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Cardinal Freeman Village

Concept plan ESD Report

Prepared for
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c/- epm Projects Pty Ltd

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B	Minor Updates	09/10/2012
C	Concept Plan Issue	11/10/2012
D	Minor Update	17/10/2012

The success and realisation of the proposed initiatives will be dependent upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved. The use of computer simulation is by its nature predictive with output based on historic weather data and standard assumptions. The results of any computer simulations within this report do not guarantee future performance.

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Executive Summary

This report identifies the ESD initiatives for the Cardinal Freeman Village development, located at 137 Victoria Street, Ashfield. Sustainability has been considered for the whole Concept Plan, which includes five stages of development.

The following minimum requirements apply to this development:

- Compliance with the Director General's Requirements (as set out in Application MP 08_0245);
- BCA Section J for Energy Efficiency; and
- Building and Sustainability Index (BASIX) for all residential development and seniors living (ILU's), stipulating minimum performance in energy, water and thermal comfort.

An integrated approach to environmentally sustainability design (ESD) involves a broad range of environmental indicators, beyond the minimum requirements. The proposed development has been evaluated in response to the Director General's requirements by addressing the following key elements:

- Energy & Emissions: Reducing greenhouse gas emissions through energy efficiency of building services and building façades;
- Indoor Environmental Quality (IEQ): Preservation of amenity including internal air quality, light and comfort;
- Water management: Conserving water and preserving natural waterways;
- Materials selection to reduce impacts on the internal and external environments;
- Impacts of Construction & Operation: Minimise natural resource consumption, waste, pollution and toxicity during the construction and operation of the facility; and
- Transport, Emissions & Ecology.

The key strategies proposed to address the aforementioned issues include:

- Creation of village environment to maximise the developments positive impact on the community as a whole;
- Minimisation of car parking and implementation of initiatives to encourage the alternative means of transport;
- Passive building design;
- Efficient building services;
- Water efficient tapware, toilets and appliances;
- Centralised Solar Hot Water;
- Rainwater Harvesting;
- On site stormwater detention;
- Consideration to material selection and specification; and
- Implementation of environmental and waste management policies.

1 Overview

This report identifies the Environmental and Ecologically Sustainable Design (ESD) initiatives for the Cardinal Freeman Village development for the concept -planning stage of the project. The initiatives outlined within this document set the framework for all future stages of the project with regards sustainability.

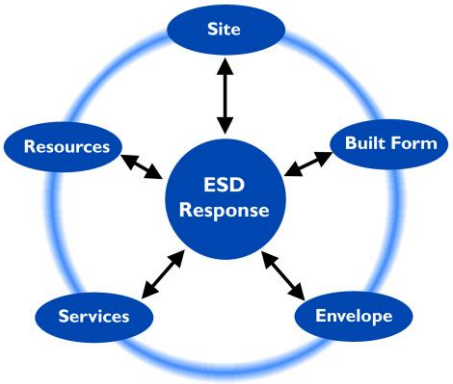
1.1 Objectives

The components of the development will be evaluated in response to the following primary ESD issues as outlined in the Director General's requirements for the project:

- Potential impacts on air quality as a result of any increase in traffic and congestion arising from the development on surrounding developments;
- Potential water quality and flow impacts of the development on local waterways;
- Address the requirements of NSW State plan sections E3 with regards Cleaner air and progress on greenhouse gas reductions;
- Address the requirements of NSW State plan sections E4 with regards delivering better outcomes for native vegetation, biodiversity, land, rivers, and coastal waterways;
- Management to prevent, control, abate or minimise environmental impacts;
- Reduce risks to human health and environmental degradation and
- Assessment of the effectiveness and reliability of the measurements and any residual impact.

1.2 Integrated Design Approach

The integrated design process is crucial to delivering good environmental outcomes. It is the process by which all of the design variables that affect one another are considered together and resolved holistically. This approach looks at the entire building as a whole with the emphasis on integrating the different aspects of the building's design.



It is recognised that the development of ESD solutions will be an integrated approach with the project team as a whole. As such this ESD concept plan has been developed in conjunction with the client, architect, mechanical, electrical, hydraulic engineers as well as the traffic, landscaping and acoustic consultants.

2 Project Background

The Cardinal Freeman Retirement Village comprises 348 units of accommodation and aged care beds. The Village currently accommodates around 400 residents in a mix of accommodation types which cater to the varying needs of residents and the aged within the community.

The Village has a long history of association with aged care services to the local community. It was established through a series of building programs which began in 1978 involving the construction of a range of aged care and seniors housing accommodation.

The site is fully self-contained and comprises a range of services and amenities for residents including consulting rooms, village shop, on-site dining room, hairdressing salon, library, billiards room, activity centre, and chapel. A shuttle bus to the local shopping and community areas is also available to residents.

The unique model of care at the Village is based on providing a continuum of care including self care (ILU), assisted living, hostel (low care) and nursing home (high care) accommodation. This enables seniors to age in place, with transition from self care through the various stages to palliative care provided in the nursing home available within a single site.

The Cardinal Freeman Village development is located at 137 Victoria Street, Ashfield, and comprises an entire city block bounded by Clissold Street, Queen Street, Victoria Street and Seaview Street. The site has an area of approximately 4.1 hectares. The site can be seen below in the context of the surrounding site.

The proposal maintains all four levels of care ('continuum of care'), provides a significant increase of new units with underground parking, while retaining a portion of older ILU's to maintain sufficient affordable market accommodation. This landscape Concept plan proposes over 3,000m2 of consolidated open space including new landscape curtilage adjacent to the site heritage items.

The proposed concept plan incorporates the following:

- Demolition of a number of buildings and provision of approximately 373 new and refurbished ILU's and Aged care beds (240 Independent Living units, 133 new residential care beds);
- Resulting in a similar quantum of units / beds in the village to that approved.

It is proposed that the development of the site will be divided into the following proposed construction staging:

- Stage 1: 'Care Precinct' and 'Village Green Precinct' and
- Stage 2: 'Victoria Precinct'

Stage 1 is to be assessed under Department of planning (DoP) Project application with this Concept plan submission. Stage 2 will be assessed in the future utilising the local planning instruments with Ashfield Council under a typical Development Application methodology.

3 Concept Plan Development Proposal

The concept plan proposes to achieve the following:

- A senior's community maintaining a continuum of care and diverse housing choices to meet the demand of an ageing population in the inner west sub region for the next 15 to 20 years.
- Provide a seniors community that meets market expectations and is the preferred full service ageing in place community for seniors in the inner west.
- Develop the site to a suitable yield to support the necessary replacement of infrastructure (transport and services), community facilities, and heritage curtilage.
- Provide a responsive and corrective planning solution that responds to the heritage curtilage of Glentworth House and Chapel.
- Retain the landscape character of a well vegetated village by maintaining or improving the soft landscape and tree retention across the site.
- Improve security through sensible landscape treatment of open space, by improving lighting and electronic monitoring passive surveillance and vehicle access arrangements.
- Socially responsible resident management plans and staging considerations to ensure minimal disruption of services and amenity to existing residents of the village.
- Improved address including site layout design to create and reinforce the Village hub/focal point including signage strategy to improve way finding.
- Pedestrian network strategy to provide accessible links across the site to ensure true ageing in place can be provide and social interaction can be maintained for the longest period.
- Building designs responding to amenity, sustainability, urban context in a considerate and balanced response to all competing concerns.
- Develop an urban design response appropriately addressing the local and internal site context.

4 Regulatory Framework

Minimum regulatory ESD requirements applying to this site include the following:

- Building & Sustainability Index (residential only); and
- BCA Section J for Energy Efficiency (non-residential)

4.1 BASIX

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning. The objectives of the BASIX scheme are relative to an average development in NSW.

- 40% reduction in water consumption
- 20-40% reduction in greenhouse gas emissions, depending on building height.
- Minimum thermal performance requirements for heating and cooling loads.

A separate BASIX assessment will be carried out for the residential component of each stage of the development.

Stockland's own charter requires a 5% uplift on the targets outlined in BASIX. Therefore the target for water and energy is 45% and 35% respectively

4.2 BCA Section J

The Building Code of Australia Section J sets minimum energy performance requirements for all new non-residential developments. The minimum requirements cover air-conditioning, ventilation, lighting, power and hot water, as well as building fabric considerations including thermal construction and insulation, building sealing, glazing and shading.

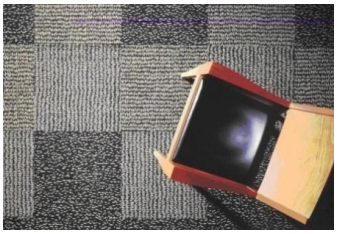
The Deemed-to-Satisfy Provisions in Section J of the BCA 2008 are defined in eight parts:

- Part J1 – Building Fabric
- Part J2 – External Glazing
- Part J3 – Building Sealing
- Part J4 – Air Movement
- Part J5 – HVAC Systems
- Part J6 – Artificial Light & Power
- Part J7 – Hot Water Supply
- Part J8 – Access for Maintenance

Each stage of the proposed Concept plan will be developed to meet the BCA energy efficiency requirements for non-residential buildings.

5 Statement of ESD Principles and Commitments

The concept plan has been evaluated in response to the Director General's requirements and the following framework will be addressed by each stage of the development to ensure that the objectives are being met. For additional information please refer to sections 8 and 9 of this report:

	ESD Initiatives
Management	• Environmental Management Plan during construction and operation; • Waste Management Plan during construction and operation; and • Minimise natural resource consumption, waste, pollution and toxicity during the construction and operation of the facility.
Indoor Environmental Quality	• Preservation of amenity including internal air quality, daylighting and comfort; • Efficient Air conditioning and ventilation; • Maximise External Views; and • Minimisation of Volatile Organic Compound emissions.
Energy Conservation	• Reducing greenhouse gas emissions through energy efficiency of building services and building façades; • Natural Ventilation where possible; • Investigate the use of solar gas boosted hot water at each stage; • Variable Speed Drives and CO control for Car Park Ventilation; and • Energy monitoring via Building Management Systems. 
Transport	• Good public transport links; • Transportation and Travel Guide; • Provision of cyclist facilities for staff and visitors; and • Regular bus service to Ashfield CBD. 
Water Conservation	• Conserving water and preserving natural waterways; • High Efficiency fittings; and • Alternative Sources – rainwater storage.  
Materials	• Reduce impacts on the internal and external environments; • Preference for environmentally responsible materials; • Low embodied energy & high recycled content; • Minimise Volatile organic compounds; and • Dedicated waste recycling areas. 
Emissions	• All refrigerants used in air conditioning equipment will have an Ozone Depletion potential of zero; and • Filtered stormwater runoff.

6 Director General's Requirements

The development concept plan aims to meet the specific requirements of the Director General with regards ESD. The following section outlines how each specific requirement will be achieved.

6.1 Potential impacts on air quality as a result of any increase in traffic and congestion arising from the development on surrounding developments

As outlined in the traffic impact assessment carried out by McLaren Traffic Engineers as part of the concept planning process the additional motor vehicle traffic will not increase significantly. Therefore any potential impact upon the air quality of the surrounding developments will be negligible.

Proposed on site car parking has been minimised to encourage the use of other forms of transport, while complying with the relevant standards. This will have a net positive impact on the air quality of the surrounding developments.

6.2 Potential water quality and flow impacts of the development on local waterways

In order to provide an environmentally sensitive solution for the site redevelopment the primary focus shall be retaining rainwater on site for sanitary flushing and irrigation purposes. Based on the above the intent of the proposed stormwater management plan is to;

- Harvest rainwater for sanitary flushing and landscape watering
- Reduce the outflow from the site and;
- Discharge cleaner water into the downstream catchments.

Where water cannot be retained for reuse the development will further reduce the flow from the site through the inclusion of an onsite detention system.

It is also envisaged that gross pollutant traps and sediment control will be introduced to improve the quality of the water by removing debris and hydrocarbons collected on site before discharging to the Council's infrastructure.

6.3 Address the requirements of NSW State plan sections E3 with regards Cleaner air and progress on greenhouse gas reductions

6.3.1 Cleaner air

The concept plan focused on creating a village environment within the development incorporating the Village Green Precinct which is centrally located at the centre of the site and will function as the new 'Village Heart' for community meeting, activity and interaction.

The creation of an open village space, the retention of a significant portion of landscaping and minimising parking and traffic within the site boundary will have a positive impact on the local air quality. Reducing energy use and the incorporation of renewable energy will assist in delivering improvements on a state level.

6.3.2 Greenhouse gas reductions

The Concept plan strategy for the development exceeds minimum requirements set by BASIX and BCA section J. This will be achieved through careful planning at each stage of the development to ensure that the building orientation, massing and fabric construction are optimised to minimise the need for air conditioning and artificial lighting.

When air conditioning and artificial lighting are required to be operated the systems utilised will be high efficiency therefore minimising their impact on the GHG emissions for the development.

There will be significant greenhouse gas emission reductions through the proposed implementation of a central solar pre-heated hot water system to larger unit blocks capable of achieving efficient use of this technology.

During the initial planning phase, consideration has also been given to Cogeneration and Photovoltaic Panels. However, at this stage, they are not deemed feasible for the development due to significant capital costs and extended payback periods associated with the technology. The inclusion of renewables within the scheme will be re-evaluated and fully tested at key stages of the site redevelopment to see if this position changes over time (e.g. as new technology or government funding becomes available or capital costs are reduced).

6.4 Address the requirements of NSW State plan sections E4 with regards delivering better outcomes for native vegetation, biodiversity, land, rivers, and coastal waterways.

The landscaping strategy aims:

- To respect and enhance the character of the site, including the existing heritage values; to respond to the scale of proposed buildings and site by reinforcing the framework of larger trees; and
- To include gardens of domestic scale to enhance the residential character.

Landscape design should create different experiences, and recognisable territories within the site by using a variety of different planting types, colours, textures, and scents; and using seats to identify a place or destination and reinforcing the communal accessibility of the gardens. Tree planting should also recognise that the site makes a contribution to the quality and character of the streetscape and neighbourhood.

The concept focuses on ensuring that the objectives for section E4 of the plan are met by introducing the following control measures:

6.4.1 Biodiversity

- Employ low maintenance, hardy, indigenous species where appropriate to the visual and physical environment; and
- Retain existing features where possible, recycle or re use materials.

6.4.2 Water

- Utilise rainwater reticulation for landscape irrigation, and direct runoff to landscape areas to encourage infiltration and cleaning of stormwater;
- Restrict irrigation to contained or rooftop landscapes, and promote the use of sub-soil drip irrigation systems with automated timers and rainwater/soil moisture sensor control override in those areas;
- aim to minimise encroachment on impervious surface area to pre-development condition; and
- increase roof water collection opportunities by connection to existing buildings (that are to be retained).

6.4.3 Community

The development will respond to the community issues in two defined ways:

- **Urban context**
  - Retain and reinforce the strong public domain interface of walls, fences, gateways and boundary trees, that define the block of the village within the framework of streets;
  - Retain and where possible, highlight the features – the significant trees and buildings, that 'mark' the village within it's urban setting;
  - Ensure that gateways for vehicles and pedestrians are clearly defined, to encourage physical interaction between the village and the surrounding areas; and
  - Reinforce the relationship between Glenworth House and key surrounding heritage items down Victoria Street, through landscape design.
- **Social Context**
  - Encourage casual socialisation through site design, with activity points along paths, and by creating the potential to meet and greet neighbours;
  - Enhance privacy to units without compromising safety or views out;
  - Enhance the sense of entry and arrival at communal entrance points;
  - Encourage use of outdoor areas by providing a range of use areas and spatial types, catering for diverse activities and group sizes;
  - Design for activities specific to Seniors; and
  - Design for inclusion of a children's play area within sight of community facilities.

6.5 Management to prevent, control, abate or minimise environmental impacts.

Effective environmental and waste management will be implemented throughout the demolition, construction and operational stages of development.

6.5.1 Environmental Management Plan

An Environmental Management Plan (EMP) will be developed to regulate the environmental impacts of the development during construction. This will identify potential environmental impacts and strategies to mitigate these impacts, as well as outlining methods for auditing and tracking the impacts and responsible parties.

The EMP would be used to set out guidelines and polices in the environmentally responsive operation of the various different facilities, providing:

- A statement on the development's Environment Policy and its objectives; and
- A series of key environmental performance indicators and targets for improvements, as well as the tracking of on-going performance based on predicted environmental performance benchmarks.

6.5.2 Construction Waste Management

The EMP will include a Waste Management Plan, specifying recycling targets for demolition and construction waste. It is recommended that construction and demolition contracts stipulate a minimum target for diversion of waste from landfill. This may be achieved through recycling or reuse.

Purchasing policy should minimise waste from products and packaging and encourage the use of products which have minimum environmental impact. Preference should be given to prefabricated materials, in order to reduce the amount of on-site construction waste.

Consideration will be given for the construction contract to include commitments for the following:

- Establishment of a waste management area on site for the sorting and segregation of waste;
- Identification of appropriate waste sub-contractors for recycling, costs of collection and timing of collection service;
- Participation in waste minimisation training for contractors and sub-contractors; and
- Provision of separate waste skips for cardboard, timber, metal, soft plastic, polystyrene, insulation, concrete, glass and bricks (where space will allow).

6.5.3 Operational Waste Management

To encourage and facilitate effective waste management once the development is in operation, sufficient spatial provision should be made to allow for the effective separation of waste from recycling.

A Waste Management Plan, consistent with Ashfield City Council's Waste Management Policy will be submitted with each detailed application (project application).

Waste Management practices for ILU Buildings will be generally consistent with Better Practice Guide for Waste Management in Multi Unit Dwellings, Resource NSW and Ashfield DCP 'Planning for Less Waste'.

Waste storage facilities for garbage and recycling containers in ILU Buildings and RACF are to be provided either in a centralised garbage/recycling room accessible to garbage compactors or in a facility where bins can be easily wheeled to the street for collection.

The location and design of waste collection facilities are to be recessive when viewed from public places. Any waste facilities located between the front alignment of any building and any public street or open space must be in a screened enclosure.

Provide separate waste collection areas for residential and any commercial waste.

6.5.4 Handover & Education

In recognition of effective handover being critical to the success of a development in achieving its environmental aspirations, a simple and concise building users' guide will be developed to inform and educate building users, residents and tenants on how to capture and promote strong on-going environmental performance.

In addition, a tenant fitout guide will be provided for commercial building uses, with the objective of encouraging tenants to consider ESD principles in tenancy design, fitout and operations.

6.6 Reduce risks to human health and environmental degradation.

Indoor air quality is affected by ventilation rates inside buildings and contamination of indoor air by people, internal finishes, odours, and external influences.

Indoor air pollutant levels in most buildings exceed those outdoors by 2-5 times, due to a variety of toxic emissions given off by chemicals present in typical building materials, including paints, furnishings, floor coverings, adhesives and cleaning products.

Contamination of indoor air by common indoor pollutants will be reduced in this development by careful material selection, including low-VOC paints, adhesives and carpets, as well as low formaldehyde composite wood products.

Effective ventilation can be provided by passive and active means. In residential and seniors living buildings, natural ventilation will be encouraged where possible. Where possible, hallways will incorporate ventilation openings to allow partial or full natural ventilation.

In commercial and retail areas, the following will be considered in the mechanical design:

- Increasing fresh air rates above AS1668;
- Carbon Dioxide Monitoring and Control (or 100% outside air with no recirculation)
- Mixed-mode air conditioning.

7 Alternate Energy Option Investigated

Good ESD outcomes are to be achieved by employing passive measures relating to building construction and traditional services. In addition Aevum Stockland Limited has investigated a number of Alternative Energy options at the concept plan stage. These include:

- Centralised Solar Hot Water
- Cogeneration
- Photovoltaics

7.1 Centralised Solar Hot Water

Consideration has been given to the provision of a centralised solar hot water system for each of the ILU blocks. The system will offset the consumption of gas or electricity that would ordinarily be required to generate hot water for the residential accommodation and the RACF building.

Each block would be required to have a solar panel array fitted to the roof of the building which would be connected to a centralised storage system before being distributed to the dwellings. The system would then be backed up by a natural gas supply.

The feasibility of this approach compared to a more traditional arrangement will need to be tested for each block and each stage of the development. It is likely, due to efficiencies of scale that this approach may not be appropriate for the smaller blocks within the development, however this will be reviewed during the detailed development of each stage.

7.2 Cogeneration

The use of cogeneration was considered for the development to provide onsite power via gas fired generation.

Due to the existing nature of the development, the phasing of the development, the impact upon local air quality and the disruption and cost involved in the required infrastructure works it was not determined to be suited to the site.

7.3 Photovoltaics

The use of photovoltaic (PV) panels throughout the development to produce on-site electricity generator was also considered, however the cost of the installation even considering the government funding currently available made this option unviable at this time.

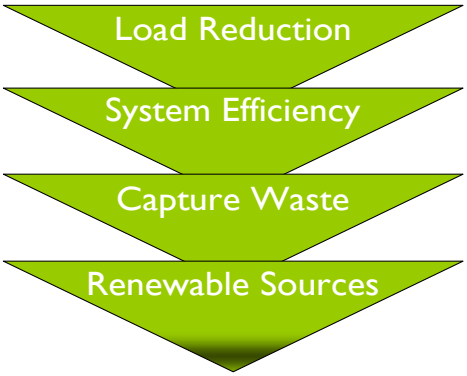
This option will be monitored and retested at key stages of the development to see if the economics of the option become more favourable as technology and costs change over time.

8 ESD considerations to be investigated as part of the staged development

8.1 Energy & Emissions

Greenhouse reductions are achieved in a staged approach:

- Reduction in overall energy consumption through demand reduction and energy efficiency.
- Reduction in electricity and gas utility consumption by utilising waste products and renewable energy technologies.



The integrated energy strategies being considered for this project include:

Load Reduction	• Passive design • Mixed-mode AC systems • Daylighting to reduce reliance on artificial lighting; • Selection of energy efficient lighting and equipment • Water efficiency in hot water systems
System Efficiency	• Efficient air-conditioning services; • Fluorescent or T5 lighting where possible with lighting control systems • Selection of efficient equipment and appliances
Renewable Sources	• Solar hot water for RAC and larger ILU blocks • Consider alternative energy sources, including solar PV at key review stages in the development programme

8.2 Passive Design

The development will utilise passive design to minimise the amount of air-conditioning required and therefore significantly reduce the building's energy consumption and greenhouse performance. A building's form, fabric and orientation will have the biggest influence on its thermal comfort and environmental performance. The following factors will be considered in the detailed stages of the design:

- Orientation
- Shading
- Structure
- Insulation
- Glazing

An efficient building fabric reduces heat losses and gains inside the building. This not only affects sizing of the mechanical plant but also the thermal comfort of occupants.

Choice of glazing will be vital in reducing heating and cooling energy consumption and maintaining occupant comfort. The selected glazing will help to avoid heat gains in the summer and aim to reduce losses in the winter. Consideration will be given to incorporating effective shading features into the design to avoid the necessity for low shading coefficients in the glass, which usually also decrease the visible light transmission (VLT) of the glass. To maximise the natural daylight within the buildings, VLT should be as high as possible.

Passive design will be developed on a Stage by Stage basis pending design development.

8.3 Energy Efficient Systems and Services

Energy consumption can be reduced through the efficient design of lighting, air-conditioning and ventilation systems, as well as water heating and other services. Cardinal Freeman Village will consider improved energy efficiency in design and operation, utilising the following initiatives.

8.3.1 Lighting

An efficient lighting design and control strategy will be considered to reduce artificial lighting energy consumption and allow maximum advantage to be taken of daylight. Lighting power density will be required to meet BCA requirements. The following are proposed:

- Efficient light fittings including T5 fluorescent lamps or metal halides (commercial and retail) and compact fluorescent lamps (residential);
- Low-power LED lamps can be used in feature lighting and are now available with excellent temperature control;
- Daylight dimming of external and streetscape perimeter lighting, as well as internal lighting adjacent to windows; and
- Efficiency controls including timers and motions sensors in car parks, common areas and infrequently used areas such as plant rooms.

8.3.2 Heating, Ventilation & Cooling (HVAC)

The following energy initiatives will be considered to help reduce air-conditioning and ventilation energy:

- Residential bathrooms and laundries will be individually ducted and controlled;
- When air conditioning is provided, it will be zoned so that only occupied areas are cooled, and spaces with different occupancy patterns or different cooling loads are zoned separately;
- Supply and extract ventilation with efficiency controls to common spaces; and
- Enclosed car park areas will be designed with Variable Speed Drive (VSD) and carbon monoxide (CO) monitoring, as well as passive supply or passive exhaust where possible.

8.3.3 Hot Water

A central roof-mounted solar hot water system will provide hot water for the domestic hot water needs of the RAC and the larger blocks of ILU's. These systems will typically deliver approximately 60% of yearly water heating energy.

8.4 Tracking & Monitoring

To enable the effective monitoring and tracking of energy consumption, sub-metering should be provided to major energy use, to help identify areas of inefficiency with potential for improvement. This will be achieved either via the Building Management System (BMS) where applicable or via a simple metering system as appropriate.

8.5 Indoor Environment Quality

Indoor Environmental Quality (IEQ) affects occupant amenity and incorporates thermal comfort, indoor air quality, daylight and acoustic quality. These are outlined below with respect to the Concept Plan, and will be developed further during detailed design.

8.5.1 Thermal Comfort

Passive heating and cooling strategies will be considered for incorporation into the design, which will improve occupant thermal comfort. These will include:

- Wall and roof insulation not only reduce heat gain and loss, but will also moderate radiant temperatures from the walls, floor and ceiling;
- Building facades with large areas of glazing will have a combination of external shading and high-performance glass to reduce heat transfer and radiant temperatures in proximity to the windows;
- Balcony overhangs provide effective external shading; and
- Air temperatures through the use of significant ventilation openings within the façade.

8.5.2 Daylight, Glare and External Views

The level of natural light in buildings is primarily determined by the extent and type of glazing, and the depth of the building floorplate. Extent of glazing must be optimised to allow maximum daylight, views, and winter sun, while minimising uncomfortable glare and excessive solar heat gains in summer. Glazing should be selected with a high Visual Light Transmission to maximise daylight penetration.

8.6 Water Conservation & Management

Water conservation strategies proposed for this project include:

- Firstly, reducing the inherent amount of mains or potable water consumed within the development through demand management, then;
- Substituting mains water required to meet this demand by utilising alternative sources such as rainwater and stormwater.

8.6.1 Demand Management

Strategies to minimise consumption will differ depending on development type, and many include water-efficient fittings and fixtures, water-efficient appliances and low-water use air-conditioning and irrigation systems. In order to reduce the overall water consumption for this development, the following initiatives will be considered:

	Water Conservation Strategies
Fixtures	• efficient wash hand basin taps; • efficient kitchen taps; • efficient WC's; • 3 star showerheads; • Low-flush urinals; and • Efficient cleaners taps. 
Appliances	• 4 star water-efficient dishwashers; and • 4-Star water-efficient clothes washing machines. 
Air-conditioning Systems	• Limited use of water cooled system; and • Where Cooling towers are used, water treatment will be set up to minimise water consumption, as well as reducing chemical use in treatment.
Landscape Irrigation	• Water-efficient native species; and • Consider subsurface irrigation systems for non-native or drought resistant species.

8.6.2 Rainwater Harvesting & Reuse

Harvested rainwater will be considered to supplement the following non-potable water uses:

- Common area landscape irrigation;
- Private landscape irrigation;
- Toilet flushing;and
- Car-washing & waste area wash-down.

Rainwater will be drained from the roofs of buildings and filtered, before storage in below-ground tanks for reuse. This approach is demonstrated in the figure below.

8.6.3 Landscape Selection

The use of native, drought-resistant planting will be considered to reduce water consumption used in irrigation. Sub-soil irrigation systems should be considered where non-native species are selected.

8.6.4 Tracking and Monitoring

Sub-metering via building management systems on major water uses can identify abnormal usage patterns usually associated with leaks, helping to reduce the considerable water lost in this way.

8.6.5 Groundwater & Stormwater management

In order to reduce the impacts of stormwater runoff from the site, the following stormwater management strategies will be considered:

- Rainwater capture from rooftops for reuse in buildings will reduce stormwater runoff as well as mains potable water use;
- Stormwater detention will be provided to minimise runoff quantites; and
- The use of permeable surfaces will be considered where suitable, allowing stormwater to seep directly into the earth and reducing stormwater flows off-site.

8.7 Transport

To encourage residents and staff to cycle, secure and accessible bicycle storage will be included for building residents and visitors.

8.8 Emissions

In addition to the reduction in greenhouse emissions as a result of lower on-site energy usage, a further reduction in emissions to land, air and water will be considered in the following ways:

- Where available, thermal insulation products will be selected which have a low Ozone Depletion Potential in their manufacture and composition, reducing the impacts of insulation on the atmosphere;
- 100% of refrigerants by volume will have an Ozone Depletion Potential of zero; and integrated refrigerant leak detection will ensure early identification of leaks;
- Estimated wastewater discharge to sewer will be reduced relative to a standard building through the implementation of water efficiency measures; and
- External light pollution will be controlled by careful lighting design, in accordance with AS 4282-1997 as outlined in the external lighting strategy report.

8.9 Materials Selection

Consideration will be given to sourcing environmentally responsible materials during the development of each stage. Material selection strategies include:

- Avoidance of ecologically sensitive products;
- Selection of materials with a low embodied energy & high recycled content;
- Low toxicity material selection;
- Low impact on the indoor environment;
- Durability, flexibility and recyclability;
- Emissions in manufacture and composition, including greenhouse gases and ozone depleting substances; and
- Waste reduction.