enable command and fault status shall be via low level interfaces. All other monitoring and control shall be via a high level interface.

Each fan shall be monitored for running status via the VSD running status.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan status, an alarm shall be raised on the BMCS operator's station and the fan shall be commanded off.

In the event of a fault being reported from the fan VSD an alarm shall be raised at the BMCS operator's station and the fan shall be commanded off.

The underload/time parameters shall be set up on the VSD such that if the motor torque/current drops below the selected load curve parameter for the set time, indicating a malfunction e.g. a broken belt, the variable speed motor shall be stopped and a fault alarm raised at the BMCS operator’s station.

9.7.2.5 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.8 Carpark Ventilation System

9.8.1 General

The carpark ventilation system comprises a supply and exhaust fan.

The carpark ventilation system shall be variable volume in response to carbon monoxide (CO) sensors in compliance with AS/NZS 1668.2.

Refer to Mechanical Services Schematics and Layout Drawings for numbers and location of equipment and sensors.

9.8.2 Automatic Operation

9.8.2.1 System Enable

The system shall be enabled by any of the following:

- A dedicated carpark ventilation time schedule
- Any CO sensor detects a concentration greater than [15]ppm
- Via a manual override command via the system graphic

Upon being enabled the system shall be configured as described under system start-up

At all other times the system shall be configured as described under system shutdown

9.8.2.2 System Start-Up

Upon being enabled the system shall be configured as follows:

- The supply and exhaust fans shall be enabled and run at a speed determined by the measured CO.

9.8.2.3 System Shutdown

Upon being shutdown the system shall be configured as follows:

- The supply and exhaust fans shall be disabled

9.8.2.4 Unoccupied Mode

In the event that the CO level detected is above [15]ppm but the carpark is unoccupied as determined by the time schedule, the system shall remain enabled for a minimum time period of [15] minutes and shall only be disabled upon the CO level falling below [15]ppm for [10] minutes.

9.8.2.5 Exhaust Fan Carbon Monoxide (CO) Control

The CO exposure limit setpoint (EL) shall be set to [30]ppm. The maximum CO reading in the carpark shall be used to determine the exhaust fan speed control.

The exhaust fan speed shall be determined during commissioning to satisfy the following criteria:

- The minimum volume that is exhausted from the carpark shall be 25% of the maximum design volume.
- Whenever the CO level detected is ≥ 80% of the EL setpoint, the maximum design volume shall be exhausted.
- Whenever the CO level detected is ≤ 50% of the EL setpoint, the minimum volume shall be exhausted.

- When the CO level detected between 50% and 80%, the volume exhausted shall be linear between the minimum and maximum volumes.

An operator shall have the facility to remove rogue CO sensors from the high select calculation via the system graphic.

An alarm shall be raised in the event that the CO level rises above the EL for {5} minutes.

A high priority alarm shall be raised in the event that the CO level rises above [150]% or the EL.

9.8.2.6 Supply Fan Tracking

The supply air fans shall track the exhaust air fans such that the volume air supplied to the carpark air is maintained at 75% of the volume exhausted.

A look-up table shall be populated during commissioning in conjunction with the air balancing Subcontractor that relates the number of exhaust air fans running and associated speeds to the number of supply fans required and associated speeds.

9.8.2.7 Fan Monitoring

Enable command, speed control and fault status shall be via low level interfaces. All other monitoring and control shall be via a high level interface.

The fans shall be monitored for a running status via a differential pressure switch piped across the fan and the VSD ‘running’ status.

In the event that a VSD is taken out of automatic control via the local touchpad display, indication shall be provided on the BMCS. The signal to the BMCS shall be provided via a volt free contact or via a HLI.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan running status, an alarm shall be raised on the BMCS operator's station and the fan shall be commanded off.

In the event of a fault being reported from a VSD, an alarm shall be raised at the BMCS operator's station.

9.9 Diesel Room Ventilation System

9.9.1 General

The diesel room ventilation system comprises a constant speed supply fan, constant speed exhaust fan and a supply air filter.

9.9.2 Automatic Operation

9.9.2.1 Enable/Disable

The system shall be enabled 24 hours a day.

9.9.2.2 Filter Monitoring

A differential pressure switch shall be provided to measure the pressure drop across the filter. In the event that the pressure drop across the filter becomes indicative of a dirty filter condition, an alarm shall be raised on the BMCS operator's station.

9.9.2.3 Fan Monitoring

The supply and exhaust air fans shall be monitored for running status via a differential pressure switch piped across the fan wired in series with an auxiliary contact on the motor starter.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan status, an alarm shall be raised on the BMCS operator's station and the fan shall be commanded off.

In either condition the fan shall not re-enter the normal automatic control sequence until the BMCS operator acknowledges that the fan fault alarm has been cleared, and operates the fault reset at the BMCS operator's station.

9.10 Lift Motor Room AC

9.10.1 General

Each lift motor room system comprises the following:

- Exhaust air fan
- 2 no. (duty/standby) PAC units.

9.10.2 Automatic Operation

9.10.2.1 Exhaust Air Fan

The exhaust air fan shall run 24 hrs

9.10.2.2 PAC Unit Sequence

The PAC units shall operate in a duty/standby manner with sequence rotation based on hours run and failure.

The sequence rotation shall occur on a weekly basis at a time selected by the operator e.g. Monday @ 0100 hrs.

In the event of a PAC fault, the failed unit shall be removed from the sequence and the healthy unit enabled.

9.10.2.3 Temperature Control

The PAC units cooling stages shall be enabled/disabled to maintain the space temperature sensor at setpoint [34]°C.

9.10.2.4 Out of Limits Alarm

In the event that the temperature in the lift motor room rises above [40]°C an audible alarm shall be raised on the BMCS and both PAC units shall be enabled. Both units shall remain enabled until the alarm is reset by the operator.

9.10.3 PAC Monitoring and Failure

The BMCS shall monitor each PAC unit for a running status and fault.

9.11 Miscellaneous Fans

9.11.1 General

All fans detailed in the BMCS points schedule shall be monitored and controlled by the BMCS.

Refer to Mechanical Services Schematics and Layout Drawings for numbers and location of equipment.

9.11.2 Automatic Operation

9.11.2.1 Enable/Disable

Each fan shall have a dedicated time schedule for enable/disable

9.11.1 Fan Monitoring

Each DOL fan shall be monitored for a running status via an auxiliary contact on the motor starter.

Each VSD fan shall be monitored for running status and fault on the VSD.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan running status, an alarm shall be raised on the BMCS operator's station.

9.12 Miscellaneous PAC Units

9.12.1 General

All PAC units detailed in the BMCS points schedule shall be monitored and controlled by the BMCS.

Each PAC unit shall have a dedicated terminal unit controller (TUC) mounted on the unit and a space temperature sensor.

Refer to Mechanical Services Schematics and Layout Drawings for numbers and location of equipment.

9.12.2 Automatic Operation

9.12.2.1 Enable/Disable

Each PAC unit shall have a dedicated time schedule for enable/disable

9.12.3 Temperature Control

The PAC units cooling stages shall be enabled/disabled to maintain the space temperature sensor at setpoint.

Out of limits alarms shall be raised in the event that the measured space temperature is {2}K above setpoint for {5} minutes.

9.12.4 Fan Monitoring

Each DOL fan shall be monitored for a running status via an auxiliary contact on the motor starter.

Each PAC unit shall be monitored for a fault.

In the event of a fan failure, as detected by a mismatch between the BMCS command to the fan and the fan running status, an alarm shall be raised on the BMCS operator's station.

9.13 Primary Chilled Water (CHW)

9.13.1 General

The primary chilled water system is designed to provide a flow temperature of 6°C with a return temperature of 13°C at full load.

The primary chiller plant comprises the following mechanical components:

- 2 no. (lead/lag) 1075 kW water cooled electric chillers, each with an associated primary pump, piped in parallel configuration;
- Absorption chiller with associated primary pump piped in a “side car arrangement”;

Note: the absorption chiller and associated pump control is by the tri-generation Subcontractor, with interfaces to the BMCS as described below.

Two secondary circuits draw water from the primary flow header and return to the primary return header, any surplus flow flows through the primary bypass.

Each chiller shall have an associated thermal energy meter, comprising a magnetic flow meter installed in series and matched temperature sensors. The flow meter shall have a remote display located adjacent to the associated chiller. The position of the flow meter shall adhere to the manufacturers recommended installation guidance.

All interfaces between the BMCS and the tri-generation system shall be via terminals in the tri-generation control panel within the tri-generation plantroom.

The BMCS Subcontractor shall provide all cabling between the DDC and the tri-generation control panel.

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.13.2 Automatic Operation

9.13.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Cooling call from either of the two secondary circuits
- Manual command from the BMCS operator station

Upon no enable commands being active the plant shall be configured as described under plant shutdown.

9.13.2.2 System Start-Up

Upon being enabled the lead electric chiller shall be enabled as described under ‘Electric Chiller Start-Up / Shutdown’ and the absorption chiller shall be enabled as described under ‘Absorption Chiller start-up/shutdown’.

Further enabling/disabling of chillers shall be as described under ‘Chiller Staging’.

9.13.2.3 System Shutdown

Upon the system being disabled all electric chillers shall be disabled as described under ‘Electric Chiller Start-up/Shutdown’ and the absorption chiller disabled as described under ‘Absorption Chiller start-up/shutdown’.

9.13.2.4 Electric Chiller Start-Up / Shutdown

When a chiller is required to run as determined by the chiller staging strategy, the plant shall be configured as follows:

- The associated chilled water and condenser water pumps shall be enabled
- Once the running status has been received for both pumps, the chiller shall be enabled.

When a chiller is required to stop as determined by the chiller staging strategy or a system disable command, the plant shall be configured as follows:

- The chiller shall be disabled.
- The associated chilled water and condenser water pumps shall continue to run for [2] minutes, after which time they shall be disabled.
- Indication that a pump is in ‘run-on’ mode shall be displayed on the system graphic.

9.13.2.5 Absorption Chiller Start-Up/Shutdown

The CHW pump associated with the absorption chiller will be enabled/disabled by the tri-generation control system.

The BMCS shall enable/disable the absorption chiller via a 'remote start/stop' signal to the tri-generation control panel.

The BMCS shall only enable the absorption chiller upon receipt that the 'engine is active' via the tri-generation control panel.

9.13.2.6 Electric Chiller Sequencing

The chillers shall operate in a lead/lag manner with rotation based upon hours run and failure.

The chiller sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when either both chillers are running or both chillers are shutdown.

Total hours run for each chiller shall be displayed on the system information page graphic with an associated reset button.

In the event of a lead chiller failure, a rotation shall occur and any further rotation shall be inhibited until the failed chiller failure alarm has been cleared.

In the event of a mains power failure (as monitored at the diesel generator control panel), chiller CHR-L31-1 shall become the lead chiller (as described under 'Mains Power Failure' below).

9.13.2.7 Electric Chiller Staging

Whenever the system is enabled the lead chiller shall run.

Staging 'ON' and 'OFF' of the lag chiller shall be based on the flow through the primary bypass (as measured by the flow meter) and the refrigeration load on the enabled chillers (as calculated via the measured flow and delta T).

Staging Up

In the event that either of the following criteria are true for [10] minutes, the lag chiller shall be enabled:

- Flow though the primary bypass is less than [10]% of the design flow for one primary pump.
- The refrigeration load on the lead chiller is greater than [90]% of the design.

Staging Down

In the event that either of the following criteria are true for [10] minutes, the lag chiller shall be disabled:

- Flow though the primary bypass rises to [120]% of the design flow for one primary pump.
- The operating capacity for both chillers is below [30]% of full load

An operator shall have the facility to remove any of the above staging criteria via a tick box on the system graphic. Note: at least one criteria must remain enabled for staging up and down.

Staging up and down time delays shall be adjustable independently via the system graphic.

An operator shall have the facility to remove any of the above conditions from the staging up or staging down decisions via the system graphic.

9.13.2.8 Chiller Temperature Control

Each chiller has its own integral controls that control the chilled water flow temperature at setpoint.

The chilled water flow temperature setpoint for the electric chillers (not absorption) shall be reset by the BMCS via a high level interface as described under ‘chilled water temperature reset’.

9.13.2.9 CHW Temperature Setpoint Reset

Chilled water reset shall only be available when the lead electric chiller is running i.e. the lag chiller is disabled. The BMCS shall reset the flow temperature setpoint of the electric chillers via the HLI.

The chilled water flow temperature shall be reset between the limits of [6]°C and [10]°C based on the position of the AHU valves and the 2-port valve associated with the low rise high temperature CHW heat exchanger.

Upon all CHW valves remaining below [60]% open for a time period of [5] minutes, the chiller flow temperature setpoint shall be raised at a rate of [0.1]K per minute.

Upon any CHW valve opening greater than [90]%, the chiller flow temperature setpoint shall be lowered at a rate of [0.1]K per minute.

CHW reset shall be inhibited whenever the CHW flow temp is {1.5}K or more above or below the active setpoint.

An operator shall have the facility to disable the chilled water flow temperature reset strategy via the system graphic.

In the event that the secondary circuit differential pressure setpoint reset strategy has been enabled the CHW temperature reset shall not be available (and vice versa).

Indication that the chilled water flow temperature has been reset shall be displayed on the system graphic.

9.13.2.10 Mains Power Failure Mode

In the event of a mains power failure (as monitored at the diesel generator control panel), the BMCS shall disable both electric chillers, chiller CHR-L31-1 shall become the lead chiller and CHR-L31-2 the lag chiller.

The tri-generation control system will detect a loss of mains power and change the operating mode from ‘Parallel’ to ‘island’ mode. The tri-generation system will also provide a signal that ‘BMCS Load Shedding is Required’. The BMCS shall monitor these points via the tri-generation control panel.

The BMCS shall monitor the status of the chiller ATS via the SCADA system and output this information to the tri-generation control panel.

Upon receipt of the following signals, the BMCS shall enable the lead chiller (on the gas generator):

- Power Failure
- Chiller ATS in generator position
- Engine Active
- Operating mode = Island

The lag chiller shall remain disabled.

9.13.2.11 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator’s station and that pump commanded off. A failed flag for that pump shall be set.

Pump running status shall be determined by an auxiliary contact on the flow meter (set for minimum chiller flow) and the VSD running status.

The associated chiller shall be deemed to have failed and removed from the chiller sequence.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator’s station.

9.13.2.12 Bypass Flow Monitoring

In the event that reverse flow is detected in the bypass pipework an alarm shall be raised on the BMCS operator station.

9.13.2.13 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.13.2.14 Electric Chiller Monitoring and Failure

Each electric chiller shall be monitored for a lock-out fault that causes the chiller to shutdown via low level interface.

In the event of a chiller lock-out fault an alarm shall be raised and the chiller shall be deemed to have failed.

Each chiller shall also be monitored for the points detailed in the points schedule via high level interface.

9.13.2.15 Absorption Chiller Monitoring and Failure

The absorption chiller shall be monitored for a lock-out fault that causes the chiller to shutdown via low level interface.

In the event of a chiller lock-out fault an alarm shall be raised and the chiller shall be deemed to have failed.

9.13.2.16 Refrigerant Leak Detection

The BMCS shall monitor the refrigerant leak detection system for a fault and leak detected status.

In the event that either are active an alarm shall be raised on the BMCS.

9.14 Secondary CHW System No.1(AHUs and Low Rise Chilled Beams)

9.14.1 General

The secondary CHW system is variable volume, it draws water from the primary flow header and serves the office AHUs (located on levels 30 and 19) and the tertiary high temperature CHW system located on level 19 serving the low rise chilled beams.

The system consists of 2 no. (lead/lag) variable speed pumps and a low flow bypass.

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.14.2 Automatic Operation

9.14.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Cooling call from any office floor AHU
- Cooling call from the tertiary CHW low rise high temperature chilled water system;
- Manual command from the BMCS operator station

Upon being enabled a cooling call shall be sent to the primary chilled water plant, the lead secondary pump shall be enabled and the differential pressure control shall be enabled.

Upon no enable commands being active, or the primary chilled water system being unavailable to run, the plant shall be configured as described under plant shutdown.

9.14.2.2 Plant Shutdown

When required to shutdown, all pumps and their associated control loops shall be disabled. The cooling call to the primary chilled water plant shall be removed.

9.14.2.3 Differential Pressure Control

The circuit shall have a differential pressure sensor located at the end of the riser with an associated setpoint (to be determined during commissioning) and P+I control loop.

The differential pressure sensor shall be wired directly to the DDC controller controlling the pumps.

The speed of the lead pump and the bypass valve shall be modulated in sequence via the P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump output reaching above 90% for {30} seconds, the lag pump shall be enabled slowly ramped up at a rate of {10}%/min until both pumps are running at the sampe speed, at which time the pumps shall modulate in unison via the P+I control loop to maintain the differential pressure sensor at setpoint.

With both pumps enabled, upon the output to each pump being below 40% for {60} seconds, the lag pump shall be disabled and slowly ramped down at a rate of {10}%/min and the lead pump shall continue to modulate via a P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump operating at minimum speed and the differential pressure continues to rise, the pump speed shall be fixed and the bypass control valve shall modulate to maintain the differential pressure sensor at setpoint. Note: the pump speed and valve shall never modulate simultaneously.

9.14.2.4 Pump Sequencing

The 2 no. secondary pumps shall operate in a lead/lag manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when either both pumps are running or both pumps are shutdown. At the time of rotation the pump with the least run hours shall become the lead pump.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

Upon failure of any pump it shall be taken out of the sequence.

9.14.2.5 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.15 Secondary CHW System No.2 (High Rise Chilled Beams)

9.15.1 General

The secondary CHW system is variable volume, it draws water from the primary flow header and serves the high rise chilled beams.

The system consists of 2 no. (lead/lag) variable speed pumps, an injection circuit arrangement and a low flow bypass.

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.15.2 Automatic Operation

9.15.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Upon any office floor in the high rise being in cool down, occupied or after hours mode of operation,
- Manual command from the BMCS operator station

Upon being enabled a cooling call shall be sent to the primary chilled water plant, the lead secondary pump shall be enabled, the injection circuit temperature control shall be enabled and the differential pressure control shall be enabled.

Upon no enable commands being active, or the primary chilled water system being unavailable to run, the plant shall be configured as described under plant shutdown.

9.15.2.2 Plant Shutdown

When required to shutdown, all pumps and their associated control loops shall be disabled and the 3-port injection valve shall be driven to the full bypass position. The cooling call to the primary chilled water plant shall be removed.

9.15.2.3 Injection Circuit Temperature Control

The injection circuit 3-port valve shall modulate via a P+I control loop to maintain the flow water temperature at setpoint [14.0] °C +/- 0.5K.

9.15.2.4 High Dew point Temperature Reset

The injection circuit flow temperature setpoint shall be reset according to the highest floor dew point on the occupied office floors served.

In the event that the highest floor temperature dew point rises above [14.0]°C, the injection circuit flow temperature setpoint shall be increased such that it is the same temperature.

9.15.2.5 Differential Pressure Control

The circuit shall have a differential pressure sensor located at the end of the riser with an associated setpoint (to be determined during commissioning) and P+I control loop.

The differential pressure sensor shall be wired directly to the DDC controller controlling the pumps.

The speed of the lead pump and the bypass valve shall be modulated in sequence via the P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump output reaching above 90% for {30} seconds, the lag pump shall be enabled slowly ramped up at a rate of {10}%/min until both pumps are running at the sampe speed, at which time the pumps shall modulate in unison via the P+I control loop to maintain the differential pressure sensor at setpoint.

With both pumps enabled, upon the output to each pump being below 40% for {60} seconds, the lag pump shall be disabled and slowly ramped down at a rate of {10}%/min and the lead pump shall continue to modulate via a P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump operating at minimum speed and the differential pressure continues to rise, the pump speed shall be fixed and the bypass control valve shall modulate to maintain the differential pressure sensor at setpoint. Note: the pump speed and valve shall never modulate simultaneously.

9.15.2.6 Pump Sequencing

The 2 no. secondary pumps shall operate in a lead/lag manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when either both pumps are running or both pumps are shutdown. At the time of rotation the pump with the least run hours shall become the lead pump.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

Upon failure of any pump it shall be taken out of the sequence.

9.15.2.7 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.16 Tertiary CHW System (Low Rise Chilled Beams)

9.16.1 General

The secondary CHW system is variable volume, it is coupled with Secondary CHW system No.1 via plate heat exchangers and serves the low rise chilled beams.

The system comprises 2 no. (lead/lag) variable speed pumps and a low flow bypass.

Temperature control is via the 2-port control valve located on the secondary side of the plate heat exchangers.

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.16.2 Automatic Operation

9.16.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Upon any office floor in the low rise being in cool down, occupied or after hours mode of operation,
- Manual command from the BMCS operator station

Upon being enabled a cooling call shall be sent to the secondary chilled water system No.1, the lead tertiary pump shall be enabled, the temperature control shall be enabled and the differential pressure control shall be enabled.

Upon no enable commands being active, or the primary chilled water system being unavailable to run, the plant shall be configured as described under plant shutdown.

9.16.2.2 Plant Shutdown

When required to shutdown, all pumps and their associated control loops shall be disabled and the 2-port valve shall be driven closed. The cooling call to the secondary chilled water plant shall be removed.

9.16.2.3 Temperature Control

The 2-port valve located on the secondary side of the plate heat exchangers shall modulate via a P+I control loop to maintain the flow water temperature at setpoint [14.0] °C +/- 0.5K.

9.16.2.4 High Dew point Temperature Reset

The flow temperature setpoint shall be reset according to the highest floor dew point on the occupied office floors served.

In the event that the highest floor temperature dew point rises above [14.0]°C, the injection circuit flow temperature setpoint shall be increased such that it is the same temperature.

9.16.2.5 Differential Pressure Control

The circuit shall have a differential pressure sensor located at the end of the riser with an associated setpoint (to be determined during commissioning) and P+I control loop.

The differential pressure sensor shall be wired directly to the DDC controller controlling the pumps.

The speed of the lead pump and the bypass valve shall be modulated in sequence via the P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump output reaching above 90% for {30} seconds, the lag pump shall be enabled slowly ramped up at a rate of {10}%/min until both pumps are running at the sampe speed, at which time the pumps shall modulate in unison via the P+I control loop to maintain the differential pressure sensor at setpoint.

With both pumps enabled, upon the output to each pump being below 40% for {60} seconds, the lag pump shall be disabled and slowly ramped down at a rate of {10}%/min and the lead pump shall continue to modulate via a P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump operating at minimum speed and the differential pressure continues to rise, the pump speed shall be fixed and the bypass control valve shall modulate to maintain the differential pressure sensor at setpoint. Note: the pump speed and valve shall never modulate simultaneously.

9.16.2.6 Pump Sequencing

The 2 no. secondary pumps shall operate in a lead/lag manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when either both pumps are running or both pumps are shutdown. At the time of rotation the pump with the least run hours shall become the lead pump.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

Upon failure of any pump it shall be taken out of the sequence.

9.16.2.7 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.17 Condenser Water System (Primary)

9.17.1 General

The condenser water system serves the chillers, tri-generation system and the tenant condenser water system.

The condenser water system is designed to provide a leaving cooling tower temperature of 28.5°C with an entering cooling tower temperature of 34°C when operating at full load.

Each cooling tower fan's enable/disable signal, cooling tower isolation valve's open/close signals and the tenant primary condenser water pump's enable/disable signals, shall have latching relays such that the plant remains in its last state upon DDC failure. Latching relays shall be provided by the BMCS Subcontractor and located in the associated field control panel (FCP).

Each VSD shall be configured such that upon receipt of an enable signal and absence of a speed control signal the VSD will run at a default speed.

All interfaces between the BMCS and the tri-generation system shall be via terminals in the tri-generation control panel within the tri-generation plantroom. The BMCS Subcontractor shall provide all cabling between the DDC and the tri-generation control panel.

The condenser water system consists of the following mechanical components:

- 2 no. condenser water pumps associated with the electric chillers (1 per chiller) controlled via VSDs.

- 2 no. (duty/standby) pumps associated with the tri-generation system (gas generator and the absorption chiller). Full control of these pumps is by the tri-generation control system.
- 3 no. (duty/ 1st standby/ 2nd standby) pumps associated with the tenant condenser water system
- 2 No. cooling towers, each with an associated variable speed fan
- Cooling tower bypass control valve
- Tri-generation 3-port mixing valve

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.17.2 Automatic Operation

9.17.2.1 System Enable/Disable

The system shall be enabled and upon any of the following:

- Request for condenser water from an electric chiller;
- Request for auxiliaries from the tri-generation system;
- Request for condenser water from a tenant secondary condenser water system;
- Manual command via the system graphic;

When no enable commands are active the system shall be configured as described under plant shutdown.

An operator shall have the facility to enable/disable the system via the system graphic.

9.17.2.2 System Start-Up

Upon the system being enabled the system shall be configured as follows:

- Cooling tower isolation valves for the required towers shall be driven open;
- Upon receipt of at least one cooling tower isolation valve open status, the required condenser water pump(s) shall be enabled.
- Upon receipt of the pump running status, the cooling tower fans and their associated temperature control loops shall be enabled.
- Cooling tower bypass valve temperature control loop shall be enabled.
- Tri-generation 3-port valve shall be enabled (only if there is a call from the tri-generation system for condenser water)

9.17.2.3 Plant Shutdown

When required to shutdown the system shall be configured as follows:

- The condenser water pump(s) shall be disabled
- Cooling tower isolation valves shall be driven closed

- Cooling tower bypass valves shall be driven fully open
- Tri-generation 3-port valve shall be driven to the full bypass position (whenever the call for condenser water from the tri-generation system is removed)
- Cooling tower fans and their associated temperature control loops shall be disabled

9.17.2.4 Cooling Tower Staging

Upon a demand from any of the plant listed below, an additional cooling tower shall be enabled:

- Low rise or high rise tenant condenser water system
- Electric Chiller CHR-L31-1
- Electric Chiller CHR-L31-2
- Tri-generation

Note: As there are a greater number of demands than cooling towers, once all towers are enabled further demands shall not enable cooling towers.

In the event that the cooling tower fans on the enabled towers are running at greater than {90}% for {5} minutes a further cooling tower shall be enabled.

Upon the cooling tower fans on the enabled towers running less than {40}% for {5} minutes and the number of plant (listed above) requesting a demand is less than the number of towers running, a cooling tower shall be disabled.

9.17.2.5 Cooling Tower Sequencing

The 3 no. cooling towers shall operate in a lead/1st lag/2nd lag manner with sequence rotation based on fan hours run and tower failure.

The tower sequence rotation shall occur on a weekly basis at a time selected by the operator e.g. Monday @ 0100 hrs. At the time of rotation the tower with the least hours run shall become the lead tower, followed by the 1st lag and 2nd lag.

The towers that are running and are required to run following the rotation shall remain enabled.

The towers that are disabled but are required to run following the rotation shall be enabled and proved running prior to disabling any towers that are not required to run following the rotation.

In the event of a tower failure, the next available tower in the sequence shall be enabled and the failed tower shall be shutdown and removed from the sequence.

9.17.2.6 Cooling Tower Temperature Control

Two temperature sensors shall be located in the common tower leaving tower pipework for redundancy. The average of the two sensors shall be used as the input to the cooling tower temperature control loop. In the event that the measured temperature values have a differential greater than {1}K for {5}minutes, an alarm

shall be raised on the BMCS. An operator shall have the facility to disable either sensor from the calculation (not both).

The cooling tower fans shall be set up with minimum and maximum fan speeds (as advised by the tower manufacturer) set in the variable speed drives. The fans shall be modulated between these speeds, with 0% representing minimum speed and 100% representing maximum speed.

Each enabled fan shall be modulated in unison between 0% and 100%, via a proportional plus integral action control loop, to maintain the common tower leaving water temperature at a condenser water setpoint, as determined by the condenser water temperature reset strategy.

When the cooling tower fans are enabled and the output to the fans remains at {0}%, the cooling tower fans shall be disabled in {2} minute intervals until the fan speed on the enabled towers rises above {10}%. In the event that the fan speed on the enabled towers rises above {20}%, the cooling tower fans shall be enabled in {2} minute intervals until the fan speed on the enabled towers falls below {20}%.

9.17.2.7 Condenser Water Temperature Reset

The cooling tower temperature control setpoint shall depend on whether the electric chillers are running. Whenever the electric chillers are disabled and there is a demand from the tenant condenser water or tri-generation system, the setpoint shall be [29.5]°C.

Whenever the electric chillers are enabled the condenser water temperature setpoint shall be reset between upper [29.5]°C and lower [18.0]°C limits (as advised by the chiller manufacturer), depending on the ambient wet bulb temperature and the cooling tower approach setpoint (set as a constant).

The minimum off tower temperature that can be achieved is governed by the outside air wet bulb temperature plus the cooling tower approach value (as advised by the cooling tower manufacturer).

The approach value shall be user adjustable via a high level password access, initially set to [3.0]K.

e.g. If the wet bulb temperature = 18°C, the minimum off tower temperature shall be reset to 21°C.

An operator shall have the facility to disable the condenser water temperature reset strategy via the system graphic. When disabled the setpoint shall be fixed at [29.5]°C.

9.17.2.8 Tri-Generation Pump Sequencing

Duty/Standby sequence rotation of the tri-generation pumps will be by the tri-generation control system.

9.17.2.9 Tri-Generation Temperature Control

Whenever there is a demand for condenser water from the tri-generation system, the temperature control loop shall be enabled. The 3-port control valve shall modulate via a P+I control loop to maintain the tri-generation entering condenser water temperature sensor at setpoint [29.5]°C +/- 0.5K.

When there is no demand for tri-generation condenser water, the 3-port valve shall be driven to the full bypass position.

9.17.2.10 Tri-Generation Pump Speed Control

Speed control of the tri-generation pumps will be by the tri-generation control system.

9.17.2.11 Tri-Generation interfaces

The BMCS shall monitor for a ‘demand for auxiliaries’ signal from the tri-generation control panel.

The BMCS shall provide status to the tri-generation control panel that ‘auxiliaries are active’ upon receipt of running status from the cooling tower fan.

9.17.2.12 Tenant Primary Condenser Water Pump Sequencing

The 3 no. primary tenant condenser water pumps shall operate in a duty/ 1st standby / 2nd standby manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall occur on a weekly basis at a time selected by the operator e.g. Monday @ 0100 hrs. At the time of rotation the pump with the least hours run shall become the duty pump, followed by the 1st standby and 2nd standby.

At the time of rotation the new duty pump shall be enabled and slowly ramped up to the same speed as the existing duty pump, at which point it shall be controlled to maintain the differential pressure and the new standby pump shall be slowly ramped down and disabled.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

9.17.2.13 Tenant Primary Condenser Water Pump Speed Control

The control strategy for the primary tenant condenser water pumps shall be dependent on whether the electric chillers are running or disabled.

Whenever the electric chillers are disabled the duty pump shall run at a constant speed (determined during commissioning).

Whenever there is an electric chiller running the speed of the duty pump shall modulate according to the position of the 3-port mixing valves on the secondary side of each tenant secondary condenser water circuit (low rise and high rise). In the event that all valves are less than {60}% open to their associated plate heat

exchangers, the speed of the duty pump shall be reduced at a rate of {10}%/minute until any valve is open greater than {70}% open, when the pump speed shall be fixed. In the event that any valve is greater than {80}% open, the duty pump shall be increased at a rate of {10}%/minute until all valves are open less than {70}%, when the pump speed shall be fixed.

In the event that communications are lost with secondary condenser water DDC, the pump shall default to run at a constant speed.

9.17.2.14 Cooling Tower Bypass Control

The condenser water bypass control valve shall modulate in sequence via a P+I control loop to maintain the common off tower temperature at {1}K below the active condenser water temperature setpoint, such that as the temperature falls below setpoint the bypass valve opens.

9.17.2.15 Cooling Tower Maintenance Switch

An operator shall have the facility to put each tower into maintenance mode via the system graphic. When selected for maintenance mode the tower fans and associated control loops shall be disabled, all alarms inhibited and the inlet isolation valve driven closed.

In the event that an operator attempts to put two towers into maintenance mode a warning pop-up shall be displayed on the system graphic that requires acknowledgement before the tower enters maintenance mode.

9.17.2.16 Cooling Tower Fan Monitoring and Failure

In the event of a fan failure as detected by a mismatch between the command to the fan and the fan status, a tower failed alarm shall be raised on the operator station and the tower shall be deemed to have failed and shutdown.

9.17.2.17 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to a pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

In the case of the electric chiller's pumps, the associated chiller shall be deemed to have failed and the chiller sequence rotated.

In the case of the tri-generation system, the duty pump shall be disabled and the standby pump enabled. In the event that both pumps fail a further alarm shall be raised on the BMCS and the 'auxiliaries healthy' signal to the tri-generation control panel shall be removed.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.17.2.18 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.17.2.19 Automatic Dosing System

There is a packaged automatic dosing system which shall be monitored for a common fault via a volt free contact.

9.17.2.20 Cooling Tower Level Monitoring

Each cooling tower shall be monitored for high and low level via level switches and an alarm shall be raised on the BMCS.

9.18 Tenant Secondary Condenser Water

9.18.1 General

There are two secondary tenant condenser water systems; one serving the high rise (levels 21 - 29) and one serving the low rise (levels 6 - 17). Each system is a closed circuit coupled with the primary condenser water system via plate heat exhchangers.

The secondary condenser water systems are designed to provide a flow temperature of 29.5°C with a return temperature of 35°C at full load.

Each tenant secondary condenser water pump's enable/disable signals shall have latching relays such that the plant remains in its last state upon DDC failure. Latching relays shall be provided by the BMCS Subcontractor and located in the associated field control panel (FCP).

Each VSD shall be configured such that upon receipt of an enable signal and absence of a speed control signal the VSD will run at a default speed.

Each secondary system comprises the following mechanical components:

- 2 No. plate heat exchangers (each with an associated 3-port control valve).
- 3 no. (duty/ 1st standby/ 2nd standby) pumps
- Low flow bypass

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.18.2 Automatic Operation

Each tenant secondary condenser water system shall operate as described below.

9.18.2.1 System Enable/Disable

The system shall be enabled 24 hours a day.

An operator shall have the facility to disable the system via a high level password access via the system graphic.

9.18.2.2 Temperature Control

There are two plate heat exchangers associated with each system, each designed for 100% capacity. Each plate heat exchanger has an associated 3-port valve.

The 2 no. 3-port valves shall modulate in unison via a P+I control loop to maintain the flow temperature sensor at setpoint [29.5]°C +/- 0.5K.

9.18.2.3 Tenant Secondary Condenser Water Pump Speed Control

Each secondary circuit shall have a differential pressure sensor located approximately 2/3 down the riser with an associated setpoint (to be determined during commissioning) and P+I control loop. The DP sensor shall be wired directly to the DDC controlling the pump.

The speed of the duty pump shall be modulated via the P+I control loop to maintain the differential pressure sensor at setpoint.

9.18.2.4 Tenant Secondary Condenser Water Pump Sequencing

The 3 no. secondary tenant condenser water pumps shall operate in a duty/ 1st standby / 2nd standby manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall occur on a weekly basis at a time selected by the operator e.g. Monday @ 0100 hrs. At the time of rotation the pump with the least hours run shall become the duty pump, followed by the 1st standby and 2nd standby.

At the time of rotation the new duty pump shall be enabled and slowly ramped up to the same speed as the existing duty pump, at which point it shall be controlled to maintain the differential pressure and the new standby pump shall be slowly ramped down and disabled.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

9.18.2.5 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to a pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.18.2.6 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.18.2.7 Cooling Tower Level Monitoring

Each cooling tower shall be monitored for high and low level via level switches and an alarm shall be raised on the BMCS.

9.19 Primary Heating Hot Water (HHW)

9.19.1 General

The heating hot water system is a variable primary volume system, designed to provide a flow temperature of 62°C with a return temperature of 42°C at full load.

The system serves AHUs, trench heaters, DHW heat exchanger and the secondary HHW system.

The system comprises the following mechanical components:

- 4 no. 330 kW condensing hot water heaters (HWH), each with a dedicated primary pump with VSD;
- Connection to the tri-generation heat rejection heat exchanger, with a dedicated pump with VSD.
- Low flow bypass

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.19.2 Automatic Operation

9.19.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Heating call from any office AHU;
- Heating call from the secondary HHW system;
- Heating call from any [4] trench heating valves;
- Manual command from the BMCS operator station

In the event that the tri-generation engine system is 'Active', the system shall also be enabled upon a demand from the Domestic Hot Water heat exchanger (as described below under 'Domestic Hot Water Heat Exchanger).

Upon no enable commands being active the plant shall be configured as described under plant shutdown.

9.19.2.2 System Start-Up

Upon a system enable command the plant shall be configured as follows:

- The lead HWH/Heat Exchanger pumps shall be enabled;
- Upon receipt of the pump running status via the associated flow meter, the HWH/heat exchanger shall be enabled.

Further enabling/disabling of HWH/heat exchangers shall be as described under 'HWH/Heat Exchanger staging'.

9.19.2.3 Plant Shutdown

Upon a plant shutdown command the plant shall be configured as follows:

- HWHs shall be disabled as described under HWH shutdown
- Heat Exchanger pump and temperature control loop shall be disabled;
- Bypass valve shall be driven open

9.19.2.4 HWH Shutdown

Upon being disabled the HWH shall be configured as follows:

- The HWH shall be disabled;
- The associated pump shall continue to run for a period of {5} minutes (as advised by the HWH manufacturer) to dissipate residual heat before being disabled.

9.19.2.5 HWH Sequencing

The HWHs shall operate in a lead/1stlag/2nd lag/3rd lag/4th lag manner. Sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when all HWHs are shutdown.

Total hours run for each HWH shall be displayed on the system information page graphic with an associated reset button.

In the event of a HWH failure it shall be removed from the sequence until the alarm has been cleared.

9.19.2.6 Heat Exchanger / HWH Staging

Whenever the tri-generation engine has been 'Active' for {10}minutes, the heat exchanger shall be the lead heat source; otherwise the lead HWH shall be the lead heat source.

Staging up and down shall be based on a comparison of the measured system heating load and the capacity of the HWHs. The load on each HWH shall be measured as a function of the flow and delta T via the thermal energy meters.

Staging Up

When only the heat exchanger is running and the leaving temperature on the HHW side is greater than [1.0]K above setpoint and the associated 3-port valve is greater than {90}% open for {2} minutes, the lead HWH shall be enabled.

Upon the measured load on a HWH exceeding {90}% of its capacity for {5} minutes, the next HWH in sequence shall be enabled.

Upon staging up, the bypass shall be driven open and remain open until minimum flow has been detected through all HWHs required to run for the stage for {10} seconds.

Staging Down

HWHs shall be disabled in sequence upon the measured load remaining below {45}% for {10} minutes.

9.19.2.7 Tri-Gen Heat Exchanger Temperature Control

Once enabled, the 3-port valve shall modulate via a P+I control loop to maintain the leaving water temperature at the active supply water temperature setpoint (as described below).

9.19.2.8 Supply Water Temperature Setpoint Reset

The BMCS shall reset the HWH flow temperature setpoint according to the return water temperature in order to maximise the HWH efficiency.

Upon start-up the boiler setpoint shall be set to [62]°C. Upon the boiler return water temperature rising above [42]°C for {10}minutes the reset program shall be enabled as follows:

Every {5} minutes the primary return water temperature shall be recorded. In the event that the return water temperature is above [42]°C, the supply water temperature shall be reset down by the same amount that the return water temperature is above [42]°C. e.g. if the return water temperature is measuring 46°C the boiler supply temperature setpoint shall be set to 58°C.

All AHU and the secondary circuit heat exchanger valve positions shall be scanned every [15] minutes. In the event that any valve is {100}% open the reset program shall be disabled for [30] minutes and ‘reset inhibited’ indication displayed on the system graphic.

9.19.2.9 Domestic Hot Water Heat Exchanger

The intent of the domestic hot water heat exchanger is to use the excess heat being transferred by the tri-generation heat exchanger that is not being used by the heating system.

Whenever there is no demand for heating and the tri-generation engine is ‘Active’, the domestic hot water heat exchanger shall be enabled.

When there is a heating call, the domestic hot water heat exchanger shall only be enabled when the tri-generation engine is 'Active' and the tri-generation heat exchanger 3-port valve is less than {80}% open to the heat exchanger.

Upon being enabled the plant shall be configured as follows:

- The two port control valve on the HHW side of the heat exchanger shall modulate via a P+I control loop to maintain the temperature on the domestic hot water side of the heat exchanger at [68]°C ± 0.5K.

When the heat exchanger is not enabled, the plant shall be configured as follows:

- The two port control valve on the HHW side of the heat exchanger shall be closed

9.19.2.10 Differential Pressure Control

A differential pressure sensor with an associated setpoint and P+I control loop shall be located in the riser between the flow and return pipework. The sensor shall be wired directly back to the pump DDC controller.

The differential pressure setpoint shall be determined during commissioning in conjunction with the mechanical Subcontractor such that with all valves fully open (with any diversity applied) the design flow is achieved for each coil.

Each hot water heater shall have an associated minimum and maximum flow setpoint (as advised by the manufacturer) which shall equate to 0 -100%.

The flow setpoint for each enabled HWH shall be reset in unison between minimum and maximum via the output from the differential pressure control loop to maintain setpoint. The flow setpoint reset rate of change shall be limited to {10}%/min (or as advised by the manufacturer).

Upon reaching the minimum flow setpoint, the bypass valve shall modulate to maintain differential pressure and the flow setpoint shall be fixed. Once the bypass valve is fully closed and the differential pressure decreases, the bypass valve position shall be fixed and the flows setpoint shall be increased.

Whenever the tri-generation heat exchanger is enabled and all HWHs are disabled, the heat exchanger pump and the bypass control valve shall modulate in sequence via the P+I control loop to maintain the differential pressure sensor at setpoint. Upon a HWH being enabled the heat exchanger pump shall maintain maximum volume through the heat echanger.

9.19.2.11 Heat Exchanger / HWH Pump Speed Control

Upon being enabled the pump shall modulate via a P+I control loop to maintain the associated magnetic flow meter at setpoint ± 1 l/s. The flow setpoint shall be reset as described under 'Differential Pressure Control'.

9.19.2.12 Bypass Valve Override

The bypass valve shall be overridden open proportionally to maintain the flow through the hot water heater at the minimum flow setpoint minus {10}%.

9.19.2.13 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump running status shall be determined by an auxiliary contact on the flow meter (set for minimum HWH flow) and the VSD running status.

The associated HWH shall be deemed to have failed and removed from the HWH sequence.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.19.2.14 VSD Local/Auto Monitoring

The local/auto status of each VSD shall be monitored by the BMCS and an alarm raised at the BMCS operators station for the appropriate fan should the VSD be put into manual control via the VSD facia mounted control panel.

9.20 Secondary HHW

9.20.1 General

The secondary HHW system is variable volume, it is coupled with primary HHW system via plate heat exchangers and serves the low rise trench heaters and underfloor heating circuit.

The system comprises 2 no. (lead/lag) variable speed pumps and a low flow bypass.

Temperature control is via the 2-port control valve located on the primary side of the plate heat exchangers.

Refer to Mechanical Services schematics and layout drawings for numbers and locations of equipment.

9.20.2 Automatic Operation

9.20.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Heating call from any office AHU;
- Heating call from any [4] trench heating valves;
- Manual command from the BMCS operator station

Upon being enabled a cooling call shall be sent to the primary HHW system, the lead secondary pump shall be enabled, the temperature control shall be enabled and the differential pressure control shall be enabled.

Upon no enable commands being active, or the primary chilled water system being unavailable to run, the plant shall be configured as described under plant shutdown.

9.20.2.2 Plant Shutdown

When required to shutdown, all pumps and their associated control loops shall be disabled and the 2-port valve shall be driven closed. The heating call to the secondary chilled water plant shall be removed.

9.20.2.3 Temperature Control

The 2-port valve located on the primary side of the plate heat exchangers shall modulate via a P+I control loop to maintain the flow water temperature at the secondary flow setpoint +/- 0.5K.

The secondary flow setpoint shall be reset according to the active primary flow setpoint such that it is maintained at [2.0]K below.

9.20.2.4 Differential Pressure Control

The circuit shall have a differential pressure sensor located at the end of the riser with an associated setpoint (to be determined during commissioning) and P+I control loop.

The differential pressure sensor shall be wired directly to the DDC controller controlling the pumps.

The speed of the lead pump and the bypass valve shall be modulated in sequence via the P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump output reaching above 90% for {30} seconds, the lag pump shall be enabled slowly ramped up at a rate of {10}%/min until both pumps are running at the sampe speed, at which time the pumps shall modulate in unison via the P+I control loop to maintain the differential pressure sensor at setpoint.

With both pumps enabled, upon the output to each pump being below 40% for {60} seconds, the lag pump shall be disabled and slowly ramped down at a rate of {10}%/min and the lead pump shall continue to modulate via a P+I control loop to maintain the differential pressure sensor at setpoint.

Upon the lead pump operating at minimum speed and the differential pressure continues to rise, the pump speed shall be fixed and the bypass control valve shall modulate to maintain the differential pressure sensor at setpoint. Note: the pump speed and valve shall never modulate simultaneously.

9.20.2.5 Pump Sequencing

The 2 no. secondary pumps shall operate in a lead/lag manner with sequence rotation based on hours run and failure.

The pump sequence rotation shall be on a weekly basis on a day selected by the operator e.g. Monday and at a time when either both pumps are running or both

pumps are shutdown. At the time of rotation the pump with the least run hours shall become the lead pump.

In the event of a pump failure, the next available pump in the sequence shall be enabled and the failed pump shall be shutdown and removed from the sequence.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

Upon failure of any pump it shall be taken out of the sequence.

9.20.2.6 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.21 HHW Underfloor Heating Circuit

9.21.1 General

The underfloor heating circuit is located on level B1 and serves the ground floor lobby. The circuit is coupled with the secondary HHW system via a plate heat exchanger.

The system comprises a constant volume pump.

There shall be 4 no. space temperature sensors located in the foyer area.

Temperature control is via the 2-port control valve located on the secondary side of the plate heat exchanger.

9.21.2 Automatic Operation

9.21.2.1 System Enable/Disable

The system shall be enabled upon any of the following:

- Dedicated foyer time schedule
- Manual command from the BMCS operator station

Upon being enabled a HHW call shall be sent to the secondary HHW system which in turn will generate a call to the primary HHW system.

Upon receipt that the primary and secondary HHW systems are running the underfloor heating pump shall be enabled and the temperature control loop shall be enabled.

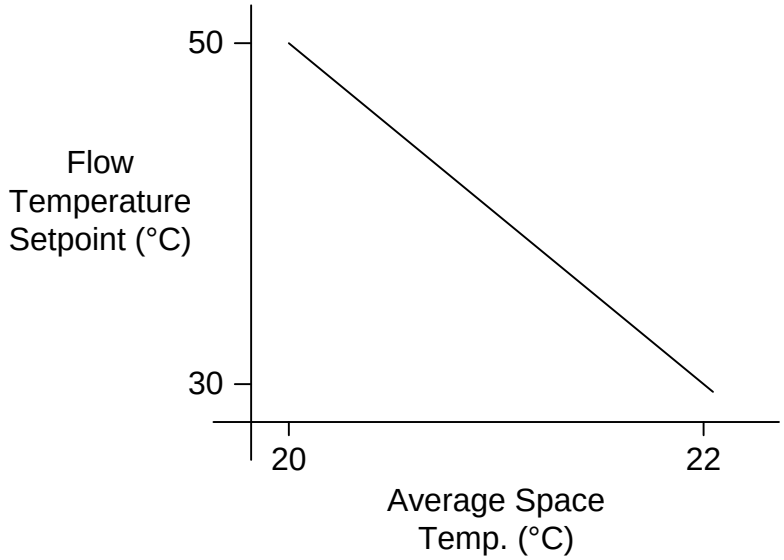
9.21.2.2 Plant Shutdown

Upon being shutdown the pump shall be disabled and the 2-port valve driven fully closed.

9.21.2.3 Temperature Control

The 2-port valve located on the secondary HHW side of the plate heat exchanger shall modulate via a P+I control loop to maintain the flow water temperature at the setpoint +/- 0.5K.

The flow water temperature setpoint shall be reset according to the average of the floor space temperature sensors as follows:



A critical alarm shall be raised and the system shutdown in the event that the flow temperature exceeds [55]°C. A manual reset shall be required.

9.21.2.4 Pump Monitoring and Failure

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off and the system shutdown. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.22 Tri-Generation System

9.22.1 General

The tri-generation system comprises a gas generator engine, absorption chiller, hot water heat exchanger and associated ancillary plant.

The tri-generation control panel will control all tri-generation plant and associated ancillary plant.

The BMCS shall interface with the tri-generation control system via a Modbus over RS485 protocol. The interface shall be 2-way.

Whenever the tri-generation gas engine is ‘Active’ the BMCS shall enable/disable the absorption chiller via a low level interface to the tri-generation control panel. Refer to the ‘Primary Chilled Water’ system for further details.

Whenever the tri-generation gas engine is ‘Active’ the BMCS shall control the flow through the hot water heat exchnager. Refer to the ‘Primary Heating Hot Water’ system for further details.

9.22.2 Interfaces

High Level Interface

The BMCS shall interface with the tri-generation control system via a Modbus over RS485 protocol. The interface shall allow 2-way communication.

Low Level Interfaces

The following low level interfaces shall be monitored/controlled via the tri-generation control panel.

Engine

Active	DI
Fault	DI
Demand for Auxiliaries	DI
Auxiliaries active (cooling towers)	DO
Operating mode (parallel / island)	DI
Chiller ATS status	DO
Load shedding required	DI

Absorption Chiller

Enable/disable	DO
Chiller running status	DI
Chiller fault	DI

9.23 Hydraulic Services Control and Monitoring

9.23.1 Domestic Cold Water Storage Tank

The domestic cold water storage tank is split into two sections. The BMCS shall monitor the following level switches in the cold water storage tank and raise the relevant alarm if level is exceeded:

Alarm Reference	Description	Operation
A-DCW-OF-1	Overflow alarm section 1.	Alarm on BMCS
A-DCW-OF-2	Overflow alarm section 2.	Alarm on BMCS
A-DCW-HL-01	High level alarm section 1.	Alarm on BMCS (tank full)
A-DCW-HL-02	High level alarm section 2.	Alarm on BMCS (tank full)
A-DCW-LL-01	Low level 20% capacity alarm section 1.	Alarm on BMCS (tank low)
A-DCW-LL-02	Low level 20% capacity alarm section 2.	Alarm on BMCS (tank low)
A-DCW-ULL-01	Ultra Low level 10% capacity alarm section 1.	Alarm on BMCS, pumps stopped
A-DCW-ULL-02	Ultra Low level 10% capacity alarm section 2.	Alarm on BMCS, pumps stopped

9.23.2 Mains Water Booster Set

The mains water booster pump set shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.3 Cold Water Booster Set

The cold water booster pump set shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.4 Domestic Hot Water Heaters

There are 5 No. gas fired domestic hot water heaters.

The BMCS shall enable/disable the heaters and pumps according to a time schedule.

Once enabled the heaters shall operate to their own internal temperature controls.

9.23.5 Heat Exchanger

Refer to HHW system for details of heat exchanger control sequences.

The BMCS Contractor shall free issue a thermal energy meter (comprising a flow meter and temperature sensor) for installation by the hydraulic contractor.

9.23.6 Domestic Hot Water Circulating Pumps

There are 4 No. pumps associated with the domestic hot water system.

The BMCS shall enable/disable the heaters and pumps according to a time schedule.

Once enabled the heaters shall operate to their own internal temperature controls.

9.23.6.1 Pump Sequencing

Each pair of circulating pumps shall operate in a duty/standby manner with changeover based on hours run and failure.

The pumps shall rotate their duty/standby sequence on a run time basis such that every [7] days, at a time when the plant is shutdown, the pump with the least run time hours shall become the duty.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

9.23.6.2 Pump Monitoring and Failure

Pump running status shall be determined by the status of a differential pressure switch installed across the pump.

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.23.7 Rainwater Tank

The rainwater tank is split into two sections. The BMCS shall monitor level switches, raise alarms and carry out control functionality according to the following table:

Alarm Reference	Description	BMCS Operation
A-RW-OF-1	Overflow alarm section 1.	Alarm on BMCS
A-RW-OF-2	Overflow alarm section 2.	Alarm on BMCS
A-RW-HL-01	High level alarm section 1.	Alarm on BMCS
A-RW-HL-02	High level alarm section 2.	Alarm on BMCS
A-RW-RW-01	40% capacity alarm section 1	Close motorised valve RW-MV-03
A-RW-RW-02	40% capacity alarm section 2	Close motorised valve RW-MV-03

Alarm Reference	Description	BMCS Operation
A-RW-LL-01	20% capacity alarm section 1	Close motorised valve RW-MV-01 Open motorised valve RW-MV-03
A-RW-LL-02	20% capacity alarm section 2	Close motorised valve RW-MV-02 Open motorised valve RW-MV-03
A-RW-ULL-01	10% capacity alarm section 1	Stop pumps
A-RW-ULL-02	10% capacity alarm section 2	Stop pumps

9.23.8 NPCW Buffer Tank

The NPCW buffer tank is split into two sections. The BMCS shall monitor level switches, raise alarms and carry out control functionality according to the following table:

Alarm Reference	Description	BMCS Operation
A-RW-OF-1	Overflow alarm section 1.	Alarm on BMCS
A-RW-OF-2	Overflow alarm section 2.	Alarm on BMCS
A-RW-HL-01	High level alarm section 1.	Alarm on BMCS
A-RW-HL-02	High level alarm section 2.	Alarm on BMCS
A-RW-RW-01	40% capacity alarm section 1	Close motorised valve RW-MV-03
A-RW-RW-02	40% capacity alarm section 2	Close motorised valve RW-MV-04
A-RW-LL-01	20% capacity alarm section 1	Close motorised valve RW-MV-01 Open motorised valve RW-MV-03
A-RW-LL-02	20% capacity alarm section 2	Close motorised valve RW-MV-02 Open motorised valve RW-MV-04
A-RW-ULL-01	10% capacity alarm section 1	Stop pumps
A-RW-ULL-02	10% capacity alarm section 2	Stop pumps

9.23.9 NPCW Transfer Pumps

The NPCW transfer pumps shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.10 NPCW Tank

The level 33 non-potable cold water tank is split into two sections. The BMCS shall monitor the following level switches in the cold water storage tank and raise the relevant alarm if level is exceeded:

Alarm Reference	Description	Operation
A-NPCW-T-OF-01	Overflow alarm section 1.	Alarm on BMCS
A-NPCW-T-OF-02	Overflow alarm section 2.	Alarm on BMCS

Alarm Reference	Description	Operation
A-NPCW-T-HL-01	High level alarm section 1.	Alarm on BMCS
A-NPCW-T-HL-02	High level alarm section 2.	Alarm on BMCS
A-NPCW-T-LL-01	40% capacity alarm section 1	Open motorised valve CW-MV-01
A-NPCW-T-LL-02	40% capacity alarm section 2	Open motorised valve CW-MV-02
A-NPCW-T-ML-01	50% capacity alarm section 1	Close motorised valve CW-MV-01
A-NPCW-T-ML-02	50% capacity alarm section 2	Close motorised valve CW-MV-02

9.23.11 NPCW Booster Set

The flush water booster pump set shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.12 Cooling Tower Transfer Pumps

The cooling tower transfer pumps shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.13 Rain Water Storage Tanks

There are two rain water storage tanks. The BMCS shall monitor the following level switches in the rain water storage tank and raise the relevant alarms:

Alarm Reference	Description
RW-T1-100%F	Tank 1 at 100% capacity
RW-T2-100%F	Tank 2 at 100% capacity
RW-T1-30%F	Tank 1 at 30% capacity
RW-T2-30%F	Tank 2 at 30% capacity
RW-T1-5%F	Tank 1 at 5% capacity (suppress operation of RW-MV-03)
RW-T2-5%F	Tank 2 at 5% capacity Tank 1 at 5% capacity (suppress operation of RW-MV-04)

9.23.14 Rainwater Chlorination Equipment

The NPCW chlorination equipment shall be monitored by the BMCS for a fault alarm via a volt free contact.

Upon receipt of a fault alarm the BMCS shall disable the chlorination equipment.

Motorised valves MV-01 and MV-02 on the emergency fill line shall be open/closed under the dictates of the level switches.

9.23.15 Cooling Tower RO Equipment

The cooling tower RO equipment shall be monitored by the BMCS for a fault alarm via a volt free contact.

Upon receipt of a fault alarm the BMCS shall disable the cooling tower RO equipment and open motorised valves MV01 and MV02 on the emergency fill line under the dictates of the level switches.

9.23.15.1 Leak Detection Software

In order to achieve Green Star point Water Meter (Wat-2), the BMCS shall be programmed to generate an alarm upon a sudden increase in water consumption or new trend in water consumption sensed by the Incoming Cold Water Meters and Domestic cold water sub-meters, which indicates the likelihood of a leakage.

9.23.16 Sanitary Waste Pump Out Units

The sanitary waste pump out units shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.17 Waste Water Pump Out Units

Each waste water pump out unit shall be monitored by the BMCS for a fault alarm via a volt free contact.

9.23.18 Black Water Balance Tank

The black water treatment plant shall be monitored by the BMCS for a fault alarm via a volt free contact. When a fault is received the BMCS shall disable transfer pumps BW-ST-01 and 02.

The recycled water day tank is split into two sections. The BMCS shall monitor level switches, raise alarms and carry out control functionality according to the following table:

Alarm Reference	Description	Operation
A-BW-OF-01	Overflow alarm section 1.	Alarm on BMCS.
A-BW-OF-02	Overflow alarm section 2.	Alarm on BMCS.
A-BW-HL-01	High level alarm section 1.	Alarm on BMCS Suppress operation of pumps Ref: BW-SMP-01 and 02
A-BW-HL-02	High level alarm section 2.	Alarm on BMCS Suppress operation of pumps Ref: BW-SMP-01 and 02
A-BW-PS-01	70% capacity alarm section 1	Pumps Ref: BW-SMP-01 and 02 stop
A-BW-PS-02	70% capacity alarm section 1	Pumps Ref: BW-SMP-01 and 02 stop

Alarm Reference	Description	Operation
A-BW-LL-01	50% capacity alarm section 1	Pumps Ref: BW-SMP-01 or 02 start provided low level alarm in rainwater tanks RW-T- 01 and 02 are at 5%
A-BW-LL-02	50% capacity alarm section 2	Pumps Ref: BW-SMP-01 or 02 start provided low level alarm in rainwater tanks RW-T- 01 and 02 are at 5%
A-RW-ULL-01	10% capacity alarm section 1	Open motorised valve RW-MV-01
A-RW-ULL-02	10% capacity alarm section 2	Open motorised valve RW-MV-01

9.23.18.1 Transfer Pumps

The duty transfer pump shall always run unless a tank low level cut out is active.

9.23.18.2 Pump Sequencing

Each pair of pumps (transfer and sewer mining) shall operate in a duty/standby manner with changeover based on hours run and failure.

The pumps shall rotate their duty/standby sequence each time the duty pump is disabled.

An operator shall have the facility to manually select the pump sequence via the system graphic.

Pump total run time with an associated reset button and run time since last changeover shall be displayed on the system graphic.

9.23.18.3 Pump Monitoring and Failure

Pump running status shall be determined by the status of a differential pressure switch installed across the pump.

In the event of a pump failure as detected by a mismatch between the command to the pump and the pump status, an alarm shall be raised on the operator's station and that pump commanded off. A failed flag for that pump shall be set.

Pump failure alarms shall be inhibited for {10} seconds after pump starting.

The failed pump shall not re-enter the normal automatic control sequence until the operator resets the pump failed flag at the operator's station.

9.23.19 Sprinkler Storage Tank

The sprinkler storage tank is split into two sections. The BMCS shall monitor the following level switches in the cold water storage tank and raise the relevant alarm if level is exceeded:

Alarm Reference	Description
A-FS-OF-1	Overflow alarm section 1.
A-FS-OF-2	Overflow alarm section 2.
A-FS-HL-01	High level alarm section 1.
A-FS-HL-02	High level alarm section 2.

9.23.20 Hydrant Storage Tank

The hydrant storage tank is split into two sections. The BMCS shall monitor the following level switches in the cold water storage tank and raise the relevant alarm if level is exceeded:

Alarm Reference	Description
A-FH-OF-1	Overflow alarm section 1.
A-FH-OF-2	Overflow alarm section 2.
A-FH-HL-01	High level alarm section 1.
A-FH-HL-02	High level alarm section 2.

9.23.21 Over Pressure indication

There are 3 separate pressure reducing zones in each of the water services systems. The BMCS shall monitor the pressure in each of the pressure reducing zones (pressure sensor to be provided by the BMCS Subcontractor). The BMCS shall record the pressure in each zone at midnight and calculate the average over the first 3 months post PC. This average shall be used to determine abnormal pressures. The following table details the pressure sensors and associated BMCS alarm requirements:

Reference	Alarm Pressure
PRV-PW-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-PW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-PW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-NPW-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-NPW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-NPW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.

Reference	Alarm Pressure
PRV-DHW-HP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-DHW-MP	When the sensed pressure at midnight has increased by 10% above the trended average.
PRV-DHW-LP	When the sensed pressure at midnight has increased by 10% above the trended average.

9.24 Electrical Services Control and Monitoring

Refer to BMCS equipment schedule for Electrical Services points that require monitoring on the BMCS. The BMCS Subcontractor shall coordinate with the Electrical Subcontractor to ensure all interfaces are compatible.

9.25 Fire Detection & Alarm System Monitoring

The BMCS shall monitor the fire detection & alarm system via a high level interfaces for the following:

- Fire Panel Healthy/Fault
- Fire Alarm Active (individual monitoring for each fire zone)
- Zone Fault (e.g. detector)

In the event of a fire alarm, the BMCS shall mimic all hard wired logic such that any consequential alarms as a result of the fire alarm system shall be inhibited.

9.26 Lift System Monitoring

The following lifts shall be monitored by the BMCS:

- 4 x low rise passenger lifts;
- 4 x high rise passenger lifts;
- 1 x car park shuttle passenger lift;
- 1 x dedicated goods lift.

The BMCS shall monitor the following points via a low level interface at the top floor machine area for each lift :

- Lift failed to start;
- Lift on fire service;
- Alarm button pressed;
- Emergency recall operation;
- Stop button pressed;
- Lift on independent service; 22
- Lift on maintenance control;

- Lift machine room high temperature alarm.

The BMCS shall monitor each lift circuit breaker/meter via a high level interface at the top floor machine area, for up to 10 points.

9.27 Security System Monitoring

The BMCS shall interface with the access control and CCTV system via a high level interface for two way communication.

9.28 Energy and Water Monitoring System

9.28.1 General

A dedicated Energy and Water Monitoring software package shall be provided with in built energy/water management and targeting functions.

Data manipulation shall be straight forward and user friendly such that data from a particular meter for different time periods, or data from different meters over a particular time period, can be displayed graphically and compared.

It shall be possible for the operator to easily create virtual metering points which shall store the result from summation of selected energy meters. It shall be possible for the BMCS operator to select any energy meter to be included for summation into a virtual meter.

The system shall trend water consumption for each water meter and have the ability to detect an unusual trend in consumption that may be indicative of a leak in order to raise an appropriate alarm to the building manager. The leak detection software shall be time of day specific i.e. small uses overnight may set off an alarm whilst greater uses during the day do not. The contractor shall provide a written description detailing the leak detection capability of the system.

The system shall have the facility for the user to configure virtual meters i.e. addition or subtraction of real meters.

The following electrical energy meters, provided and installed by the Mechanical Contractor, shall be monitored:

9.28.2 Mechanical Services Electrical Energy Meters

Refer to the MCC schedules in the Mechanical Services specification for numbers and locations of energy meters. The BMCS Contractor shall interface with each meter via a modbus HLI.

9.28.3 Electrical Services Electrical Energy Meters

The following electrical energy meters, installed by the Electrical Contractor, shall be monitored via a high level interface:

- MSB 1
- MSB 2
- GSB

- GSB-CB-G1
- GSB-CB-G2
- GSB-CB-G3
- GSB-ACB-C2

The BMCS shall monitor all meters connected to the SCADA system via a single HLI to the SCADA system.

9.28.4 Hydraulic Services Water and Gas Meters

The following water and gas meters, installed by the Hydraulic Contractor, shall be monitored via a pulse input signal. Refer to Hydraulic Services drawings for numbers and locations of equipment.

Water Meters	**Number**	**Level**
Incoming water meter	WM-01	B1
Sprinkler tank top up	WM-02	B3
Retail water meter	WM-03	B1
Hydrant tank top up	WM-04	L3
L18 Kitchen water meter	WM-05	L18
Water Meters	**Number**	**Level**
Hot water supply	WM-06	L31
NPCW top up	WM-07	L33
Cold water tank top up	WM-08	L33
L30 Kitchen water meter	WM-09	L30
Retail water meter	WM-10	B1
Retail water meter	WM-11	B1
NPCW meters	**Number**	**Level**
Treated Rainwater meter	NPWM-01	B2
Treated Black water meter	NPWM-02	B2
NPCW to cooling towers	NPWM-03	L33
NPCW to WCs and Urinals	NPWM-04	L33
L30 Irrigation meter	NPWM-05	L30
L18 Irrigation meter	NPWM-06	L18
B1 Garbage Room meter	NPWM-07	B1
Hot water meters	**Number**	**Level**
Level 18 Kitchen	HWM-01	18
Level 30 Kitchen	HWM-02	30

Gas meters	Number	Level
Incoming meter Cogen	GM-01	B1
Incoming meter building	GM-02	B1
Tenancy retail meter	GM-03	B1
L18 Kitchen meter	GM-04	L18
HW plant meter	GM-05	L31
Mechanical plant meter	GM-06	L33
L30 Kitchen meter	GM-07	L30

10 Points Schedule

The points detailed within the following schedules are intended to assist the BMCS Subcontractor only, and do not relieve the BMCS Subcontractor of their responsibility to include all necessary points to make the entire system fully functional in accordance with the scope and Controls Sequences detailed elsewhere in this document.

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Office AHUs		
AHU-19-1	**Low Rise East Internal Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
RAF-19-1	Return Air Fan (VSD)		dedicated to AHU-19-1
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Exhaust air damper	AO	dedicated to AHU-19-1
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	
	Return air humidity sensor	AI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Supply air static pressure sensor	AI	
	Mixed air chamber static pressure sensor	AI	for monitoring only
	Level 19 plantroom space temperature sensor	AI	located adjacent to AHU outside air intake. Used for economy cycle decision for all AHU located in L19 plantroom
	Level 19 plantroom space humidity sensor	AI	
AHU-19-2	**Low Rise West Internal Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
RAF-19-2	Return Air Fan (VSD)		dedicated to AHU-19-2
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Exhaust air damper	AO	dedicated to AHU-19-2
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	
	Return air humidity sensor	AI	
	Supply air static pressure sensor	AI	
	Mixed air chamber static pressure sensor	AI	for monitoring only
AHU-20-1	**Low Rise East Villages AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	

BMS Points Schedule

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Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
RAF-20-1	Return Air Fan (VSD)		common fan for AHU-20-1 and AHU-20-3
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Exhaust air damper	AO	common damper for AHU-20-1 and AHU-20-3
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	

BMS Points Schedule

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Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	common sensor for AHU-20-1 and AHU-20-3
	Return air humidity sensor	AI	common sensor for AHU-20-1 and AHU-20-3
	Supply air static pressure sensor	AI	
	Return air static pressure sensor	AI	common sensor for AHU-20-1 and AHU-20-3
	Level 20 plantroom space temperature sensor	AI	located adjacent to AHU outside air intake. Used for economy cycle decision for all AHU located in L20 plantroom
	Level 20 plantroom space humidity sensor	AI	
AHU-20-2	**Low Rise West Villages AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	

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Reference	Description	Point Type	Notes
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
RAF-20-2	Return Air Fan (VSD)		common fan for AHU-20-2 and AHU-20-4
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	

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Reference	Description	Point Type	Notes
	Exhaust air damper	AO	common damper for AHU-20-2 and AHU-20-4
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	common sensor for AHU-20-2 and AHU-20-4
	Return air humidity sensor	AI	common sensor for AHU-20-2 and AHU-20-4
	Supply air static pressure sensor	AI	
	Return air static pressure sensor	AI	common sensor for AHU-20-1 and AHU-20-3
AHU-20-3	**Low Rise East Perimeter Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
AHU-20-4	**Low Rise West Perimeter Zone AHU**		

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Reference	Description	Point Type	Notes
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	

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Reference	Description	Point Type	Notes
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
RAF-20-3	**Low Rise High Level Village Exhaust**		
	Return Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed

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Reference	Description	Point Type	Notes
AHU-30-1	**High Rise East Villages AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	

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Reference	Description	Point Type	Notes
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	common sensor for AHU-30-1 and AHU-30-3
	Return air humidity sensor	AI	common sensor for AHU-30-1 and AHU-30-3
	Supply air static pressure sensor	AI	
	Level 30 plantroom space temperature sensor	AI	located adjacent to AHU outside air intake. Used for economy cycle decision for all AHU located in L30 plantroom
	Level 30 plantroom space humidity sensor	AI	
AHU-30-2	**High RiseWest Villages AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	

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Reference	Description	Point Type	Notes
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Return air temperature sensor	AI	common sensor for AHU-30-2 and AHU-30-4
	Return air humidity sensor	AI	common sensor for AHU-30-2 and AHU-30-4
	Supply air static pressure sensor	AI	
AHU-30-3	**High Rise East Perimeter Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

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Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
AHU-30-4	**High Rise West Perimeter Zone AHU**		

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Reference	Description	Point Type	Notes
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	

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Reference	Description	Point Type	Notes
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
AHU-31-1	**High Rise East Internal Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	

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Reference	Description	Point Type	Notes
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
AHU-31-2	**High Rise West Internal Zone AHU**		
	Supply Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	

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Reference	Description	Point Type	Notes
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Minimum outside air damper	AO	
	Outside air damper	AO	
	Return air damper	AO	
	Panel filter differential pressure sensor	AI	
	Bag filter differential pressure sensor	AI	
	Cooling coil control valve	AO	
	Heating coil control valve	AO	
	Supply air temperature sensor	AI	averaging element temperature sensor
	Supply air humidity sensor	AI	
	Supply air static pressure sensor	AI	
	Level 31 plantroom space temperature sensor	AI	located adjacent to AHU outside air intake. Used for economy cycle decision for all AHU located in L31 plantroom
	Level 31 plantroom space humidity sensor	AI	
RAF-31-3	**High Rise High Level Village Exhaust**		
	Return Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	

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Reference	Description	Point Type	Notes
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed
SSF-R-1	**Smoke Spill / High Rise East Office Exhaust Fan**		
	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	

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Reference	Description	Point Type	Notes
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed
SSF-R-2	**Smoke Spill / High Rise West Office Exhaust Fan**		
	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	

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Reference	Description	Point Type	Notes
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed
	Low Rise - Tenant General Exhaust		
GEF-31-1	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	

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Reference	Description	Point Type	Notes
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed
	High Rise - Tenant General Exhaust		
GEF-R-1	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Static pressure sensor	AI	located 2/3 down the riser, wired directly to the DDC controlling the fan speed

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Reference	Description	Point Type	Notes
	Office Floor Controls		
	Space relative humidity sensor	AI	6 no. per office floor, located adjacent to a nominated space temperature sensor and used to calculate space dew point temperature.
	Carbon Dioxide sensor	AI	2 no. per office floor.
	Trench Heaters		points required for each duct re-heat, refer to mechanical serviced floor layout drawings for number and location of zones
	2-port valve	AO	
	Space temperature sensor	AI	refer to mechanical layout drawings for numbers and locations
	Fan enable/disable	DO	common output for all fans in a zone
	Fan trip	DI	common status for all fans in a zone
	Chilled Beam Zone (Typical)		points apply to each chilled beam zone, refer to mechanical serviced floor layout drawings for number and location of zones
	Control valve output	AO	
	Condensation sensor	DI	mounted on chilled beam
	Space temperature sensor	AI	refer to mechanical layout drawings for numbers and locations
	VAV Box (Typical)		points apply to each CAV box, refer to mechanical services floor layout drawings for number and location of zones.
	Space temperature sensor	AI	refer to mechanical layout drawings for numbers and locations
	Air flow	AI	
	Damper position	AO	
	CAV Box (Typical)		points apply to each CAV box, refer to mechanical services floor layout drawings for number and location of zones

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Reference	Description	Point Type	Notes
	Air flow	AI	
	Damper position	AO	
TEF-R-1	**East Office Toilet Exhaust**		
	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Isolation damper	DO	
TEF-R-2	**West Office Toilet Exhaust**		

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Reference	Description	Point Type	Notes
	Exhaust Air Fan (VSD)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	Isolation damper	DO	
	Carpark Ventilation		
CSF-2-1	Supply Air Fan		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	

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Reference	Description	Point Type	Notes
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
CEF-B2-1	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Broken belt	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	

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Reference	Description	Point Type	Notes
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Fire Mode "RUN" Active	HLI	
	Fire Mode "STOP" Active	HLI	
	High static pressure switch	DI	
	Low static pressure switch	DI	
	Space CO sensors	AI	refer to mechanical services layout drawings for numbers and locations
	Diesel Room Ventilation		
SAF-B2-1	Supply Air Fan		
	Enable	DO	
	Running Status	DI	
EAF-B2-2	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Differential pressure switch	DI	installed across the supply air fan
	Differential pressure switch	DI	installed across the supply air filter
	Differential pressure switch	DI	installed across the exhaust air fan

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Reference	Description	Point Type	Notes
	Basement Ventilation & A/C		
SAF-2-1	Supply Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
EAF-B2-1	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
PAC-B1-1	PAC Unit (Security Room)		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
PAC-B1-2	PAC Unit (Main Switch Room)		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	

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Reference	Description	Point Type	Notes
	Isolation valve	DO	
PAC-B2-1	PAC Unit (Distribution Room)		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
PAC-B2-2	PAC Unit (Distribution Room)		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
	Basement Toilet Exhaust		
EAF-B2-3	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
	Fire Control Room		

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Reference	Description	Point Type	Notes
SAF-B1-1	Supply Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
	Lift lobby		
SAF-3-1	Outside Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
PAC-3-1	PAC Unit		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
	Low Rise Lift Motor Room		
EF-20-1	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	

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Reference	Description	Point Type	Notes
PAC-20-1	PAC Unit no.1		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
PAC-20-2	PAC Unit no.2		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
	High Rise Lift Motor Room		
EF-31-1	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
PAC-31-1	PAC Unit no.1		
	Enable	DO	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
PAC-31-2	PAC Unit no.2		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
	Goods Lift Motor Room		
EF-33-1	Goods Lift Motor Room Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
PAC-33-1	PAC Unit no.1		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Isolation valve	DO	
PAC-33-2	PAC Unit no.2		
	Enable	DO	
	Fault	DI	
	Cooling stage 1	DO	
	Cooling stage 2	DO	
	Isolation valve	DO	
	Black Water Room		
EF-31-2	Exhaust Air Fan		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
	Atruim Natural Ventilation		
	Louver no.1 open command	DO	
	Louver no.1 closed command	DO	
	Louver no.2 open command	DO	
	Louver no.2 closed command	DO	
	Louver no.3 open command	DO	
	Louver no.3 closed command	DO	
	Louver no.4 open command	DO	

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Reference	Description	Point Type	Notes
	Louver no.4 closed command	DO	
	Switch in Open position	DI	local override
	Switch in closed poistion	DI	local override
	Primary Chilled Water System		
CHR-31-1	Electric Chiller		
	enable command	DO	
	lock-out	DI	
	running status	DI	
	Flow temperature setpoint	AO	
	CHW flow status	HLI	
	CDW flow status	HLI	
	CHW entering temperature	HLI	
	CHW leaving temperature	HLI	
	CDW entering temperature	HLI	
	CDW leaving temperature	HLI	
	comms status	HLI	
	chiller running amps	HLI	
	chiller power (Kw)	HLI	
	active cooling capacity	HLI	
	Flow temperature setpoint	HLI	
	manual reset required alarm	HLI	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Fault type	HLI	
	additional monitoring point x 15	HLI	
CHR-31-2	Electric Chiller		
	enable command	DO	
	lock-out	DI	
	running status	DI	
	Flow temperature setpoint	AO	
	CHW flow status	HLI	
	CDW flow status	HLI	
	CHW entering temperature	HLI	
	CHW leaving temperature	HLI	
	CDW entering temperature	HLI	
	CDW leaving temperature	HLI	
	comms status	HLI	
	chiller running amps	HLI	
	chiller power (Kw)	HLI	
	active cooling capacity	HLI	
	Flow temperature setpoint	HLI	
	manual reset required alarm	HLI	
	Fault type	HLI	
	additional monitoring point x 15	HLI	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Absorption Chiller		
	enable command	DO	
	running status	DI	
	lock-out fault	DI	
CHP-31-1	Primary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CHP-31-2	Primary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CHP-31-3	Absorption Chiller Pump		
	Running Status	HLI	
	Speed Output	HLI	
	Fault	HLI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Chiller No.1 entering temperature sensor	AI	
	Chiller No.1 leaving temperature sensor	AI	
	Chiller No.1 flow meter	AI	

BMS Points Schedule			**Project:** 8 Chifley Square
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Reference	Description	Point Type	Notes
	Chiller No.1 flow status	DI	
	Chiller No.2 entering temperature sensor	AI	
	Chiller No.2 leaving temperature sensor	AI	
	Chiller No.2 flow meter	AI	
	Chiller No.2 flow status	DI	
	Absorption chiller leaving temperature sensor	AI	
	Absorption chiller entering temperature sensor	AI	
	Common primary flow temperature sensor	AI	
	Common primary return temperature sensor	AI	
	Primary return temperature sensor	AI	
	Primary return temperature sensor	AI	
	Buffer tank high level temperature sensor	AI	
	Buffer tank low level temperature sensor	AI	
	Primary bypass flow meter	AI	
	Secondary Chilled Water Circuit No.1		
LT-CHP-31-1	Secondary CHW Pump		
	Enable	DO	

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Reference	Description	Point Type	Notes
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
LT-CHP-31-2	Secondary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Differential pressure sensor	AI	
	Flow temperature sensor	AI	
	Return temperature sensor	AI	
	Tertiary heat exchangers entering temperature sensor	AI	
	Tertiary heat exchangers leaving temperature sensor	AI	
	Low flow bypass valve	AO	
	Secondary Chilled Water Circuit No.2		
HT-CHP-31-1	Secondary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
HT-CHP-31-2	Secondary CHW Pump		

BMS Points Schedule			**Project:** 8 Chifley Square
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Reference	Description	Point Type	Notes
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Differential pressure sensor	AI	
	Flow temperature sensor	AI	
	Return temperature sensor	AI	
	3-port mixing valve (injection circuit)	AO	
	Low flow bypass valve	AO	
	Tertiary Chilled Water Circuit		
HT-CHP-19-1	Tertiary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	

BMS Points Schedule

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Reference	Description	Point Type	Notes
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
HT-CHP-19-2	Tertiary CHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	2-port valve	AO	

BMS Points Schedule			**Project:** 8 Chifley Square
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Reference	Description	Point Type	Notes
	Differential pressure sensor	AI	
	Flow temperature sensor	AI	
	Return temperature sensor	AI	
	Low flow bypass valve	AO	
	Primary Condenser Water System		
CT-33-1	Cooling Tower Fans		
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CT-33-2	Cooling Tower Fans		
	Enable	DO	latching relays required
	Disable	DO	

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Reference	Description	Point Type	Notes
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CT-33-3	Cooling Tower Fans		
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	

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Reference	Description	Point Type	Notes
	Fault type	HLI	
CWP-31-1	Chiller CDW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CWP-31-2	Chiller CDW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	

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Reference	Description	Point Type	Notes
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CWP-31-3	Tri-Gen CDW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
CWP-31-4	Tri-Gen CDW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

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Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
T-CWP-31-1	Tenant Primary CW Pump		
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
T-CWP-31-2	Tenant Primary CW Pump		

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Reference	Description	Point Type	Notes
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
T-CWP-31-3	Tenant Primary CW Pump		
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	

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Reference	Description	Point Type	Notes
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	Low temperature bypass valve	AO	
	Tri-generation 3-port mixing valve	AO	
	common off-cooling tower temperature sensor	AI	located after bypass
	common off-cooling tower temperature sensor	AI	located after bypass
	common on-tower temperature sensor	AI	
	Tri-generation entering temperature sensor	AI	
	Tri-generation leaving temperature sensor	AI	
	Tenant common primary return temperature sensor	AI	
	Tri-Generation demand for auxiliaries	DI	via terminals within tri-gen control panel
	Cooling tower running i.e. auxiliaries are active, status to tri-gen system	DO	via terminals within tri-gen control panel
	Chiller no.1 flow meter	AI	ultrasonic or electromagnetic type
	Chiller no.2 flow meter	AI	ultrasonic or electromagnetic type
	Tri-gen flow meter	AI	ultrasonic or electromagnetic type
	Cooling tower No.1 inlet isolation valve open command	DO	latching relays required

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Reference	Description	Point Type	Notes
	Cooling tower No.1 inlet isolation valve close command	DO	latching relays required
	Cooling tower No.2 inlet isolation valve open command	DO	latching relays required
	Cooling tower No.2 inlet isolation valve close command	DO	
	Cooling tower No.3 inlet isolation valve open command	DO	latching relays required
	Cooling tower No.3 inlet isolation valve close command	DO	
	Cooling tower no.1 high level switch	DI	
	Cooling tower no.1 low level switch	DI	
	Cooling tower no.2 high level switch	DI	
	Cooling tower no.2 low level switch	DI	
	Cooling tower no.3 high level switch	DI	
	Cooling tower no.3 low level switch	DI	
	Chemical Dosing		
	Fault	DI	
	Tenant Secondary Condenser Water		dedicated DDC controller for each tenant secondary circuit
T-CWP-31-3	Tenant Secondary CW Pump		serving levels 21 to 29
	Enable	DO	latching relays required

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Reference	Description	Point Type	Notes
	Disable	DO	latching relays required
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
T-CWP-31-4	Tenant Secondary CW Pump		serving levels 21 to 29
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	

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Reference	Description	Point Type	Notes
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
T-CWP-19-1	Tenant Secondary CW Pump		serving levels 6 to 17
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	

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Reference	Description	Point Type	Notes
T-CWP-19-2	Tenant Secondary CW Pump		
	Enable	DO	latching relays required
	Disable	DO	
	Running Status	DI	
	Speed Output	AO	VSD configured to run at set speed upon loss of speed signal
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	High Rise Circuit		
	Differential pressure sensor	AI	
	Flow temperature sensor	AI	
	Return temperature sensor	AI	
	3-port mixing valve no.1	AO	located on the secondary side of the heat exchangers
	3-port mixing valve no.2	AO	located on the secondary side of the heat exchangers

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Reference	Description	Point Type	Notes
	Low Rise Circuit		
	Differential pressure sensor	AI	
	Flow temperature sensor	AI	
	Return temperature sensor	AI	
	3-port mixing valve no.1	AO	located on the secondary side of the heat exchangers
	3-port mixing valve no.2	AO	located on the secondary side of the heat exchangers
	Heating Hot Water		
HWH-33-1	Hot Water Heater no.1		
	Enable command	DO	
	Running status	DI	
	Temperature setpoint reset	AO	
	lock-out fault	DI	
HWH-33-2	Hot Water Heater no.2		
	Enable command	DO	
	Running status	DI	
	Temperature setpoint reset	AO	
	lock-out fault	DI	
HWH-33-3	Hot Water Heater no.3		

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Reference	Description	Point Type	Notes
	Enable command	DO	
	Running status	DI	
	Temperature setpoint reset	AO	
	lock-out fault	DI	
HWH-33-4	Hot Water Heater no.4		
	Enable command	DO	
	Running status	DI	
	Temperature setpoint reset	AO	
	lock-out fault	DI	
HWP-33-1	HHW Pump no.1		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	

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Reference	Description	Point Type	Notes
	Fault type	HLI	
HWP-33-2	HHW Pump no.2		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
HWP-33-3	HHW Pump no.3		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	

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Reference	Description	Point Type	Notes
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
HWP-33-4	HHW Pump no.4		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	

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Reference	Description	Point Type	Notes
HWP-33-5	HHW Pump (tri-gen heat exchanger)		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	HWH No.1 entering temperature sensor	AI	
	HWH No.1 leaving temperature sensor	AI	thermal meter, ultrasonic or electromagnetic type
	HWH No.1 flow meter	AI	
	HWH No.1 flow status	DI	via aux.contact on flow meter
	HWH No.2 entering temperature sensor	AI	
	HWH No.2 leaving temperature sensor	AI	thermal meter, ultrasonic or electromagnetic type

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Reference	Description	Point Type	Notes
	HWH No.2 flow meter	AI	
	HWH No.2 flow status	DI	via aux.contact on flow meter
	HWH No.3 entering temperature sensor	AI	thermal meter, ultrasonic or electromagnetic type
	HWH No.3 leaving temperature sensor	AI	
	HWH No.3 flow meter	AI	
	HWH No.3 flow status	DI	via aux.contact on flow meter
	HWH No.4 entering temperature sensor	AI	thermal meter, ultrasonic or electromagnetic type
	HWH No.4 leaving temperature sensor	AI	
	HWH No.4 flow meter	AI	
	HWH No.4 flow status	DI	via aux.contact on flow meter
	Tri-gen heat exchanger leaving temperature sensor	AI	thermal meter, ultrasonic or electromagnetic type
	Tri-gen heat exchanger leaving temperature sensor	AI	
	Tri-gen heat exchanger flow meter	AI	
	Domestic hot water heat exchanger 2-port valve	AO	located on the primary HHW side of the heat exchnager
	Domestic hot water temperature sensor	AI	located on the secondary DHW side of the heat exchanger
	DHW heat exchanger entering temperature sensor	AI	located on DHW side of heat exchanger. thermal meter, ultrasonic or electromagnetic type
	DHW heat exchanger leaving temperature sensor	AI	

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Reference	Description	Point Type	Notes
	DHW heat exchanger flow meter	AI	
	Common flow temperature sensor	AI	
	Common return temperature sensor	AI	
	Low flow bypass valve	AO	
	Secondary Heating Hot Water System		serving floors 6 to 17
HHWP-19-1	Secondary HHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	

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Reference	Description	Point Type	Notes
	Energy (Kwh)	HLI	
	Fault type	HLI	
HHWP-19-2	Secondary HHW Pump		
	Enable	DO	
	Running Status	DI	
	Speed Output	AO	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	2-port valve	AO	located on the primary side of the heat exchanger

BMS Points Schedule			**Project:** 8 Chifley Square
Revision: Tender Issue		**Job Number:** 220622	**Date:**28/01/11
Reference	Description	Point Type	Notes
	Secondary flow temperature sensor	AI	located on the secondary side of the heat exchanger
	Underfloor Heating		
	Underfloor Heating Pump		
	Enable	DO	
	Running Status	DI	
	Fault	DI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	
	Motor Current	HLI	
	Power (Kw)	HLI	
	Energy (Kwh)	HLI	
	Fault type	HLI	
	2-Port control valve	AO	located on secondary HHW side of heat exchanger
	Flow temperature sensor	AI	located on underfloor heating side of heat exchanger

BMS Points Schedule			**Project:** 8 Chifley Square
Revision: Tender Issue		**Job Number:** 220622	**Date:**28/01/11
Reference	Description	Point Type	Notes
	Space temperature sensor	AI	
	Space temperature sensor	AI	
	Space temperature sensor	AI	
	Space temperature sensor	AI	
	Tri-Generation		
	Tri-Generation Gas Engine		
	Running status	DI	
	Common fault	DI	
	Request for Auxiliaries	DI	
	Auxiliaries run status	DO	VFC provided for tri-gen control interface
	Tri-Generation Ventilation		
SAF-32-1	Supply Air Fan		control by tri-generation control panel
	Running Status	HLI	
	Speed Feedback	HLI	
	VSD Out of Auto Control	HLI	
	Motor Voltage	HLI	

BMS Points Schedule			**Project:** 8 Chifley Square
Revision: Tender Issue		**Job Number:** 220622	**Date:**28/01/11
Reference	Description	Point Type	Notes
	Motor Current	HLI	
	Power (Kw)	HLI	
	Power (Kwh)	HLI	
	Warning	HLI	
	Alarm	HLI	
	Trip/locked	HLI	
	Hydraulic Monitoring and Control		
	Cold Water Storage Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	Low level 20% section 1	DI	level switch provided by others
	Low level 20% section 2	DI	level switch provided by others
	Low level 10% section 1	DI	level switch provided by others
	Low level 10% section 2	DI	level switch provided by others

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Mains Water Booster Set		
	Fault	DI	
	Cold Water Booster Set		
	Fault	DI	
	Domestic Hot Water		
HWH-1	Hot Water Heater No.1		
	Enable	DO	
	Fault	DI	
HWH-2	Hot Water Heater No.2		
	Enable	DO	
	Fault	DI	
HWH-3	Hot Water Heater No.3		

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Enable	DO	
	Fault	DI	
HWH-4	Hot Water Heater No.4		
	Enable	DO	
	Fault	DI	
HWH-5	Hot Water Heater No.5		
	Enable	DO	
	Fault	DI	
DHWC 01	Low Pressure Pump Set		
	Pump a enable	DO	
	Pump b enable	DO	
	Pump Status	DI	via DPS installed across pumps
DHWC 02	Medium Pressure Pump Set		

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Pump a enable	DO	
	Pump b enable	DO	
	Pump Status	DI	via DPS installed across pumps
DHWC 03	High Pressure Pump Set		
	Pump a enable	DO	
	Pump b enable	DO	
	Pump Status	DI	via DPS installed across pumps
DHWC 04	High Pressure Pump Set		
	Pump a enable	DO	
	Pump b enable	DO	
	Pump Status	DI	via DPS installed across pumps
	Rainwater Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	40% level section 1	DI	
	40% level section 2	DI	
	20% level section 1	DI	
	20% level section 2	DI	
	10% level section 1	DI	
	10% level section 1	DI	
	Isolation Valve RW-MV-01	DO	
	Isolation Valve RW-MV-02	DO	
	Isolation Valve RW-MV-03	DO	
	Isolation Valve RW-MV-04	DO	
	NPCW Buffer Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	40% level section 1	DI	
	40% level section 2	DI	
	20% level section 1	DI	
	20% level section 2	DI	
	10% level section 1	DI	
	10% level section 1	DI	
	Isolation Valve RW-MV-01	DO	
	Isolation Valve RW-MV-02	DO	
	Isolation Valve RW-MV-03	DO	
	Isolation Valve RW-MV-04	DO	
	NPCW Transfer Pumps		
	Fault	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	NPCW Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	40% level section 1	DI	
	40% level section 2	DI	
	20% level section 1	DI	
	20% level section 2	DI	
	10% level section 1	DI	
	10% level section 1	DI	
	Isolation Valve RW-MV-01	DO	
	Isolation Valve RW-MV-02	DO	
	Isolation Valve RW-MV-03	DO	
	Isolation Valve RW-MV-04	DO	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	NPCW Booster Set		
	Fault	DI	
	Cooling Tower Transfer Pumps		
	Fault	DI	
	Rain Water Storage Tanks		
	Tank 1 at 100% capacity	DI	level switch provided by others
	Tank 2 at 100% capacity	DI	level switch provided by others
	Tank 1 at 30% capacity	DI	level switch provided by others
	Tank 2 at 30% capacity	DI	level switch provided by others
	Tank 1 at 5% capacity	DI	level switch provided by others
	Tank 2 at 5% capacity	DI	level switch provided by others
	Rainwater Chlorination Equipment		
	Fault	DI	
	Enable	DO	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Valve MV 01	DO	
	Valve MV 02	DO	
	Cooling Tower RO Equipment		
	Fault	DI	
	Enable	DO	
	Sanitary Waste Pump Out Units		
	Fault	DI	
	Waste Water Pump Out Units		
	Fault	DI	
	Black Water Balance Tank		
	Fault	DI	
	Low level pump cut out (section A)	DI	
	Low level pump cut out (section B)	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Transfer pump BW-ST-01 enable	DO	
	Transfer pump BW-ST-01 status	DI	
	Transfer pump BW-ST-02 enable	DO	
	Transfer pump BW-ST-02 status	DI	
	Transfer pump BW-SMP-01 enable	DO	
	Transfer pump BW-SMP-01 status	DI	
	Transfer pump BW-SMP-02 enable	DO	
	Transfer pump BW-SMP-02 status	DI	
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	Section 1 at 70% capacity	DI	level switch provided by others
	Section 2 at 70% capacity	DI	level switch provided by others
	Section 1 at 50% capacity	DI	level switch provided by others
	Section 2 at 50% capacity	DI	level switch provided by others

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Section 1 at 10% capacity	DI	level switch provided by others
	Section 2 at 10% capacity	DI	level switch provided by others
	Sprinkler Storage Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	Hydrant Storage Tank		
	Overflow section 1	DI	level switch provided by others
	Overflow section 2	DI	level switch provided by others
	High level section 1	DI	level switch provided by others
	High level section 2	DI	level switch provided by others
	Over Pressure Indication		
	Potable Water High Pressure Sensor	AI	

BMS Points Schedule			**Project:** 8 Chifley Square
Revision: Tender Issue		**Job Number:** 220622	**Date:**28/01/11
Reference	Description	Point Type	Notes
	Potable Water Medium Pressure Sensor	AI	
	Potable Water Medium Pressure Sensor	AI	
	Non-Potable Water High Pressure Sensor	AI	
	Non-Potable Water Medium Pressure Sensor	AI	
	Non-Potable Water Medium Pressure Sensor	AI	
	Domestic Hot Water High Pressure Sensor	AI	
	Domestic Hot Water Medium Pressure Sensor	AI	
	Domestic Hot Water Medium Pressure Sensor	AI	
	Electrical Monitoring and Control		
	Major Power Plant Alarms		
	INCOMING POWER SUPPLY 1 Power Failure Relay	DI	MSB-1
	INCOMING POWER SUPPLY 2 Power Failure Relay	DI	MSB-2
	MSB-1 ACB	DI	
	MSB-2 ACB	DI	
	MSB-ACB-G1	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	GENERATOR SET, MASTER FAULT	DI	via gen control panel
	GENERATOR SET, AUTOMATIC UNAVAILABLE	DI	
	GENERATOR SET, STATUS	DI	
	GENERATOR SET, RUN	DI	
	GENERATOR SET, ON TEST	DI	
	BULK FUEL TANK ROOM LEAKAGE ALARM	DI	
	BULK FUEL TANK LOW LEVEL	DI	
	BULK FUEL TANK HIGH LEVEL	DI	
	DAY TANK LOW LEVEL	DI	
	DAY TANK OVERFLOW	DI	
	BULK FUEL TANK TRANSFER PUMP NO. 1 STATUS	DI	
	BULK FUEL TANK TRANSFER PUMP No 1 ALARM	DI	
	BULK FUEL TANK TRANSFER PUMP NO. 2 STATUS	DI	
	BULK FUEL TANK TRANSFER PUMP No 2 ALARM	DI	
	BULK FUEL TANK TRANSFER PUMP NO. 3 STATUS	DI	
	BULK FUEL TANK TRANSFER PUMP No 3 ALARM	DI	
	GSB Manual Transfer Switch Position	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	AUTO START 1	DI	
	Starter Battery	DI	
	Electrical Monitoring and Alarms		
	Tenant DB-L06 ATS	DI	
	Tenant DB-L07 ATS	DI	
	Tenant DB-L08 ATS	DI	
	Tenant DB-L09 ATS	DI	
	Tenant DB-L10 ATS	DI	
	Tenant DB-L11 ATS	DI	
	Tenant DB-L12 ATS	DI	
	Tenant DB-L13 ATS	DI	
	Tenant DB-L14 ATS	DI	
	Tenant DB-L15 ATS	DI	
	Tenant DB-L16 ATS	DI	
	Tenant DB-L17 ATS	DI	
	Tenant DB-L21 ATS	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Tenant DB-L22 ATS	DI	
	Tenant DB-L23 ATS	DI	
	Tenant DB-L24 ATS	DI	
	Tenant DB-L25 ATS	DI	
	Tenant DB-L26 ATS	DI	
	Tenant DB-L27 ATS	DI	
	Tenant DB-L28 ATS	DI	
	Tenant DB-L29 ATS	DI	
	House UPS	HLI	
	Light control (interface with DALI system)	HLI	
	Emergency lighting monitoring system	HLI	
	SCADA system interface	HLI	
	Electrical Metering		
	MSB 1 multi-function meter	HLI	
	MSB 2 multi-function meter	HLI	

BMS Points Schedule			**Project:** 8 Chifley Square
Revision: Tender Issue		**Job Number:** 220622	**Date:**28/01/11
Reference	Description	Point Type	Notes
	GSB multi-function meter	HLI	
	GSB-CB-G1 multi-function meter	HLI	
	GSB-CB-G2 multi-function meter	HLI	
	GSB-CB-G3 multi-function meter	HLI	
	GSB-ACB-C2 multi-function meter	HLI	
	Lift Monitoring		
	Lift Monitoring		points required for each lift (10 no. total)
	Lift failed to start	DI	
	Lift on fire service	DI	
	Alarm button pressed	DI	
	Emergency recall operation	DI	
	Stop button pressed	DI	
	Lift on independent service	DI	
	Lift on maintenance control	DI	
	Lift machine room high temperature control	DI	

BMS Points Schedule

Project: 8 Chifley Square

Revision: Tender Issue **Job Number:** 220622 **Date:**28/01/11

Reference	Description	Point Type	Notes
	Circuit Breaker Monitoring	HLI	10 points

Appendix A

Glossary of Terms Used

A1

ADC	:	Analogue to Digital Converter
ASD	:	Automatic Star Delta Starter
BMCS	:	Building Management and Control System
Buffer	:	Semi-conductor memory (RAM) used for temporary storage of I/O or communications data.
CDM	:	Construction Design Management
Communications Channel	:	Path along which one or more intelligent devices may communicate.
Communications Controller	:	Intelligent device which arbitrates one or more communications channel.
Controller	:	Standalone intelligent control device, fully programmable, with peer to peer communications capability, capable of DDC control of plant. Usually with a capacity of more than 16 input/output points. Also referred to as an outstation.
Controller Network	:	Second highest data communications level associated with a BMCS. Allows the transfer of information between controllers and/or communications controllers.
DAC	:	Digital to Analogue Converter
DDC	:	Direct Digital Control
DOL	:	Direct On Line Starter
EEPROM	:	Electronically Erasable Programmable Read Only Memory
EPROM	:	Erasable Programmable Read Only Memory
Escrow Agreement	:	Software source code held by a third party nominated by the Client.
Event Record	:	Stored historical information detailing a particular alarm event, control parameter change, database change, or operator logging action.
FCU	:	Fan Coil Unit / Air Handling Unit
Forced Point	:	The overriding of any input or output to a specific value. Forcing is applicable to both digital and analogue points.
Gateway	:	Device which allows communications between two separate communications channels.
Global Communication	:	The transfer of information between devices on a communications network.
HVAC	:	Heating, Ventilating and Air Conditioning
I/O	:	Input/Output
I/O Module	:	Printed circuit board which plugs into a controller to provide the required BMCS inputs and outputs.
Intelligent Device	:	Processor based device including controllers, unitary controllers, communications controllers and operators' stations.
ISDN	:	Integrated Services Digital Network
MCC	:	Motor Control Centre

On Line	:	State when a controller on a network is ready to receive and transmit data.
Operator's Station	:	Computer based colour graphics terminal. Connected to the BMCS network and capable of receiving and displaying real time plant information.
Outstation	:	See 'Controller'
PROM	:	Programmable Read Only Memory
PSTN	:	Public Switched Telephone Network
RAM	:	Random Access Memory
RCD	:	Residual Current Device
Real Time	:	Relating to current information obtained from inputs, outputs and virtual points or programs. It does not relate to stored or historical data.
ROM	:	Read Only Memory
Scan Time - I/O	:	The time taken by a BMCS controller to read all its inputs, process them, send output signals and be ready to read input signals again.
Scan Time - Alarms	:	The time taken between the occurrence of the alarm and for it to be reported and displayed at the BMCS operator's station or nominated output device e.g. a remote printer.
Schematics	:	Graphical representation of plant layout, complete with real time point information displayed on the operator's station.
Software Licence	:	Includes any form of document or agreement which may limit the Client's use of the software resident in the BMCS.
Supervisory Network	:	Highest data communications level associated with a BMCS. Allows transfer of information between outstations and operators' stations and between operators' stations.
Token	:	Communications flag passed between intelligent devices on a common communications channel. An intelligent device is only allowed to initiate communications when it has the token.
Trend Log	:	A collection of stored data samples relating to either physical I/O or virtual points. Each sample is collected at a fixed time interval from the previous sample collected.
Unitary Controller	:	Applications specific controller usually with a capacity of less than 16 input/output points.
Unitary	:	Lowest data communications level associated with a Controller Network BMCS. Allows the transfer of information between unitary controllers and/or their associated communications controller.
Universal Point	:	A physical input/output point which may be used for either analogue or digital purposes.
UPS	:	Uninterruptable Power Supply
VAV	:	Variable Air Volume
VDU	:	Visual Display Unit
VFC	:	Volt Free Contact
VGA	:	Video Graphics Array. A colour graphics display specification

Virtual Point	:	Software point, which may or may not be linked to a physical I/O point, used for the internal transfer of information by a controller.
Wild Card Character	:	Specific alphanumeric character in a point identifier which substitutes for any other alphanumeric character when a search of points is conducted.

A2 Schedule of System Detail

A schedule of system details shall be returned with the Tender.

Any variations from the requirements of the Specification shall be listed, otherwise it will be assumed that the proposed system is fully in accordance with the Specification and as detailed on the drawings and the associated schedules.

The tenderer's Schedule of System Details shall identify the type of system offered, with the manufacturer's complete technical literature and the type, location, physical size, finishes and power ratings of all major items of equipment. This shall include the number and location of controllers and details of the point address system, data protection arrangements and password/key devices. Any clearly defined and stipulated variations in cable runs and total number of controllers which optimises the hardware and wiring costs shall also be scheduled.

A3 Pricing Schedule

PRICE SUMMARY	
1. Total (excluding converged network option)	$
2. Total (including converged network option)	$
3. Converged Network (= 2 -1)	$

A3.1 Contract and Preliminaries Tender Analysis Sheet

ITEM	DESCRIPTION	QUANTITY	RATE	$	p
(a)	Project Establishment				
(b)	Site Supervision				
(c)	Insurances				
(d)	Storage				
(e)	Other: Tenderer to List				
CONTRACT AND PRELIMINARIES SUM:					

(Carry forward to Tender Analysis Summary Sheet)

A3.2 Technical Preambles Tender Analysis Sheet

ITEM	DESCRIPTION	QUANTITY	RATE	$	p
(a)	Installation and Fabrication Drawings				
(b)	Quality Assurance System				
(c)	Formalities				
(d)	Protection of Works				
(e)	CDM				
(f)	Commissioning and Testing				
(g)	Performance and Acceptance Tests				
(h)	Operations and Maintenance Manuals				
(i)	Record Drawings				
(j)	Client Instruction/Training				
(k)	Spare Parts and Tools				
(l)	Other: Tenderer to List				
ITEM	DESCRIPTION	QUANTITY	RATE	$	p
TECHNICAL PREAMBLES SUM:					

(Carry forward to Tender Analysis Summary Sheet)

A3.3 BMCS and Controls Tender Analysis Summary Sheet

Provide details where an item price is different for the converged network option.

ITEM	DESCRIPTION	QUANTITY	RATE	$	p
(1)	Items of BMCS Equipment:				
	(a) CP enclosures (inc. transformer, ups, fuses etc)				
	(b) Intelligent controllers				
	(c) Servers				
	(d) Operator's Stations				
	(e) Touch screen panels				
	(f) Printers				
	(g) Printer (Colours)				
(2)	Sensors: Tenderer to provide a separate list of items.				
(3)	Valves: Tenderer to provide a separate list of items.				
(4)	Controls Wiring				
(5)	BMCS Communications Network				
(6)	Containment System				
(7)	Contract and Preliminaries Sum From Previous Sheet				
(8)	Technical Preambles Sum From Previous Sheet				
(9)	Any Other Items: Tenderer to provide separate list.				
TOTAL:					

Signed:	
Company:	
Dated:	

A4 Provisional Schedule of Rates

A4.1 General

The quantities in this schedule are not intended to represent the extent of the BMCS/Controls Subcontractor's works and shall be used only as a basis for agreement of instructions.

The total of this schedule of rates shall be expended or deducted in whole or in part as instructed.

The rates entered against each of the individual items shall be those upon which the Tender is based and shall be used for variations both before and during the course of the BMCS Subcontractor's works.

The rates for each item shall include the installation (excluding wiring), engineering, testing, commissioning and acceptance demonstration costs associated with that item and based on normal working hours.

Particular attention is drawn to the number of each item specified. These rates shall be used for obtaining costs for one of each item as required.

All equipment detailed in the rates shall comply with the relevant clauses in the Specification.

A4.2 Controls (based on labour being already on site)

HLI point to third party equipment (assuming HLI hardware/cabling is already in place)	5 No.
Duct humidity sensor	5 No.
Pressure switch (for pipework)	5 No.
Pressure switch (for ductwork)	5 No.
Water flow switch	5 No.
Room temperature sensor	5 No.
Outside air temperature sensor	5 No.
Dew Point Sensors	5 No.
Immersion temperature sensor	5 No.
Duct temperature sensor	5 No.
Duct temperature sensor (averaging element type)	5 No.
Duct humidity sensor	5 No.
Room humidity sensor	5 No.
Outside air humidity sensor	5 No.
Pressure sensor (for pipework including tubing)	5 No.
Pressure sensor (for ductwork including tubing)	5 No.
Differential pressure transmitter/orifice plate/carrier ring	2 No.
Electromagnetic flow meter	2 No.

Ultrasonic flow meter (water flow 150 l/s in 200mm pipe)	2 No.
Velocity sensor (probe type)	2 No.
Velocity sensor (solid state type)	2 No.
Heat meter comprising electromagnetic flow meter, flow and return temperature sensors and controller (water flow 40 l/s in 150mm pipe)	2 No.
Natural gas sensor (sensor head and cone)	1 No.
Carbon dioxide (CO2) sensor	1 No.
Carbon monoxide (CO) sensor	1 No.
Nitrogen dioxide (NO2) sensor	1 No.
Refrigerant gas sensor	1 No.
Panic button	5 No.
	Total $

A4.3 Actuators

Modulating, 1m2 damper	5 No.
Modulating, 2m2 damper	5 No.
Modulating, 1m2 damper (fail safe)	5 No.
Two position, 1m2 damper	5 No.
Two position, 2m2 damper	5 No.
Auxiliary switch pack (two switches)	5 No.
	Total $

A4.4 Control Valves

15mm 2-port lift and lay	10 No.
15mm 3-port lift and lay	10 No.
20mm 2-port lift and lay	10 No.
20mm 3-port lift and lay	10 No.
32mm 2-port lift and lay	5 No.
32mm 3-port lift and lay	5 No.
40mm 2-port lift and lay	5 No.
40mm 3-port lift and lay	5 No.
50mm 2-port lift and lay	5 No.
50mm 3-port lift and lay	5 No.
65mm 2-port lift and lay	5 No.
65mm 3-port lift and lay	5 No.
80mm 2-port lift and lay	5 No.
80mm 3-port lift and lay	5 No.
100mm 2-port lift and lay	5 No.
100mm 3-port lift and lay	5 No.

125mm 2-port lift and lay	2 No.
125mm 3-port lift and lay	2 No.
100mm butterfly valve	2 No.
125mm butterfly valve	2 No.
150mm butterfly valve	2 No.
200mm butterfly valve	2 No.
	Total $

A4.5 BMCS Equipment

Controller, excluding I/O cards. Largest type without extension boards.	1 No.
Point capacity ..... points:	
Inputs and outputs include any necessary hardware, software, graphics, assuming spare capacity on existing cards:	
Digital input	10 No.
Digital output	10 No.
Analogue input	10 No.
Analogue output	10 No.
List of all card types:	
1.	1 No.
2.	1 No.
3.	1 No.
4.	1 No.
5.	1 No.
6.	1 No.
7.	1 No.
8.	1 No.
Intelligent Unitary Controller (IUC)	2 No.
VDU	1 No.
CPU (keyboard and PC)	1 No.
Colour printer	1 No.
Touch Screen Panel	1 No.
	Total $

A4.6 Cabling

2 Core 1.5mm2 LSF sheath cable	20m
6 Core 1.5mm2 LSF sheath cable	20m
10 Core 1.5mm2 LSF sheath cable	20m
2 Core 1.5mm2 PVC sheath cable	20m
6 Core 1.5mm2 PVC sheath cable	20m
10 Core 1.5mm2 PVC sheath cable	20m
2 Core 1.5mm2 MICC/LSF cable	20m
1 Twisted pair Beldon LSF cable, overall screened	20m
3 Twisted pair Beldon LSF cable, overall screened	20m
6 Twisted pair Beldon LSF cable, overall screened	20m
Communications cable to suit system LSF sheath	20m
2 Core 1.5mm2 XLPE/SWA/LSF cable	20m
	Total $

A4.7 Cable Trunking

50 x 50 single compartment galvanised trunking	20m
100 x 150 single compartment galvanised trunking	20m
	Total $

A4.8 Conduit

20mm diameter galvanised screwed welded	20m
25mm diameter galvanised screwed welded	20m
20mm diameter flexible	20m
25mm diameter flexible	20m
	Total $

A5 Ongoing Maintenance

A5.1 Maintenance Levels

There are three levels of ongoing maintenance, preventative, intermediate and comprehensive, that are defined below. The minimum service for each of the three levels of maintenance contract, shall be as detailed below.

Unless otherwise agreed, emergency call out shall be charged extra to the base contract.

A5.2 Preventative

Shall include:

- Preventative maintenance on a 2 visits per year basis. Duties shall include items 1 to 7, 9 to 14 and 16 to 21 from the list below. Item 21 shall be attended to outside of normal working hours at a time agreed with the appointed building facilities manager;
- Report and record faults and calibration of sensors/instrumentation;
- Rectify faults, excluding main plant faults and recalibrate sensors and instrumentation. Cost of labour and parts to be agreed with the appointed building facilities manager/client;
- Telephone support during normal working day;
- On site response to emergency call out within 8 working hours;
- Essential site specific spares held in stock, off site, by the BMCS/Controls Subcontractor or use in an emergency call out. Essential site specific spares shall include but not be limited to BMCS controller hardware e.g. input/output modules, communications board (where separate), power supply etc. Spares used shall be chargeable to the client. Stock shall be replenished as used;
- Loan of BMCS operator's station hardware e.g. PC, monitor, keyboard, printer etc. if original equipment removed from site for repair.

A5.3 Intermediate

Shall include:

- Preventative maintenance on a 12 visits per year basis. Duties shall include items 1 to 21 from the list below. Item 21 shall be attended to outside of normal working hours at a time agreed with the appointed building facilities manager;
- Report and record faults;
- Rectify faults, excluding main plant faults. Cost of labour and parts to be agreed with the appointed building facilities manager/client;
- Report and record calibration of sensors and instrumentation;
- Recalibrate sensors and instrumentation where required, cost to be inclusive;
- Telephone support during normal working day;

- On site response to emergency call out within 4 working hours;
- Essential site specific spares held in stock, off site, by the BMCS/Controls Subcontractor or use in an emergency call out. Essential site specific spares shall include but not be limited to BMCS controller hardware e.g. input/output modules, communications board (where separate), power supply etc. Spares used shall be chargeable to the client. Stock shall be replenished as used;
- Loan of BMCS operator's station hardware e.g. PC, monitor, keyboard, printer etc. if original equipment removed from site for repair.

A5.4 Comprehensive

- Shall include:
- Preventative maintenance on an 8 hour, 6 days per week (Monday to Saturday) basis excluding bank holidays. Duties shall include items 1 to 24 from the list below;
- Report and record faults;
- Rectify faults, excluding main plant faults, the cost of labour to be inclusive, the cost of replacement parts, excluding frequency inverters, to be inclusive when they have become faulty through normal wear and tear;
- Report and record calibration of sensors and instrumentation;
- Recalibrate sensors and instrumentation where required, cost to be inclusive;
- Telephone support 24 hours per day;
- On site response to emergency call out within 2 hours of call on a 24 hours, 365 days per year basis;
- Essential site specific spares held in stock, on site, by the BMCS/Controls Subcontractor for use in an emergency call out. Essential site specific spares shall include but not be limited to BMCS controller hardware e.g. input/output modules, communications board (where separate), power supply etc. Spares used shall only be chargeable to the client if they have become faulty through reasons other than normal wear and tear;
- Loan of BMCS operator's station hardware e.g. PC, monitor, keyboard, printer etc. if original equipment removed from site for repair.

A5.5 Preventative Maintenance Duties

Item Action

A5.5.1 BMCS:

Clean operator's station(s) e.g. monitor screen, housings etc. Clean and check operation of printer(s).

1. Carry out manufacturer's maintenance procedures i.e. perform diagnostic tasks where appropriate, clean filters, clean disc and tape drives etc.

2. Check all cables and connectors.

3. Check integrity of communications network between the operator's station(s), controllers and where applicable unitary controllers.
4. Check standby battery reserves/operation of UPS systems.
5. Check from the operator's station the operation of all plant e.g. boilers, chillers, pumps, fans, electric re-heaters, terminals units, valves and dampers in conjunction with associated safety devices by overriding the auto condition and forcing plant on/off, open/closed etc.
6. Software changes to be fully backed-up if any are made e.g. sensor calibration off-sets, etc.
7. Check from the operator's station all controller and PC based software programs including control loops, rotational points, control strategies, global information etc.

A5.5.2 Field Equipment/Plant:

1. Check overall condition of all automatic control valves i.e. check for correct stroke/travel, check that valve is not letting by excessively, check for gland leakage etc. Lubricate in accordance with the manufacturer's requirements.
2. Check overall condition of all damper actuators i.e. check for correct stroke/travel, check auxiliary switches and potentiometers, check spring return if applicable etc. Lubricate in accordance with the manufacturer's requirements.
3. Inspect, clean and check calibration of all sensors and instruments.
4. Check power and control wiring connections at plant and control devices.
5. Check condition and operation of all on/off control devices e.g. thermostats, humidistats, differential pressure switches, flow switches, level switches etc.
6. Check generation of alarms associated with digital inputs by operating field equipment.
7. Visual inspection of condition of main plant i.e. typically pulley belt failure etc.

A5.5.3 Building Performance:

1. Check space temperatures at start of occupancy and time setpoints achieved. Adjust parameters if necessary following consultation and agreement with the appointed building facilities manager.
2. Check space temperature/humidity during occupation. Adjust parameters if necessary following consultation and agreement with the appointed building facilities manager.
3. Submit monthly report of building performance to the appointed building facilities manager/client as required.

Note:

a) Operation of plant under fire and fireman's override conditions is covered by the building statutory fire alarm/evacuation tests, it is not included under Preventative Maintenance.

APPENDIX 3.7.1 PART III

8 CHIFLEY SQUARE – STATEMENT OF ENVIRONMENTAL EFFECTS

PLANNING
BUILDING
HERITAGE
LANDSCAPE
URBAN DESIGN

CITY PLAN SERVICES

mirvac

AustralianSuper

STATEMENT OF ENVIRONMENTAL EFFECTS

Stage 2 Development Application

8 Chifley Square, Sydney

MARCH 2008

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PLANNING
BUILDING
HERITAGE
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URBAN DESIGN
CITY PLAN SERVICES

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1.0 INTRODUCTION

1.1 Outline of the Proposal

This Statement of Environmental Effects has been prepared for Mirvac Projects Pty Ltd by City Plan Services Pty Ltd for submission to City of Sydney Council in support of a Stage 2 Development Application ("DA") seeking approval for the demolition of the existing building, partial excavation of the site and the erection of a 30 level commercial building and commercial use on land at 8 – 12 Chifley Square, Sydney.

It is noted that the subject land is currently occupied by a 21 level glass and concrete commercial building known as the "Goodsell Building" and the Stage 1 Consent has granted approval for the demolition of this building.

The Real Property description of the subject land is Lot 10 in Deposited Plan No. 752057.

A detailed description of the proposal is provided under **Section 4.0.**

1.2 Environmental Assessment

This application is submitted pursuant to the provisions of Section 83B of the Environmental Planning and Assessment Act, 1979 ("EP&A Act") which relates to Staged Development Applications, as follows:

> ***83B Staged development applications***
>
> *(1) For the purposes of this Act, a staged development application is a development application that sets out concept proposals for the development of a site, and for which detailed proposals for separate parts of the site are to be the subject of subsequent development applications. The application may set out detailed proposals for the first stage of development.*
>
> *(2) A development application is not to be treated as a staged development application unless the applicant requests it to be treated as a staged development application.*
>
> *(3) If consent is granted on the determination of a staged development application, the consent does not authorise the carrying out of development on any part of the site concerned unless:*
>
> *(a) consent is subsequently granted to carry out development on that part of the site following a further development application in respect of that part of the site, or*
>
> *(b) the staged development application also provided the requisite details of the development on that part of the site and consent is granted for that first stage of development without the need for further consent.*
>
> *(4) The terms of a consent granted on the determination of a staged development application are to reflect the operation of subsection (3).*

This report is a Statement of Environmental Effects (SEE) that assesses the proposal in sufficient detail for the Consent Authority to assess the proposal as a Stage 2 DA.

It is noted that a Stage 1 DA Consent was granted by the Central Sydney Planning Committee ("CSPC") on 15 February 2007 (refer **Attachment 1**).

1.3 Purpose of this Report

The purpose of this document is to describe the existing improvements on the site and site context, detail the proposed development, review the applicable planning regime relating to the proposal, assess the degree of compliance and examine the environmental effects of the development when measured against the Evaluation Criteria prescribed under the Environmental Planning and Assessment Act 1979 ("EP & A Act").

In respect of the assessment of the proposal, where impacts are identified, measures proposed to mitigate any harm to environmental amenity have been addressed in this report.

It is concluded that a new commercial building with a total floor space area of 21,738 sqm (and floor space ratio of 13.75 : 1) will contribute significantly to the availability of A – Grade/Premium Grade building stock in this important financial district of the Sydney CBD.

It is noted that the Stage 2 proposal seeks the approval of an additional 10% of commercial FSA on the basis of demonstrated design excellence and a positive contribution to the public domain pursuant to Clause 10(1) of Sydney Local Environmental Plan 2005 (SLEP 2005"). The additional 10% equates to a floor space area of 1,976.25sqm (being an Floor Space Ratio of 1.25 : 1).

The height, scale and form of the proposal generally complies with the Stage 1 DA consent envelope, and Council's controls, and the "reverse - podium" design contributes positively to the spatial character of Chifley Square opposite and the streetscape generally. The reverse – podium form provides a public space of 1,120sqm and is of significant architectural merit and will provide a high quality of amenity for the public, particularly in terms of solar access.

Where variations to compliance have been identified these matters are separately assessed and considered. In terms of the current application, there are variations proposed in respect of setbacks and street wall/podium height, and these matters were the subject of consideration as a part of the Stage 1 DA process. In particular, the Stage 1 DA Consent identified a need to give detailed consideration to the setback of the northern (Hunter Street) façade and this matter was the subject of assessment and resolution as part of the Design Competition conducted by the Proponent.

The development has been assessed in accordance with the Section 79C (1) of the E P & A Act, and a summary of this assessment is provided in **Section 6.0** of this report.

It is confirmed that this Statement has been prepared pursuant to Section 78A of the E P & A Act and Clause 50 of the Environmental Planning and Assessment Regulation, 2000 (the "Regulation").

A summary of the assessment of the proposal and issues identified are contained in **Section 7.0**.

1.4 Consent Authority

The subject site is located within the boundaries of the City of Sydney Council, and the proposed development has a projected value of greater than $50mill. Accordingly, the Central Sydney Planning Committee ("CSPC") is the consent authority pursuant to the provisions of the City of Sydney Act 1988.

The proposal seeks approval for a Stage 2 development consent to be granted pursuant to Section 80 (4) of the Environmental Planning and Assessment Act, 1979 (the Act) and meets the intent of the Design Excellence provisions of the SLEP 2005.

1.5 Document References

This report should be read in conjunction with the following plans and reports:

- Stage 1 Development Consent (DA D/02/00282) dated 15 February 2007 (refer **Attachment 1**);

- Jury Endorsement Meeting Minutes dated 17 December 2007 and 27 February 2008 (refer **Attachment 2**);

- Two (2) Survey Plans numbered 72419.DGN, Sheet 1 of 2 and Sheet 2 of 2, prepared by Rygate and Company Pty Ltd and dated 2/12/06, and, two (2) survey plans numbered 72890.DGN, Sheet 1 of 2 and Sheet 2 of 2, prepared by Rygate and Company Pty Ltd and dated 16/10/07 (refer **Attachment 3**);

- Thirty – three (33) Stage 2 DA plans numbered DA-001 A, DA-002 A, DA-010 A, DA-011 A, DA-013 A, DA-014 A, DA-015 A, DA-016 A, DA-017 A, DA-018 A, DA-019 A, DA-020 A, DA-021 A, DA-022 A, DA-023 A, DA-024 A, DA-025 A, DA-026 A, DA-027 A, DA-030

A, DA-031 A, DA-032 A, DA-033 A, DA-034 A, DA-040 A, DA-041 A, DA-042 A, DA-043 A, DA-050 A, DA-051 A, DA-100 A and DA-101 A inclusive, prepared by Lippmann Associates in association with RSH + P, and Mirvac Design and dated 29 February 2008 (refer **Attachment 4**);

- Design Report prepared by Lippmann Associates in association with RSH + P, and Mirvac Design and dated February 2008 (refer **Attachment 5**);

- Two (2) shadow diagrams numbered DA-130 A and DA-131 A, prepared by Lippmann Associates in association with RSH + P, and Mirvac Design and dated 29 February 2008 (refer **Attachment 6**);

- One (1) Floor Space Area (FSA) and Floor Space Ratio (FSR) plans numbered DA-120 A, prepared by Lippmann Associates in association with RSH + P, and Mirvac Design and dated 29 February 2008 (refer **Attachment 7**);

- Materials, Finishes and Colour Schedule prepared Mirvac Design (refer **Attachment 8**);

- Photo - montages prepared by RSH + P (refer **Attachment 9**);

- One (1) public domain/landscape plans numbered DA 01, prepared by ASPECT Sydney and dated February 2008 and Landscape Statement dated 20 February 2008 (refer **Attachment 10**);

- Heritage Assessment and Heritage Impact Statement prepared by Tropman & Tropman Architects Pty Ltd, referenced 0736:HA & HIS, dated February 2008 (refer **Attachment 11**)

- Geotechnical Assessment prepared by Douglas Partners, referenced 45192-01 and dated February 2008 (refer **Attachment 12**)

- Site and Remediation Assessment prepared by Douglas Partners, referenced 45306 and dated December 2007 (refer **Attachment 13**)

- Transport and Parking Assessment Report prepared by Colston Budd Hunt & Kafes Pty Ltd referenced 6343/2 and dated February 2008 (refer **Attachment 14**);
- Public Art Strategy prepared by Mirvac Projects Pty Ltd and dated February 2008 (refer **Attachment 15**);

- Energy Efficiency (ESD) Report prepared by Arup Pty Ltd, referenced 86427/00, dated February 2008 (refer **Attachment 16**)

- Environmental Management Plan prepared by Mirvac Projects Pty Ltd, referenced Issue B and dated 12 December 2007 incorporating Demolition Management Plan and Construction Management Plan (refer **Attachment 17**);

- Place Management Plan and Security Plan (CPTED Assessment) prepared by Mirvac Projects Pty Ltd and dated February 2008 (refer **Attachment 18**);

- Waste Management Plan prepared by J D MacDonald Waste Management Consultants and dated February 2008 (refer **Attachment 19**)

- Existing and Proposed Services Plan prepared DA-002 A, prepared by Lippmann Associates in association with RSH + P, and Mirvac Design and dated 29 February 2008 (refer **Attachment 20**)

- Concept Stormwater Plan prepared by Arup Pty Ltd, referenced CSK001 and dated 20 February 2008 (refer **Attachment 21**)

- Building Services & Energy Efficiency Report prepared by Arup Pty Ltd, referenced 86427 and dated November 2007 (refer **Attachment 22**);

- Building Code of Australia ("BCA") Report prepared by Philip Chun and Associates referenced 07328 and dated 26 February 2008, and, Fire Safety Strategy Concepts Report prepared by Arup Pty Ltd referenced 86427-90 and dated February 2008 (refer **Attachment 23**)

- Wind Effects and Wind Tunnel Report prepared by Cermak Peterka Petersen referenced 07 – 4151 and dated November 2007 (refer **Attachment 24**);

- Noise Impact Assessment prepared by Renzo Tonin & Associates Pty Ltd, referenced TD759-01D02 and dated 20 February 2008 (refer **Attachment 25**)

- Reflectivity Report prepared by Arup Pty Ltd, referenced 86427 – Issue B and dated February 2008 (refer **Attachment 26**)

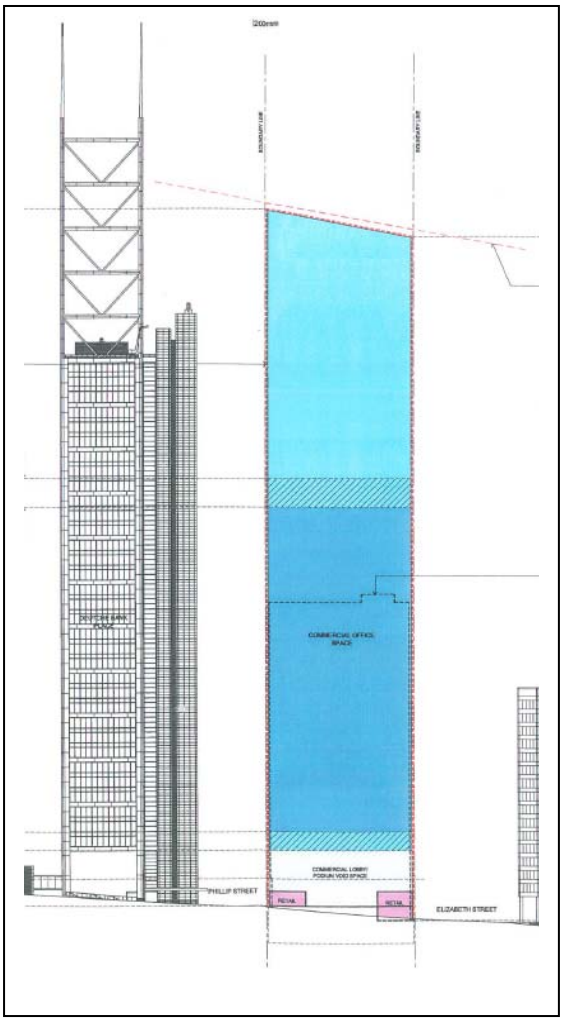
- Accessibility Report prepared by Morris-Goding Accessibility Consulting, referenced V2 and dated 20 February 2008 (refer **Attachment 27**)

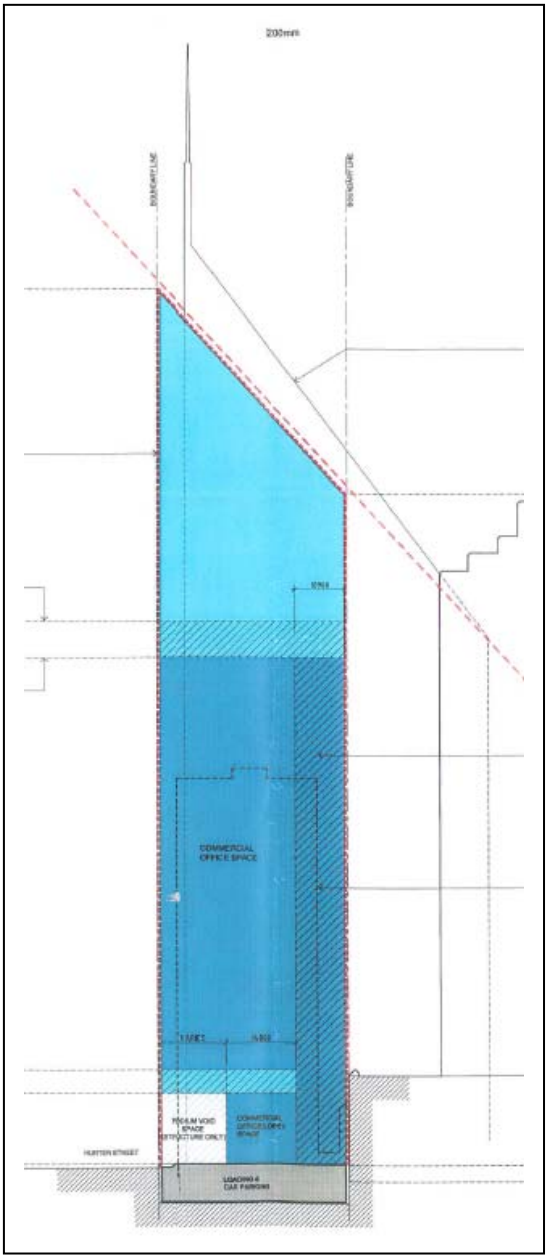
- Lighting Strategy Statement and Exterior Lighting Concept Plan prepared Arup Pty Ltd dated February 2008 (refer **Attachment 28**).

2.0 PLANNING HISTORY

2.1 Planning History: Stage 1 DA

A Stage 1 DA was prepared in accordance with the provisions of "*Part 5 – Urban form, design excellence and environmental design*" of SLEP 2005 and lodged with the City of Sydney Council on 12 October 2006. The subject application prescribed an envelope for the development of a commercial building on the subject land in addition to seeking a consent for the demolition of the existing building. The approved envelope is a detailed in **Figure 1** below.





F I G U R E 1
Stage 1 DA Consent Envelope

The Stage 1 application proposed a commercial building envelope with a height up to 190 metres (RL216 metres) and FSR of 13.75:1. The proposed envelope had been designed to fit within the Martin Place Sun Access Plane as prescribed by the Sydney LEP 2005 controls. The existing building, known as the Goodsell Building, was proposed to be demolished.

The Central Sydney Planning Committee, at the meeting held on 15 February 2007, resolved to approve the Stage 1 DA, and a copy of the subject consent and consent plans are provided in **Attachment 1.**

Part (A) of the Consent prescribed the applicable conditions imposed on the consent (refer **Attachment 1**). A summary of compliance with the Stage 1 Part (A) conditions of consent are provided in **Table 1** below.

Parts (B) and (C) of the Consent identified the requirement that the Design Competition Brief be approved by the Director City Planning in consultation with the Central Sydney Planning Committee or a sub-committee of the Central Sydney Planning Committee;

Part (D) of the Consent reinforced the strategic importance and unique characteristics of the subject development site which is located in the heart of the business core of the CBD, has three street frontages and forms the southern edge of the Chifley Square Special Area, and, required that the architects partaking in the design competition consider options that maximise the opportunities afforded by the approved building envelope to create a landmark building, which may include:

(a) making maximum use of the height available;

(b) excluding the void/'reverse podium' at the base of the tower;

(c) maximising the opportunities of the site to activate the street and substantially improve the public domain

so as to ensure that the resulting building constitutes the best possible outcome for the site having regard to the unique characteristics of its context.

In general, with regard to the south elevation of the tower adjacent to the boundary of the Colonial Centre site, detailed consideration should be given to the design of the façade to ensure a high quality outcome. Such consideration should have regard to the use of high quality materials and opportunities for the activation and articulation and/or setback of the façade.

The winning design as assessed by the Jury, successfully met the nominated criteria, and satisfied the following matters;

- making maximum use of the height available;
- maximising the opportunities of the site to activate the street and substantially improve the public domain
- the design of the southern façade, and in particular, the use of high quality materials and opportunities for the activation and articulation and/or setback of the façade.

The winning entry, as with all of the design competition entries, saw the merit in the reverse – podium concept, and retained the void at the base of the tower, and accordingly, there has been no consideration necessary to the deletion of the reverse-podium void.

2.2 Competitive Design Process

The provisions of "*Part 5 – Urban form, design excellence and environmental design*" of SLEP 2005 prescribe that the design of the new building in the circumstances applying to the subject proposal be the subject of a competitive design process prior to the preparation of any Stage 2 DA.

Accordingly, a Design Competition was conducted between March 2007 and July 2007, at which time the Jury, by majority decision, resolved to award the design competition to Lippmann + Associates ("LA") and Rogers Stirk Harbour Partnership ("RSH + P") scheme subject to a number of qualifications.

JURY CONSIDERATIONS

The provisions of Section 7 (I) of the Design Competition Brief prescribe the requirements for the Jury's assessment and determination of a winning entry, and included the weighting to be given to each of the main Competition Brief Objectives and the Jury took into account the applicable Objectives and weightings in the assessment of each Entry.

It is noted that the Jury had extensive technical assistance from a range of technical experts including summaries and presentations at various times during the running of the Competition.

The provisions of Section 6 (c) - Project Budget prescribed a construction budget of $107.5 mill (based on a FSR of 13.75 : 1), however, it is noted that all Competition Entries were assessed to be in excess of this budget, and this matter was taken into consideration.

WINNING DESIGN

The Jury gave consideration to the five (5) entries submitted, and resolved to short – list two Entries for further consideration.

The Jury members subsequently confirmed that the three (3) main determinants for the choice of a winning entry between the two short-listed Entrants were as follows;

a) the quality of the ground plane design and response to the public domain;

b) the design and amenity of the "reverse podium" space; and,

c) the design qualities and innovation in the building tower design and facades above the reverse podium level.

The Jury further qualified the important parameters for further adjudication of the design as follows:

a) an acknowledgement that the success of the reverse-podium space will in great part be determined by the quality of public art installations and that this consideration should be an integrated process driven by the architectural design team for the building;

b) further design resolution of the northern façade with a particular consideration of the competing demands for solar efficiency, façade appearance and internal amenity and views;

c) some design development of the eastern and western façade may be required along the principles setout in (b) above;

d) The ultimate mix of the proposed 3 level villages throughout the building would be subject to further input / advice from leasing and marketing experts to determine the most appropriate mix. This may result in a combination of successive full floor plates interspersed with two level and three level villages with voids and open interconnecting stairs.

In respect of the decision to award the competition to the LA + RSHP entry, the Jury had due consideration to the requirements of the Design Competition Brief and the requirements of the Conditions of Consent to the Stage 1 DA approval, in addition to those matters detailed above.

In particular, the Jury were satisfied that the winning LA + RSHP scheme had considered and addressed conditions:

- . 2(b) and 5(b) of the Stage 1 DA, which dealt with the allowable setback along Hunter Street; and

- 2(c) and 2(d) of the Stage 1 DA, which dealt with the alignment of the building along Elizabeth and Phillip Street so as to maintain the existing view lines to Chifley Square.

ADDITIONAL FLOOR SPACE AREA PURSUANT TO CLAUSE 10 – SLEP 2005

The Jury were acutely aware of the importance of considering the two (2) short-listed Entries in the context of the need to recommend that the additional 10% of FSA available pursuant to *"Clause 10 (1) (a) - Waiver of certain development standards"* of SLEP 2005, and that there was a requirement to understand the provisions that applied under Clause 10.

In terms of Clause 10, the Jury noted that the relevant objectives of the waiver clause incorporated a consideration of the following provisions of SLEP 2005;

- . Clause 53 - Objectives for floor space ratio controls;

- . Clause 67 – Heritage Objectives;

- . Clause 74 - Development within the vicinity of a heritage item;

- . Part 7 - Clauses 77 and 78 relating to Special Areas; and,

- . The Special Area Character Statement for Chifley Square (Special Area No. 14).

In respect of the 10%, the Jury identified on a number of occasions those aspects of the Entries that would be worthy of an award of 10% and these were as follows;

1) functional high amenity ground plane;

2) high degree of accessibility and usability for the public at the ground plane in the ratio of approximately 33% "private" and 66% "public";

3) maximise opportunities for ESD with the achievement of a minimum 5 stars Greenstar and a possible 6 star Greenstar rating and a minimum 5 Star (+) ABGR rating (which exceeds the requirement for the Competition Brief).

It is relevant to note that the area of the ground plane set aside for public use and access is 70%, and therefore greater than the 66% recommended by the Jury.

On assessment of the above design aspects, the Jury considered that the winning LA + RSHP Entry was worthy of receiving the additional 10% of FSA available.

Further, the Jury made the interesting observation that the Applicant should be given the best chance and opportunity to achieve the 10% additional FSA in this case as there were strong public interest/efficiency issues arising from the maximization of employment, the generation of floor space with good access to public transport and a design which achieves high energy efficiencies compared to older, less appropriately located commercial floor space which did not contribute to an improved metropolitan environment.

OTHER JURY RECOMMENDATIONS

Importantly, in addition to a final determination of a competition winner, the Jury made two further observations/recommendations as follows;

1) That the Council give consideration to widening the Elizabeth Street footpath on the alignment of the eastern kerbline along the area south of Hunter Street for form an extended footpath “blister” which would contribute to the overall area available to the public domain west of the subject development site; and,

2) That the Council give serious consideration to relocating or modifying the existing Chifley Square café on Hunter Street as it is assessed to have a negative impact on the existing public domain and will be detrimental to the creation of the cohesive and linked urban space between the existing Chifley Square and the new public realm contemplated by the winning Competition Entry.

The Elizabeth Street footpath kerb alignment in question is situated to the west of the site (refer **Photo 1** below) and to the south of the Hunter Street intersection. Further discussions relating to provision of a kerb protuberance will need to consider the relevant benefits to the public domain and the traffic and parking efficiencies of the subject intersection.

The existing Chifley Square café structure and wall to the northern alignment of Hunter Street does create an unfortunate truncation of the spatial character of the site and the Square (refer **Photo 2** below), and there are obvious benefits and opportunities for the public domain if the subject structure could be moved.

P H O T O 1

Elizabeth Street footpath south of Hunter Street

P H O T O 2

Relationship between the Site and the Chifley Sq Café across Hunter Street

Ultimately, the Jury recognised that these are matters for the City of Sydney Council as both the Elizabeth Street Road reserve and Chifley Square are under the care, control and management of the Council and any future arrangements will be the subject of a separate Voluntary Planning Agreement.

2.3 Planning History: Stage 2 DA

The proposed Stage 2 DA has been the subject of a number of Pre – DA meetings held with Council Officers conducted on 21 September 2007, 8 October 2007 and 26 November 2007.

At these meetings, the proposed Stage 2 scheme was generally supported, subject to a number of considerations and specific requests for information, and all relevant matters have been addressed in this DA.

Subsequently, on 17 December 2007 and 27 February 2008, the original Design Competition Jury met and gave consideration to the Stage 2 design and resolved to endorse the Stage 2 Application.

A summary of the considerations at that meeting are contained in the Jury Endorsement Meeting Minutes contained in **Attachment 2.**

2.4 Compliance with the Stage 1 DA Consent

The Central Sydney Planning Committee, at the meeting held on 15 February 2007, resolved to approve the Stage 1 DA for 8 Chifley Square, Sydney by unanimous vote subject to various conditions of consent.

Part (A) of the Consent prescribed the applicable conditions imposed on the consent (refer **Attachment 1**), and prescribed the sixteen (16) conditions of approval to be addressed as a requirement of preparing and submitting a Stage 2 DA.

A summary of the compliance with the Stage 1 DA conditions of consent are provided in **Table 1** below.

TABLE 1: Conditions & Compliance with Stage 1 DA Consent

Part (A) Conditions	Compliance	Comment
- CONDITION (1) **(1) APPROVED DEVELOPMENT** Stage 1 development consent is granted only for: (a) The building envelope, but no building works; (b) The general arrangement of uses within the development being; (i) basement level car parking and servicing accessed via Elizabeth Street; (ii) office tower foyer and publicly accessible open space with a minimum height of 15 metres to the underside of the tower; (iii) office tower with service core and plant located along the south boundary; and (iv) ground level retail use.	Yes	The Stage 2 DA is consistent with the Stage 1 DA as detailed in Part (1) of the consent. Refer Stage 2 DA plans (**Attachment 4**)
- CONDITION (2) **(2) DESIGN MODIFICATIONS** The building envelope must be modified as follows: (a) The tower building envelope shall be reduced in height so as to fully comply with the Martin Place sun access plane; (b) The tower building envelope shall be set back from the northern boundary of the site to the alignment of the existing Goodsell building so as to maintain the existing street alignment along the south side of Hunter Street and to maximise daylight and sun light access into the publicly accessible open space at the base of the building;	Yes Yes	The Stage 2 DA building is within the Stage 1 DA approved envelope and below the Martin Place Sun Access Plane. The northern (Hunter Street) elevation has been extended beyond the existing building alignment pursuant to the consideration and decision of the Design Competition Jury (refer **Condition 5 (b)** below and as further discussed with Council's Planning Officers at Pre Stage 2 DA meetings.

(c) The building alignment at lower levels on Elizabeth and Phillip Streets shall maintain the predominant street alignment of the existing Goodsell Building and the adjoining Colonial Centre; and (d) The basement and ground level retail spaces shall be designed to retain views northwards to Chifley Square and provide active street frontages.	Yes Yes	Refer Stage 2 DA plans (**Attachment 4**) Refer Stage 2 DA plans (**Attachment 4**)
- CONDITION (3) **(3) STAGE 2 DEVELOPMENT APPLICATION/COMPETITIVE DESIGN PROCESS** (a) The detailed design of the whole development shall be the subject of a Stage 2 development application; (b) The detailed design of the whole development shall be the subject of a competitive design process in accordance with the provisions of Chapter One Part 5 of the Sydney Local Environmental Plan 2005 and Section 12 of the Central Sydney Development Control Plan 1996; and (c) The competitive design process must be held prior to the lodgment of the Stage 2 development application for the development.	Yes	A Design Competition has been undertaken and endorsed.
- CONDITION (4) **(4) DESIGN EXCELLENCE** The detailed design of the whole development shall exhibit design excellence in accordance with the provisions of Chapter One Part 5 of the Sydney Local Environmental Plan 2005.	Yes	A Design Competition has been undertaken and endorsed.
- CONDITION (5) **(5) STAGE 2 - BUILDING** (a) The Stage 2 design for the whole development shall be wholly contained within the approved building envelope except as may be allowed by this consent.	Yes	The Stage 2 DA building is within the Stage 1 DA approved envelope and below the Martin Place Sun Access Plane.

(b) The consent authority may consider a Stage 2 design resulting from a competitive process that exhibits design excellence which may result in limited minor projections beyond the approved envelope. Any projection beyond the alignment of the existing north facing elevation of the Goodsell building will only be considered subject to the proposed development clearly satisfying the intent of the approved set back being to maintain an appropriate alignment with the existing buildings along south side of Hunter Street and to maximise daylight and sun light access into the publicly accessible open space at the base of the building. *Design Competition Brief* ***6. COMPETITION OBJECTIVES*** ***(b) Design Objectives*** *iii. Setback Along Hunter Street* ➢ *In cognisance of the above two noted conditions it is noted that design submissions may achieve a setback from the Hunter Street boundary which is less than what presently exists, on the proviso that such design meets the objectives of:* ▪ *Maintaining an appropriate alignment with neighbouring buildings along southern side of Hunter Street; and* ▪ *Maximise daylight and sun light access into publicly accessible open space at the base of the new building.*	Yes Yes	The northern (Hunter Street) elevation has been extended beyond the existing building alignment pursuant to the consideration of the Design Competition Jury considerations of the Winning Scheme, and has met the "Design Competition Brief". Refer to assessment in **NOTE A** below.
- CONDITION (6) **(6) FLOOR SPACE RATIO - CENTRAL SYDNEY** The following applies to Floor Space Ratio: (a) The maximum Floor Space Ratio (FSR) for the whole of the development site must not exceed 12.5:1 calculated in accordance with the Sydney Local Environmental Plan 2005. For the purpose of the calculation of this FSR, the maximum Floor Space Area of the development is to be 19,762.5sqm. (b) The floor space in excess of a FSR of 8:1 shall be subject to a requirement to purchase heritage floor space (HFS) in accordance with the requirements of Clause 62 of the Sydney Local Environmental Plan 2005.	Yes	The Stage 2 DA is seeking the additional 10% permissible pursuant to Clause 10 (1) (a) – "Waiver of certain development standards" of SLEP 2005 – refer to **Section 5.2** below. Noted

(c) The amount of HFS to be purchased may be reduced in accordance with Clause 62 of the Sydney Local Environmental Plan 2005 if the consent authority is satisfied that the resulting Stage 2 development exhibits design excellence and is the result of a design competition.		Noted
- CONDITION (7) **(7) ECOLOGICALLY SUSTAINABLE DEVELOPMENT** The detailed Stage 2 design for the whole development shall incorporate ESD initiatives consistent with attaining an Australian Building Greenhouse Rating (ABGR) of 5 stars and 5 star Green Star rating. (a) Notwithstanding the above minimum criteria the Stage 2 development should strive to achieve the highest possible ESD targets consistent with current best practice. (b) The Stage 2 DA shall be subject of a sustainability report that demonstrates compliance with the above.	Yes Yes	Refer ESD Report (**Attachment 16**) Refer ESD Report (**Attachment 16**)
- CONDITION (8) **(8) WIND** (a) The Stage 2 DA scheme shall be subject to wind tunnel testing to ascertain the impacts of the development on the ground level wind environment and the wind conditions within the proposed podium void. Sole reliance on street tree planting to ameliorate adverse wind effects is not appropriate. (b) The design of the building shall be such that it satisfies the wind criteria contained in Section 4.2 of the Central Sydney Development Control Plan 1996. (c) A wind report shall be submitted with the Stage 2 DA demonstrating compliance with the above.	Yes Yes Yes	Refer Wind Effects Report and Wind Tunnel Test Results (**Attachment 24**) Refer Wind Effects Report and Wind Tunnel Test Results (**Attachment 24**) Refer Wind Effects Report and Wind Tunnel Test Results (**Attachment 24**)

- CONDITION (9) **(9) TRAFFIC AND ACCESS REQUIREMENTS** (a) A maximum of 32 off-street car parking spaces and 6 service and delivery spaces are to be provided. The design, layout, signage, line marking, lighting and physical controls of all off-street parking facilities must comply with the minimum requirements of Australian Standard AS/NZS 2890.1 - 2004 Parking facilities Part 1: Off-street car parking and Council's Development Control Plan.	Yes	Refer Transport and Parking Report (**Attachment 14**)
(b) Accessible parking for people with mobility impairment shall be provided and designed in accordance with Australian Standard AS/NZS 2890.1 - 2004 Parking facilities Part 1: Off-street car parking and the City of Sydney Access Development Control Plan 2004.	Yes	Refer Transport and Parking Report (**Attachment 14**)
(c) Where a car park is serviced by lifts, accessible spaces for people with mobility impairment are to be located to be proximate to such lifts. Where a car park is not serviced by lifts, accessible spaces for people with mobility impairment are to be located at ground level, or accessible to ground level by a continually accessible path of travel, preferably under cover.	Yes	Refer Transport and Parking Report (**Attachment 14**)
(d) The on-site car parking spaces, exclusive of service car spaces, are not to be used by those other than an occupant or tenant of the subject building.	Yes	Refer Transport and Parking Report (**Attachment 14**)
(e) Service, delivery, courier spaces and loading docks must be located close to the service entrance and away from other parking areas.	Yes	Refer Transport and Parking Report (**Attachment 14**)
(f) Precise design details of the layout of the car parking areas shall be submitted for approval as part of the Stage 2 development application. These details shall include: (i) Adequate space to allow manoeuvring and turning of the different sized service vehicles; (ii) Provision of parking facilities for motorcycles and bicycles; and (iii) Provision of a cyclists changing room which is to be located close to bicycle	Yes	Refer Transport and Parking Report (**Attachment 14**)

parking and is to include showers with clothes change area and personal lockers; (iv) Appropriate sign(s) must be provided and maintained within the site at the point(s) of vehicular egress, compelling drivers to stop before proceeding onto the public way.		
- CONDITION (10) **(10) SECTION 61 CONTRIBUTIONS PAYABLE** The whole development shall be the subject of a cash contribution comprising 1% of the total cost of the development. The contribution is payable to the City of Sydney pursuant to section 61 of the City of Sydney Act 1988 and the Central Sydney Contribution (Amendment) Plan 2002.	Yes	Noted
- CONDITION (11) **(11) SIGNAGE STRATEGY** A detailed signage strategy for the development shall be submitted with the Stage 2 DA. The signage strategy must include information and scale drawings of the location, type, construction, materials and total number of signs proposed for the building.	No	It is considered that the proposed Stage 2 design provides appropriate opportunities for signage at both ground level and at roof level (in respect of potential naming rights for the building), and, these can be detailed under a separate DA.
- CONDITION (12) **(12) PUBLIC ART** The Stage 2 DA shall incorporate: (a) Detailed concepts for the provision of high quality art work within the development in publicly accessible locations eg. near main entrances, lobbies and street frontages, in accordance with the Central Sydney DCP 1996 and the Public Art Policy; and (b) Detailed concepts for the design and treatment of the construction hoardings to be used to incorporate artworks so as to make a positive contribution to the public	Yes Yes	Refer Public Art Strategy (**Attachment 14**) and **Section 5.6** below. Refer Public Art Strategy (**Attachment 14**) and **Section 5.6** below.

parking and is to include showers with clothes change area and personal lockers; (iv) Appropriate sign(s) must be provided and maintained within the site at the point(s) of vehicular egress, compelling drivers to stop before proceeding onto the public way.		
- CONDITION (10) **(10) SECTION 61 CONTRIBUTIONS PAYABLE** The whole development shall be the subject of a cash contribution comprising 1% of the total cost of the development. The contribution is payable to the City of Sydney pursuant to section 61 of the City of Sydney Act 1988 and the Central Sydney Contribution (Amendment) Plan 2002.	Yes	Noted
- CONDITION (11) **(11) SIGNAGE STRATEGY** A detailed signage strategy for the development shall be submitted with the Stage 2 DA. The signage strategy must include information and scale drawings of the location, type, construction, materials and total number of signs proposed for the building.	No	It is considered that the proposed Stage 2 design provides appropriate opportunities for signage at both ground level and at roof level (in respect of potential naming rights for the building), and, these can be detailed under a separate DA.
- CONDITION (12) **(12) PUBLIC ART** The Stage 2 DA shall incorporate: (a) Detailed concepts for the provision of high quality art work within the development in publicly accessible locations eg. near main entrances, lobbies and street frontages, in accordance with the Central Sydney DCP 1996 and the Public Art Policy; and (b) Detailed concepts for the design and treatment of the construction hoardings to be used to incorporate artworks so as to make a positive contribution to the public	Yes Yes	Refer Public Art Strategy (**Attachment 14**) and **Section 5.6** below. Refer Public Art Strategy (**Attachment 14**) and **Section 5.6** below.

domain during construction shall be provided. The public art concepts shall be prepared by a person with expertise in public art. With regard to the construction hoardings the concepts shall incorporate the provision of existing recognised art works and/or the provision of specifically commissioned artworks and shall not just consist of the provision of commercial retail images. Funding of the public art shall be in addition to Section 61 contributions and public domain upgrades.		Noted
- CONDITION (13) **(13) PUBLIC DOMAIN PLAN** A. detailed Public Domain Concept Plan for the improvement of the public domain adjoining the site and publicly accessible areas within the site shall be submitted with the Stage 2 Development Application. The plan shall detail the relationship of the proposed podium void to the surrounding streetscape, with sufficient information on access, materials, levels, finishes, lighting, landscaping and the like to illustrate the design and operation of all publicly accessible areas and surrounding footpaths, and their consistency with City policies and standards. Such details shall be prepared in accordance with the City if Sydney's Public Domain Manual. The improvement of the public domain shall be in addition to Section 61 contributions.	Yes	Refer Public Domain Plan/Landscape Plan and Statement (**Attachment 10**) Noted
- CONDITION (14) **(14) STREET TREES** Any Stage 2 Development Application must be accompanied by a construction method statement including a methodology prepared by a qualified arborist for the protection and retention of existing street trees. Alternatively, the public domain plan may propose removal/replacement of street trees as part of a detailed landscape proposal for the site.	Yes	Refer Demolition Management Plan (DMP) and Construction Management Plan (CMP) in the Environmental Management Plan (**Attachment 17**), and, refer to Public Domain Plan/Landscape Plan and Statement (**Attachment 10**) for street tree planting. .

- CONDITION (15) **(15) CONSTRUCTION MANAGEMENT** The Stage 2 Development Application for the whole development shall be supported by a detailed construction management plan for the development.	Yes	Refer Demolition Management Plan (DMP) and Construction Management Plan (CMP) in the Environmental Management Plan (**Attachment 17**)
- CONDITION (16) **(16) NO DEMOLITION PRIOR TO STAGE 2 APPROVAL** Demolition or excavation must not commence until a Construction Certificate - after Stage 2 approval - has been issued for construction of a substantive building.	Yes	Noted

NOTE A: Hunter Street Setback

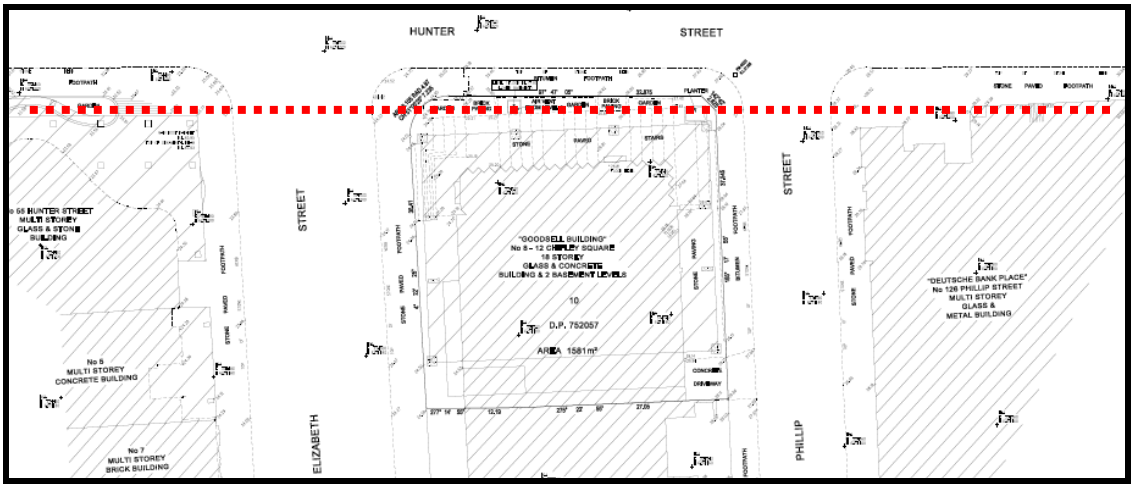
Condition (5) of the Stage 1 DA Consent states, in part, the following;

> *"(a) The Stage 2 design for the whole development shall be wholly contained within the approved building envelope except as may be allowed by this consent.*
>
> *(b) The consent authority may consider a Stage 2 design resulting from a competitive process that exhibits design excellence which may result in limited minor projections beyond the approved envelope. Any projection beyond the alignment of the existing north facing elevation of the Goodsell building will only be considered subject to the proposed development* ***clearly satisfying the intent of the approved set back being to maintain an appropriate alignment with the existing buildings along south side of Hunter Street and to maximise daylight and sun light access into the publicly accessible open space at the base of the building****."*

Accordingly, the two key matters relate to maintaining an appropriate streetscape relationship in Hunter Street and maximizing sunlight/daylight access to the "reverse – podium" space.

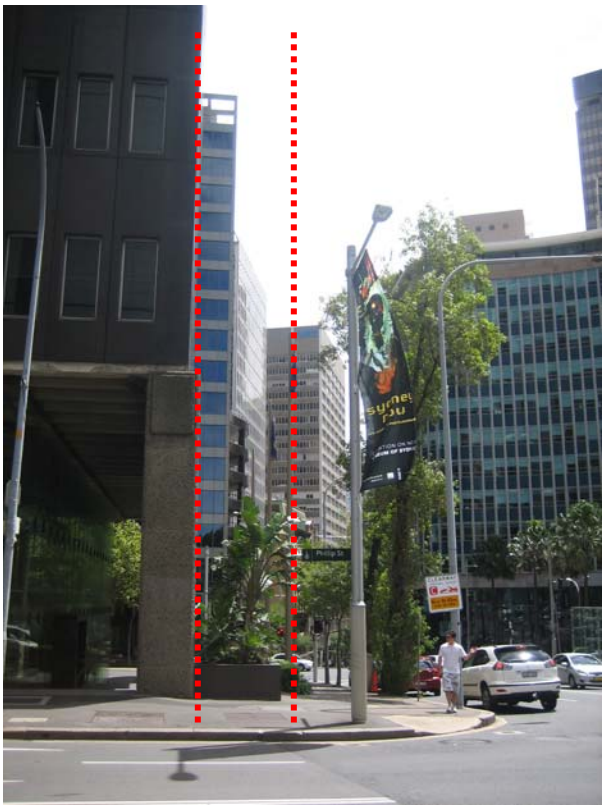
It is worth reiterating that the Jury, in its deliberations, took into consideration this requirement of the Stage 1 DA consent and concluded that the winning entry had successfully met these two conditions (2(b) and 5(b)) of the approval.

The context of the prevailing setbacks is detailed in **Figure 2** below and in **Photos 3, 4, 5** and **6** below.



F I G U R E 2

Exisitng Hunter Street building alignments between No. 55 and No. 126 Phillip Street



P H O T O 3

Existing building alignment and Hunter Street boundary – looking west

P H O T O 4

Deutsche Bank Place Hunter Street alignment – looking west

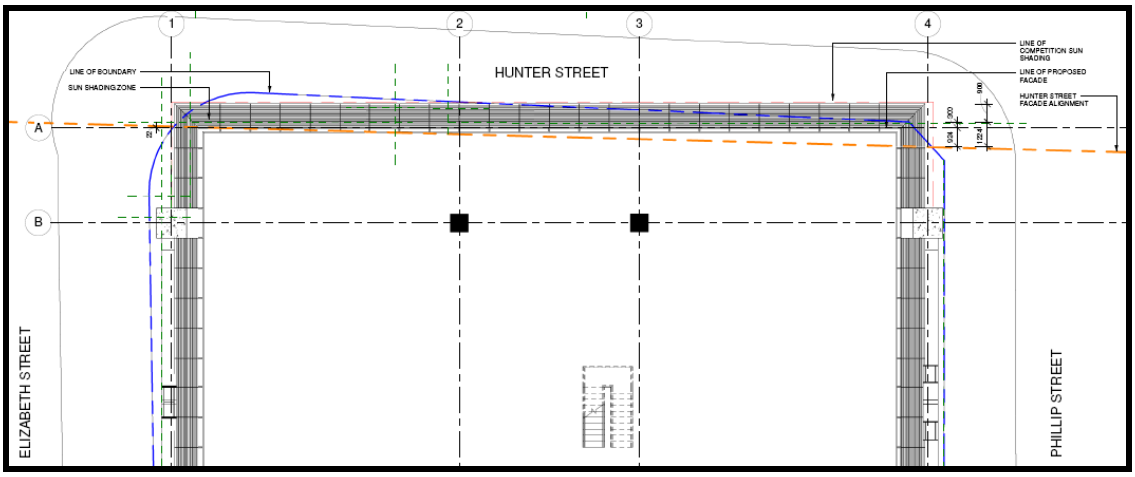
P H O T O 5

Hunter Street building alignments – looking east (note curved street alignment)

P H O T O 6

Hunter Street building alignments – looking east (note curved street alignment)

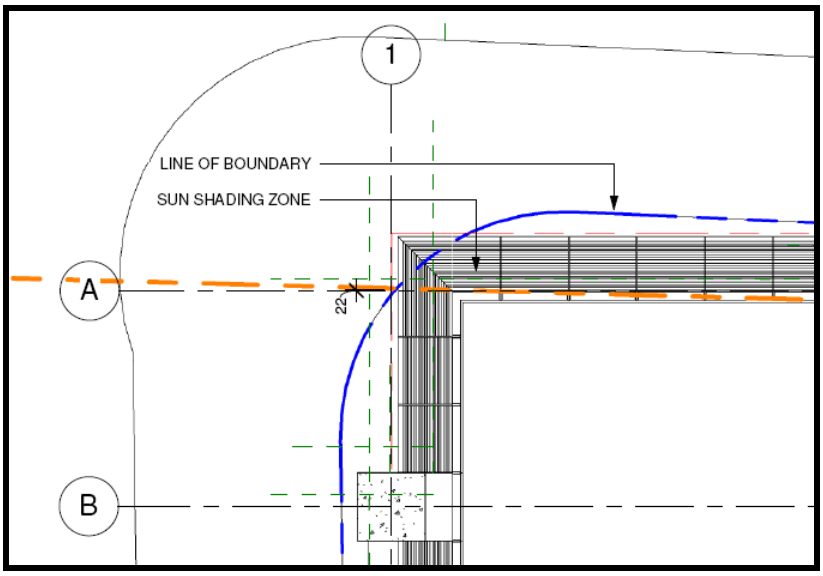
The proposed Hunter Street setback is detailed in **Figures 3, 4** and **5** below, and depict the relationship of the glazed building line to the Hunter Street property boundary, and the location of the projecting sunshades beyond.



F I G U R E 3

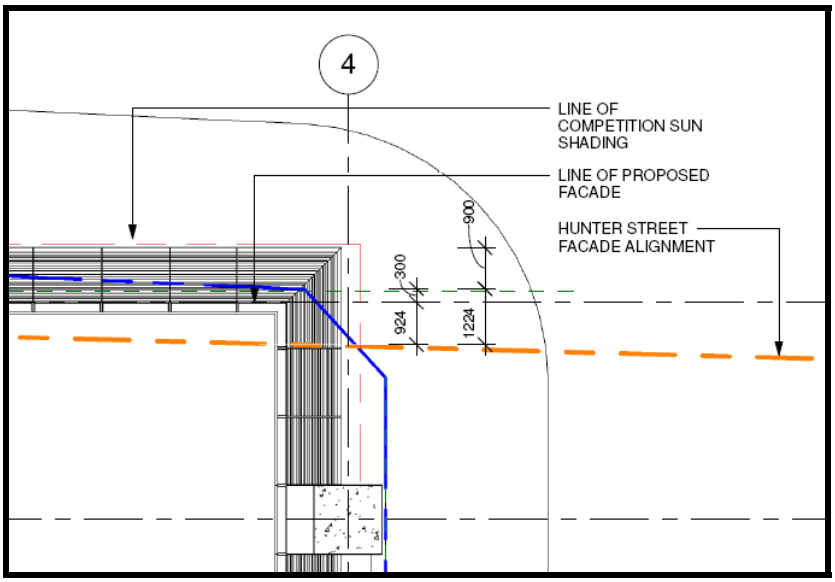
Hunter Street setback of proposal

At all locations along the northern street alignment the new building façade is within the site boundary, and due to the irregular boundary , this northern façade setback is greater at the western end than the eastern end (refer **Figures 4** and **5**).



F I G U R E 4

Hunter Street setback detail at Elizabeth Street



F I G U R E 5

Hunter Street setback detail at Phillip Street

Accordingly, as can be seen from the location of the glazing line and the sunshading above, the western portion of the glazing line is setback behind the average setback line established by No. 55 Hunter Street and No. 126 Phillip Street(the orange dotted line), while the eastern portion is slightly forward of the average setback (the orange dotted line).

It is not considered that the sunshading devices in themselves create a strong visual alignment, such as that of a facade, and it is only the small encroachment of the glazing line beyond the average setback line (orange line) at the eastern end of the northern façade that requires consideration.

There are a number of features of the local streetscape and urban context that require consideration. In particular, the "kink" in the alignment of Hunter Street at Bligh Street and the significant fall in level from the subject site towards the west means the southern wall of the street is highly visible in street-long views (refer **Photos 5** and **6**).

In particular, due to the curve and fall in the road alignment it is difficult to read the proposed facade in line with other facades, and their relationship to ground level, and, it is more a siting of the whole elevation within the curved streetscape that is seen from the west.

Further, due to the curved street alignment, the new façade will always appear to be at or new the alignment of Deutsche bank Place, and not forward of the main building alignment as seen from the west.

This Hunter Street street-wall is clearly defined by strong upright street-aligned buildings of more than 80m height. Furthermore, the Hunter St facade of the Deutsche Bank is 160m tall at roof level and continues with a spire structure up to 240m.

There are no podia along any portion of the Hunter Street street wall.

It is assessed that, having regard to the character of existing built form in Hunter Street, and considering the east/west alignment of Hunter Street, that a building form that sits at and slightly over the average building alignment of the two most adjacent buildings is appropriate and meets the intent of minimising negative effects relating to daylight access (refer Shadow Diagrams – **Attachment 6**) and wind effects (refer Wind Effects and Wind Tunnel Report – **Attachment 24**).

In terms of sunlight access, the proposed setback alignment to Hunter Street bears a relationship to the height of the "reverse – podium", which achieves a height to the soffit of 18.75 metres to 22.03 metres.

The ground level of the subject site benefits from this relationship, and in terms of sunlight and daylight access to the "reverse – podium", the Shadow Diagrams (refer **Attachment 6**) verify that the Plaza area will be useable year round. The shadow diagrams in particular demonstarte a considerable depth of penetraation of sunlight in mid – winter between 12.00noon and 2.00PM, to the extent that between 65% to 80% of the upper an dlower plaza area are in full sunlight between 12.00noon and 2.00pm mid – winter. In August, notwithstanduing that the increased altitude of the sun is higher, between 50% and 60% of the area being predominantly the Lower Plaza is in full sunlight between 12.00noon and 2.00pm.

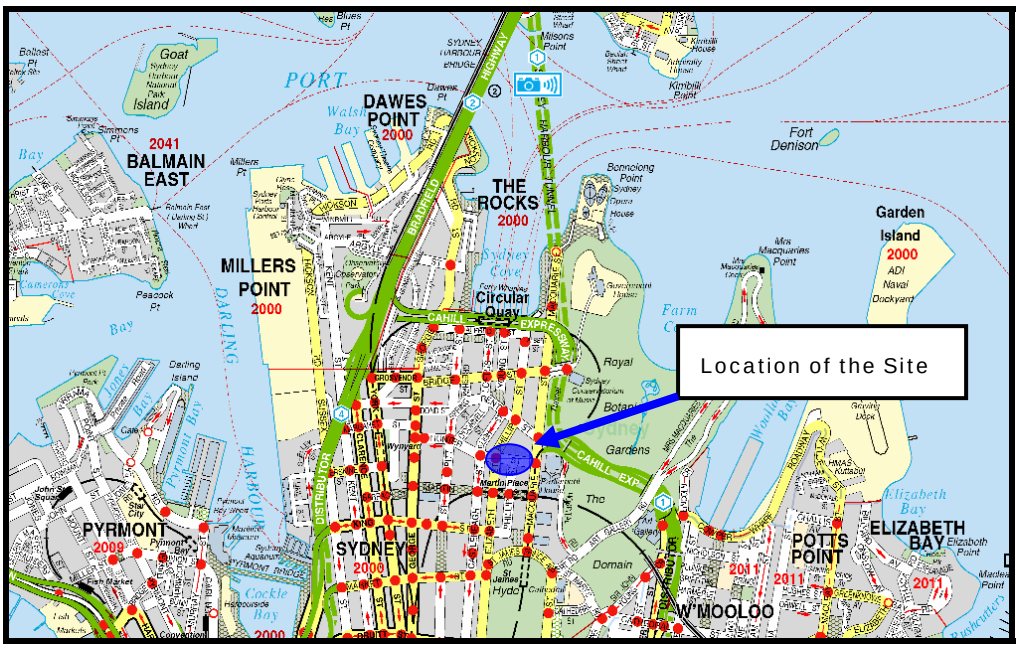
3.0 THE SITE AND CONTEXT

3.1 Local and Regional Context

The subject site is located on the eastern portion of the City Centre, north of Martin Place in the principal commercial, business, legal area of the CBD, and is situated amongst a mix of principally commercial offices and retail uses (refer **Figures 6 and 7**).

A key feature of this locality is the visual and spatial qualities of Chifley Square which is located opposite the subject site and is bounded by Hunter Street, Phillip Street and the podium of Chifley Tower (No 2 Chifley Square).

Another key built form element in this precinct is the recently completed Deutsche Bank tower, located at the corner of Phillip Street and Hunter Street, and known as 126 Phillip Street. This new development comprises 34 levels of commercial office space above a 15 metre high atrium void at street level. A prominent feature of this building is the roofscape, which is characterised by a 60 metre high space frame architectural roof feature.



F I G U R E 6
Context Map

The site is located in the heart of the CBD and as such has a wide choice of public transport services. The main public transport services available within close proximity to the site include Rail Access in Martin Place, Bus Access along Elizabeth Street, Ferry Services at Circular Quay and frequent convenient taxi services.

F I G U R E 7
Context Aerial Photo

3.2 The Site

The subject land is formally identified as being Lot 10 in Deposited Plan No.752057, being No.8-12 Chifley Square. The site accommodates a 21 level commercial building known as the "Goodsell" Building.

The "Goodsell" Building comprises a 21 level commercial reinforced concrete and steel building with a curtain wall of concrete panels with generally small window penetrations and was constructed in 1970.

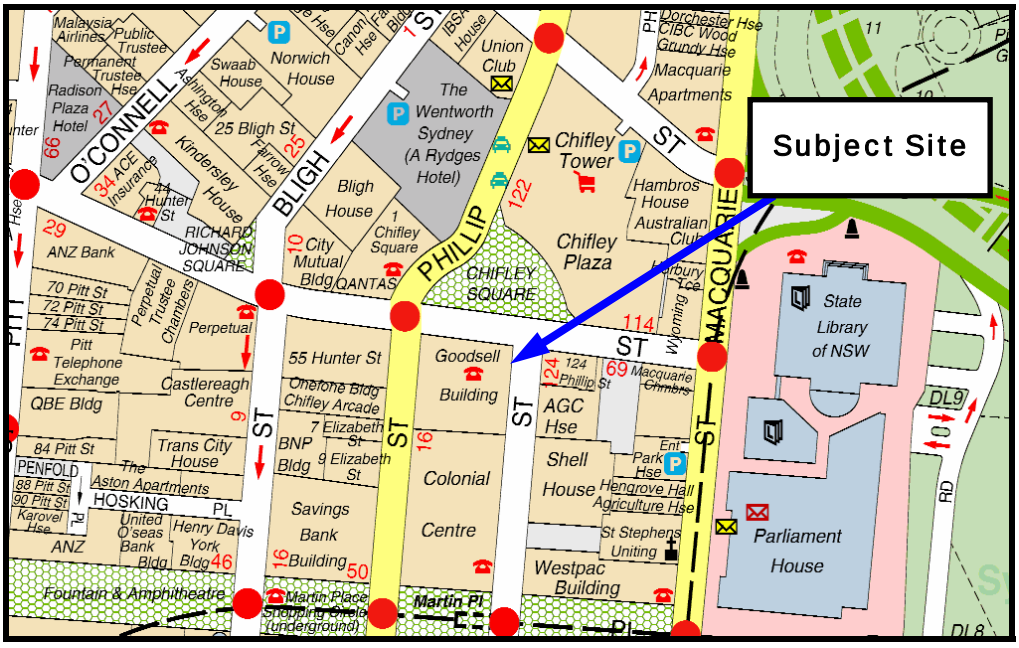
The ground floor features a deep colonnade constructed from off form concrete which presents a rather brutal appearance and character to the adjacent public domain. The colonnade space is observed to be deeply shadowed and uninviting.

The site features a frontage of approximately 38.534m to Hunter Street (north), 37.563m to Phillip Street (east) and 37.545m to Elizabeth Street (west) with a total site area of 1,581sqm (refer **Attachment 3** – Survey Plans).

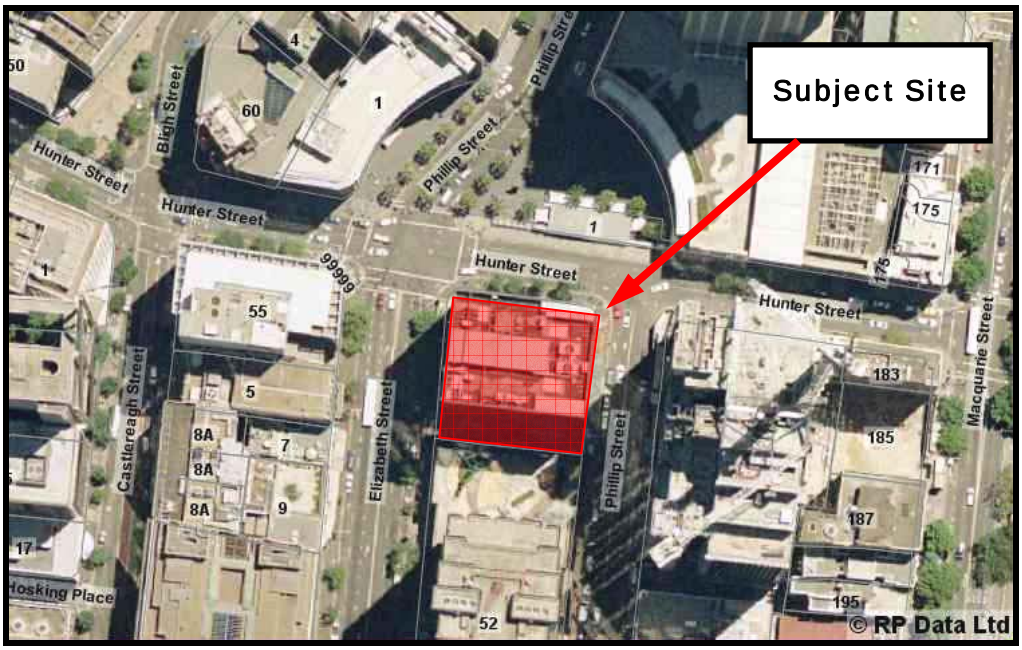
The site is situated at the southern alignment of Chifley Square with a main street frontage to Hunter Street. The subject site occupies a prominent location having side boundary alignments to both Phillip Street to the east and Elizabeth Street to the west.

The site has a high profile position as it has three frontages to the principal streets within the City Centre and is part of the Chifley Square Precinct providing useable public domain within a prime commercial precinct (refer **Figure 8**).

The aerial photo at **Figure 9** illustrates the sites relationship to Chifley Square and proximity to Martin Place which emphasises the sites strategic importance within the City Centre.



F I G U R E 8
Site Plan



F I G U R E 9
Site Aerial Photo

3.3 Surrounding Development

Buildings adjacent to the subject site are mostly mixed use and typically comprise commercial/retail activity on the ground floor commercial to the upper floors.

3.3.1 To the north

Directly opposite the site, being to the north is the open space area known as Chifley Square. Also north of the site are the multi-level retail/commercial buildings known as No. 2 Chifley Place, the former Qantas Building and "The Sofitel Wentworth" Hotel.

The podium to No. 2 Chifley Square is 33 metres high and the tower is 201 metres.

The maximum height of the Sofitel Building is 65 metres and the former Qantas Building features a maximum height of approximately 61 metres and importantly, the parapet line of the former Qantas Building is situated at 51 metres.

3.3.2 To the south

To the south of the site is the Colonial Centre at Nos. 109 - 135 Phillip Street. The Colonial Centre building comprises a 35 storey glass and concrete commercial office tower situated above a 5 storey podium.

The podium is 23 metres in height and the tower is 145 metres in height. It is also apparent that the subject site features a significant setback to the tower element of the Colonial Centre due to the width of the Colonial Centre podium abutting the southern (rear) boundary of the site (refer **Figure 9**).

This arrangement result in the office tower having a 20 metres setback to the southern boundary of the subject site The setback area on top of the Colonial Centre podium features a garden with sculptural elements, and a small outdoor passive recreation space for the use of the buildings occupants (refer **Photo 16** below).

3.3.3 To the west

To the west, on the opposite site of Elizabeth Street, is located a 21 storey glass and concrete commercial building which is generally constructed to the boundary alignments, and is known as No. 55 Hunter Street. No. 55 Hunter Street is between 68 and 83 metres in height.

Further west, beyond No. 55, the street alignment of Hunter Street curves in alignment and falls significantly to the west towards the intersection with Bligh Street and beyond.

3.3.4 To the east

To the east, on the opposite alignment of Phillip Street, is located the recently completed Deutsche Bank Place tower, known as 126 Phillip Street. The Deutsche Bank Place building comprises 34 levels of commercial office space above a 15 metre high atrium void at Hunter Street level.

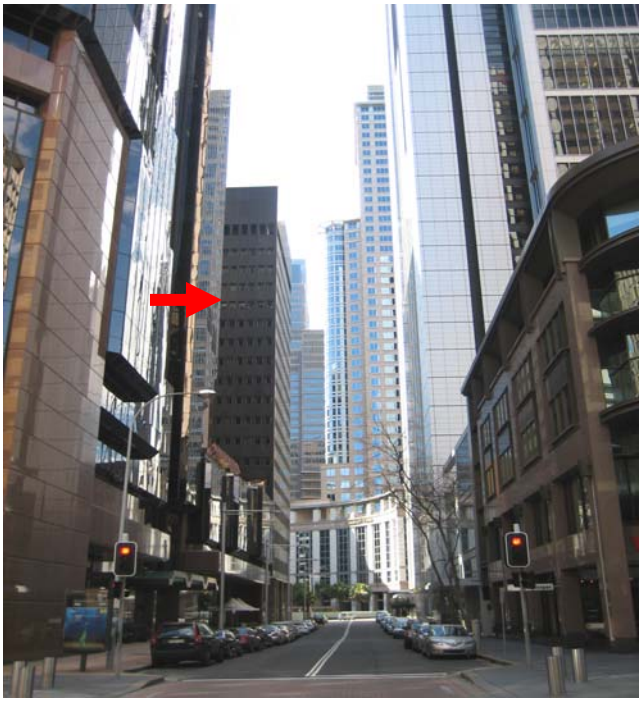
The street wall height of the Deutsche Place building is 156 metres, and a prominent feature of this building is the roofscape, which is characterised by a 60 metre high space frame architectural roof feature.

The set of eight (8) photos below detail the context and features of the site and locality as described above.

P H O T O 7
View from northern end of Phillip Street looking south across Chifley Square to the subject building

P H O T O 8
Distant view from northern end of Phillip Street looking south to the subject building

P H O T O 9
View north along Elizabeth Street



P H O T O 1 0
The view north along Phillip Street towards Chifley Square

P H O T O 1 1
Looking east up Hunter Street with the Deutsche Bank building in the background

P H O T O 1 2
Looking north along Elizabeth Street toward the heritage-listed former Qantas Building

P H O T O 1 3
Looking towards Chifley Square from Elizabeth & Hunter Streets

P H O T O 1 4
Looking north along Phillip Street towards Chifley Square

4.0 DESCRIPTION OF THE DEVELOPMENT

4.1 General Description

The proposal seeks a consent for a 30 level commercial building which accommodates 21 levels of commercial floor space, and with two full basement levels and a part third level basement for the provision of car parking spaces and parking for delivery vehicles and loading/unloading in basement levels. In addition, the basement levels are designed to accommodate plant rooms, a new substation and bicycle parking with change room facilities.

The 21 levels of commercial floor space are grouped together in a unique "commercial village" concept, incorporating twelve (12) "villages", varying in height between one storey and three storeys. Each "village" comprises one, two or three levels and the two and three storey "commercial villages" are interconnected floors, which is a strong emerging trend in modern office design (refer **Table 2** and **Figure 13**).

The ground plane of the tower comprises a large void area of 5 levels known as the "reverse – podium", and at the mid-level, a second volume comprising 3 levels is provided and is known as the "mid – level sky garden". The ground plane is split into a Lower Plaza and Upper Plaza and is to be open space available to the public. A small retail tenancy is proposed at the Lower Plaza level fronting Elizabeth Street.

The top-most level of the building features a roof terrace with architectural roof feature above, and to the south are 4 levels of plant rooms.

The external appearance of the building form is in the "functional – style" and the main structural elements in steel and the "mega" columns in high quality prefabricated concrete give the proposal a very distinctive character.

Further, the cantilevered fire stairs clad in metal provide a dynamic articulation to the eastern and western elevations.

The proposed floor space area comprises a total of 21,738 sqm of commercial office and retail floor space and achieves a Floor Space Ratio of 13.75 : 1. A set of Floor Space Area Calculation plans is contained in **Attachment 7.** The FSA has been measured in accordance with the definitions contained in Clause 6 "Dictionary" of the Sydney Local Environmental Plan 2005.

A summary of the proposed floor space area and floor space ratio is provided in **Table 2** below.

Table 2: Level by Level Description and Floor Space Area (FSA)

LEVEL	DESCRIPTION	FLOOR SPACE AREA (FSA) 3 – Level Village 2 – Level Village 1 – Level Village Open Space/Plaza Area
LEVEL 34	Plant	
LEVEL 33	Plant	
LEVEL 32	Plant Roof & Architectural Roof Feature	
LEVEL 31	Plant	
LEVEL 30	Plant & Roof Terrace	56
LEVEL 29	Commercial Floor/Lifts & Services	918
LEVEL 28	Commercial Floor/Lifts & Services	937
LEVEL 27	Commercial Floor/Lifts & Services	1,098
LEVEL 26	Commercial Floor/Lifts & Services	1,098
LEVEL 25	Commercial Floor/Lifts & Services	937
LEVEL 24	Commercial Floor/Lifts & Services	1,098
LEVEL 23	Commercial Floor/Lifts & Services	1,098
LEVEL 22	Commercial Floor/Lifts & Services	937
LEVEL 21	Commercial Floor/Lifts & Services	1,098
LEVEL 20	Commercial Floor/Lifts & Services	1,098
LEVEL 19	Commercial Floor/Lifts & Services	937
LEVEL 18	Commercial Floor/Lifts & Services	1,098
LEVEL 17	Void over, Lifts & Services	
LEVEL 16	Void over, Lifts & Services	
LEVEL 15	Mid – Rise Sky Garden, Lifts & Services	30
LEVEL 14	Commercial Floor/Lifts & Services	914
LEVEL 13	Commercial Floor/Lifts & Services	1,095
LEVEL 12	Commercial Floor/Lifts & Services	1,095
LEVEL 11	Commercial Floor/Lifts & Services	914
LEVEL 10	Commercial Floor/Lifts & Services	1,095
LEVEL 9	Commercial Floor/Lifts & Services	1,095
LEVEL 8	Commercial Floor/Lifts & Services	914
LEVEL 7	Commercial Floor/Lifts & Services	914
LEVEL 6	Commercial Floor/Lifts & Services	1,095
LEVEL 5	Void over/Lifts & Services/	
LEVEL 4	Void over/Lifts & Services/	
LEVEL 3	Void over/Lifts & Services/	
LEVEL 2	Void over/Lifts & Services/	
LEVEL 1	Plaza /Lobby, Lifts & Services	151
LEVEL B1	Access off Elizabeth Street, car parking, motorcycle spaces, loading/unloading bays and courier parking, lifts, plant and garbage rooms. Retail/Café Tenancy	18
LEVEL B2	Car parking, lifts, change rooms and showers, bicycle parking and plant. Substation.	
LEVEL B3	Black-water recycling plant and Grease Arrestor Room. Access stairs,	
• TOTAL FSA (sqm)		21,738

The key considerations in respect of the context and assessment of the Stage 2 DA proposal are summarised below under relevant sub-sections, and together, these considerations inform the Consent Authority of the issues that have been recognised and addressed by the proposal;

- Development Statistics
- Design Philosophy
- Heritage Considerations
- Building Form, Character and Height
- Materials and Finishes
- Wind Effects and Reflectivity
- Noise Impact Assessment
- Transport and Parking Assessment
- Public Domain
- Energy Efficiency and Building Services
- Place Management and Security
- Waste Management
- Building Code of Australia Assessment and Fire Safety Strategy

4.2 Development Statistics

A numerical summary of the proposal is provided in **Table 3** below.

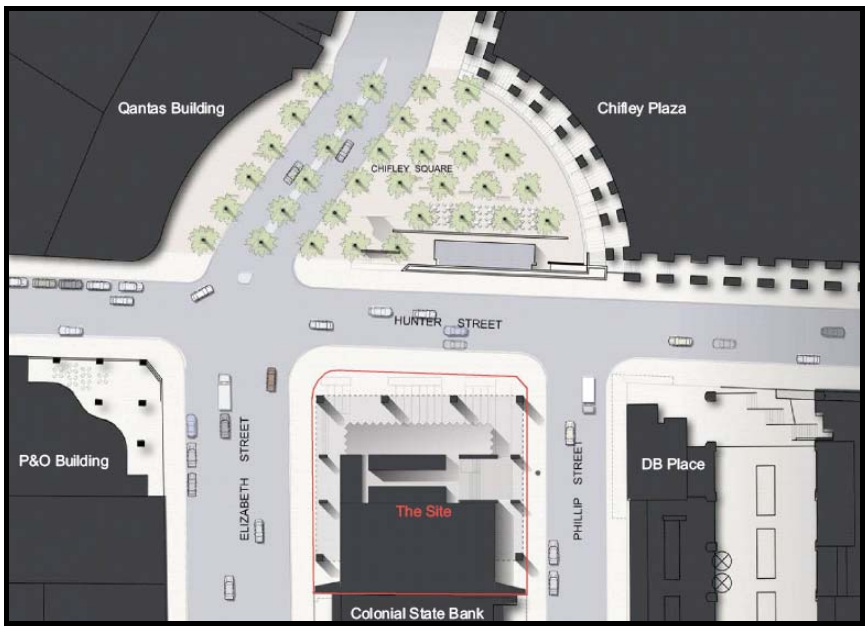
Table 3: Development Statistics

Component Proposal	
Site area	**1,581sqm**
Floor Space Area ("FSA")	**21, 738sqm**
Floor Space Ratio ("FSR")	**13.75:1**
Building Height	**136.3 – 139.9 metres (max)**
Reverse - Podium Height ➢ **above Hunter Street** ➢ **above Elizabeth Street** ➢ **above Phillip Street**	 **18.75 – 22.03 metres** **22.03 metres** **18.75 metres**
No. of Commercial floors	**21 floors**

Mix of Commercial Villages ➢ **One Level** ➢ **Two Level** ➢ **Three Level** **Total No. of Commercial Villages**	 **5** **5** **2** **12**
Car parking spaces	**32**
Disabled parking	**1**
Loading/Unloading spaces	**1 x Medium Truck & 1 x Small Truck**
Courier Spaces	**4**
Motorcycle spaces	**4 (equivalent to one car space)**
Bicycle spaces	**128 + 28 visitor (total = 156)**

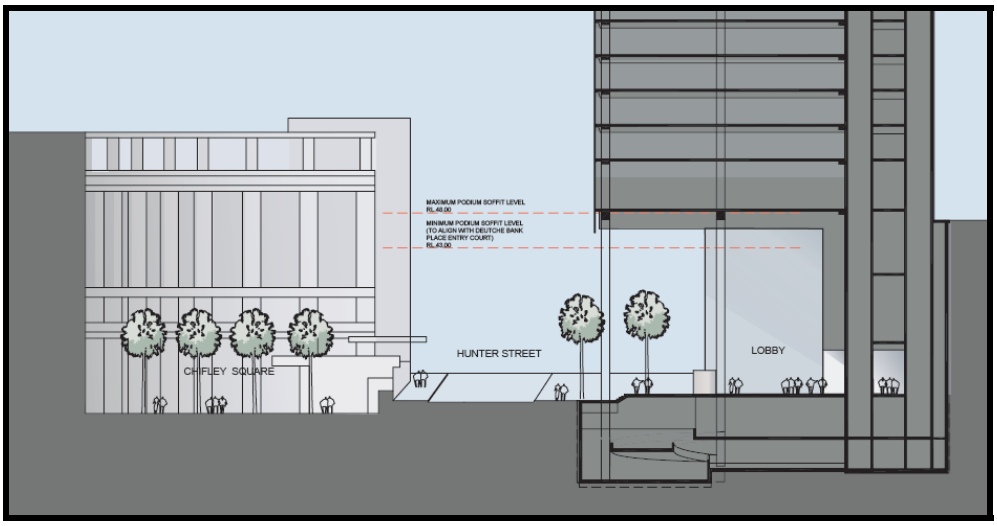
4.3 Design Philosophy

The winning architects have collaborated to complete the Stage 2 DA design and have summarised their approach and desired outcomes for this building in the "Design Report" contained in **Attachment 5.** A key to the successful design outcome is the relationship between the builtform and streetscape context of the subject site and in particular, the important relationship to Chifley Square to the north (refer **Figure 10** below).



F I G U R E 1 0
Existing Site Context and adjacent Public Domain

The common theme running thought the Stage 1 DA application and approval, the Design Competition and now the Stage 2 DA, is the "reverse – podium", which creates an important spatial and functional connection with Chifley Square to the north as detailed in **Figure 11** below.



F I G U R E 1 1
"Reverse – Podium" Principle from Stage 1 DA Approval

The soffit to the "reverse – podium" is situated at RL 46.85 metres, and is consistent with the Stage 1 DA consent which prescribed a nominal height to this space of between RL 43 metres and RL 48 metres.

4.4 Heritage Considerations

The proposal has been considered in detail in the Heritage Assessment/Impact Statement Report prepared by Tropman & Tropman (refer **Attachment 11**), and recognises the significance of the townscape, adjacent heritage items, and Chifley Square, as an area of historic significance and public benefit.

The key summary and recommendations are extracted below.

> ***"12.0 CONCLUSION***
>
> *12.1 Chifley square is a relatively young architectural environment and it can be said that the heritage significance of the square and the surrounding buildings is still evolving.*
>
> *12.2 The existing Goodsell Building at 8-12 Chifley Square appears to have reached the end of its life cycle for its use as a building providing safe, good quality office accommodation and accessible.*

12.3 The proposed re-development which includes demolition of the existing building provides the opportunity for design outcomes that continue to support and enhance the good quality urban and civic townscape which have recently been generated at Chifley Square. The proposal has the
potential to be a good quality adaptive development supporting and enhancing the Square's significant cultural values.

12.4 The re-development will support the 1957 former Qantas House and recent good quality commercial architecture. The proposed tall building has a raised level entry podium that is level to Phillip Street, an enclosed setback lobby space facing north and a tall commercial tower structure reinforcing the Square's alignment at a high level.

12.5 This re-development also provides the opportunity to detail a façade that respects and reinforces the southern alignment, reflects light into Chifley Square and provides a significant community space for the people who work and occupy places in the area.

12.6 The level podium and setbacks of the entrance lobby of the re-development have the opportunity of extending Chifley Square's spatial context. The proposed new entry podium at 8-12 Chifley Square will allow overlooking of the Square and reinforce the historic and culturally significant streetscape.

12.7 The re-development has been designed to achieve a minimum 5 star Green Star & ABGR rating. This rating signifies a best practice rating and is consistent with other aspects of the building design in relation to its international credentials and global significance.

12.8 This is an acceptable redevelopment, provided the recommendations listed are undertaken. Tropman and Tropman Architects believe the design outcome would continue to support and enhance the good quality urban and civic townscape which have recently been generated at Chifley Square. The proposal has the potential to be a good quality adaptive development supporting and enhancing the Square's significant cultural values."

4.5 Building Form, Character and Height

Building Form and Character

The LA & RSH + P scheme presents a traditional square floor plate design with a single skin glass external façade to the north beyond which is cantilevered a series of horizontal sunshades. Similar sunshade screens are provided to the eastern and western elevations and detailed design drawings are provided at DA– 100 A and DA– 101 A (refer **Attachment 4**).

The overall appearance of the proposal is one of high quality finishes including prefabricated concrete "mega" columns and painted steel structural elements which present a "functional – style" building (refer **Figure 12**). The side elevations present a "skeletal" form with expressed steel trusses and clear glazing, and a glazed presentation to the rear elevation completes the creation of a light transparent appearance (refer **Figure 12**).

F I G U R E 1 2
Structural Expression

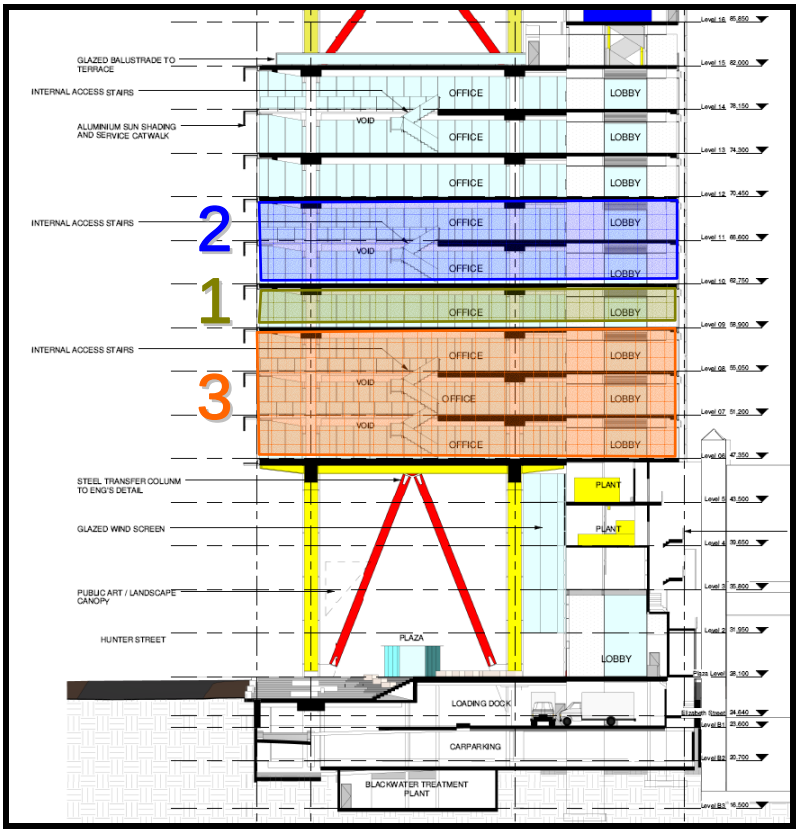
The structural system accommodates a minimal column layout within each floor plate and loads are carried outwards to the external masonry frame which is given added stiffness by the buildings main core.

The form of the ground plane adopts a split level fronting Elizabeth Street and a series of steps provide for pedestrian access from east to west. The main building lobby is at grade with the Phillip Street level.

Commercial "Villages", Floor Plates and Levels

Typical floor plates comprise a lettable area of approximately 1,000 sqm, with an additional area of approximately 400 sqm as services zone along the southern alignment of each floor.

Accordingly, each two – storey village comprises a maximum of 2,035sqm of FSA and each three storey village comprises a maximum of 2,953 sqm. The interconnectivity is provided via stairs as detailed in **Figure 13** below.



F I G U R E 1 3
One, Two and Three Level Commercial Village Configurations in section

Each "village" floor plate is built to the external walls, and features a void cut-out in the middle to provide a visual connectivity (and physical connection via stairs) between each of the levels of the 2 and 3 level villages.

Height

The proposal complies with the Stage 1 DA approved envelope and the "Martin Place Sun Access Plane". The relevant Reduced Levels and actual height for the envelope are detailed in **Table 4** below.

Table 4: Maximum building height

Site Boundary	Maximum Height of Approved Stage 1 DA Envelope (RL in metres to A.H.D.)	Proposed Maximum Height (RL in metres to A.H.D.)	Proposed Height (in metres)
Phillip Street	**173.50 – 216.80**	**164.4 (plant & roof feature)**	**136.3 (min)**
Hunter Street	**214.50 – 216.80**	**164.4 (roof feature)**	**136.3 – 139.9**
Elizabeth Street	**170.55 – 214.50**	**164.4 (plant & roof feature)**	**139.9 (max)**
Southern (rear) Elevation	**170.55 – 173.50**	**164.4 (plant)**	**136.3 – 139.9**

4.6 Materials and Finishes

A summary of the proposed palette of Materials, Finishes and Colours is detailed in **Attachment 8** and are expressed in the Photomontages provided in **Attachment 9.**

The main features of the expressed structure are off – form prefabricated concrete with a high quality finish, and the steel elements are to be coated with a high – performance finish in red and yellow (refer **Figure 12** above).

The glazing is a curtain wall system of high performance clear glazing, and the expressed sunshading devices are constructed in clear finish anodised aluminium.

The cantilevered fire stairs to the east and west are the other significant external feature, and are to be clad in perforated aluminium balustrade panels with a hight of 1500mm.

4.7 Wind Effects and Reflectivity

Wind Effects

A Wind Effects and Wind Tunnel Report report has been prepared by Cermak Peterka Petersen Pty. Ltd (refer **Attachment 24**) and the findings of this analysis conclude as follows;

> ***"EXECUTIVE SUMMARY***
> *A wind-tunnel study of the 8 – 12 Chifley Square, to be located in Sydney, Australia, was conducted to assess pedestrian wind comfort. A plastic model of the project was fabricated to a 1:300 scale and centered on a turntable in the wind tunnel. Replicas of surrounding buildings within a 430-m radius were constructed and placed on the turntable.*
>
> *The wind-tunnel testing was performed in the natural boundary-layer wind tunnel of CPP, Inc., Fort Collins, Colorado. Approach boundary layers representative of a built-up environment were established in the test section of the wind tunnel. The boundary-layer mean wind speed profiles had a power-law exponent of 0.22 and 0.23. These correspond to Terrain Category 3 approach profiles in AS/NZ1170, with appropriately varying turbulence characteristics for flows over the park or not (see Figure 4). The wind flow had appropriate turbulence characteristics. Measurements of winds likely to be experienced by pedestrians were made with a hot-film anemometer at 24 locations for 16 wind directions each. These measurements were combined with wind statistics to produce graphs of wind speed versus the percentage time that wind speed is exceeded for each location. Comparison of wind speeds to published acceptability criteria are shown in Tables 5 and 6.*
>
> *The wind environment at ground level around the tower was found to be generally reasonable and should not require mitigation. The Upper and Lower Plaza were found suitable for their intended purposes. The pedestrian accessible sky garden and rooftop on level 30 should be suitable for long term activities. A glass screen wall was also tested around the Upper Plaza level and the wind conditions were compared with the previous configuration without the screen wall. The screen wall slightly improved the wind conditions on the west end of the plaza. However, the wind accelerating between the plaza and the screen walls could cause slightly windier conditions, on the east end of the plaza, than those without the screen wall."*

The conclusions above have meant that the "reverse – podium" and mid – rise skygarden do not require wind – screens/wind – shields to be erected, thus ensuring that the open transparent appearance is maintained and enhanced.

Accordingly, it is concluded that the proposed development is unlikely to adversely impact upon the existing streetscape and use of public open space. Importantly, it confirms that the reverse – podium area will achive an acceptable environmental performance for use by the public.

Reflectivity

A reflectivety report has been prepared by Arup Pty Ltd (refer **Attachment 26**) and the findings of this analysis conclude as follows;

> ***"3 Conclusions***
> *The proposed building generally performs well in terms of solar reflectivity, and glare is unlikely to exceed the limits of acceptability of the Hassall methodology that could affect drivers on surroundings streets in most of the cases. The only exception would be from the north façade towards point 3. Around the 15th of March at 7.15am the lower reflected solar angle will be lower than 20° (car windscreen cut-off), and the luminance is likely to exceed 500 Cd/m² meaning that disability glare could be produced towards driver's eyes. Proposed external shading devices might be able to reduce that, and no major glare impacts on drivers are expected.*
>
> *From the perspective of building occupants and pedestrians, in any possible location where unwanted reflections are received, the observer is easily able to adjust their view, reducing the impact of the reflections. Pedestrians move at a rate significantly slower than that of a vehicle. It is for this reason that is acceptable to assume that it is safe to divert their vision in order to avoid glare."*

4.8 Noise Impact Assessment

A Noise Impact Assessment report has been prepared by Renzo Tonin Pty. Ltd (refer **Attachment 25**) and concludes as follows;

> ***"8. CONCLUSION***
> *Renzo Tonin & Associates have conducted a noise impact assessment from activities associated with the proposed commercial building at 8 Chifley Square, Sydney.*
>
> *Noise emissions from mechanical plant, car park activities and additional traffic on public roads have been addressed and were assessed in accordance with relevant noise requirements from DECC and the City of Sydney Council. In-principle noise control recommendations have been provided to aid in reducing noise to acceptable levels."*

4.9 Transport and Parking Assessment

A traffic and carparking assessment of the subject development has been undertaken by Colston Budd Hunt & Kafes Pty Ltd (refer **Attachment 14**) which has determined that the proposed development is satisfactory for this site and as follows :

> *"Summary*
> *3.22. In summary, the main points relating to the transport implications of the proposed development are as follows:-*
>
> *(i) the proposed development provides some 21,740m2 of commercial floor space;*

(ii) the site is highly accessible to public transport services;

(iii) the proposed parking provision is considered appropriate;

(iv) access and internal layout arrangements are considered appropriate; and

(v) the surrounding road network will be able to cater for the traffic generated by the proposed development."

4.10 Public Domain

The key elements forming the response to the "Public Domain" are considered and addressed in a variety of reports and plans generally as follows;

- Public Domain/Landscape Plan and Statement (**Attachment 10**)
- Accessibility (**Attachment 27**)
- Public Art (**Attachment 15**)
- Lighting Strategy and Exterior Lighting Concept Plan (**Attachment 28**)
- Exisitng and Proposed Services (**Attachment 20**)

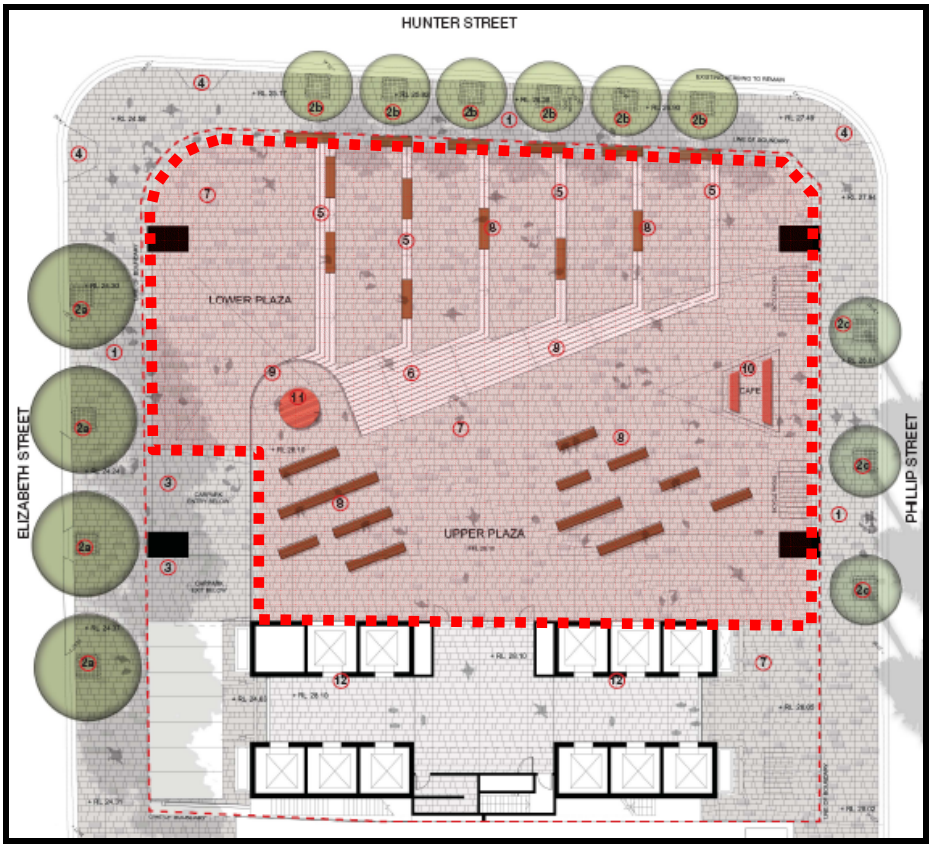
Public Domain/Landscape Concept

The ground plane within the "reverse – podium" comprises two Plaza levels, the Lower Plaza and the Upper Plaza, and together provide 1,120sqm of "Public Domian" which is open to and fully accessible to the public (refer **Figures 14** and **15** below).

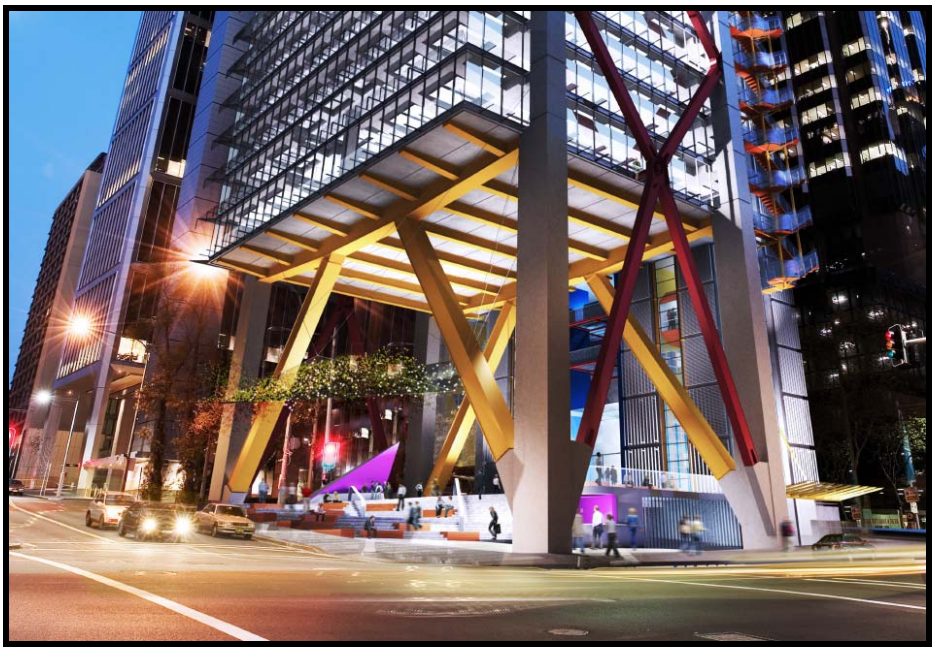
The area of 1,120sqm compares favourably with the passive use area of Chifley Square to the north which features an area of approximately 1,200sqm (excluding adjacent public footpaths).

This area of 1,120sqm equates to approximately 70% of the total site area of the development site and in itself makes a very clear statement about the intent of the reverse – podium space. The area is contiguous with the adjacent "public domain" and is intended to be a place for the public and tenants alike to passively recreate and enjoy the urban landcape and urban vistas over Chifley Square available from the elevated position particularly the Upper Plaza.

Further, the Lower Plaza incorpoates a small retail tenacy adjacent to Elizabeth Street, providing additional activation of this street domain.



F I G U R E 1 4
Public Domain/Landscape Plan with publicly accessible/useable area shaded Red



F I G U R E 1 5
"Reverse – Podium" Public Space seen from Hunter and Elizabeth Streets

Importantly, one of the main functions of this space is all year round useablity, and the accompanying Wind Effects and Wind Tunnel Report (refer **Attachment 24**) and the Shadow Diagrams (refer **Attachment 6**) verify that the Plaza area will be useable year round. The shadow diagrams in particular demonstarte a considerable depth of penetraation of sunlight in mid – winter between 12.00noon and 2.00PM, to the extent that between 65% to 80% of the upper and lower plaza area are in full sunlight between 12.00noon and 2.00pm mid – winter.

In August, notwithstanduing that the increased altitude of the sun is higher, between 50% and 60% of the area being predominantly the Lower Plaza is in full sunlight between 12.00noon and 2.00pm.

The proposal directly responds to the provision of a large public domain area to compliment the existing Chifley Square open public domain area with the "reverse – podium" space to a height of generally 18m to 22m high along Hunter Street and extending around into Phillip and Elizabeth Streets.

A number of photo – montages have been prepared to explain and express the unique attributes of this site and the relationship to the public domain, as detailed in **Attachment 9.** The concept provides for an open podium which would provide cover for it's users and opportunities for activities to be undertaken, as does presently happen in Chifley Square.

Accessibility

Morris-Goding have prepared an accessibility assessment (refer **Attachment 27**) which states in summary as follows;

> *" **1. EXECUTIVE SUMMARY***
>
> *The Access Review Report is a key element in design development of 8 Chifley Square, Sydney an appropriate response to the AS1428 series, Building Code of Australia (BCA), and City of Sydney Access DCP. Morris-Goding Accessibility Consulting has prepared the Access Report to provide advice and strategies to maximise reasonable provisions of access for people with disabilities. The development has been reviewed to ensure that ingress and egress, paths of travel; circulation areas, toilets, lifts and car parking comply with relevant statutory guidelines. In general, the development has accessible paths of travel that are continuous throughout. In line with the reports recommendations, the proposed development has demonstrated a reasonable degree of accessibility.*
>
> *The Development Application drawings indicate that compliance with statutory requirements, pertaining to site access, common area access, accessible parking and accessible sanitary facilities, can be readily achieved. The recommendations in this report are associated with the building design. These recommendations should be addressed prior to construction certificate."*

Public Art Policy

Public Art Strategy prepared by Mirvac Projects Pty Ltd and dated February 2008 (refer **Attachment 15**) and public art installations will be an integral outcome for the success of the reverse – podium space. A contribution of artwork to the public domain needs to take into account a number of factors if it is to be successful and valued by the public. These factors include the following:

- Context;
- Views & Experience;
- Sculptural Opportunities;
- Lighting

It is proposed that a detailed Public Art Brief will be formulated in consultation with Council and implemented prior to the commencement of construction of the reverse – podium.

Exterior Lighting Strategy

The proposed lighting strategy has been developed having regard to the City of Sydney's Lighting Strategy and a Lighting Strategy Statement and Exterior Lighting Concept Plan has been prepared by Arup Pty Ltd (refer **Attachment 28**). The key considerations have naturally been the reverse – podium space, and the roof feature of the building, and these and other matters have been addressed by Arup.

4.11 Energy Efficiency (ESD) and Building Services

The proposed development is designed and configured to achieve a minimum **5 – star ABGR** and **5 – star Green Star** ratings, and the methodologies for meeting both criteria are addressed in the ESD Report prepared by Arup Pty Ltd (refer **Attachment 16**).

> *"**1 Introduction and Executive Summary***
>
> *This report outlines the proposed design intent for the building services (mechanical, electrical and hydraulic) and Ecologically Sustainable Development of the proposed new building at 8 Chifley Square, Sydney CBD. The report has a bias on energy efficiency measures within the design.*
>
> *In accordance with good practice it is intended that sensible and appropriate levels of technology and design be applied to reduce energy wastage and carbon dioxide emissions arising from the operation of the facility both for financial and environmental reasons without reducing the functional standards necessary.*

The design is targeting a 5 star energy performance as measured by the Australian Building Greenhouse Rating (ABGR) scheme.

The air conditioning system will be a modern, passive chilled beam system and under floor air supply. The underfloor supply is a low pressure drop system to minimise fan energy use and increase opportunities for free cooling. A well sealed high performance facade is essential for the proper operation of the chilled beam and underfloor system.

The new HVAC systems are to be adaptable to respond to a range of environmental standards which can vary depending on area function. Systems will, where appropriate, make use of free cooling and differing operating modes in response to external climatic conditions. Where feasible, this will provide an improved level of indoor environmental control as well as improved energy consumption performance. The key energy efficacy initiatives of the mechanical plant are:

• Central cooling and heating plant and controls systems will be new, efficient systems;
• New low energy light sources will be specified;
• Co-generation plant generating electricity and cooling will be used to minimise carbon emissions;
• High performance facade;
• Low pressure drop fans and chilled beams
In addition, the following initiatives are also being investigated;
• Potential for PV cells on roof;
• Ability to naturally vent lift lobbies on all floors when outside conditions are adequate;

Overall, based on preliminary energy analysis of a typical office floor, the predicted energy consumption performance will be 50% less than the 'typical' performance of Sydney CBD offices. The project has targeted a design building energy performance of 5 star ABGR. The design of the building is also achieving a high degree of overall sustainability through water reduction, reduced emissions of items such as CFCs, improved indoor environmental quality and the use of more environmentally friendly materials. A balanced approach to these issues where appropriate leads to a minimum 5 Star Green Star target."

A part of the strategy in achieving industry best practice for energy efficiency is employing state of the art building systems, and the Building Services Report prepared by Arup Pty Ltd (refer **Attachment 22**) summarises the key features of the building services for the proposed development and considers the following matters;

"1 Introduction

Arup has been commissioned by Mirvac AS to provide a multidisciplinary services design for the new commercial office building located at 8 Chifley Square. The services disciplines comprise:

• Mechanical Services;
• Electrical Services;
• Fire and Hydraulic Services;
• Vertical Transportation Services;

The proposed development is a new multi-storey commercial office tower.

The buildings targeted energy performance is five (5) Star in accordance with the Department of Energy, Utilities and Sustainability's (DEUS) Australian Building Greenhouse Rating (ABGR) scheme.

In addition the building is to achieve a minimum five (5) Star Green Star Rating in accordance with Green Building Council of Australia.

The building is being targeted towards premium tenants particularly those in financial and legal professions. The development is therefore being designed in accordance with the Property Council of Australia's (PCA) Premium grade guidelines for commercial office buildings as a minimum benchmark. Review of the typical requirements of the targeted tenant market for the building has identified areas where the design can be improved, providing services at a level over and above the Premium grade requirements of the PCA."

Part 9 of the report has given particular consideration to the "*Stage 1 DA Conditions"* and to the *"City of Sydney Major DA Document Services Requirements".*

4.12 Place Management and Security

The Place Management and Security (CPTED) Report considers practical polices for management of the place in particular the plaza and CPTED design principles as detailed in the report (refer **Attachment 18**) are summarised below;

"The amount of open public space at Ground floor, coupled with the transparent nature of the entry lobby enclosure, allows maximum surveillance by security personnel, as well as tenants who may be exiting the building late at night.

Similarly, the openness at Ground floor allows significant surveillance from outside the site and on approach to it. Areas that may not be under natural or technical (CCTV) surveillance, or other areas that should not have unauthorised public access have controlled access.

Public and private space is clearly distinguished on the ground floor by glass walls and security entry points to the main lift lobbies. Although this is designed to be transparent and open in nature quasi public space, it still provides a clear separation between the public and private domains.

It is anticipated that the public domain areas will be maintained by the building management, and be kept in an inviting and clean manner in order to minimise the potential for crime and to maintain safety and security."

4.13 Waste Management

The Waste Management Report considers waste management practices for the new development (refer **Attachment 19**) and has ensured that on – site storage areas are correctly sized and appropriately accessible.

4.14 Building Code of Australia Assessment and Fire Safety Strategy

An assessment of the compliance of the proposed development against relevant BCA assessment and Fire Safety Strategy Concepts report have been undertaken by Phillip Chun & Associates and Arup Pty Ltd (refer **Attachment 23)** and present an integrated approach where all potential design scenarios have been understood and incorporated into the final DA plans.

.

BCA Assessment

The BCA assessment notes that the development is to utilise the performance provisions of the Building Code of Australia (BCA) and notes that where an alternate fire engineered approach for compliance is required, Arup Pty Ltd have confirmed the suitability of this approach.

Fire Safety Strategy Concepts

The Arup Pty Ltd Fire Safety Strategy (refer **Attachment 23**) concludes as follows;

> ***"5 Conclusion***
> *The concept fire safety strategy has been developed with the input of the design team and the Certifier. It is considered that the strategy for the villages and other fire engineered strategies outlined in this report can be developed to meet the performance requirements of the BCA 2007. As such there are no fire safety reasons to prevent Council from issuing development consent."*

5.0 STATUTORY PLANNING CONSIDERATIONS AND ASSESSMENT OF COMPLIANCE

5.1 Overview

The Environmental Planning and Assessment Act 1979 (the Act) sets the legislative framework for planning in NSW. The Act prescribes those requirements to be considered in respect to the development of land, and in particular, **Section 79C (1)** of the Act sets out those matters to be assessed as follows;

- **Section 79C (1) (a) -** the provisions of:
  - (i) any environmental planning instrument; and
  - (ii) any draft environmental planning instrument that is or has been placed on public exhibition and details of which have been notified to the consent authority; and
  - (iii) any development control plan; and
  - (iv) any matters prescribed by the regulations,

  that apply to the land to which the development application relates.

- **Section 79C (1) (b) -** the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality

- **Section 79C (1) (c) -** the suitability of the site for development

- **Section 79C (1) (d) -** any submissions made in accordance with this Act or the regulations (being the E P & A Regulations 2000)

- **Section 79C (1) (e) -** the public interest

Section 79C (1) (a) is an important assessment consideration, and prescribes the environmental planning instruments and policies that are to be considered in respect to the assessment of development.

Those environmental planning instruments ("EPI's") and policies (ie Development Control Plans) that are relevant to the subject land are detailed in **Section 6.0** below.

The statutory and strategic planning instruments, which guide this proposal, are:

- State Environmental Planning Policy No. 55 - Remediation of Land & City of Sydney Contaminated Land DCP 2004
- Sydney Local Environmental Plan 2005
- Central Sydney Development Control Plan 1996
- City of Sydney Heritage Development Control Plan 2006
- City of Sydney City of Sydney Access Development Control Plan 2004

Other Development Control Plans and Council Policies

- Public Art Policy
- City of Sydney Exterior Lighting Strategy

5.2 State Environmental Planning Policy (SEPP) No.55 – Remediation of Land and City of Sydney Contaminated Land DCP 2004

The object of this State Policy is to provide for a state-wide planning approach to the remediation of contaminated land. It is noted that any such works on site would be classified as "Category 1" (pursuant to Clause 9 of SEPP 55) and accordingly, the Council is required to grant consent to those remediation works.

The Council's "City of Sydney Contaminated Land DCP 2004" provides a comprehensive understanding of the appropriate matters for review and the necessary procedures to be followed in circumstances where any remediation may be required.

A "Site and Remediation Assessment" has been undertaken by Douglas Partners (refer **Attachment 13**) and the subsequent report summarises the potential contamination and remediation issues as follows;

> ***"EXECUTIVE SUMMARY***
>
> *This report presents the findings of a Phase 1 Contamination Assessment conducted by Douglas Partners Pty Ltd (DP) at the Goodsell Building, 8-12 Chifley Square, Sydney.*
>
> *The site fronts Hunter, Elizabeth and Phillip Streets. The project was commissioned by Mirvac Limited, the developers of the proposed construction of a new high rise office tower, for development application purposes.*
>
> *The site covers a rectangular area of approximately 0.152 ha and is currently occupied by the Goodsell Building. The entire site is covered with the building footprint/car park.*

The objective of this assessment was to assess whether the site is suitable for continued commercial use. The current assessment comprises a study of available site history and other relevant information, supplemented by a site inspection. The scope of works does not include intrusive soil or groundwater sampling and hence no detailed comments can be made regarding the subsurface conditions.

As the site has been of commercial office land use since at least 1905 when it was used for Police Offices, the history of the site does not indicate an elevated potential for contamination. The excavation undertaken for the construction of the current basement levels when Goodsell Building was constructed would have resulted practically in the removal of all filling from the site. The test bore logs provided further evidence that the site is founded on sandstone bedrock, with only a veneer of gravel base course filling placed beneath the floor slabs.

On the basis of the available site information, some of the known previous onsite activities (diesel ASTs, cafeteria cooling system and sewerage sump) may theoretically present some potential for localised contamination, however due to the good condition of the concrete basement floor slabs, and the presence of sandstone bedrock immediately beneath the slab, the risk of soil/groundwater contamination is low, as the potential contaminants would have effectively been contained above/sealed by the concrete slab.

From site observations and available information, the overall potential for contamination on-site is considered to be insignificant, given that:

- *The past land use of commercial offices are of low risk;*
- *The practical removal of all filling during the construction of the existing building, which is founded immediately on sandstone bedrock;*
- *Substantial depth to groundwater table such that the potential for contamination migration will be insignificant;*
- *the majority of the site is sealed beneath the concrete basement floor; and*
- *The concrete floor slabs were noted to be in good condition.*

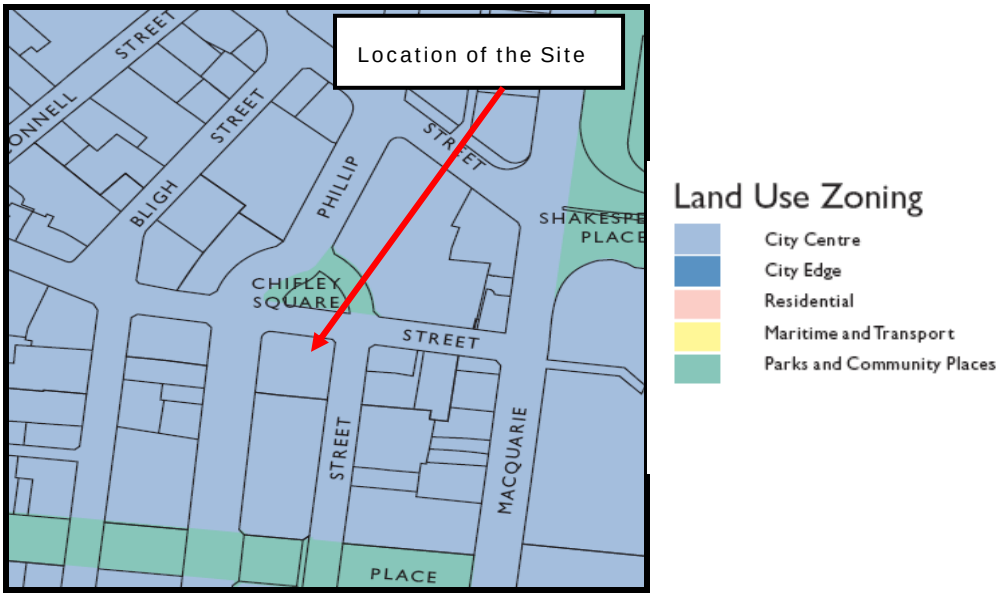
***In summary, the site is considered to be suitable for its proposed redevelopment as a high rise office tower**."*

5.3 Sydney Local Environmental Plan (LEP) 2005

The Sydney Local Environmental Plan 2005 (LEP 2005) was gazetted on 9 December 2005, and prescribes the main land use zoning and development standards applicable to the subject site.

- Zoning and Permissibility

The subject land is zoned "City Centre" pursuant to **Clause 32** of LEP 2005 (refer **Figure 16**) and the properties on immediately adjacent boundaries and in the vicinity are also zoned "City Centre", apart from Chifley Square which is zoned "Parks & Community Places".



F I G U R E 1 6
Zoning Map

Within the City Centre zoning commercial development is permissible on the subject land with consent pursuant to **Clause 37** of LEP 2005.

The relevant objectives are prescribed under **Clause 36** of LEP 2005 as follows;

36 Objectives of the City Centre zone

The objectives of the City Centre zone are:

(a) to encourage Central Sydney's role and growth as one of the Asia-Pacific region's principal centres for finance, commerce, retailing, tourism, cultural activities, entertainment and government,
(b) to permit a diversity of uses which reinforce the multi-use character of Central Sydney,

(c) to facilitate the development of buildings and works that are of a scale and character consistent with achieving the other objectives of this zone,

(d) to provide for increased residential development with appropriate amenity and to ensure the maintenance of a range of housing choice,

(e) to enhance the amenity of parks and community places by protecting sun access,

(f) to ensure wind levels are consistent with pedestrian comfort and the amenity of the public domain,

(g) to ensure satisfactory sky exposure, levels of daylight and ventilation to the public areas of Sydney, including the parks, places, streets and lanes,

(h) to recognise and enhance the character of Special Areas,

(i) to facilitate the conservation of items and areas of heritage significance,

(j) to protect the fine-grained urban fabric of Central Sydney, especially the existing network of streets and lanes, and to provide for high quality development that contributes to the existing urban form,

(k) to extend retail uses on frontages to retail streets,

(l) to provide active frontages to streets.

The proposal for redevelopment of this land is consistent with the intent of the Zone Objectives as

1. The development concept will provide modern, high amenity, energy efficient office accommodation within the city core;

2. The building is to be designed to comply with envelope controls and thus will achieve appropriate solar access to public lands;

3. The building design will be compatible in scale and bulk to other buildings in the locality, including the Deutsche Bank Building, Qantas Building and Chifley Plaza Tower;

4. The design of the proposal has had due regard to the principals of the SLEP 2005 Special Area - "Chifley Square" and,

5. The building design will add to the built form in the City Centre.

On the basis of this advice it is considered that the proposed building will be consistent with the zone objectives.

- **Height**

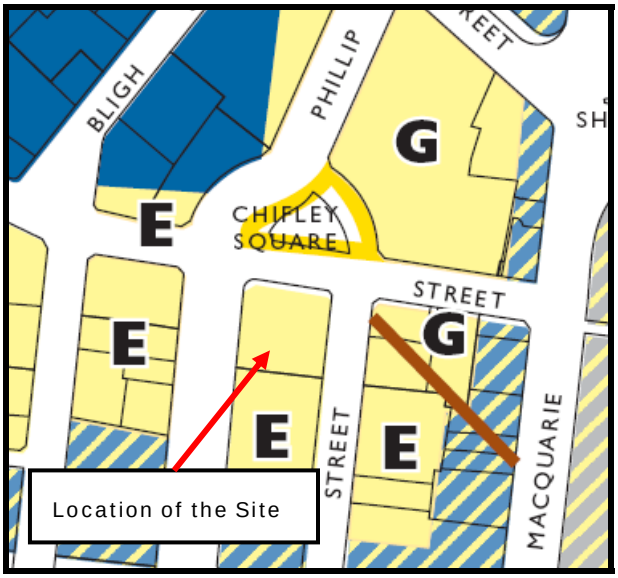
The consideration of the objectives of height for development on the subject land is set down under **Clause 47** of the LEP and identifies a number of considerations as follows;

47 Objectives for control of the height of buildings

The objectives for control of the height of buildings in Central Sydney are:
(a) to allow sunlight access to key areas of the public domain by ensuring that:
(i) further overshadowing of certain parks and community places is avoided or limited during nominated times, and

(ii) existing overshadowing of certain parks and community places is reduced in the long term, and
(b) to provide a transition of building heights between localities and street blocks, and
(c) to provide high quality urban form for all buildings, while maintaining satisfactory sky exposure and daylight:
(i) to the public areas of Central Sydney, including the parks, places, streets and lanes, and
(ii) to existing buildings and to the sides and rear of tower forms, and
(d) to confine ground level wind speeds to velocities which ensure pedestrian comfort and amenity of the public domain, and
(e) to allow for and promote the ventilation of the City by the free movement of air around and between tower structures, and
(f) to provide sun access to significant sandstone buildings in Special Areas in order to improve the ground level environmental quality of public spaces, and
(g) to ensure that tower development occurs on sites capable of providing appropriate urban form and amenity, and
(h) to nominate heights that will provide a transition in built form and land use intensity between the City Centre zone and adjoining lower scale localities within and adjacent to Central Sydney, and
(i) to provide for view sharing along the edges of Central Sydney, and
(j) to ensure an appropriate height transition between new buildings and heritage items or Special Areas.

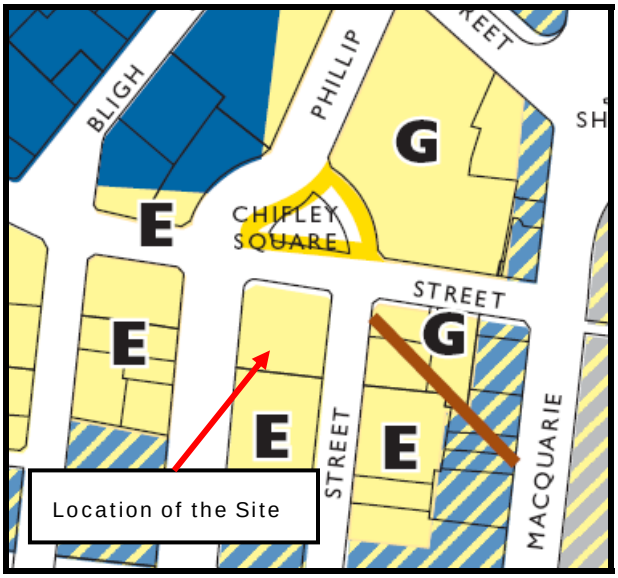
In terms of this particular land, height is controlled by a sun access plane, which is established by **Clauses 48 and 49** of LEP 2005, with the intent of minimizing any impact of overshadowing on Martin Place between 12.00noon and 2.00PM, as demonstrated in the plans and schedule at **Figures 17** and **18** below.



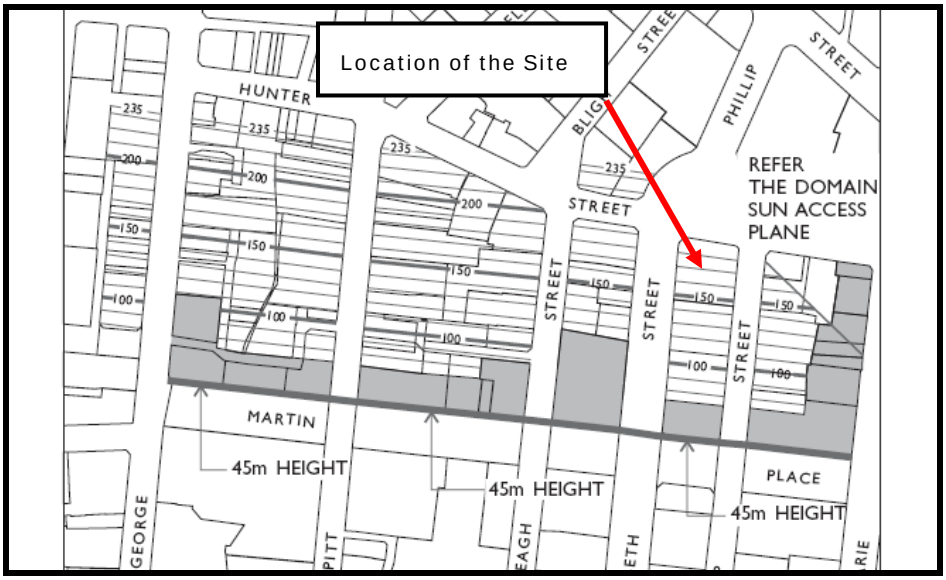
F I G U R E 1 7
Height Plan

(ii) existing overshadowing of certain parks and community places is reduced in the long term, and
(b) to provide a transition of building heights between localities and street blocks, and
(c) to provide high quality urban form for all buildings, while maintaining satisfactory sky exposure and daylight:
(i) to the public areas of Central Sydney, including the parks, places, streets and lanes, and
(ii) to existing buildings and to the sides and rear of tower forms, and
(d) to confine ground level wind speeds to velocities which ensure pedestrian comfort and amenity of the public domain, and
(e) to allow for and promote the ventilation of the City by the free movement of air around and between tower structures, and
(f) to provide sun access to significant sandstone buildings in Special Areas in order to improve the ground level environmental quality of public spaces, and
(g) to ensure that tower development occurs on sites capable of providing appropriate urban form and amenity, and
(h) to nominate heights that will provide a transition in built form and land use intensity between the City Centre zone and adjoining lower scale localities within and adjacent to Central Sydney, and
(i) to provide for view sharing along the edges of Central Sydney, and
(j) to ensure an appropriate height transition between new buildings and heritage items or Special Areas.

In terms of this particular land, height is controlled by a sun access plane, which is established by **Clauses 48 and 49** of LEP 2005, with the intent of minimizing any impact of overshadowing on Martin Place between 12.00noon and 2.00PM, as demonstrated in the plans and schedule at **Figures 17** and **18** below.



F I G U R E 1 7
Height Plan



F I G U R E 1 8
Sun Access Plane Diagram – **"Plane E : Martin Place"**

The proposal complies with the permissible envelope identified for this site as defined by the Martin Place Sun Access Plane.

The maximum permissible height pursuant to the "Sun Access Plane" is to RL 216.8 metres at the intersection of Phillip and Hunter Streets and varies around the other alignments of the site as set out above but to a maximum of 190 metres.

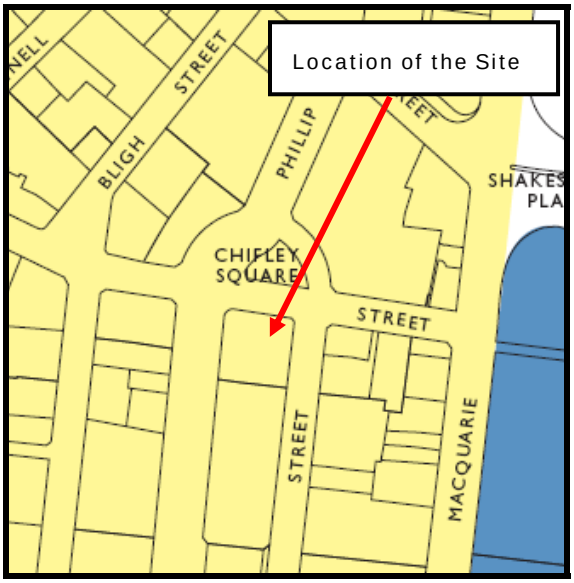
The Stage 2 DA proposal achieves a maximum height to RL 164.4 metres, with two exhaust stakes rising a further 4.5 metres above this level.

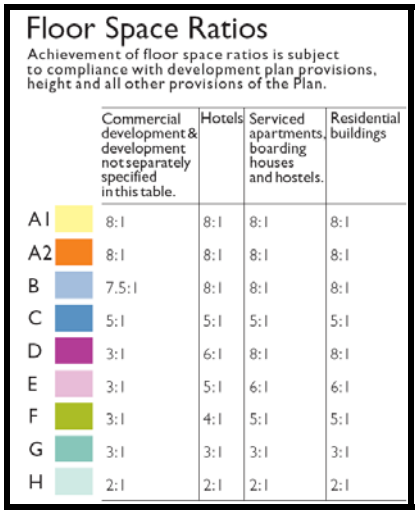
It is relevant to note that whether the FSR was 12.5 : 1 or the 13.75 : 1 as sought, the allowable building height would be well below the maximum permitted by the Sun Access Plane, and accordingly, there can be no adverse impact in terms of overshadowing by virtue of the additional floor space.

- **Floor Space Ratio**

Controls for Floor Space Ratios within the City Centre are set down in the Map for permissible FSR (refer **Figure 19)** where the subject land is identified as being within the "A1 Area" with a permissible maximum FSR of 12.5 : 1 for commercial uses (being 8.0 : 1 + 4.5 : 1) as prescribed under **Clause 54** of LEP 2005.

It is noted that pursuant to **Clause 29(5)** of SLEP 2005, 50% of the Floor Space Area (FSA) above 8 : 1 (to the maximum allowable of 12.5 : 1) must be purchased as Heritage Floor Space (HFS).





Floor Space Ratios

Achievement of floor space ratios is subject to compliance with development plan provisions, height and all other provisions of the Plan.

	Commercial development & development not separately specified in this table.	Hotels	Serviced apartments, boarding houses and hostels.	Residential buildings
A1	8:1	8:1	8:1	8:1
A2	8:1	8:1	8:1	8:1
B	7.5:1	8:1	8:1	8:1
C	5:1	5:1	5:1	5:1
D	3:1	6:1	8:1	8:1
E	3:1	5:1	6:1	6:1
F	3:1	4:1	5:1	5:1
G	3:1	3:1	3:1	3:1
H	2:1	2:1	2:1	2:1

F I G U R E 1 9
Floor Space Ratio Plan : A1 zone under LEP 2005

- **Floor Space Ratio Variation & Assessment**

The provisions of **Clause 10(1)** of LEP 2005 allow

10 Waiver of certain development standards

(1) Consent may be granted to development of land in Central Sydney, or of land in Ultimo-Pyrmont that is not in a master plan area, even though the proposed development contravenes a maximum height or maximum floor space ratio for a building, or a maximum vehicle parking requirement, imposed by a development standard, but only if the consent authority is satisfied that:

(a) all the objectives of the development standard will be fulfilled, and

(b) the contravention will not:

(i) create an undesirable precedent for other development, or

(ii) diminish the overall effect of the development standard for development in the vicinity of the site, and

(c) the particular physical attributes of:

(i) the site, in terms of location, context, slope, site configuration and the like, and

(ii) the proposed development, in terms of urban form, bulk, height, floor space ratio, carparking, and the like,

will render the strict application of the development standard unreasonable or unnecessary in the circumstances, and

(d) the proposed development will improve or contribute positively to the public domain and would achieve design excellence.

The relevant matters required to be considered to allow the waiver are addressed below;

(a) all the objectives of the development standard will be fulfilled, and

The relevant objectives under LEP 2005 state as follows;

53 Objectives for floor space ratio controls

The objectives for the control of floor space ratios in Central Sydney are:

(a) to ensure a degree of equity in relation to development potential for sites of different sizes and for sites located in different parts of Central Sydney, and

(b) to ensure that proposals for new buildings are assessed with due regard to the development plan, design excellence, urban design and built form provisions of this plan, and

(c) to provide a framework for the award and allocation of heritage floor space, and

(d) to provide sufficient floor space for high quality development for the foreseeable future, and

(e) to encourage the provision of residential and visitor accommodation, and

(f) to encourage the provision of certain uses and facilities that provide a public benefit, and

(g) to regulate the density of development and generation of vehicular and pedestrian traffic.

The development intensity of the Stage 2 DA proposal, at a FSR of 13.75 : 1, is well within the approved building envelope which is in compliance with the sun access plane and is consistent with recent development and Stage 2 approvals in the locality.

The potential impacts with reference to overshadowing, wind effects, traffic volumes are all within acceptable parameters, specifically considering that the additional floor space is effectively only 1,976.25 sqm or approximately 2 floors.

The applicable amount of heritage floor space will be purchased to facilitate the additional 10% of FSA.

The subject application adopts the spirit and intent of the design excellence process articulated by LEP 2005, and the Stage 1 DA approval has successfully completed a Design Competition process (refer **Section 2.0** above).

The development generates significant public benefits with regard to the amenity of the public domain and the spatial character of Chifley Square, which is a Townscape Item and within a Special Area as detailed under **Section 4.10** above.

(b) the contravention will not:

(i) create an undesirable precedent for other development, or

(ii) diminish the overall effect of the development standard for development in the vicinity of the site, and

The variation will not set a precedent as the particular circumstances of this case, having read to the location and relationship to Chifley Square and generous compliance with the building height and car parking requirements under LEP 2005 means the site is unique.

In this regard, the effectiveness of the FSR standard will not be diminished.

(c) the particular physical attributes of:

(i) the site, in terms of location, context, slope, site configuration and the like, and

(ii) the proposed development, in terms of urban form, bulk, height, floor space ratio, carparking, and the like,

will render the strict application of the development standard unreasonable or unnecessary in the circumstances, and

The variation will not set a precedent as the particular circumstances of this case, having regard to the location and relationship to Chifley Square and generous compliance with the building height and car parking requirements under LEP 2005 means the site is unique.

In this regard, strict application of the FSR standard is unnecessary.

(d) the proposed development will improve or contribute positively to the public domain and would achieve design excellence.

The subject application adopts the spirit and intent of the design excellence process articulated by LEP 2005, and the development generates significant public benefits with regard to the amenity of the public domain and the spatial character of Chifley Square, which is a Townscape Item and within a Special Area.

In urban design terms, the subject site has a substantial capacity, being within a generous visual catchment, and the additional 2 floors will enhance the appreciation of the urban environment through the achievement of a higher more substantial building which is necessary to form a strong urban edge to Chifley Square.

In fact, subject to compliance with the sun access plane, which is achieved, a higher more robust building form is seen as desirable.

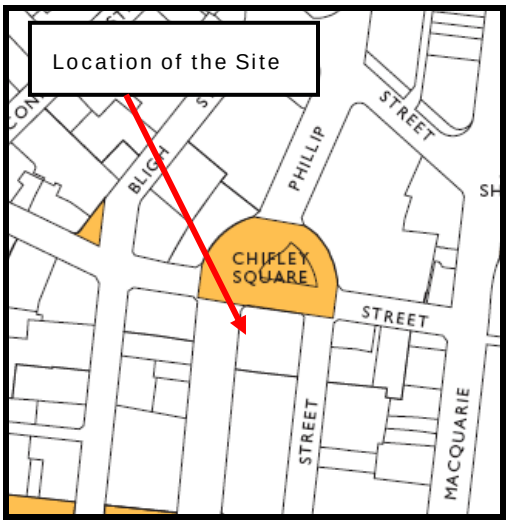
On the basis of the assessment above, is considered that the subject site merits the waiver of strict compliance with the FSR control of 12.5 : 1, and accordingly, the Stage 2 DA merits the award of a maximum FSR of 13.75 : 1.

- Heritage

Part 6 of LEP 2005 address heritage matters in the City centre, and the objectives are prescribed at Clause 67 as follows;

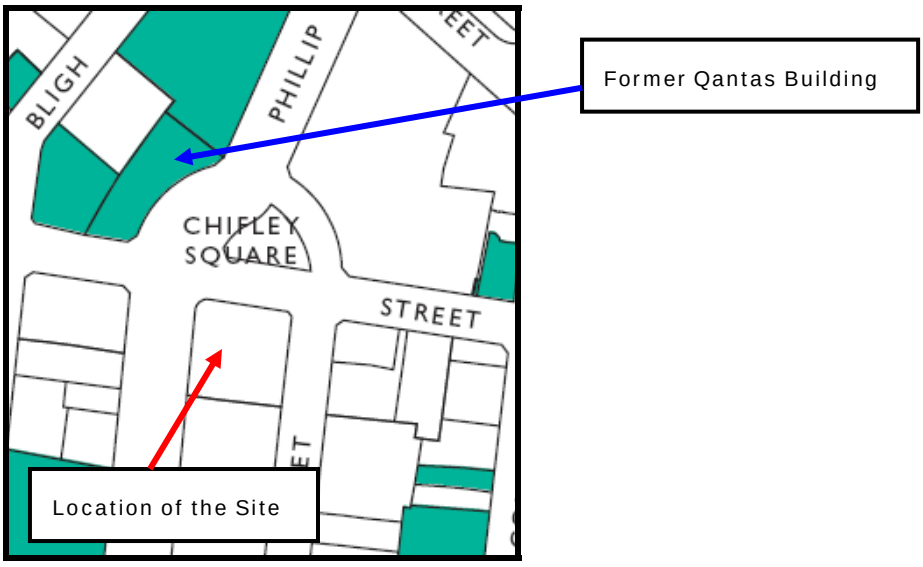
> ***"67 Objectives***
> *The objectives of the heritage provisions are:*
>
> > *(a) to conserve the heritage of Central Sydney, and*
> > *(b) to integrate heritage conservation into the planning and development control processes, and*
> > *(c) to provide for public involvement in heritage conservation, and*
> > *(d) to ensure that any development does not adversely affect the heritage significance of heritage items, and*
> > *(e) to provide greater certainty in the management of the heritage of Central Sydney, and*
> > *(f) to encourage high quality design and the continued use or adaptive re-use of heritage items."*

The subject site is situated adjacent to an Item of Townscape Heritage, being Chifley Square (***CSHI 8078)*** as detailed in **Figure 20** below.



F I G U R E 2 0
Heritage Townscape Plan

In addition, the subject site is situated in the vicinity of an Item of Heritage being the former Qantas Building at No 1 Chifley Square, as detailed below in **Figure 21.**



F I G U R E 2 1
Heritage Items

The relevant assessment criteria in respect of these items of heritage are prescribed in **Clause 74** of LEP 2005 as follows;

> ***"74 Development within the vicinity of a heritage item***
> *The consent authority, when considering an application for development within the vicinity of a heritage item, must take into account the impact of the proposed development on the heritage significance of the heritage item."*

The Heritage Statement (refer **Attachment 11** and **Section 4.4 above**) supports the design and contextual contribution made by the new building which will have a positive reinforcement role of the urban townscape of Chifley Square.

Further, the Heritage Assessment undertaken as a part of the Stage 1 DA and the Stage 1 DA consent have approved the demolition of the exisitng building on the site.

- **Special Area – Chifley Square**

Part 7 of the LEP 2005 refers to Special Areas and details a number of specific elements which characterise a Special Area.

> ***"78 Identification of Special Areas***
> *Special Areas are considered to be of significance in terms of the heritage conservation, urban design and planning management of Central Sydney and are shown on the Central Sydney Special Areas Map."*

The Special Area for Chifley Square (No. 14) is detailed in **Figure 22** below.

F I G U R E 2 2

Special Area Plan – "**(14) Chifley Square"**

Part 7 - Clause 77 of LEP 2005 prescribes the relevant objectives for all Special Areas as follows;

> ***"Part 7 – Special Areas***
>
> ***77 Objectives for the controls for Special Areas***
>
> *The objectives for the controls for Special Areas are:*
>
> *(a) to protect Special Areas from development incompatible with the particular character and significance of each Special Area and to retain and enhance its unique character, and*
>
> *(b) to reinforce the distinctive attributes and qualities of the built form of Special Areas by ensuring that development has regard to the fabric and prevailing character of each Area in scale, proportions, street alignment, materials and finishes, and*
>
> *(c) to conserve and protect heritage items and their settings, and*
>
> *(d) to maintain a high level of daylight access to streets, lanes, parks and other public domain spaces, and*
>
> *(e) to encourage active street frontages to the public domain, and*
>
> *(f) to conserve, maintain and enhance existing views and vistas to buildings and places of historic and aesthetic significance within Special Areas."*

Clause 79 of LEP 2005 prescribes the relevant objectives for the Chifley Square Special Area as follows;

> ***"79 Objectives for each Special Area***
>
> *The consent authority, in considering a development application for land in a Special Area, must have regard to the following matters:*
>
> *(a) the development plan provisions of this plan,*
>
> *(b) the objectives for the controls for Special Areas set out in clause 77,*
>
> *(c) the character statement and the specific objectives for the Special Area, as set out in Schedule 6,*
>
> *(d) the Central Sydney Heritage Inventory maintained by the Council, and any conservation management plan, heritage impact statement or urban design study required by the consent authority,*
>
> *(e) any plan of management required by the consent authority,*
>
> *(f) the provisions of any relevant development control plan or policy adopted by the Council."*

With reference to the **Chifley Square Special Area Character Statement**, this states that:

Schedule 6 Character statements and objectives for Special Areas

(Clause 79 (c))

14 Chifley Square

Character Statement

The original concept of the semi-circular form was first proposed by John Sulman in 1908. The same concept resurfaced in 1937 and was proposed by City Engineer Garnsey, as a means of relieving traffic congestion at the junction of Hunter and Elizabeth Streets. The scheme was implemented in 1947. The completion of Qantas House, with a curved form, in 1957 made a major contribution to the creation of Chifley Square. The place was officially named "Chifley Square" in 1961 in honour of the late Hon J.B. Chifley, former Prime Minister of Australia, and a year later Elizabeth Street was extended creating a public square with a traffic island in the middle. The final semi-circular form of the Square was formed with the completion of Chifley Tower in 1993 to the east of the Square, which completed the curved form of Qantas House to the west. The building was designed by an international designer and follows the picturesque romantic skyscraper style of the early 20th century American office towers. ***The detailed elements of the building, whether at street or upper levels exhibit a rather lofty and imposing presence, expressing the corporate nature of the building, which is entirely appropriate by virtue of its location in the financial core of the city. Further public domain works were implemented in 1996-1997 to reclaim the Square, improve its quality and create a sophisticated public plaza. The area is characterised by large-scale high rise tower buildings interspersed with lower scale development.*** *Despite the fact that the majority of the towers at the edges of the Square are seen as individual elements within the cityscape, they follow the street alignment at lower levels, with a curved alignment to the north creating a distinct sense of enclosure for the Square. The curved form of the Square and the recent Aurora Place to the east, visible within this setting, create a unique urban landscape within the Sydney CBD and provide a visual relief and break in the intensely built up area of the financial centre.*

The highlighted extracts above are particularly relevant to the current proposal, and the demolition of the existing building will make way for a new development which will better articulate the important character of Chifley Square and its environs.

In terms of the **Chifley Square Special Area,** the relevant objectives are as follows:

"Objectives

The objectives for this Special Area are as follows:

(a) to recognise and enhance Chifley Square as one of the major public open spaces in the heart of the financial centre of the city,

(b) to promote and encourage the use of the space as a destination and meeting place for people,

(c) to interpret the history of the place and its evolution in the design of both public and private domain and create a distinct sense of place inherent in the character of Chifley Square,

(d) to reinforce the urban character and distinct sense of enclosure of Chifley Square by emphasising and reinforcing the semi-circular geometry of the space, requiring new buildings to be integrated with the form of existing buildings and limiting the height of new buildings,

(e) to protect and extend sun access to the Square during lunchtime hours from mid-April to the end of August,

(f) to unify the Square and improve the relationship between the space and the buildings forming it."

The subject application adopts the spirit and intent of the design excellence process articulated by LEP 2005, and the development generates significant public benefits with regard to the amenity of the public domain and the spatial character of Chifley Square, which is a Townscape Item and within a Special Area.

The height, scale and form of the building envelope is compliant with Council's controls, and the "reverse – podium" design contributes positively to the spatial character of Chifley Square opposite and the streetscape generally. The "reverse - podium" form provides public domain of significant architectural merit and will provide a high quality of amenity for the public.

There are no adverse impacts arising from the absence of a setback above street wall height, and the resultant building form is consistent with similar forms evident in adjacent and nearby development, particularly the Deutsche Bank Place building to the east.

The site forms an important part of the streetscape vistas from the north and along Phillip Street from the south, and the reverse – podium void extending between Elizabeth Street and Phillip Street will enhance the public domain, and provide a visual connection to the open space of Chifley Square opposite.

Accordingly, all relevant requirements for the Chifley Square "Special Area" are assessed as being met, and indeed, it is concluded that this important civic space will be enhanced by the proposal.

- Car Parking

Clause 65 - Tenant car parking provisions of SLEP 2005 applies to the subject site and requires that parking provided in relation to a use or a building must not exceed the maximum set out in the following formula;

$$\textit{Commercial/Retail Development} = \frac{\textit{Site Area}}{50}$$

Sub-Clause (9) is relevant and states as follows;

> *"(9) A maximum number of car spaces set by this clause is to be rounded up to the nearest whole number if it is not a whole number."*

Accordingly, the maximum number of car parking spaces permitted on the subject site is 32 cars.

It is noted that parking for service and delivery vehicles, motorcycle parking, bicycle parking and car parking for people with mobility impairment are in addition to the requirement for 32 cars and the relevant requirements have been met (refer **Table 5**).

- Summary of Assessment under LEP 2005

The degree of compliance as assessed above is summarised in **Table 5** below.

TABLE 5: Consideration of the Sydney LEP 2005

Matter to be considered	Compliance	Comment
CHAPTER ONE		
Part 5 – Urban Form & Design Excellence **Clause 26** – Design Excellence	Yes	The Stage 2 DA has been prepared in accordance with the provisions of Part 5 of LEP 2005, and has successfully completed a Design Competition process.
CHAPTER TWO		
City Centre Zoning **Clause 36** – City Centre Zone Objectives	Yes	The proposed development satisfies the relevant objectives of this zone. In this regard, the development: ▪ Proposes an appropriate building form and use that provides business opportunities in the area; ▪ Improves the safety and security of the site with increased surveillance; and ▪ Activates the street frontages

Clause 37 – Use & Development	Yes	The proposal is permissible with development consent.
Part 3 – Height of Buildings **Clauses 48 & 49** – Height	Yes	The Stage 2 DA height complies with the height control as prescribed by the Sun Access Plane.
Part 4 – Floor Space Ratio **Clause 54** – Maximum FSR Maximum FSR is 12.5:1 (A1)	Yes	The development proposes a total FSR of 12.5 : 1.
CHAPTER ONE – Part 1 ***Clause 10 - Waiver of certain development standards*** *(1) Consent may be granted to development of land in Central Sydney, or of land in Ultimo-Pyrmont that is not in a master plan area, even though the proposed development contravenes a maximum height or maximum floor space ratio for a building, or a maximum vehicle parking requirement, imposed by a development standard, but only if the consent authority is satisfied that:*	Yes	An additional 10% of 1.25 : 1 of FSR is sought under the waiver provisions as addressed previously.
Part 6 – Parking On-site basement parking. Maximum of 32 spaces	Yes	Refer to the Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**
Part 6 - Heritage Clause 67 – Objectives Clause 74 – Development in the vicinity of heritage Items	Yes Yes	A Heritage Statement has been prepared by Tropman & Tropman and is provided in **Attachment 11**.
Part 7 - Special Areas Clause 77 – Objectives Clause 79 : (14) – Chifley Square	Yes Yes	A Heritage Statement has been prepared by Tropman & Tropman and is provided in **Attachment 11**. A Heritage Statement has been prepared by Tropman & Tropman and is provided in **Attachment 11**.

It can be seen from the table that the replacement development achieves full compliance with the statutory provisions under the LEP 2005.

5.4 Central Sydney Development Control Plan (DCP) 1996

The Central Sydney DCP has been prepared to provide more detailed provisions relating to assessment of development than are contained within the Central Sydney LEP 1996.
The provisions contained within the DCP support development that will:

- protect and enhance the public domain; and
- contribute to the prosperity and character of Central Sydney.

The proposal has been assessed against the provisions of the Central Sydney DCP 1996 and the degree of compliance is summarised in **Table 6** below:

TABLE 6: Consideration of the Central Sydney DCP 1996

Matter to be considered under CSDCP 1996	Compliance	Comment
SECTION 2 – BUILDING FORM AND CHARACTER		
Clause 2.1 – Building to the street alignment **Provisions** 2.1.1 **New buildings are to have street frontages built predominantly to the street alignment** (see Figure 2.3). 2.1.2 Circumstances where building predominantly to the street alignment may be inappropriate include development where:	Yes	The main building envelope is aligned with all 3 street frontages except at ground where the "reverse – podium" provides for areas of public domain and activation.
Clause 2.2 – Street Frontage Heights 2.2.1 **The street frontage height of a new building is to be between 20 metres and 45 metres above street ground level** (see Figure 2.4), except in certain Special Areas where specific street frontage heights are nominated – see Section 2.4. Within this range, the street frontage height should have regard to:		It is assessed that, having regard to the character of existing built form in Hunter Street, and considering the east/west alignment of Hunter Street, that an envelope with a zero setback above street wall height is appropriate and meets the intent of minimising negative effects relating to daylight access and wind effects (refer **Note A – Section 2.4** above).

(i) the street frontage heights of adjacent buildings, (ii) the predominant street frontage height in the vicinity of the proposed building, (iii) the location of the site in the street block, ie., corner sites can generally include special design emphasis, such as increased street frontage height of one or two storeys compared with adjacent sites (see Figure 2.7), (iv) site size. ie. small sites (less than 1,000 square metres) may attain a street frontage height of 45 metres regardless of the above criteria.	Yes Yes Yes N/A	No less, there are strong urban design arguments in favour of a zero setback above a street wall height as articulated below; (a) The site forms an important part of the streetscape vistas from the north and along Phillip Street from the south, and the reverse – podium extending between Elizabeth Street and Phillip Street will enhance the public domain, and provide a visual connection to the open space of Chifley Square opposite. (b) While the building will be less prominent looking north along the alignments of Elizabeth and Phillip Street, the unique street level environment created by the reverse – podium of generally 18 to 22 metres will be seen as being contiguous with the spatial environment of Chifley Square from the closer view. (c) The height, scale and form of the building is compliant with Council's controls, and the "reverse – podium" design contributes positively to the spatial character of Chifley Square opposite and the streetscape generally. The "reverse - podium" form provides public domain of significant architectural merit and will provide a high quality of amenity for the public.
Clause 2.3 – Front Setbacks 2.3.1 **Above the street frontage height, buildings are to be set back a weighted average of 8 metres. This setback may be reduced in part by up to 2 metres (to achieve architectural variety) provided the weighted average setback from the street frontage alignment is 8 metres (see Figure 2.8). No part of the building is to be set back less than 6 metres.**		The southern alignment of the subject site is the "rear" boundary and the applicable control is ambiguous.

Side and rear setbacks 2.3.6 Above a height of 45 metres, windows or balconies of commercial buildings are to be set back at least 3 metres from side boundaries (see Figure 2.11).	Yes/No	This issue is assessed further in **NOTE 1 BELOW**.
Clause 2.3 – Front Setbacks for Special Areas	N/A	There is no special front setback requirement prescribed for the Chifley Square Special Area (refer to **Clause 2.3**)
Clause 2.5 – Street frontage activities 2.5.2 **Buildings with frontages to major pedestrian streets** (see Figure 2.27) are to contribute to the liveliness and vitality of those streets by providing one or more of the following at ground level: (i) retailing, food/drink outlets, customer counter services or other activities which provide pedestrian interest, (ii) enclosed shopfronts with window displays of goods and services within, and/or artworks (see Figure 2.28), (iii) open shopfronts to food outlets and/or interiors with tables and chairs for diners, (iv) indoor queuing space for activities that may involve queuing (including automatic teller machines) so that footpaths remain free for pedestrian movement. Recesses in the street alignment for these activities are inappropriate. (v) a high standard of finish for shopfronts. Non-retail uses at street level may not be approved in major pedestrian streets if the consent authority considers that there would be an over concentration of such uses or a fragmentation of the retail frontage	Yes	The main building form is aligned with all 3 street frontages except at ground level where the podium – void provides for areas of public domain and activation. **Elizabeth Street** is identified as a major pedestrian street, and the design of the ground plane (Lower Plaza) provides an activated inviting space which is to be anchored by a small retail tenancy.
2.5.3 **Buildings with frontages to all other streets and lanes** are to contribute to the liveliness and vitality of these streets by: (i) providing visual interest, (ii) providing well designed and attractive entrances, lobbies and	Yes	The Phillip Street and Hunter Street alignments fall within **Clause 2.5.3** and rely upon the at

commercial uses at ground level, (iii) incorporating, where practicable, either open or enclosed shopfronts with window displays of merchandise or services within, and/or artworks, (iv) providing enclosure on corner sites to define the corner.		– grade access to the Upper and Lower Plaza levels to maintain an interaction and activation of the adjacent street alignments.
2.5.4 Ground floor uses are to be at the same level as the footpath. Split level arcades or open retail forecourts at a different level to the footpath are inappropriate because they separate the activities within them from the street.	Yes	Refer Public Domain/Landscape Plan and Statement – **Attachment 10.**
2.5.5 The ground floor of all development is to be flush with the street footpath for the predominant level of the street frontage and at the main entry to the building.	Yes	Refer Public Domain/Landscape Plan and Statement – **Attachment 10.**
Clause 2.6 – Building Bulk **Commercial buildings** 2.6.1 Above a height of 120 metres, the size of the floorplate of commercial buildings is not to exceed 1,400 square metres FSA, or 25% of the site area, whichever is greater (see Figure 2.29).	Yes	Building height is 136 metres (max) and complies with the max floor plate areas (refer **Table 2** above).
Clause 2.7 – Building exteriors 2.7.1 Adjoining buildings (particularly heritage buildings) are to be considered in the design of new buildings in terms of: (i) building to the street alignment, (ii) street frontage heights (see Figure 2.5), (iii) setbacks above street frontage heights, (iv) facade proportions including horizontal or vertical emphasis and (v) the provision of enclosed corners at street intersections.	Yes	Refer Architects Design Statement and Schedule of Materials and Finishes (**Attachments 5 and 8**).
2.7.2 Building exteriors are to be designed with regard to the following criteria:	Yes	Refer Materials and Finishes Schedule (**Attachment 8**) and the Photo-montages (**Attachment 9**).

(i) the predominant masonry character and articulation of Central Sydney is to be reinforced, particularly at lower levels of buildings,	Yes	Refer Materials and Finishes Schedule (**Attachment 8**) and the Photo-montages (**Attachment 9**).
(ii) materials used (including glass) are to be predominantly light in colour to gain better quality reflected light into the streets and to reflect the characteristic light colours of Central Sydney,	Yes	Refer Materials and Finishes Schedule (**Attachment 8**) and the Photo-montages (**Attachment 9**).
(iii) extensive expanses of blank glass or solid wall are to be avoided. Where development exposes the blank side of an adjoining building, a visually interesting treatment should be applied to that wall.	Yes	Refer Materials and Finishes Schedule (**Attachment 8**) and the Photo-montages (**Attachment 9**).
2.7.3 Minor projections from building walls (beyond those permitted by the Building Code of Australia) that extend into the public space are permitted providing there is a public benefit and that the projections do not detract from significant views and vistas. Examples of such projections are (see Figures 2.33 and 2.34): • expressed cornice lines that assist in enhancing the streetscape, • other projections such as entry canopies and bay windows that give visual interest.	Yes	The sunshading screens to the northern alignment will project over the boundary to a small extent on the Hunter Street alignment. The sunhading screens to the western and eastern alignments are within the adjacent street boundaries.
2.7.4 Balconies and terraces should be provided, particularly where buildings overlook parks and on low rise parts of buildings. Gardens on the top of setback areas of buildings are encouraged.	N/A	
2.7.5 The tops of buildings are to be designed so that they: (i) integrate with the design of the building and conceal plant and equipment (see Figure 2.36), (ii) provide a minimum step height of two storeys (see Figure 2.37), (iii) promote a visually distinctive and interesting Central Sydney skyline.	Yes N/A Yes	The proposal has been design to feature an architectural element at roof level which will contribute to the City skyline (refer Montages – **Attachment 9**), and all plant is concealed within the 4 level small – plate areas to the south of the roof terrace at Level 30.

SECTION 3 – PEDESTRIAN AMENITY		
Clause 3.3 – Restriction of vehicle access and footpath crossings **Location of Vehicle Access** 3.3.1 New vehicle access points are restricted in retail streets and are not favoured in pedestrian priority places (see Figure 3.5). Where practicable, vehicle access is to be from lanes and minor streets rather than major pedestrian streets.	Yes	A Traffic and Parking Assessment Report, prepared by Colston Budd Hunt & Kafes can be found in **Attachment 14**.
3.3.2 Service vehicle access is to be combined with parking access and limited to a maximum of one access point per building.	Yes	A Traffic and Parking Assessment Report, prepared by Colston Budd Hunt & Kafes can be found in **Attachment 14**.
3.3.3 Where practicable, adjoining buildings are to share or amalgamate vehicle access points. Internal on-site signal equipment is to be used to allow shared access. Where appropriate, new buildings should provide vehicle access points so that they are capable of shared access at a later date.	N/A	
3.3.4 Vehicle access may not be required or may be denied to some heritage buildings, subject to a Conservation Plan. Design of Vehicle Access	N/A	
3.3.5 Wherever practicable, vehicle access is to be a single crossing with a nominal width of 2.7 metres over the footpath, and perpendicular to the kerb alignment. In exceptional circumstances, a double crossing with a nominal width of 5.4 metres may be permitted for safety reasons (see Figure 3.6).	Yes	A two way access ramp system is proposed off Elizabeth Street and is addressed in the Traffic and Parking Assessment Report, prepared by Colston Budd Hunt & Kafes can be found in **Attachment 14**.
Clause 3.5 - Awnings & Colonnades **Awnings** 3.5.1 Awnings are to be provided to the full extent of the street frontage of buildings in the		

locations nominated in Figure 3.9, except in cases where: (i) there is no existing continuity of awnings on buildings within the same block on the same side of the street, (ii) there would be a major adverse impact on a heritage streetscape. 3.5.2 Awnings may be considered on other streets subject to urban design and heritage considerations. 3.5.3 All awnings are to be designed and provided in accordance with the Council's *Policy and Guidelines for Awnings*.	N/A Yes Yes	Partial awnings are provided to the Elizabeth Street alignment and the Phillip Street alignment. Otherwise extensive weather protection is provided to the ground plane by virtue of the reverse – podium void and accessibility.
Clause 3.6 – Artworks 3.6.1 High quality artworks in new development are to be provided in publicly accessible locations such as near main entrances, lobbies and street frontages (see Council's *Public Art Policy* and Figure 3.10).	Yes	The reverse podium plaza and building lobby will accommodate artwork in accordance with the Public Art Strategy (refer **Attachment 15**)
Clause 3.7 – Footpath Paving 3.7.1 Footpath paving is to be provided in accordance with Council's *Footpath Paving Design Policy* in the following paving types (see Figure 3.11):	Yes	The footpath will be suitably paved according to pavement type as nominated in the DCP. (refer Public Domain/Landscape Plan in **Attachment 10**).
Clause 3.8 – Easy access 3.8.1 All buildings are to be designed in accordance with Council's *Access Policy.* 3.8.2 The main entry to new buildings for the general public is also to be the entry designed and identified for use by people with mobility impairments. For this reason main entries consisting only of revolving doors will be discouraged.	Yes Yes	The main pedestrian entry points are located on Elizabeth and Phillip Streets to the Lower and Upper Level Plazas respectively and meet required standards. (Refer Accessibility Statement in **Attachment 27**)

3.8.3 The main entry is to be level with the street footpath where practicable, and should be located in a continuous level path of travel to the lift core (see Figure 3.12).	Yes	Refer Accessibility Statement (**Attachment 27**)
SECTION 4 – ENVIRONMENTAL MANAGEMENT		
Clause 4.1 – Sunlight to publicly accessible spaces 4.1.1 Shadowing effects of new buildings on publicly accessible space are to be considered for the hours of 12 noon to 2 pm between 14 April and 21 June. 4.1.2 Depending on the nature and use of a particular space, periods outside 12 noon to 2 pm may also be required to be considered under Section 90 of the *Environmental Planning and Assessment Act 1979*. This consideration may result in the need for modification of shadow impact outside the 12 noon to 2 pm period.	Yes N/A	The site is not situated in close proximity to any significant public places and meets the Martin Place Sun Access Plane requirements as setout in LEP 2005. Refer Shadow Diagrams in **Attachment 6**.
Clause 4.2 – Wind Standards 4.2.1 To ensure public safety and comfort (see Figure 4.2) the following maximum wind criteria are to be met by new buildings: • 10 metres/second in retail streets (see Figure 2.27), • 13 metres/second along major pedestrian streets, parks and public places (see Figure 2.27), • 16 metres/second in all other streets. 4.2.2 Building design should minimise adverse wind effects on recreation facilities on open terraces within developments. 4.2.3 A Wind Effects Report is to be submitted with the DA for all buildings taller than 45 metres above street level.	Yes Yes Yes Yes	Refer Wind Effects Report and Wind Tunnel Test results contained in **Attachment 24**. Refer Wind Effects Report and Wind Tunnel Test results contained in **Attachment 24**. Refer Wind Effects Report and Wind Tunnel Test results contained in **Attachment 24**. The Wind Effects Report prepared by CPP (Refer **Attachment 24**.)

Clause 4.3 – Energy efficiency of buildings 4.3.1 An Energy Efficiency Report is required to accompany the DA for any new building with a construction cost of $1 million or more.	Yes	A building services/energy efficiency report has been prepared by Arup Pty Ltd and is provided in **Attachment 16.**
Clause 4.4 – Noise reduction 4.4.1 All residential buildings and serviced apartments are to be constructed so that the repeatable maximum L Aeq (1 hour) level does not exceed the maximum noise levels specified in Clauses 6.1.14, 6.1.15 and 6.1.16 4.4.2 The consent authority may require a Noise Impact Assessment Report to accompany a DA.	N/A Yes	Renzo Tonin Pty Ltd have prepared a Noise Impact Assessment - Refer **Attachment 25.**
Clause 4.5 – Reflectivity 4.5.1 New buildings and facades should not result in glare that causes discomfort or threatens safety of pedestrians or drivers. 4.5.2 Visible light reflectivity from building materials used on the facades of new buildings should not exceed 20%. 4.5.3 A Reflectivity Report that analyses the potential solar glare from the proposed new development on pedestrians or motorists may be required.	Yes Yes Yes	Arup Pty Ltd have prepared a Reflectivity Report - Refer **Attachment 26** and any identified glare or reflectivity is within appropriate limits. Refer **Attachment 26.** Arup Pty Ltd have prepared a Reflectivity Report - Refer **Attachment 26.**
Clause 4.7 – External lighting of buildings 4.7.1 Any external lighting of buildings is to be considered with regard to : (i) the integration of external light fixtures with the architecture of the building (for example, highlighting external features of the building), (ii) the contribution of the visual effects of external lighting to the character of the building, surrounds and skyline,	Yes Yes	Refer Lighting Strategy Report and Exterior Lighting Concepts Report in **Attachment 28** prepared by Arup Pty Ltd.

(iii) the energy efficiency of the external lighting system, (iv) the amenity of residents in the locality, (v) the impact on the night sky, having particular regard to observed effects from Sydney Observatory.	Yes N/A Yes	
SECTION 5 – ON-SITE PARKING		
Clause 5.1 – Design and location of on-site parking **Traffic and Parking Report** 5.1.1 Where any proposed development includes on-site parking, a Traffic and Parking Report is required.	Yes	The basement car parking is designed to comply with the Council's parking requirements with the maximum entitlement of **32 car parking spaces.** The Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**
5.3 Parking for people with mobility impairment 5.3.1 Car parking for people with mobility impairment is to be provided in accordance with Australian Standard 2890.1 This requires a minimum of 1-2% of parking spaces to be provided and appropriately designated for use by people with mobility impairments.	Yes	**One (1) disabled parking space** has been provided in accordance with relevant requirements – Refer Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**
5.4 Delivery and service vehicles 5.4.1 The following requirements apply to new development for the provision of parking spaces for delivery and service vehicles: (i) Commercial premises 1 space/3,300 sqm FSA or part (ii) Retail 1 space/350 sqm FSA or part (iii) Residential buildings 1 space for first 50 dwellings/ and Serviced Apartments serviced apartments 0.5 spaces for every 50 dwellings/apartments thereafter. (v) Hotels 1 space/50 hotel bedrooms (vi) Wholesale, industrial 1 space/700 sqm FSA or part	Yes	The basement car parking is designed to comply with the Council's parking requirements with the maximum entitlement of **2 truck loading/delivery vehicle spaces** and **4 courier spaces** – Refer Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**

(vi) Other uses 1 space for 1,750 sqm FSA or part 5.4.4 Provision is to be made for courier parking spaces (including bicycle parking facilities) near vehicle entry points and near lifts. 5.4.5 Well positioned signs to parking facilities are to be provided for all couriers, including bicycle couriers.	Yes Yes	Refer Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.** To be complied with per conditions of consent.
5.5 Bicycle parking 5.5.1 Facilities for cyclists are to be provided in all buildings that provide onsite car parking. Facilities include parking for bicycles and at least one readily accessible shower change room. 5.5.2 Bicycle parking space should equal at least one car parking space for every 100 car parking spaces or part thereof.	Yes Yes	Bicycle parking has been provided for **128 spaces** (for tenants) in the basement level B2 together with change rooms and showers, and **28 visitor bicycle spaces** are provided at Upper Plaza level off Phillip Street in accordance with Council controls – Refer Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**
5.6 Motorcycle parking 5.6.1 Motorcycle parking is to be provided in all buildings that provide on-site car parking, and is to be equal to at least one car parking space for every 100 car parking spaces or part thereof.	Yes	. A total of **4 spaces** have been provided in the basement – Refer Traffic and Parking Assessment Report by Colston Budd Hunt & Kafes Pty Ltd at **Attachment 14.**

The proposal generally complies with the development standards of the Central Sydney DCP 1996 except as addressed below.

NOTE 1: Clause 2.3 - Building setbacks

The relevant provisions relating to boundary setbacks are contained in **Clause 2.3** of CSDCP 1996, and the stated objectives are as follows;

> ***"Side and Rear Setbacks***
>
> *Side and rear setbacks, where provided, allow ventilation, daylight access and view sharing, increase privacy, and reduce adverse wind effects.*

In residential buildings and serviced apartments where windows are provided on side and rear facades, separation between such windows and other buildings is particularly important for privacy. However, in a major urban centre such as Central Sydney, the levels of privacy achievable for residential units may be less than in lower density suburban areas.

Separation between commercial buildings is less important because of a reduced requirement for privacy. Separation between mixed use buildings and other buildings will be in accord with relevant distances for component uses.

Objectives

• To enhance the amenity of building occupants in terms of daylight, outlook, view sharing, ventilation, wind mitigation, and privacy in residential buildings and serviced apartments.

• To enhance the quality of the public domain in terms of wind mitigation and daylight access."

The relevant numerical control is found in **Clause 2.3.6** of the DCP as follows;

"Side and rear setbacks

2.3.6 *Above a height of 45 metres,* ***windows or balconies*** *of commercial buildings are to be set back at least 3 metres from side boundaries (see* ***Figure 2.11****)."*

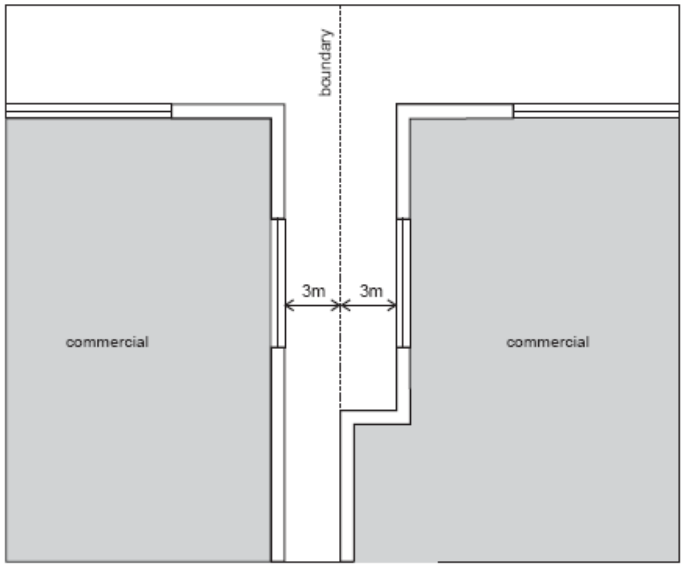


Figure 2.11

Plan of setbacks of commercial buildings above 45 metres on side and rear boundaries where windows are provided

The CSDCP 1996 prescribes further controls in relation to setbacks at **Clause 2.3.8** and notes that "***Walls without windows do not need to be set back."***

Accordingly, Clause 2.3.6 refers only to commercial building being setback from "side boundaries". It is debatable that the southern boundary of the subject site is actually a "side boundary", as it would be logical to regard the Phillip and Elizabeth Street alignments as the side boundaries, Hunter Street as the front, with the south being the "rear".

❖ **CONTEXT**

The existing building on the development site is setback **approximately 5 metres** from the common rear/side boundary with the "Colonial Centre".

The "Colonial Centre tower" in turn features a setback of approximately **20 metres** from the common boundary at podium level, and therefore well in excess of the 3 metres prescribed by Clause 2.3.6.

The Colonial Centre is a commercial building and **does not contain any residential or serviced apartment floor space.**

Further, it is noted that the Colonial Centre podium is mostly non – trafficable as it has been gated – off except for a small area abutting the northern alignment of the tower where doors provide access to tenants.

This area is not a publicly accessible space (refer **Photo 15** below).

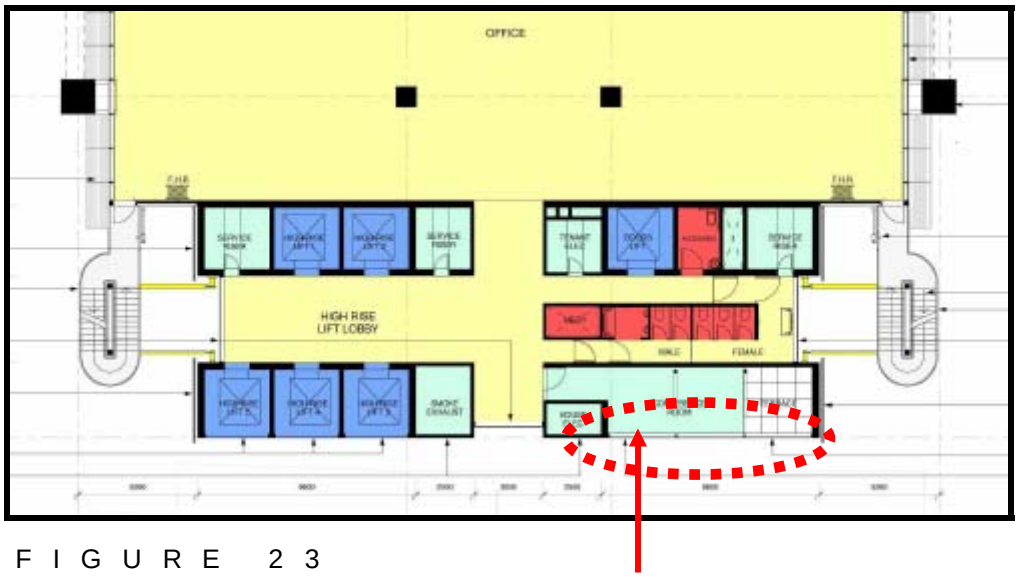
P H O T O 1 5
Colonial Centre – Northern Podium

❖ PROPOSAL

It is noted that the approved Stage 1 DA envelope was located on the southern (rear) boundary.

The proposed Stage 2 building proposes a small office conference room with balcony terrace and at four (4) levels only, (Levels 19, 22, 25 and 28), and these are expressed to the boundary setback as glass louvred walls and glass balustrades (refer **Attachment 4 – Plan No. DA – 043,** and, **Figure 23** below)**.**

Overall, the proposed building provides for a 1.5 metre setback to the rear boundary as detailed in **Plan No. DA – 025 (**refer **Attachment 4),** and is consistent for the full height of the tower where the high rise office conference rooms are located. It is noted however, that at the most south – westerly corner of the core, the setback reduces to 1.2 metres due to the deviation in the rear boundary alignment at this point.



F I G U R E 2 3
Southern Setbacks

❖ CONSIDERATION OF CLAUSE 2.3.6

Clause 2.3 – Building Setbacks of CSDCP 1996 and **Clause 2.3.6** states that "*Above a height of 45 metres, windows or balconies of commercial buildings are to be setback at least 3 metres from* ***side boundaries*** *(refer Figure 2.11)."*

As stated above, it is debatable whether the subject southern boundary of the development site is a "rear boundary" or a "side boundary".

It is the Applicants position the subject boundary is a "rear" boundary, and Clause 2.3.6 may not apply at all.

However, it is noted that the Council assessment report to the CSPC dated on 15 February 2007 stated as follows;

> *78. Above a height of 45 metres, windows or balconies of commercial buildings are to be set back at least 3 metres from side or rear boundaries. Where no windows or balconies are proposed, no setback is prescribed. The proposed envelope is to the southern (rear/side) boundary. Should windows and balconies be proposed at this elevation, it would require compliance with the DCP controls.* ***Any variation would need to demonstrate that a reduced setback would not result in unreasonable impacts to the Colonial Centre.***

Accordingly, despite the doubt, the context of the existing and proposed setbacks is important and the potential impacts of the lesser setback to the four conference rooms/balconies have been assessed.

Notwithstanding the lesser setback than 3.0 metres, any reduction to access to light and ventilation is minimal, and any such effect will not have a significant effect upon the amenity of the podium roof of the Colonial Centre considering the actual limited extent of the rear area used as accessible outdoor space and the setback of that area from the rear boundary of No. 8 Chifley Square.

In terms of privacy to the existing Colonial Centre tower, the overall commercial – to – commercial separation distance is approximately 21.5 metres, and sufficient to mitigate any privacy impacts or concerns.

In terms of a future redevelopment of the Colonial Centre site, it is noted that the subject property has an area of 3,558 sqm, and has extensive boundary dimensions to the south (Martin Place), the east (Phillip Street) and to the west (Elizabeth Street), and any residential/serviced apartment redevelopment would not be unreasonably constrained by the reduced setback of the windows and balustrades to the 4 office conference rooms/terraces.

Considering the poor access to solar access to the north in any event considering the Stage 1 DA envelope approved for the subject site, it is highly unlikely that a residential/serviced apartment redevelopment of the Colonial Centre would orientate "principal" windows and balconies to the north.

In terms of the potential for the Colonial Centre site to be redeveloped with blank walls constructed to the common boundary there will be no adverse effect on the use or amenity of the subject conference rooms except for the loss of outlook up Phillip Street to Hyde Park. The subject rooms do not rely on natural light or ventilation, and no less, in any event would receive some ventilation and daylight through the 1.2 metre setback albeit minimal.

❖ **CONCLUSION**

Accordingly, it is concluded that there are no adverse impacts arising from the lesser "rear – side" setback with the Colonial Centre site.

5.5 City of Sydney Heritage Development Control Plan 2006

The Heritage DCP 2006 applies to all of the land within the City of Sydney local government whether the City of Sydney or Central Sydney Planning Committee is the consent authority, and includes the subject site.

The DCP commenced operation on 2 January 2007.

The relevant DCP 2006 provisions in respect of "*Development in the vicinity of Heritage Items"* are as follows;

> ***"2 Vicinity controls***
>
> ***2.1 Objectives***
>
> *The objective of these provisions is to ensure that development in the vicinity of heritage items is designed and sited to protect the heritage significance of the item.*
>
> ***2.2 Provisions***
>
> *(1) Alterations and additions to buildings and structures, and new development of sites in the vicinity of a heritage item are to be designed to respect and complement the heritage item in terms of the:*
>
> *(a) building envelope;*
>
> *(b) proportions;*
>
> *(c) materials, colours and finishes; and*
> *(d) building and street alignment.*
>
> *(2) Development in the vicinity of a heritage item is to minimise the impact on the setting of the item by:*
>
> *(a) providing an adequate area around the building to allow*

interpretation of the heritage item;

(b) retaining original or significant landscaping (including plantings with direct links or association with the heritage item);

(c) protecting (where possible) and allowing the interpretation of archaeological features; and

(d) retaining and respecting significant views to and from the heritage item."

The relevant DCP 2006 provisions in respect of "*Heritage Streetscapes*" are as follows;

"4 Heritage conservation areas and heritage streetscapes

4.1 Objectives

The objectives of these provisions are to ensure that development within heritage conservation areas and heritage streetscapes:

(i) takes into consideration the contribution of the building as indicated by the Building Contributions Map;

(ii) enhances the character and heritage significance of the heritage conservation area or heritage streetscape by:

(a) maintaining the positive contribution of contributory buildings to the area or streetscape;

(b) retaining and improving the contribution of neutral buildings to the area or streetscape; and

(c) improving the contribution of detracting buildings to the area or streetscape.

(iii) is consistent with policy guidelines contained in the Heritage Inventory Assessment Report.

4.2 Provisions

(1) Development within a heritage conservation area or heritage streetscape is to be compatible with the surrounding built form and pattern of development by responding sympathetically to:

(a) existing form, massing, setbacks, scale and architectural style;

(b) site topography and landscape;

(c) views to and from the area;

(d) surrounding neighbourhood character and streetscape, including buildings; and

(e) existing subdivision patterns.

(2) Development should not project in front of the established building line towards the street.

(3) Alterations and additions are not to dominate or detract from the original building.

(4) Large expanses of solid walls are to be broken up by recesses, bays and modulations, vertical elements and/or the use of appropriate materials.

(5) Alterations and additions are to respect the uniformity of properties which form part of a consistent row, semi-pair or group of buildings.

(6) Development is to respect and minimise the impact on any significant public domain features.

(7) Any applications for development within heritage conservation areas or heritage streetscapes are to demonstrate consistency with the area's Heritage Inventory Assessment Report, in particular the Recommended Management provisions."

The proposal has been considered in detail in the Heritage Assessment/Impact Statement Report prepared by Tropman & Tropman (refer **Attachment 11**).

5.6 City of Sydney Access Development Control Plan 2004

The Access DCP provides guidance to Council, building owners and applicants in providing a barrier free environment for all persons, including those with a disability. The objectives of this Access DCP are:

- *To provide equitable access within all new developments and ensure that substantial building work carried out on or intensified use of existing buildings provides upgraded levels of access and facilities for all people.*
- *To ensure that the public domain of new development provides permeability, legibility, flexibility, consistency, integration and clarity to allow for equitable and safe access for all people.*
- *To provide a reasonable proportion of residential units in multi-unit developments which are designed to be flexible and easily modified to cater for occupants with existing disabilities or progressive disabilities.*
- *To implement the principles and fulfil the objectives established in the City of Sydney 2002 - 2005 Action Plan for People with Disabilities.*
- *To encourage consideration of access issues early in the development design process.*
- *To raise awareness and understanding of access issues for people with disabilities through investigation of best practice.*

The main issues for consideration are as follows;

- INGRESS & EGRESS
- PATH OF TRAVEL
- AMENITIES & FACILITIES
- LIGHTING
- SIGNAGE

In addition, the policy advises that there are other statutory requirements that require assessment as follows;

- AS 1428.1 - (80% of people with disabilities accommodated)
- AS 1428.2 - (90% of people with disabilities accommodated)
- AS 1428.4 - (Tactile Ground Surface Indicators)
- AS 1735.12 - (Lifts, walkways)
- BCA - Building Code of Australia
- City of Sydney Access DCP 2004

In respect of the application of this DCP to existing development (Clause 1.9), compliance with this plan is required where substantial alterations or works to an existing building are proposed, and Morris-Goding have prepared an accessibility assessment (refer **Attachment 27**).

5.7 Other relevant Development Policies

Public Art Policy

The City Council has an adopted Public Art policy dated 19 December 1994, and seeks to encourage an appreciation and understanding of art through the implementation of a strategy which includes the installation of public art works as a part of major redevelopments.

A Public Art Strategy has been prepared by Mirvac Projects Pty Ltd (refer **Attachment 15**) and acknowledged that a major contribution of artwork to the public domain will be made as a part of this development and that this “work” needs to take into account a number of factors if it is to be successful and valued by the public. These factors include the following:

- Context;
- Views & Experience;
- Sculptural Opportunities;
- Lighting

It is intended that a detailed public art brief will be prepared as a part of implementing the installation of public art within the reverse – podium space and Plazas, and will be the subject of a condition of consent to be met by the applicant.

City of Sydney Exterior Lighting Strategy

The proposed lighting strategy has been developed having regard to the City of Sydney's Lighting Strategy. This Strategy was adopted by Council in July 2000, and seeks to establish appropriate objectives, strategies and standards for the lighting of the public domain including the lighting of new buildings within then public domain.

A Lighting Strategy Statement and Exterior Lighting Concept Plan has been prepared by Arup Pty Ltd (refer **Attachment 28**), and prescribes a lighting strategy for the important elements of the proposed building and its public domain including proposed art works as follows;

(1) Interior Lighting
(2) Escape Stair
(3) Exterior Accent Lighting
(4) Roof Structure
(5) Building Entrance/Public Space
(6) Public Art

6.0 SUMMARY OF SECTION 79C ENVIRONMENTAL PLANNING ASSESSMENT

6.1 Overview

In determining the current application, the consent authority is required to consider those relevant matters listed in **Section 79C (1)** of the Environmental Planning and Assessment Act, 1979 as follows;

- **Section 79C (1) (a) -** the **provisions of** any **environmental planning instrument**; any draft environmental planning instrument, any **development control plan**; and, any matters prescribed by the regulations, that apply to the land to which the development application relates.

- **Section 79C (1) (b) -** the **likely impacts of the development**, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality

- **Section 79C (1) (c) -** the **suitability of the site** for development

- **Section 79C (1) (d) -** any **submissions** made in accordance with this Act or the regulations (being the E P & A Regulations 2000)

- **Section 79C (1) (e) -** the **public interest**

The following assessment summarizes the environmental effects of the proposed development as described in the preceding sections of this Statement, and identifies any mitigation measures recommended or proposed to address any potential impacts. **Sections 2.0, 3.0, 4.0 and 5.0** of this Statement effectively forms the "Site Analysis" for the subject Stage 2 DA, and provide a detailed understanding of the opportunities and constraints applying to the land as demonstrated in the Stage 1 DA.

The subsequent Design Competition "sharpened" the understanding of these constraints and opportunities, but significantly, the key principles established for the development of this site as the reverse – podium void, the extensive public domain space (now presented as an Upper Plaza and a Lower Plaza), the achievement of good sunlight and wind conditions achieved within these public spaces, and, a sustainable design in terms of energy efficiency, have all be maintained and indeed enhanced in the final Stage 2 design.

6.1 Section 79C (1)(a)(i) the provision of any environmental planning instrument

Consideration of **Sydney LEP 2005** is discussed in **Section 5.2** and includes an assessment of the additional 10% of FSA being sought by this application. It is noted that the subject Stage 2 DA complies with the provisions of LEP 2005.

6.2 Section 79C (1)(a)(iii) any development control plan

Consideration of the **Central Sydney DCP 1996, Sydney Heritage DCP 2006** and the **City of Sydney Accessibility DCP 2004 are** discussed in **Sections 5.3, 5.4** and **5.5.**

The only variation being sought to any DCP control is that relating to **Clause 2.3.6** of **DCP 1996** relating to the side – rear setback with the Colonial Centre to the south.

In al other respect, the Stage 2 DA complies with the relevant DCP controls.

6.3 Section 79C (1)(a)(iv) any matters prescribed by the regulations

Not relevant to this application.

6.4 Section 79C (1)(b) the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality

Section 79C (1) (b) requires the consent authority to consider:

> *(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality*

Overshadowing

An analysis of the additional overshadowing caused by the proposed development has been undertaken in shadow diagrams numbered DA-130 A and DA-131 A (refer **Attachment 6**). The diagrams have been prepared for August 14th at noon, 1pm and at 2pm; and June 21st at noon, 1pm and at 2pm.

The shadow diagrams identify that additional overshadowing will occur along parts of the neighbouring streets and footpaths. Limited additional overshadowing will occur on Macquarie Street in the PM period; otherwise, any additional overshadowing created by the proposed development complies with the relevant overshadowing controls and with the shadowing assessed under the Stage 1 DA Consent envelope, and, is therefore considered to be acceptable.

Wind Effects

A Wind Effects and Wind Tunnel Report report has been prepared by Cermak Peterka Petersen Pty. Ltd (refer **Attachment 24**) and the concludes that the proposed development is unlikely to adversely impact upon the existing streetscape and use of public open space. Importantly, it confirms that the reverse – podium area will achive an acceptable environmental performance for use by the public.

Reflectivity

A reflectivety report has been prepared by Arup Pty Ltd (refer **Attachment 26**) and that the proposed building generally performs well in terms of solar reflectivity, and glare is unlikely to exceed the limits of acceptability.

Public domain

It is considered that the proposal will contribute a building of refined and well considered architectural design that will be well integrated into the public domain as a positive contribution to the streetscape.

The key elements formimng the resposne to the “Public Domain” are considered and addressed in a variety of reports and plans generally as follows;

- Public Domain/Landscape Plan and Statement (**Attachment 10**)
- Accessibility (**Attachment 27**)
- Public Art (**Attachment 15**)
- Lighting Strategy and Exterior Lighting Concept Plan (**Attachment 28**)
- Exisitng and Proposed Services (**Attachment 20**)

Heritage

The heritage values of the subject land has been addressed through a Heritage Assessment Statement prepared by Tropman & Tropman, Architects, whom are suitably qualified to provide such a statement (refer **Attachment 11**).

Acoustic Assessment

A Noise Impact Assessment report has been prepared by Renzo Tonin Pty. Ltd (refer **Attachment 25**), and subject to various recommendations, there are no adverse impacts identifed.

Access, parking and transport

The proposal complies with the parking and access requirements for the site and will not create any adverse traffic impacts. A Transport and Parking Assessment Report, is submitted with this DA and can be found in **Attachment 14.**

Utilities

All installations will meet the requirements under the Australian Standards and the Building Code of Australia. The existing and proposed services diagram and plan in **Attachment 20** and the Stormwater Concept Plan in **Attachment 21** demonstrate that all utility requirements can be met. The Basement B2 plan identifies the location and sizing fior the installation of a new substation.

Waste Management

A Waste Management Plan, prepared by JD MacDonald, is submitted with this report at **Attachment 19,** and demonstrates that all waste can be appropriately collected and stored on site for disposal.

Energy

The proposal will incorporate energy efficient design to reduce the energy usage of the operating building (refer **Attachment 16**).

Safety, security & crime prevention

The proposed activation of the site with ground level “plazas” will encourage pedestrian activity with improved surveillance and illumination, thereby improving security and deterring crime. A CPTED assessment has been undertaken and identifies strategies for maintaining a safe public domain (refer **Attachment 18**).

Social Impact in the locality

The proposed development will provide a site population and visual interest to produce a sociable and inviting appearance to the building.

Economic impact in the locality

The proposed development will provide a positive economic impact presenting an attractive and

appropriate commercial image to potential tenants, clients and the public and making a valueable contribution to the A1 building stock in the Sydney City financial district.

Site design and internal design

It is considered that the design is responsive to the changing character of the area and that will encourage more pedestrian activity around the site.

Construction

It is presumed that the standard Council construction requirements will be applied. An Environmental management Plan ("EMP") incorporating a "Construction Management Plan" and a "Demolition Management Plan" prepared by Mirvac is provided at **Attachment 17**, and addresses issues such as; Traffic Management, Noise & Vibration Management, Waste Management, Erosion & Sediment Control and Site Management.

The construction phase of the development will generate large volumes of waste which is to be managed efficiently. Reuse of demolition and excavation material should be considered wherever possible. Areas will be allocated for construction waste, including containers for recycling and reuse. In recycling materials, the objective is to recycle and/or reuse at least 70% of construction waste as well as source operation to facilitate reusing and prevent cross contamination.

Cumulative Impacts

The proposal is generally compliant with the development standards for the site. This is also demonstrated by the lack of any environmental impact on adjoining development.

Accordingly the cumulative impact of the development on the character of the neighbourhood is expected to be negligible.

6.5 Section 79C(1)(c) – Site Suitability

The consent authority shall have regard to:

(c) the suitability of the site for the development.

Having regard to the location of the proposal, the site will adequately accommodate the development in that:

- sufficient transport services and facilities are in close proximity;

- adjacent developments do not pose any prohibitive constraints and will not be detrimentally affected by the proposal; and
- it is not subject to any natural hazards that may inhibit its operation in the proposed form.

Context and setting

It is considered that the building's presentation has been considerate of the built form context of Chifley Square and will enhance the public and pedestrian vitality of the area.

6.6 Section 79C (1)(d) – Submissions

The consent authority shall have regard to:

(d) any submissions made in accordance with this Act or the regulations.

The consent authority will need to consider the submissions received in response to the public exhibition of the proposal.

6.7 Section 79C (1)(e) – The Public Interest

The consent authority shall have regard to:

(e) the public interest.

The proposal will be in the public interest. The proposal provides a building of architectural quality and attractive presentation to tenants, clients and the public.

The proposal provides for a new "public" space in the heart of the CBD which with an area of 1,120 sqm and which achieves a high quality of sustainable environmental outcomes and amenity.

The building itself achieves minimum 5 – star energy efficiency targets and will impose a modest environmental footprint.

7.0 CONCLUSION

This Stage 2 DA proposal has been prepared after taking into account the following key matters:

- The Stage 1 DA envelope and consent conditions;
- The "Design Excellence" controls and objectives and the requirement for a Design Competition;
- The key location within the Sydney CBD and the objectives for the "City Centre" zoning under the Central Sydney LEP 1996;
- The proximity of the site to public transport, commercial and retail services, public and private recreation facilities and employment opportunities;
- The context of the site and cityscape, including the variety of existing built forms which predominantly comprises medium and high-rise commercial buildings of varying design and character; and,
- The minimal impact of the development on the amenity of the surrounding properties.

The redevelopment of No. 8 Chifley Square presents a unique opportunity to make a significant contribution to the architecture and urban design of the Sydney CBD, in one of the key areas of the city. Sydney is fortunate in having the heritage significant Chifley Square with not only the former Qantas building but also No. 2 Chifley Square, the Renzo Piano "Aurora Place" and the Sir Norman Foster "126 Phillip Street" buildings within its vicinity. With its prominent northern elevation addressing Chifley Square, the subject Site occupies an even more significant location within the visual catchment of the Square and adjacent streets.

The proposed development is entirely consistent with the aims and objectives of the SLEP 2005. A well - designed commercial building will contribute greatly to the public interest and help fulfil the objectives of the Sydney Central LEP, in particular, the following zone objectives:

(a) to encourage Central Sydney's role and growth as one of the Asia-Pacific region's principal centres for finance, commerce, retailing, tourism, cultural activities, entertainment and government,

(h) to recognise and enhance the character of Special Areas,

(l) to provide active frontages to streets.

It is concluded that a new commercial building with a floor space in excess of 21,000sqm will contribute significantly to the availability of A – Grade/Premium Grade building stock in this important financial district of the Sydney CBD.

The height, scale and form of the proposal is compliant with Council's controls, and the podium – void design contributes positively to the spatial character of Chifley Square opposite and the streetscape generally. The "reverse - podium" form provides public domain of significant architectural merit and will provide a high quality of amenity for the public.

There are no adverse impacts arising from the absence of a setback above street wall height, and the resultant building form is consistent with similar forms evident in adjacent and nearby development, particularly the Deutsche Bank building to the east. Similarly, the small variation to the side – rear setback control on the southern boundary has no short or long term impact on either the future occupants or the future redevelopment prospects for the Colonial Centre.

The proposed development seeks to utilise the provision of 10% additional FSR permitted under Clause 10 of the LEP. Permitting the provision of 10% additional FSR is considered appropriate as the proposed development provides a significant contribution to the public domain of Sydney with the reverse – podium design and open publicly accessible plaza. A detailed assessment has been undertaken of all urban design cues applicable to the site, and likely amenity impacts, and having regard to the assessment criteria under Clause 10(1), it is considered that the subject site merits the waiver of strict compliance with the FSR control of 12.5 : 1, and accordingly, the Stage 2 DA merits the award of a maximum FSR of 13.75 : 1.

The proposal addresses the matters for consideration under Section 79C of the Environmental Planning and Assessment Act, 1979. It will deliver an exemplary and appropriate development to the City of Sydney and is worthy of approval.

Job No/ Document No	Description of Issue	Prepared By/ Date	Reviewed by Project Manager/Director	Approved by Project Manager/Director
M:\Projects\CP2006\26-118 8-12 Chifley Square, Sydney\aaaaaaaaaaSTAGE 2 DA PLANS and DOCUMENTATION\STAGE 2 DA SEE & COVER\SEE-STAGE 2\Re.SEE.Stage2DA.chifleysquaresydney.26118.	*ClientDraftv1*	*AS/22.01.08*	*AS*	 ***Name: Andrew Smith*** ***Date: 3.03.08***
	ClientDraftv2	*AS/3.02.08*	*AS*	
	ClientDraftv3	*AS/8.02.08*	*AS*	
	ClientDraftv4	*AS/12.02.08*	*AS*	
	ClientDraftv4a	*AS/15.02.08*	*AS*	
	ClientDraft5	*AS/20.02.08*	*AS*	
	ClientFinal	*AS/26.02.08*	*AS*	
	ClientFinal2	*AS/28.02.08*	*AS*	
	DA-Final	*AS/3.03.08*	*AS*	
Note: This document is preliminary unless it is approved by a Project Manager or Director of City Plan Services P/L				