FJMT ARCHITECTS

BAN-ASD DEVELOPMENT

MECHANICAL, ELECTRICAL & ESD SERVICES

DRAFT PRE EA DESIGN REPORT

STEENSEN VARMING

Sydney Canberra Brisbane Melbourne

DOCUMENT REVISION AND STATUS

SP.08.REV1

Document Reference No.			Document Author	CA	
Date	**Rev**	**Issue**	**Notes**	**Checked**	**Approved**
30-09-2009	00	draft	For comment		

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1 INTRODUCTION

1.1 GENERAL

This document has been written to reflect the design intentions of the services systems. It has been written after careful review of the clients brief and consultation with the design team. It shows the intent of the current building and takes into consideration wider issues such as the client's operational and owning regimes, budget parameters and the architecture of the building. It is intended that this brief will form the basis of the services design throughout the project and be used as the monitoring tool through the design process. It includes options yet to be confirmed by the client and highlights unresolved items.

This brief encompasses mechanical, electrical, lighting and ESD components. It identifies broad but clear directions for the engineering systems. It has not been prepared as a design report but as a guideline document that will allow options to be explored but guides towards desired outcomes.

It is not intended that the general Design principles and Scope detailed in this report will be viewed as finalised or fixed; the systems will continue to be developed and refined as the design work progresses into the next and more detailed phase of the project. At that stage a return brief will be generated that solidifies the services concepts and develops them to a level that allows more accurate costing and design.

The building and engineering proposals described herein aim to provide a well engineered project which is economical to build, operate and maintain, has the requisite quality for image and function and provides a practical level of adaptability for future changes and expansion. In particular a number of key design objectives have been considered:

Safety	Installations which produce 'best practice' conditions, particularly in terms of health, containment performance and occupational use.
Environmental (internal)	Occupant comfort through the control of light, temperature, humidity, ventilation and noise.
Environmental (external)	The achievement, or betterment, of environmental policy requirements for emissions from the building, including the provision of energy conservation features where practical and cost effective.
Cost	A best value for money approach over the total life of the project is a major consideration. The capital cost, operational costs, maintenance and support costs shall be considered in the design.
Co-ordination	The design and layout of Electrical & Mechanical Services in a manner that co-ordinates with and compliments the building and structure and satisfies the Councils operational requirements throughout the effective use of space.
Maintenance	The production of specifications and designs will include features for safety, accessibility, reliability and ease of replacement.
Flexibility	Decisions regarding designs will be taken in a manner which includes the need for future adaptability/flexibility where cost parameters allow.
Marketing	The success of the project will ultimately be reflected in the ability to sell and occupy the relevant sections of the building. Close coordination with the marketing requirements shall be considered in the design of the development.

2 ESD APPROACH

Steensen Varming is committed to minimising the impact on the local and global environment through the application of environmentally sensitive and sustainable design. We actively seek to reduce the reliance on non-sustainable resources and to achieve this aim we have developed, and incorporated incorporated into the design process, the use of sophisticated modelling, analysis and verification software, together with procedures that satisfy the requirements of ISO 14001 "Environmental Management Systems". Importantly, this has resulted in enhanced environments and end-user comfort and reduced life cycle costs, in addition to a reduction in environmental impact.

Sustainability goes far beyond energy and water consumption; it encompasses the selection of materials, work methods, adaptability and, most importantly, acceptance of the occupants. This can be achieved only through a rigorous, thoughtful and quality-driven design process.

The purpose of this project report is to summarise the services and ESD initiatives that under consideration for the project. We understand that this development will seek to provide a complex that embodies cost effective and environmentally responsible initiatives for sustainable low energy design.

Ecologically Sustainable Design is a key priority for any responsible client and design team to embrace. It is therefore important that ESD principles are not pursued as the ultimate priority but respond to the functional needs at the site and the development. The best approach is to approach the design in an integrated manner to maximise the benefits to the ESD elements that are complimentary to the pursuit of providing suitable environmental conditions.

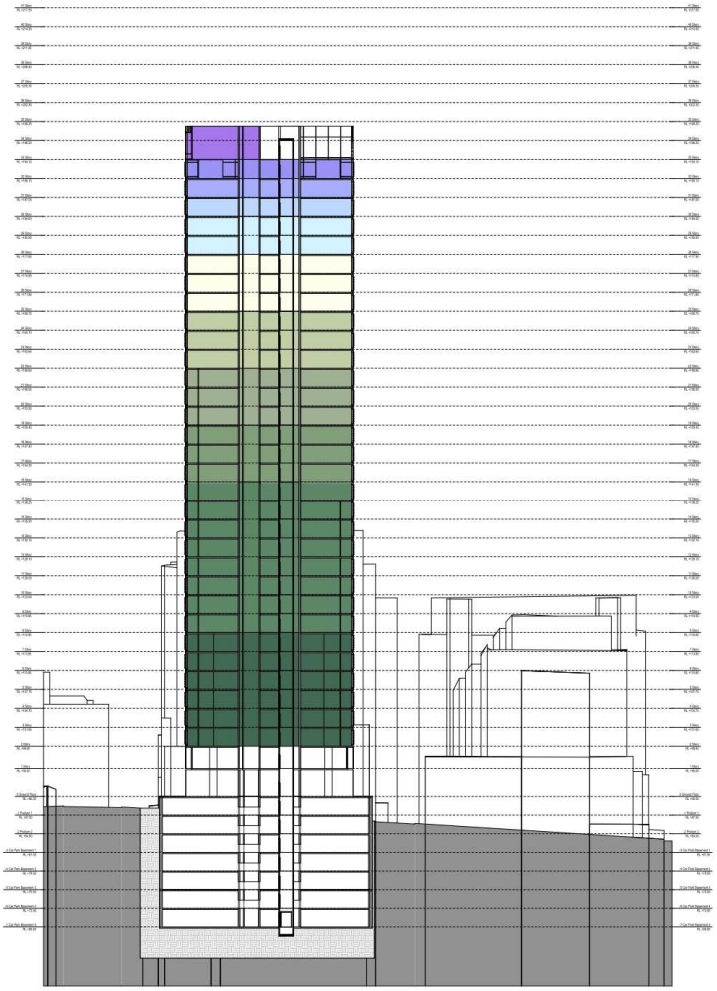
The following issues need to be considered:

- Lighting
- Temperature (not only air but, mean radiant temperature also)
- Indoor air quality – pollutant levels (either from outside or the generation from materials internally)
- Thermal and hydroscopic inertia offered by the thermal mass of the existing structures
- Material selection (both building fabric and services)
- Water Conservation
- The building's environmental footprint (CO_2 emissions, greenhouse gases)

2.1 BUILT FORM

This report sets out the current proposals for Electrical, Mechanical and ESD Building Services systems for the Draft EA for the residential development at Atchison Street, St Leonards.

The development comprised 5 levels of below ground car park, 2 levels of podium with community facilities, low rise serviced apartments with mid rise and high rise apartments.



3 STATUTORY REQUIREMENTS

This section provides a basis for the statutory design requirements for the Electrical and Mechanical Engineering Services. Design policies, regulatory requirements, design parameters and objectives form the foundations for further development and system approval.

3.1 STANDARDS / GUIDELINES

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

1. Relevant Australian Standards
2. The Building Code of Australia
3. Government Department's Regulations
4. Authorities and Councils such as:
   a) Local Council DCP
   b) The local electricity supply authority
   c) Telstra
   d) NSW Fire Brigade
   e) Environmental Protection Authority
   f) Metropolitan Waste Disposal Authority
   g) WorkCover

3.2 BUILDING CODE OF AUSTRALIA

3.3 BUILDING CLASSIFICATION - SECTION A

Building Code of Australia (BCA) requirements apply. The preliminary assumption building classifications are as follows. Further confirmation of the building's classification and any special use areas need to be defined by the BCA consultant.

Residential - Class 2 (TBC)
Retail – Class 6
Car park - Class 7a

3.4 BCA SECTION J – ENERGY EFFICIENCY REQUIREMENTS

Part J of the BCA relates to the energy performance of class 2 & 3 (residential) buildings. The section covers building fabric thermal performance, external glazing, building sealing, air movement, A/C ventilation systems, lighting and power and hot water supply. The design team needs to be aware of these new requirements as they will have an influence on service requirements, architecture and the cost plan.

The underlying goal of the new section J is to reduce greenhouse gas emissions by efficiently using energy. Reference to energy efficiency alone could be construed as regulating for the sake of saving fuel or operating costs, which may not be an appropriate goal for regulations. Such an approach could also discourage innovation in alternative energy technologies. A goal of greenhouse gas reduction could infer measures that go beyond building control powers such as power generation and reticulation.

It should also be noted that the goal is not occupant comfort. The measures are based on achieving an internal environment in which occupants may not be comfortable, but the conditions are sufficiently tolerable for occupants to minimise their use of artificial heating, cooling or lighting.

The energy used over the life of a building has an operational energy component and an embodied energy component. Operational energy is the focus of the ABCB at this time; broader environmental sustainability measures are being considered under a separate work program.

NSW Section J consists of two Subsections J(A) and J(B).

Subsection J(A) Energy Efficiency - Class 2 buildings and Class 4 parts

The need for separating these requirements from the requirements for Class 3 buildings arises because, in NSW, Class 2 buildings and Class 4 parts of buildings are subject to BASIX (the Building Sustainability Index), however Class 3 buildings are not.

BASIX is the web-based planning tool designed to assess the potential performance of certain residential buildings against a range of sustainability indices including thermal comfort and energy. Commitments made under BASIX become a condition of the relevant development consent or complying development certificate.

BASIX currently applies to all Class 1 and 2, and Class 4 parts of buildings in the Sydney area. It is progressively being applied to these building across NSW throughout 2005.

The provisions of Subsection J(A) are therefore designed to complement requirements that arise under BASIX and which are implemented via the development consent or complying development certificate (as applicable).

The following table identifies which section J items represent risk with compliance for DA;

No.	*Section*	*Description*	*DA Risk*
A1	Building Fabric	Levels of Insulation	Low
A2	**External Glazing**	**Type of glazing, shading, limits on area of glass**	**Medium**
A3	Building Sealing	Reducing infiltration and leaking of conditioned air. Control of exhaust fans	Low
A4	Air Movement	Minimum air movement, natural ventilation, for residential buildings	Low
A5	Air Conditioning and Ventilation Systems	Minimum energy efficiency for given system selection. Timers and controls	Low
A6	Artificial Lighting and Power	Maximum light fitting density and power requirements. Timers and controls	Low
A7	Hot Water Supply	Minimum insulation levels for distribution pipework. Minimal dead legs.	Low
A8	Access for Maintenance	Minimum room sizes/access spaces – superseded by OH&S requirements in NSW	Low

Complying with Section J may add to the project cost since extra controls or more efficient plant will be required. The most expensive element, double glazing, has been incorporated into the budget but other incidental items may not have been accurately factored in at this stage.

4 MECHANICAL SERVICES

4.1 PRE-EA STAGE TASKS

A number of items have been identified at this stage that may still require specific attention and resolution. Some of these issues will be resolved for this preliminary stage, while others will require further attention at later design stages. These issues include the following:

- BCA and fire engineering input to confirm building classification, smoke hazard management and stair pressurization requirements.
- BCA input for carpark levels to identify opportunities to reduce carpark exhaust requirements.
- Establish residential planning to satisfy State Environmental Planning Policy (SEPP) No. 65 – Design Quality of Residential Flat Developments requirements.
- Acoustic consultant advice regarding acoustic design guidelines and façade performance requirements for natural ventilation openings to satisfy DCP requirements.
- Establish building stratums.
- Review Basix requirements and undertake Accurate assessment of apartment types to provide initial feedback and direction on performance ratings.
- Undertake a wind study to identify suitable exhaust locations, particularly retail kitchen exhausts and determination of risk of odours migrating to residential apartments.
- Confirm specific brief requirements for each building type, such as hours of operation, strata requirements, design temperatures, budget, control, tenancy/base building relationships, zoning etc.
- Confirm number and type of miscellaneous ventilation and air conditioning systems such as, but not limited to;
    - kitchen oven, dishwasher and cooking exhaust
    - loading dock supply and exhaust
    - cleaners cupboard exhaust
    - toilet exhaust
    - waste rooms exhaust
    - laundry exhaust
    - tenancy requirements
    - communication rooms air conditioning
    - lift motor room ventilation
    - grease arrestor exhaust
    - hydraulic plantroom
    - substation
    - main switch room
- Programme and staging of works
- Specific Council requirements to be addressed for EA
- Integration of ESD initiatives

4.2 CAR PARK VENTILATION

- Mechanical ventilation, supply and exhaust will be required for the 5 storey's of basement carpark.

- Car park exhaust fan operation must be controlled using a Carbon Monoxide/Dioxide (CO_2) monitoring system under new Section J requirements. The plant may not switch off entirely - a minimum Air Change Rate of 0.5ACH must be maintained at all times.

4.3 RESIDENTIAL UNITS

The design of the apartments will optimised to allow cross-ventilation to all units. Air conditioning will be installed as a base provision and will generally comprise ducted reverse cycle systems serving each apartment.

Toilets and Laundries will be ventilated in accordance with AS1668.2-1991 via either a centralised system that will run 24hours a day (subject to confirmation of new BCA section J constraints) or individual systems serving each apartment. Make-up air will be provided by undercutting the internal doors and relies on fresh air infiltration from open windows or from an undercut to the main entry door. An alternative solution is to install acoustically treated openings to allow make up air without noise infiltration.

Kitchen Hoods will be of the recirculating type (i.e. not ducted to the façade or roof) with user changeable filters to eliminate odours and grease.

4.4 RETAIL CENTRE ON PODIUM LEVELS

The centre will be provided with fully ducted air conditioning in the public areas. Whether central condenser water system or central chillers and gas–fired boilers will provide chilled water and hot water to each tenancy for connection to tenant provided fancoil units concealed in the ceiling void.

The use of either water cooled or air cooled chillers will need to be explored. It is important in consultation with FJMT and other team members that consideration is given to the location of heat rejection equipment (cooling towers/dry condensers) and the associated acoustic / discharge impacts and the staged construction requirements.

Input from a fire engineer is an important starting point for ventilation strategy, particularly with respect to smoke exhaust. The design will be developed to comply with the minimum deemed to satisfy provisions of the BCA and space/ plant savings may be possible once a fire engineer has been consulted.

It is recommended that obnoxious exhausts such as kitchen exhausts (KE) should be exhausted at high level. Thus fire rated risers will need to pass through the building to high level to serve tenancies. Discharge points must be at least 15m from all adjacent residential buildings. Although the effect of KE fumes can be minimized through readily accessible filters and high vertical discharge velocities, it is recommended that a wind dispersion study is undertaken to review and comment on exhaust locations and the risk of odours entering residential apartments. Staging issues would require temporary arrangements if the office building is not built straight away. The kitchen exhaust must be at least 8m away from the cooling towers under the requirements of AS3666.

Options for the smaller tenancies also include the use of UV treated horizontal discharge. For ease of compliance it is recommended that each system is kept below 1000l/s (around 3m² of kitchen hood area) which may be possible for individual take-away outlets. Horizontal runs of duct must be accessed every 3m for inspection and cleaning and therefore should be avoided.

4.5 DESIGN CONDITIONS

Residential
Natural ventilation will be available to all dwellings.

Podium Retail spaces

Ambient Conditions	-	32°C DB temp 23°C WB temp
Indoor Conditions	-	24°C DB ±2°C 50% + 15% RH No lower RH limit

5 ESD BENCHMARKING

Several methods of recognised benchmarking a building are available in Australia. Three methods of benchmarking are presented within the contents of this report. They are as follows:

5.1 BASIX

BASIX (Buildings Sustainability Index) was introduced by the NSW Government. BASIX is one of the most robust sustainable planning measures in Australia, delivering equitable and effective water and greenhouse gas reductions across NSW. BASIX sets targets for residential developments in areas of water consumption, energy and thermal comfort to ensure that homes are designed to use less potable water and reduce the greenhouse gas emissions whilst maintaining adequate comfort.

BASIX is an online web program that is free and accessible to anyone. The building designer enters data relating to the house or unit design - such as location, size, building materials etc - into the BASIX tool. BASIX analyses this information and determines how it scores against the Energy and Water targets. The design must pass specific targets which vary according to location and building type. If all design requirements are met then a BASIX Certificate may be obtained. The department of Planning requires a BASIX certificate to be attached with any development applications to councils in NSW.

Launched in 2004, BASIX now applies to all new residential buildings and refurbishments of existing homes in NSW. It requires a 40% saving of water use in comparison to existing building stock and, depending on building height, between 20-40% saving in energy use. This is because taller buildings have little roof area to locate solar hot water plant and usually have basement parking to provide sufficient spaces for the number of occupants. Multi storey developments are generally more energy efficient than a large housing development anyway because each unit is smaller and require less energy to light, heat and cool.

5.2 THE BASIX TOOL

Compliance with BASIX is proven by submitting a BASIX Certificate with the EA application. The BASIX certificate is generated by visiting the BASIX website and entering all the relevant details of the development, this can be completed by anyone but requires an in-depth overall knowledge of the development. Only one certificate is required for all apartments on a site and, so long as no details change during the design process, the same certificate can be resubmitted at Construction certificate and Occupation certificate stages. If details do change (i.e. number of units, size of rainwater tank, star rating of appliances) then a new certificate must be raised. The tool can be viewed at www.basix.nsw.gov.au

After inputting general details about the development such as site areas, building types and numbers of units etc. there are then three main sections to the tool

- Water
- Thermal Comfort
- Energy

5.2.1 Water

The first questions in the water section relate to common area water use. This may be landscaping, swimming pools and water features, common shower and toilet facilities and gyms.

In comparison to single dwellings, multi-unit developments can score well in this area. Landscape area is much less on an area per person basis and, so long as there are no common pools or gyms, sensible landscaping will give a 12-18% start into the savings.

Where a swimming pool is proposed it is advisable to ensure that there are timers on the pool pump/filters and that the pool is sheltered from direct sunlight and winds. This greatly reduces the water losses by evaporation and means that the final score is largely unaffected by the inclusion of a pool.

AAA rated fixtures will also score highly and tend to be industry standard now. Putting in tap flow restrictors, AAA showerheads and AAA dual flush toilets will bring another 15%. It is assumed that all apartments will have at least AAA rated fittings and AAA dual-flush Toilets.

Savings after this are more difficult.

For developments that are 5 floors or less a rainwater tank should provide enough savings to surpass the 40% target. The tank should be big enough to provide at least 20 days worth of supply. Allowance should be made for tank location and dual reticulation back to the units for toilets and possibly laundries. Landscape irrigation and car washing should also be connected to the tank but do not improve the score significantly.

Developments greater than 5 floors cannot always rely solely on rainwater to achieve the targets. The two options in this instance are then expensive appliances or waste water recycling.

- Appliances – Providing at least 4A dishwashers and washing machines can give savings of between 6-8% but could cost around $3-4k per apartment. They must be installed prior to the day of occupation. It is likely that some rainwater collection would still be required for landscape irrigation and car wash.
- Waste Water Recycling – For larger developments this becomes very cost effective and provides savings of up to 20%. A central greywater treatment plant would treat wastewater from showers and reticulate back to flush toilets and for use in washing machines. This would cost around $1.5-2k per apartment with regular ongoing maintenance cost borne by the body corporate. Allow for a central plant (or at least one plant per block) equivalent to 1 car space per building and dual reticulation of both waste from showers and supply to toilets and laundry.

For a large development the waste water recycling system is more cost effective.

5.2.2 Thermal Comfort

This section is merely a pass or fail by showing the design of the dwelling will not lead to excessive space heating and cooling requirements.

Previously the thermal comfort of new dwellings was assessed under the Energy Smart Homes system for most council DCPs. This assessed buildings using Accurate software and was measured using stars with 3.5 the pass mark. BASIX still uses the Accurate software but no longer deals with stars.

BASIX introduces the concept of heating and cooling caps to reduce the crippling demand on infrastructure that has been seen over the past 5-10 years in mass built suburban developments. By limiting the amount of heating and cooling that will be required, DOP hope to improve the general design of dwellings by encouraging thermal mass and insulation and discouraging highly glazed facades with little or no shading that are subsequently air conditioned.

It is therefore essential that one of the first tasks is to establish the relevant targets that need to be achieved by inputting the apartment areas into the BASIX certificate straight away. Running a selection of Accurate models will establish whether the designs achieve the minimum targets.

There are additional credits that can be carried through to the energy section if the Thermal Comfort passes are exceptional. However these credits are just a few percent and are unlikely to be achieved in most cases.

The intention is to modify the shading and glazing heights of the apartments so that as many qualify for the BASIX cross-ventilation bonus as possible; this allows a reasonable extent of glazing but also gives the occupant a more comfortable space.

5.2.3 Energy

Firstly to clarify terminology, BASIX requires a reduction in greenhouse gas emissions but not necessarily a reduction in energy. That is, if an apartment has a gas fired rather than an electric hot water system but both systems actually use the same amount of energy the gas system will still score more credits because the gas emits 4 times less carbon dioxide than the grid electricity. In subsequent paragraphs energy savings are referred to but these may be a combination of energy and emission savings.

The energy section is laid out in a similar way to the water section. It begins by asking about energy use in common areas before moving onto specific dwelling details.

In general, multi-unit developments score poorly in this section. There are nearly always basement car-parking levels and hallways that need ventilating and lighting, also lifts, and sometimes swimming pools and gyms. In most instances these conspire to give a negative percentage starting point (in comparison to the benchmark dwelling) that needs to be offset through efficiency in dwellings. Natural ventilation and daylighting for car-parks and hallways should be encouraged; otherwise good zoning and lighting control is essential, as is carbon monoxide monitoring and VSD motors on car park fans.

Hot water systems have the greatest effect on energy consumption. Electric systems are generally penalised and a gas-fired, centralised system is required to balance the energy use of the central systems so that the energy section begins in the low percentages.

For developments less than 5 floors there may be enough roof space to locate solar hot water panels that will get the development close to the 30-35% mark. Allow for 2m² of panel area per apartment plus as much area again for servicing and preventing overshadowing.

For developments of more than 5 floors an entirely different approach may be required. These blocks may be an ideal candidate for a micro cogeneration system. A number of products exist in the marketplace that are designed for hospitals and hotels and can generate power and hot water at the same time - saving energy that would otherwise be lost in plant heat rejection and distribution losses. A system incorporating a 60-100kW turbine and a large hot water storage tank could provide all the hot water needed for the site and provide enough energy for all the common areas. This kind of system would cost around $1k per apartment and save 15-20% of energy use.

Hot water system sizing will be carried out by Warren Smith and Partners.

The second biggest energy consumer is the space heating and cooling system. There is little saving for not installing an air conditioning system because BASIX assumes that a home owner may subsequently install the cheapest, poorest performing unit. Ducted AC systems are only commercially available up to 4 star and will give a 5% energy saving while wall mounted splits are available up to 6 star and will give a 10% energy saving. A centralised system attached to the cogeneration or retail plant for extra capacity and reduced diversity will give similar savings to the ducted system but may be more capital cost effective and reduce the need for noisy and unsightly balcony mounted condenser units.

These two areas should give more than enough savings to achieve the 25% but alternative savings are available from installing compact fluorescent lighting (up to 8% if all the apartment is lit by CFLs) and from energy efficient appliances (up to 10-12% from 5 star fridges, dishwashers, washing machines and clothes dryers). Of these savings, clothes driers will be at least 2* rated and fluorescent lighting has been identified as an extra that will be included if required for compliance.

There are also savings to be made easily such as daylight to bathrooms and kitchens, individual toilet/laundry extract, ventilated fridge spaces, balcony or indoor clothes drying lines and zoned AC – all worth 1% each.

Incorporating renewable energy such as photovoltaic (PV) panels and small wind turbines will give bonus credits but are often cost prohibitive and are not usually required unless there is some other motivation such as corporate image or DA conditions.

5.3 ACCURATE

In order to comply with the thermal comfort requirements for BASIX, a building development needs to be analysed using ABSA recommended programs such as NATHERS or AccuRate. AccuRate is a Software program for the Australian House Energy Rating Scheme. AccuRate is the 2nd Generation of Residential Energy Rating Software for Australia from CSIRO previously Nathers.

5.4 ENERGY CONSERVATION PRIORITIES

The development will incorporate ESD initiatives that are practical and provide cost effective results. Satisfying Nathers and BASIX requirements is a base requirement and the design team will use that as a starting point for exploring ESD solutions. Some initiatives that will be explored through the DA and design process will include:

- Cross– flow ventilation, achieved in all units.
- Use of high COP (efficiency) air conditioning equipment in the shopping centre system.
- Heat recovery from the shopping centre system.
- Use the North facing roofs as an advantage for solar absorption for hot water / power and perform such shading function.

Apartments throughout the development will be naturally ventilated in all habitable rooms except for the following:

- En-suite bathrooms (Mechanical Exhaust)
- Bathrooms (Mechanical Exhaust)
- Laundries (Mechanical Exhaust)
- Main switchboard and communications room (Mechanical Supply)
- Retail Units (Mechanical Supply with provision for Air Conditioning and Kitchen Exhaust)

For these exceptions, mechanical ventilation will be provided in accordance with AS 1668.2. The discharge of “obnoxious” exhaust air shall be located a minimum of 6 m from any opening or air intake, or boundary.

5.5 BCA SECTION J

Section J of the BCA (Building Code of Australia) relates to the energy performance of buildings. The section covers energy performance, building fabric, external glazing, building sealing, air movement, A/C ventilation systems, lighting and power and hot water supply.

The underlying goal of the section J is to reduce greenhouse gas emissions by efficiently using energy. Reference to energy efficiency alone could be construed as regulating for the sake of saving fuel or operating costs, which may not be an appropriate goal for regulations. Such an approach could also discourage innovation in alternative energy technologies. A goal of greenhouse gas reduction could infer measures that go beyond building control powers such as power generation and reticulation.

It should also be noted that the goal is not occupant comfort. The measures are based on achieving an internal environment in which occupants may not be comfortable, but the conditions are sufficiently tolerable for occupants to minimise their use of artificial heating, cooling or lighting.

The energy used over the life of a building has an operational energy component and an embodied energy component. Operational energy is the focus of the Australian Building Codes Board (ABCB) at this time; broader environmental sustainability measures are being considered under a separate work program.

The minimum benchmarks listed in the BCA with regard to equipment efficiencies are intended to

prohibit the installation and use of inefficient equipment. It must be noted that it is not necessarily an indication of equipment having good energy performance if it meets the requirements of the standard.

It is noted that the new BCA also has minimum requirements for lighting loads and any new work or energy savings projects need to consider these 'minimum' benchmarks

5.6 GBCA – GREEN STAR MULTI RESIDENTIAL TOOL

Green Star is a complex rating tool that covers not only energy but also management practices, Indoor Environmental Quality (IEQ), transport, water use, material selection, site ecology and waste emissions. Rather than being strictly a performance based tool it can be more readily used as a design tool as it states that a certain building feature will be specified (or is already installed). Similar to ABGR, Green Star is a voluntary scheme.

Green Star was established by the Green Building Council of Australia and can also be applied to either a base building or just a tenancy by asking different questions in each instance. The total environmental performance of the building is benchmarked by giving it a star rating from 1-6. Ratings below 3 star are not officially recognised. A 4 star rating represents best practice while a 5 star rating represents Australian Excellence and a 6 star represents World Leader.

The Green Building Council of Australia now offers several Green Star rating tools. The tool most applicable for this project is the Green Star – Multi unit Residential tool (ver 1).
The Green star rating method may be chosen as a form of sustainable design analysis for the proposed building regardless that the rating tools do not cover specifically, similar building categories. It offers a holistic approach to the construction of the building over a wide range of issues, from water to energy, materials to indoor environmental quality and site considerations to emissions.

The Greenstar rating is achieved by demonstrating compliance with 'Points' that are organised into 9 categories, these being:

- Management,
- Indoor Environmental Quality,
- Energy,
- Transport,
- Water,
- Materials,
- Land use and Ecology and
- Emissions.
- Innovation

The categories are weighted according to the importance of environmental issues and geographical location within Australia. For instance, potable water has a greater significance in South Australia than the Northern Territory, and therefore the Water category has a higher weighting in South Australia. The ninth category is Innovation and up to 5 points are set aside to reward projects that utilise 'innovative' technology or practices. The weighted points are added together to give an overall score which corresponds to the final Greenstar rating, as follows:

Rating	*Total Weighted Points*
1 Star	10 - 19 pts
2 Star	20 - 29 pts
3 Star	30 - 44 pts
4 Star	**45 - 59 pts Best Practice**
5 Star	**60 - 74 pts Australian Excellence**
6 Star	**75+ pts World Leader**

Only ratings of 4 star and above are recognised and marketed by the Green Building Council since they represent better than average environmental credentials.

We would suggest this development seeks to attain at a minimum 5 stars with a target of 6 stars.

5.7 GREEN STAR INITIATIVES

The current initiatives proposed for the design include.

Initiatives to achieve a 4 star equivalency.

- Appoint a Green Star Accredited Professional as part of the design team from the start of the design project
- Contractually agree on commissioning clauses for commissioning and pre commissioning
- Commissioning to be specified in tender documentation to contractors
- Commitment to a 12 month building tuning after handover with quarterly reviews and a final recommissioning after 12 months
- Commissioning - Commissioning Agent
- Prepare a comprehensive building user's guide containing information on all services in the building
- Contractor is to have an energy management plan
- Contractor is to have a ISO14001 certified energy management system
- Re use or recycle 60 % of the waste generated on site while construction
- Achieve a high level of thermal comfort at reduced annual energy consumption by providing heating and cooling load of no more than 86MJ/m2/annum
- Conduct comprehensive hazardous material survey to reduce health risks to occupants
- Maintain noise levels at appropriate levels by complying with AS/NSZ 2107:2000 design sound level
- Provide unobstructed external views of >25m to 75% of living spaces of all apartments
- Reduce the carbon dioxide emission by 57% of the benchmark (NSW target = 556kgCO2/per/year)
- Provide car parking for at least 25% less car spaces than local planning allowances
- Provide car parking for at least 50% less car spaces than local planning allowances
- Provide a minimum of one secure bike storage per dwelling
- Provide one secure bicycle rack per dwelling & dedicated enclosed bicycle locker /cage per each dwelling
- Provide visitor cyclist spaces for 25% of the dwellings in an accessible on-grade location, signposted and near major public entrance
- Commuting Public Transport - 1 point based on proximity
- Demonstrate that the building is located within 400 metres of five local amenities so that the number of car trips taken by residents can be reduced
- Install water meters for all major water uses for all dwellings
- Reduce consumption of potable water for irrigation by using rain water, recycled water, or no landscaping
- Re-use land that has been previously built on (>75% of the land is previously built on)
- Prevent the risk of Legionella growth by not using a water based cooling systems for the building
- Prevent light pollution by ensuring that no light beam is directed beyond site boundaries or upwards

without falling on a surface that

In order to improve the buildings rating to a 5 star rating the following additional initiatives could be adopted.

• Provide readily accessible smart meters for monitoring the use of electricity, gas and water consumption for each individual dwelling
• Ensure that 95% of all paint used have a low content of Volatile Organic Compounds (VOC), or no paint used
• Ensure that all carpets have a low content of Volatile Organic Compounds(VOC), or no carpets used
• Ensure that all adhesive and sealants have a low VOC or none used
• All composite wood products are to have low formaldehyde content
• Provide electric lighting levels that achieve 320 Lux on kitchen, bathroom and ensuites surfaces
• Electrical Sub-metering - Install sub-metering in each dwelling
• Provide energy demand reduction systems that would reduce the peak energy demand on the electricity infrastructure by 25% of the base operation load
• Provide dwelling shutdown switch near the main entry door to turn off all lights and air conditioning. In unoccupied spaces
• Install motion sensors and daylight sensors in common areas and shared facilities to minimise energy use in unoccupied spaces
• Use energy efficient appliances within one star of the best available rating appliance within dwelling
• Use best available rating appliances in the dwelling
• Provide a formal car sharing scheme
• Install 3A rated water fixtures for sanitary use for all dwellings
• Install water meters for the domestic cold water usage for each dwelling
• Provide fire systems water from rain water tanks or recycle water sources on site
• Provide dedicated storage area, recycling and general garbage chutes &on-site disposal
• Reduce the use of concrete by 30% for in-situ concrete, 20% for pre-cast concrete and 15% for stressed concrete
• Reduce the use of PVC - 30 % by cost by using alternative products PVC Minimisation
• Achieve a net reduction in the total amount of materials used in any two of the following; structure, ductwork, unit size, prefabricated kitchens and bathrooms, finishes, cladding and pipe work
• Select flooring that has a reduced environmental impact relative to available alternatives
• Reduce lifecycle waste in at least 10% of the dwellings by designing units that are easily adapted for use by occupants with a wide range of physical abilities.
• Ensure that there is no change in net ecological value of site
• Use refrigerant with Ozone Depletion Potential(ODP) of Zero, or don't use refrigerant
• Install refrigerant recovery with automatic refrigerant pump down, or don't use refrigerant
• Reduce flow to sewer by installing 3A water fittings and fixtures
• All insulation used in the building must be made from blowing agents that have zero Ozone Depletion Potential

To achieve an estimated 6 star rating the following additional initiatives are recommended.

• Re use or recycle 80 % of the waste generated on site while construction
• Naturally or mechanically ventilate with dedicated exhaust 90% of kitchens
• Achieve a high level of thermal comfort at reduced annual energy consumption by providing heating and cooling load of no more than 30MJ/m2/annum
• Reduce internal noise levels by increasing the bounding construction for walls ceilings and floors by a min of 10% over the values stipulated in the BCA
• Provide private open space of at least 15% of internal floor area to 90% of dwellings
• Reduce the carbon dioxide emission by 70% of the benchmark (NSW target = 391kgCO2/per/year)
• Install rainwater tanks and grey water recycling and treatment facilities
• Install water efficient appliances such as WELS 4 star rated dishwashers and washing machines as base building works
• Provide common areas for the collection of oversized household items
• Reduce the use of PVC - 60 % by cost by using alternative products PVC Minimisation
• Demonstrate that materials selected for building construction representing at least 1% of the project's total contract value have a post-consumer recycled content of at least 20% or are reused from existing buildings or any other buildings.
• Achieve a net reduction in the total amount of materials used in any four of the following; structure, ductwork, unit size, prefabricated kitchens and bathrooms, finishes, cladding and pipe work.
• Install storm water filtration and treatment to prevent watercourse pollution in the event of a storm according to Victorian EPA and ANZECC guidelines
• Reduce flow to sewer by installing 4A water fittings and fixtures
• Reduce flow to sewer by installing rain water tanks
• Reduce flow to sewer by installing efficient water fixtures and grey water recycling
• Provide ample day lighting so that 60% of all habitable areas achieve a daylight factor of no less than 2.5%
• Provide ample day lighting so that 90% of all habitable areas achieve a daylight factor of no less than 2.5%
• Provide energy demand reduction systems that would reduce the peak energy demand on the electricity infrastructure by 25% of the base operation load
• Provide car parking for at least 50% less car spaces than local planning allowances
• Provide small parking spaces for at least 25% of the total car parks available
• Provide visitor cyclist spaces for 25% of the dwellings in an accessible on-grade location, signposted and near major public entrance
• Occupant Amenity Potable Water Efficiency - rainwater tanks and grey water recycling and treatment
• Reduce the use of concrete by 60% for in-situ concrete, 40% for pre-cast concrete and 30% for stressed concrete
• 75% of timber and composite timber products are to be post consumer recycled timber or to be from FSC (Forest Stewardship Council) certified sources
• 50% of the refrigerant with Global Warming Potential (GWP) of less than 10
• All the refrigerant use must have Global Warming Potential (GWP) of less than 10, or don't use refrigerant
• Reduce flow to sewer by installing 4A water fittings and fixtures

6 ESD INITIATIVES

6.1 GENERAL

The purpose of this section is to summarise the ESD initiatives that will be considered for incorporation within the Bancor development. The ideas and systems are discussed at a conceptual level only.

We understand that this project seeks to provide a development that embodies sensible initiatives for sustainable low energy design that demonstrate ESD best practice.

The following is a summary of the ESD systems discussed in this report:

• Thermal comfort • Ventilation options • Solar access/ protection • Daylighting • Internal noise levels • Hazardous materials • Private outdoor spaces • Electric lighting levels • External views	• Energy improvement • Centralised domestic hot water systems • Alternative sustainable power sources • Metering • Energy efficient appliances	• Carparking • Cyclist facilities • Public transport
• Materials • External • Internal • Re thinking construction	• Occupant water consumption reduction • Water efficient appliances • Water meters • Rainwater collection and reuse • Greywater treatment and reuse • Landscape irrigation	• Waste management
• Bio diversity		

Environmental performance is becoming an essential component of quality. The general public are looking for homes that contribute less to global warming, consume fewer natural resources, and ensure the health, comfort and safety of their families.

Such qualities are often difficult for people to judge for themselves in a housing development and hard for the developer to communicate, however, if this is done effectively the results can be very successful.

Environmental benefits can be highlighted in the following areas of a development:

- Low CO2 emissions (low energy lighting, space and water heating and air conditioning, building air tightness)
- Timber from managed regulated sources or re-used
- Reduction of internal pollutants such as formaldehyde, wood preservatives, toxic paints, volatile organic compounds (VOC's) and other particulates and fibres
- Use of recycled or demolition material
- Site development which minimises damage to local flora and fauna, re-use of existing sites and

ecological improvements

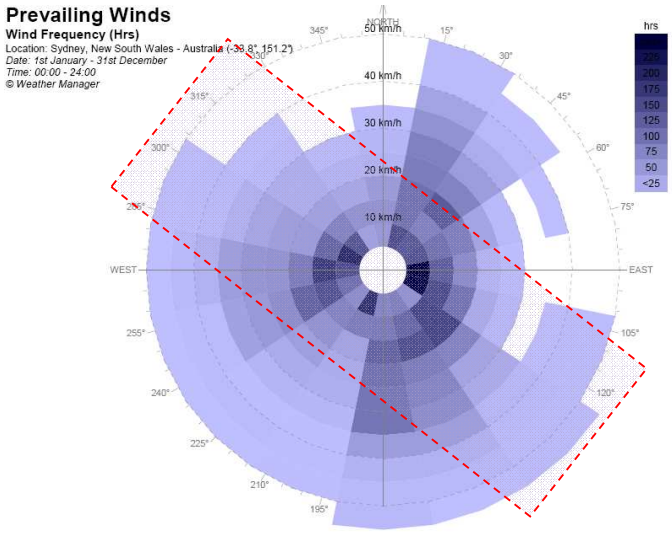
- Domestic and rainwater management
- Daylighting, passive solar heating and passive ventilation techniques
- Provision of a house log book/ user's manual

6.2 WEATHER

The climate has a dramatic effect on the expected conditions within the residential apartments. In order to calculate the environmental conditions within the school both internal heat gains and also data about the external conditions need to be taken into consideration. For the purposes of weather analysis a Test Reference Year (TRY) file is required for the local region. TRY file contains measured hourly weather data (8760 hours) deemed by the Bureau of Meteorology to represent one typical year – this includes complete data for dry bulb air temperature, solar radiation, cloud cover, relative humidity and wind speed/direction. Weather files are constructed to represent the most average conditions for the previous 20 years and are commonly used for building energy simulation and allow building designers to test the effect that modifying design features will have upon typical annual conditions.

In Sydney winds generally blow in three primary directions. In winter the wind blows predominantly from the west, the westerly winds are generally warm as they pick up heat whilst blowing over the land and dessert. In spring the wind blows predominantly from the North East. In summer the wind blows predominantly from the South East. The south easterly winds cool down as they come in contact with the ocean water.

The diagram below illustrates the predominant wind directions that may prevail on the Atchison Street site.



6.3 THERMAL COMFORT

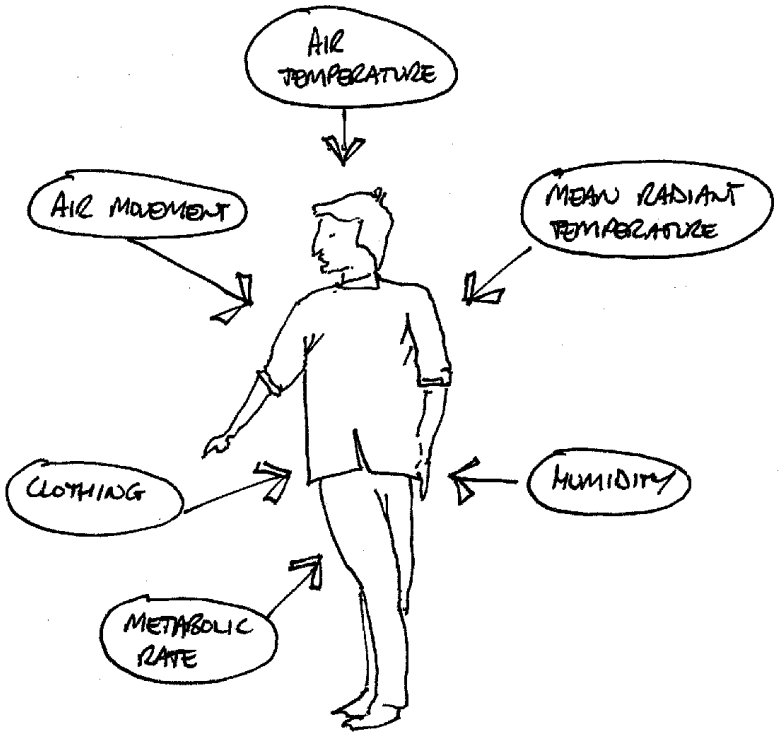
Prior to discussing the specific ESD systems that are proposed within the project, it is important to first understand how ESD systems such as shading, natural ventilation and construction materials interact and influence thermal comfort. It is important to note that thermal comfort is reliant on a total solution not the application of individual components in isolation.

The primary objective of ESD systems is to provide a habitable environment that is thermally comfortable without side reliance on more traditional systems such as air conditioning, the consequence of which is the reduction in energy consumption. It is therefore important to understand what thermal comfort is and how it is influenced.

Thermal comfort is defined as that condition of mind that expresses satisfaction with the thermal environment. Due to individual differences, it is impossible to provide a thermal environment that will satisfy everybody. As such, there will always be a percentage of dissatisfied people. The aim therefore is to provide an environment that provides a low level of occupant discomfort / dissatisfaction.

The sense of being too hot or too cold is influenced by several factors, physical activity and clothing, as well as environmental parameters: air temperature, mean radiant temperature, air velocity and humidity.

Now understanding what factors influence our thermal comfort we can address each factor separately with respect to thermal comfort provision.



6.3.1 Air Temperature

Air temperature within each residence is influenced by internal loads from lights, people, equipment such as televisions, computers, household appliances and heat gains through external walls and glazing.

To reduce air temperatures in summer, the following practices should be adopted:

- Turn lights off when adequate daylight is available.
- Turn lights off when rooms are unoccupied.
- Turn off non essential equipment overnight and when not in use.
- Close all internal blinds when apartments are unoccupied.
- Employ a night purge ventilation strategy during summer periods in combination with the thermal mass of the building structure. Refer to the natural ventilation section later in this for details of secondary ventilation scheme's that allow night purge to be achieved without compromising security.

To increase air temperatures in winter, the following is recommended:

- Close all windows overnight to prevent over cooling of the space. During times when each residence is occupied windows should be only opened as necessary for fresh air provision.

6.3.2 Mean Radiant Temperature

Mean radiant temperature is an estimate of an occupant's perception of the radiant temperature in a space. Radiant temperature is influenced by direct and diffuse solar gain, surface temperatures and artificial lighting.

Careful selection of glazing, external shading devices and internal blinds is required and will be undertaken during the design development stage.

6.3.3 Humidity

Humidity can only be controlled through use of the air conditioning systems. It is not proposed that this project will incorporate active humidification or dehumidification.

6.3.4 Air Movement

Air movement across the body promotes evaporation of perspiration. This process of water changing phase to a gas requires energy. The effect is that when perspiration evaporates the body is cooled. Generally discomfort results in summer with poor air movement and when air movement is excessive in winter.

Generally, it is expected that units with access to cross ventilation will have better air movement with the presence of external wind forces than a single sided unit. Opportunities exist to employ cross ventilation to single sided bedrooms and will be discussed later in this report.

6.3.5 Clothing Levels

Clothing Levels are measured in units of clo. Clo levels are less of an issue in a residential situation as the occupants are able to modify their clothing quite drastically whereas in commercial and retail situations there is an expectation of minimum levels of dress or uniforms/safety clothing that is fit for a purpose rather than comfort.

6.3.6 Activity Levels

Activity levels are measured in units of met which is related to the metabolic rate of the occupant carrying out a task. Again activity levels in residential settings can vary in response to environmental conditions as opposed to work or retail situations where a certain level of activity must be carried out.

6.3.7 Additional considerations for thermal comfort

Within occupied areas, if heating is required, it is usually provided to maintain thermal comfort for the inhabitants in winter and during certain times in the mid season months, and this thermal comfort is dependent on the following factors:

- radiation - the heat lost in radiation from the body, through clothing and exposed skin surfaces to cooler surroundings
- convection - the heat lost by convection from the body through clothing and exposed skin surfaces due to contact with the surrounding air, the temperature of which is considerably lower than the body
- evaporation - the heat lost from the body by evaporation from the skin, due to perspiration.

The losses for each of the above components are in the following proportions:

- radiation: 45%
- convection: 30%
- evaporation: 25%

These conditions must be controlled to maintain comfort conditions for the occupants of any building, and it therefore follows that to address these losses in the most efficient manner, the main form of heating should be from radiant sources.

6.4 BUILDING ENVELOPE

The building envelope provides an interface between the controlled internal environment and the uncontrolled and variable external climate. The design of the envelope, therefore, determines how the climate is moderated, while maximising the benefits such as air and light.

Issues such as component life, interfaces, support, water tightness, air tightness and thermal insulation all need to be considered.

The main features that affect the passive performance of a building relate to the following issues;

- Cross flow ventilation
- Adequate Solar Shading
- Incorporating thermal mass

6.5 NATURAL VENTILATION

Natural ventilation relies on the movement of outside air throughout a building to remove heat gains from within the space and to provide fresh, oxygen-rich air to occupants. Elements that influence the performance of the natural ventilation systems of each apartment include:

- Climatic conditions
- Building orientation
- Pathways throughout the building for the movement of air
- Size and location of openings
- Height and temperature difference between inlets and outlets
- Acoustic control
- Protection from high winds

Natural ventilation relies on either external wind forces or buoyancy forces to move air through a building. Whilst cross ventilation relies on pressure differences caused by wind forces to move air through a building, buoyancy ventilation does not. Buoyancy or stack ventilation relies on temperature and height difference of incoming and outgoing air to generate air movement. By allowing warm stratified air to be relieved from a building through higher level openings, (many of the apartments are staggered in height), natural ventilation can be provided without reliance on external wind forces. Thus during still periods or with slight wind, natural ventilation can be maintained, resulting in improved thermal comfort through better natural ventilation performance.

Due to the height of this development protective winter gardens are proposed to buffer external wind forces and allow controllable ventilation to the apartments.

6.6 SOLAR ACCESS / PROTECTION

Shading systems play an integral role in the thermal performance of buildings by controlling solar loads.

The design parameters for external shading systems included consideration to:

- Building / window orientation
- Sympathetic to daylight access
- Preservation of views to outside
- Compliment building aesthetics and are considerate to maintenance requirements.

The eastern facade and the western facade are likely to receive sun during the morning and afternoon respectively. Whilst some solar access could be pleasant for the occupants during the winter months, in summer it may cause discomfort, to alleviate this problem external shading devices are recommended.

In order to achieve a flexible design configuration to enable adaptation to changing market demands the following options may be adopted.

The proposed external shading devices could be designed to offer the following benefits:

Incorporate Building Integrated Photovoltaic system (BIPV) into the shading

The BIPV modules function, not as an add-on, but rather, as an integral part of the building skin. They can be used just like standard building materials offering shading, weatherproofing, thermal and acoustic protection. This cuts out the duplication of materials with standard solar modules mounted on top of the existing building structure, saving material cost and reducing environmental impact at the same time generating electricity directly from sunlight. BIPV modules provide greatly improved aesthetics and allow savings over traditional building materials and installation.

BIPV could be used to power small equipment or even the proposed fans for mechanically ventilating the apartments.

Two options of BIPV use in the proposed development are as follows

Photovoltaic glazing - the window glazing is produced with integrated PV cells which could in addition to generating electricity, also dramatically reduce the heat that enters the building. Based on the required performance a wide number of options is available, some are shown in the photos below.

Photovoltaic glazing

BIPV as an external shading device - can be integrated into the shading over the windows to not only block direct sunlight but also to provide energy as shown in the photos below.

Photovoltaic cells integrated into shading devices

Operable Shading – Control level of protection / daylight required by individual users.

The advantage of operable shading devices is that they can be adjusted at will, to either exclude or admit solar radiation. Fixed shading devices intercept the sun's rays before they hit the glazing and thereby block out any natural light penetration into the occupant space. Many of the operable types can intercept solar radiation reflected from the ground, in addition to intercepting the direct and most of the diffused radiation from the sky. Operable shading devices can admit solar radiation when this is desirable in winter; therefore operable shading devices are inherently more effective than fixed shading. Most operable shading devices can be applied with about the same effectiveness to all orientations and to any shape of window.

Façade shading shall be light in colour so that light and solar heat are reflected rather than absorbed by the shading device and re-radiated back into the apartments.

6.7 DAYLIGHTING

The introduction of natural light to a building provides illumination without the need for artificial lighting, improved space ambience, better qualities of light, view links to outside and dynamic plays of light to create effect in the specific area.

Traditionally daylight is introduced via perimeter glazing with skylight systems available for the introduction of light to central areas without perimeter facades. Perimeter and central day lighting systems should consider the following:

- Even daylight distribution across each space
- Control of solar gains
- Avoid direct sunlight penetration
- Glare control
- Integration with artificial lighting systems
- Integration with natural ventilation devices

Deep reveals offered by the winter gardens (enclosed balconies) allow for protection from the glare and heat from summer sun but allow diffuse light to penetrate into each apartment.

6.8 PRIVATE OUTDOOR SPACE

Access to landscaping is very important part of creating a positive and pleasant environment for the residents.

Active and passive recreation areas should be incorporated into the landscape design. The should include:

- Outdoor shaded seating areas for small groups
- A larger 'village green' for group gatherings
- BBQ area-associated with indoor common areas
- AA grassed amphitheatre for film nights/performances

6.9 ELECTRIC LIGHTING LEVELS

In order to provide adequate lighting for specific tasks and activities within residential dwellings, that is not over-designed; efficient fluorescent lighting should be used.

7 ENERGY

7.1 ALTERNATIVE / SUSTAINABLE POWER SOURCES

The aim of this section is to minimise energy consumption within the development with a view to reducing greenhouse gas emissions so that the building could function as a zero energy building
Energy efficiency is an item of high importance to the design team and the developments of mechanical, electrical and hydraulic services shall be designed to minimise energy consumption.

With any sustainable solution the first step is to minimise demand, only then should the system of supply be optimised. For building solutions this means providing passive systems such as appropriate glazing and shading, controllable ventilation, adequate insulation and thermal mass in construction. A climate-sensitive combination of these features is required.

A simple way to reduce greenhouse gas emissions is to use renewable energy generation systems such as photovoltaic solar panels, solar troughs and wind turbines. There are a number of alternative power solutions that could be considered as options for the site.

Traditionally the requirement for Alternative Power was based on critical loads and essential services. The requirement for these power sources for Critical and Essential loads has not changed however the opportunity to provide reliable Alternative Power sources for environmental reasons has improved in recent years.

An opportunity also exists to interface the two requirements such that the alternative power source also supports the essential or critical loads thus providing redundancy in the power system for these loads. In this case the main primary power infrastructure has the capacity to cope with the additional power loads in these periods.

7.2 ENERGY EFFICENT APPLIANCES

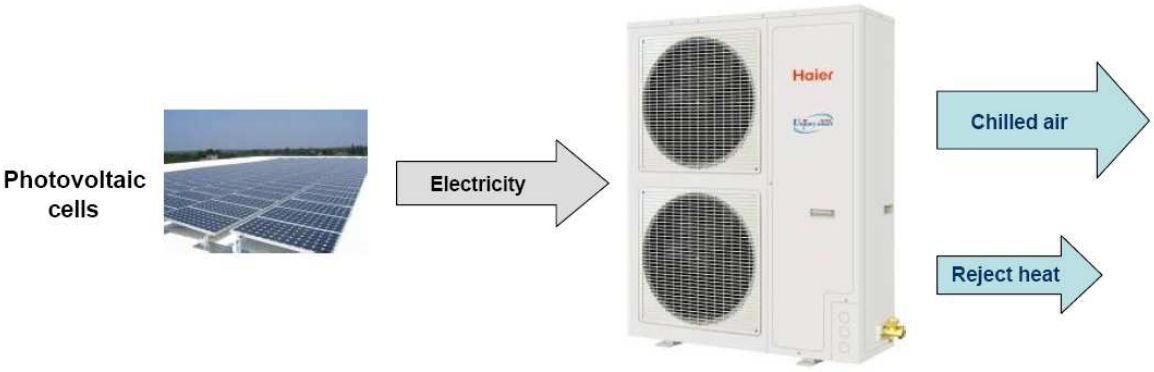
In order to improve the energy consumption it is recommended that energy efficient appliances are provided as part of the base building provisions for the serviced apartments.

Appliances such as refrigerators, clothes washers, clothes dryers and dishwashers that will be provided are within one star of the best available rating.

7.3 SOLAR AIR CONDITIONING

There are two types of solar air conditioning system, namely solar electricity driven cooling system and solar heat driven cooling system. Typical system configuration is shown in the following diagrams.

Solar electricity driven cooling system



Vapour-Compression AC System

Solar heat driven cooling system

Sorption Cooling System

8 TRANSPORT

8.1 CARPARKING

The transport sector is responsible for contributing a significant portion of Australia's greenhouse gas emissions. Reducing the number of car parks will not only encourage building occupants to use public transport thereby reducing the impact on the environment but also to car share, walk or cycle.

8.2 PUBLIC TRANSPORT

The site is located within close proximity to the Pacific Highway which ia a major road that has numerous bus stops. It is close to St Leonards train station that is a major train station interchange with frequent services. Tis can encourage students and visitors to use public transport.

9 MATERIALS

9.1 EXTERNAL

Materials & finishes will be low maintenance in order to reduce operating costs. For example there are no large painted areas; self-finished materials such as face brick, metal cladding, or pre-cast concrete that is stained or polished are used instead. Windows will be capable of being locked slightly open.

9.2 INTERNAL

Materials & finishes will be durable and easy to clean. Painted surfaces will be washable. Maintenance will be simple and cost effective. Colours will be selected to minimise the showing of stains.

100% wool commercial grade carpet to common areas and apartments with appropriate underlay will be provided.

Internal walls need to be robust for high impact resistance, special consideration to the design or layering of any plasterboard walls will need to be addressed.

9.3 RETHINKING CONSTRUCTION

Efficiencies in construction costs, time and quality will be achieved through careful consideration of the following:

- Establishment of acceptable performance criteria for the building fabric and engineering services.
- Encouraging use of standard components and standard design solutions for repetitive detail and repeating proven technical solutions.
- Agreement of whole life cost and value parameters.
- Higher quality without greater complexity or cost.
- Minimisation of over-specification

10 WATER

10.1 OCCUPANT AMMENITY WATER REDUCTION

The use of water efficient products certified to the National Water Conservation Rating and Labelling Scheme conserves water without the difficult task of having to change behavioural habits, as the performance of these products is not compromised by their reduced water usage. A fitting with a 5A rating is defined by the Water Services Association of Australia as having an excellent level of water efficiency and a rating of 1A is considered a moderate level of water efficiency.

The development should consider AAA rated taps, or standard taps fitted with 'Aqualoc' and AAAA rated Caroma 'Smartflush' toilets.

10.2 WATER EFFICIENT APPLIANCES

The development will provide AAA rated water efficient appliances as part of the base building provisions.

10.3 WATER METERS

The development will provide water meters for all major water uses in order to manage the buildings water consumption. As an option a leak detection system could be installed, with an active alarm process.

10.4 RAINWATER COLLECTION AND USE

Rainwater tanks could be incorporated into the development to collect valuable clean water for use in irrigating the landscape. For the purposed of this development a large tank could be used to store coarse filtered rainwater. Dedicated pipework to the ECs and outdoor taps would be required with clear labelling to indicate non-potable water.

10.5 LANDSCAPE IRRIGATION

A water efficient drip irrigation system with moisture sensors could be installed. All landscaped areas should contain a minimum 400mm of topsoil. The contractor will allow for Retaining walls where deemed necessary, there are to be masonry and shall not be high maintenance materials such as timber or painted render.

11 WASTE MANAGEMENT

An appropriately sized and screened garbage enclosure should be located conveniently close to the basement building entry. There will be a bin washing area in one of the bays, and consideration of the effective movement of bins to the truck collection point.

Recycling and waste bins will be provided in appropriate quantities and in accordance with the University waste contractors and local authority requirements.

12 BUILDING MANAGEMENT SYSTEM

12.1 GENERAL

The development shall be complete with a Building Management System (BMS).

A points schedule indicating each of the building services items to be monitored and controlled shall be listed. They shall include Air Conditioning, Ventilation, Electrical, Security, Lifts

The following will have interfaces to the BMS:

- Central Air Conditioning Plant
- Car park ventilation
- Common Area Lighting
- Electrical Metering (High Level)
- Power Factor Correction (Low Level)
- Lifts (Low Level)
- Security (Low Level)
- Standby Power Systems.

The BMS will control all common area plant and lighting throughout the development.

13 ELECTRICAL SUPPLY

13.1 POWER SUPPLY

Based on the current set of drawings the estimated maximum demand is TBC, the maximum demand are evaluated in accordance with NS0112.& NS0110 of Energy Australia. Based on the same principles from previous investigations with Energy Australia, electricity supply to the site could be obtained from one (1) separate chamber substation. The substation is required to be positioned on the customers property with direct access to the street.

Each chamber substation requires a dimension of approximately 11.5m by 10m (column-free), and an additional 1.5m width to cater for egress. basement type substations are possible, they require additional space for dual stair access and forced ventilation. However, the basement option has been ruled out in the previous discussion among project manager and architect due to its stringent conditions on clearances and access compared to on grade chamber substation.

The electrical supply shall be adequate to suit the requirements of the development and be reticulated via the main switchboards which located adjacent to the substation to suit the length restriction from Energy Australia.

The final position and arrangement however requires further assessment and consultation with the design team and Energy Australia. Detailed design of the substation is to be carried out by a Level 3 Service Provider and is outside the scope of our consultancy.

13.2 MAIN SWITCHBOARD & MAIN SWITCH ROOM

It is proposed that the electrical main switchboards be located adjacent to the substation in order to fulfill the length restriction requirement set by Energy Australia.

Our preliminary estimate of dimensions for the main switch room is TBC. For main switch room, 2 means of egress is required as called for in AS3000.

14 METERING

14.1 PODIUM RETAIL AREAS:

It is proposed that the electricity metering be arranged to separately meter the house services and each individual tenancy/residential unit, thereby, allowing separate billing for the house services and each individual consumer.

14.2 PODIUM RETAIL TENANT METER ROOM:

To save space on Ground Floor, retail tenant meter rooms will be located on basement level with convenient access for Energy Australia meter reading personnel.

14.3 RESIDENTIAL AREAS:

Due to the multitudes of residential units in the residential buildings especially in high rise buildings, central metering may not be practical as there is not sufficient space in one meter room to house all meters and riser duct to house all outgoing tenant risers, electrically, voltage drop and power loss is also another problem due to excessive lengthly cable run. Alternatives to be investigated is to locate the meters either at 3-floor intervals or floor-by-floor basis. Digital (smart meter) meter reading scheme is to be considered and would discussed with Energy Australia during the design stage, the benefit of digital metering is to save the effort of EA's meter reader from coming to the premises on a regular basis and at the same time digital recording of the load profile can be stored over a long period of time.

Each tenant and resident shall be responsible for individual accounts with their energy retailer of choice. In addition private meters shall be installed on selected loads to monitor power usage.

15 RISING MAINS, DISTRIBUTION BOARDS & TENANT METER BOARDS

15.1 GENERAL:

All submains for house services and tenancy services shall reticulate from the main switchboard through basement (one floor below ground level) and feed the tenancy distribution boards via the electrical services risers located at the designated positions.

No such submains are allowed to run through tenancy areas.

16 LIGHTING

16.1 GENERAL

Lighting is yet to be fully documented and finalised however all spaces will have lighting installed to Australian Standard complete with relevant lighting controls. The lighting design will play particular attention to the building's architecture and aesthetics.

Internal electrical lighting shall be designed in accordance with AS/NZS 1680 and shall use energy efficient fluorescent and metal halide sources. The building's lighting design shall be progressed in the coming weeks.

The lighting shall be designed in accordance with AS/NZS 1680 and shall use energy efficient sources where possible.

The foyers shall be have 'dramatic' lighting with emphasis on key elements within the space including the ability to illuminate art.

A challenge will be control the amount of energy use in retail lighting. Consideration to such limits need to form part of tenancy agreements.

Another challenge will be limit the over use of low voltage lighting. This can be achieved with special attention to the specialist lighting design.

The specialist lighting for major areas and features of the development will be designed in consultation with FJMT to achieve a high quality installation that compliments the architecture and ensures the aesthetics, image and technical objectives are achieved.

16.2 LIGHTING CONTROL

The building will be provided with intelligent lighting control systems to allow dimming and pre-programmed lighting settings to be achieved. Such systems will allow programming to automatically adjust lighting to suit particular times of the day or to suit external lighting conditions.

The System shall have master and individual controls at relevant locations complete with a number of preset buttons providing a range of functional configurations.

The base building system will control the following.

- o External Lighting
- o PECs
- o Internal Lighting
- o Light Dimming to selected areas

It is proposed that the control of external luminaires be via photo-electric cell and time clock control.

16.3 EMERGENCY AND EXIT LIGHTING

The Emergency and Exit lighting shall be designed in accordance with the Building Code of Australia and AS/NZS 2293 and incorporate self contained emergency exit luminaries and emergency luminaire single point units. The maintenance testing of the emergency lighting shall also be designed to suit the requirements of AS/NZS 2293.

17 HOME AUTOMATION

17.1 GENERAL

Home Automation shall be considered to selected residential apartments. The system can be offered at a number of levels. i.e.

Basic – General Lighting Control. This maybe a simple wireless system to selected loads.
Standard – Lighting, Dimming.
Premium – Lighting Dimming, Touch Screens, Control of AC, Blinds, Floor Heating, security interface and remote access.

CBUS are generally leading the industry, however there are other systems of equal capability that shall be considered.

18 LIGHTNING PROTECTION

A preliminary risk assessment as outlined by AS/NZS 1768 was carried out and suggested that lightning protection has to be provided and that surge protection at point of entry should also be provided. If protection is by means of an induction sphere similar to Dynasphere System 3000 series, a dedicated riser duct of 300mm x 300mm is preferred to house the co-axial down conductor.

19 RESIDUAL CURRENT DEVICES (RCD)

As required by AS/NZS 3000 all general purpose socket outlets within the tenancy areas shall be protected by a residual current device. Within the residential units all socket outlets and lighting circuits shall be protected by a residual current device.

RCDs shall also be installed on all other public and general services throughout the development.

20 SECURITY & INTERCOM SYSTEMS

20.1 COMMON AREAS

The primary function of the security system within the new development is to control access to and within the building. It shall also monitor alarms via the reed switches and movement detectors.

Each user of the building will be provided with an access card (proximity, swipe or fob) which can be programmed to individual user's authorisation; this will allow access to the building via the card readers. A push release button will be installed to release the door to exit or via mortice lock release integral with the handle.

The security panel will be interfaced with the fire alarm system and in the event of a full alarm all magnetic locks will release to facilitate an evacuation of the building.

Tenants will be responsible for security of their individual tenancies.

20.2 RESIDENTIAL SECTIONS

It is proposed that an electronic security and intercom system be provided throughout the development to monitor and control access into the complex.

A security gate will be provided to all car park entrances to allow authorised parking only. A proximity reader (key fob) shall be issued to each tenant so that when approaching the car park control gate a sensor will detect the key fob and open a boom gate.

The intercom system shall be provided with audio and video to all units and penthouses. An intercom receiver handset and monitor shall be installed within each unit, with the facility to allow opening of the main door and the resident car park boom gate. The intercom system shall also provide a means of access for occupants, alternatively a separate access card or fob can be provided.

Residents would gain access into their own units through dedicated lift connected to their exclusive secured carparks.

20.3 ACCESS CONTROL SYSTEM

The proposed access control system will incorporate sufficient door reader modules, electronic strikes (fail safe), electric latches (fail safe), proximity card readers and door release pushbuttons as required to serve the nominated locations.

All external perimeter doors will be electrically locked to prevent unauthorised access. Some doors will require free access during certain periods and will be set with pre-determined times to automatically unlock or open.

The alarm software will display the status of these doors, so that security staff can monitor what doors are open at all times.

The electric latch door locks along the egress path will be of fail-safe-type; these doors will allow people to escape from the building during emergency. During normal and after hours, the door reed switches will be programmed such that un-authorised use of the monitored door will raise an alarm signal to the security system.

20.4 INTRUDER DETECTION AND ALARM SYSTEM

Intruder detection and alarm system will be provided to monitor perimeter doors and incorporate zone expanders, door reed switches and passive infrared movement detectors to nominated locations as required.

All external doors will have reed switches.

The intruder alarm system will be controlled from a central security location.

Where alarm systems, are used for transmission of other applications such as fire detection system, they will also comply with the relevant standards for those systems. All equipment will be located in a position to minimise the risk of interference.

20.5 CCTV CAMERAS AND SYSTEM

A surveillance system is designed to be a deterrent to illegal activity as well as providing the ability to review incidents after the event. It is not intended for the CCTV system to be monitored at all times as incidents will be recorded automatically.

It is proposed to install a CCTV system utilising digital colour cameras throughout the development. The cameras will be fixed, with network cards required within each server. Recording of digital cameras is to be stored into new hard drives adequate to store images for a period of time required by the client.

A digital system will be software driven. It will provide continuous recordings of all cameras with search capabilities using date, time or any number of user-defined filters. The software will have the ability to be set for motion detection of a user defined area and is fully programmable by the administrator. This system will also be capable of receiving external inputs from alarms etc to enable automatic response e.g. if a duress alarm is activated the monitor will automatically save the relevant images to an event file as well as display a full screen image at the monitoring site.

All controls for this system will be software driven including camera adjustments such as contrast, brightness etc and the system has a number of security features that prevent unauthorised access to the program.

All images will be recorded onto Hard Disk Drives within the servers. The length of recording is dependent on the amount of activity, number of cameras and quality of image recorded. Each server is capable of expansion to four HDDs.

Images can be saved in either JPEG or BITMAP format, saved images can then be transferred via E-mail', CD or other data -transfer method.

The system will have the ability to be connected to external locations for retrieval of images either by the computer network or by telephone line and modem.

All areas covered by CCTV will have display warning notices provided on all entries to warn all persons entering the facility that the area is under surveillance. This warning will be displayed in all public areas within the facility where surveillance systems are in use.

Residential lifts are operated by the use of residents' own security cards, CCTV camera would be installed in each of the residential lift, images would start to be recorded upon activation of motion sensor.

21 COMMUNICATIONS

21.1 TELECOMMUNICATIONS

Podium

The Building Distributor (BD) shall be located in the Communication/IT MDF Room from which the communications cabling shall reticulate throughout the development to allow both voice and data communications to be provided at each tenancy.

Each retail tenancy shall be have a minimum of 10 pair cable.

Residential

One 4pair Cat 6 telecommunications cable shall be installed in each unit to give one telephone line.

This cable is suitable for use with a DSL (512kb/s) broadband internet. This allows the tenant to use the internet and the telephone line simultaneously.

If required the tenant is able to install a home wire-less internet connection without requiring any building work or new cables to be installed.

21.2 TELEVISION / MATV

A FM/UHF master antenna TV system shall be reticulated to allow receipt of free to air channels to all residential areas and selected retail tenancies. The system shall be capable of distribution of digital signals.

21.3 PAY TV

The Pay TV system is to be transmitted through the MATV network and made available to the residential tenants. A satellite dish shall be installed on the roof or discrete location for the Pay TV signal from Foxtel.

A cable interface from Optus shall also be considered.