ESD Report

Cabramatta East Precinct

Corner of Cabramatta Rd and Broomfield St

Cabramatta NSW 2166

REPORT

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EXECUTIVE SUMMARY

Northrop Consulting Engineers been engaged to develop this ESD report for the proposed mixed-use development, Cabramatta East Precinct, located at the corner of Broomefield St and Cabramatta Rd, Cabramatta NSW 2166.

Planning requirements were addressed to ensure that the proposed development satisfies minimum compliance with the Fairfield City Council Development Control Plan (2012) objectives and Building Sustainable Index (BASIX) requirements for energy efficiency, water efficiency and thermal comfort. Additionally, the broader context of the site was considered, to align with Cabramatta East Precinct mixed use development future plans for the Cabramatta Town Centre.

The sustainability initiatives listed in this Report have been suggested as pragmatic and cost-effective solutions for the project.

This report describes initiatives under the following nine environmental performance categories:

1. Passive Design
2. Reduced Carbon Footprint
3. Community and Liveability
4. Health and Wellbeing
5. Water Management
6. Waste Management
7. Sustainable Transport
8. Ecological Footprint
9. Smart Homes

Capital costs, estimated payback & potential operational savings (marketable to the occupant), revenue generation and improved asset value have been realised and indicated in the table below.

Table 1 Summary of Proposed Initiatives

Approach **Design Item / element**	**Capital Cost premium:** **Residential (per apartment):** Nominal - $1 - $500 Low - $500 -$2,000 Medium - $2,000 -$5,000 High - $5,000 - $7,500 Extended - > $7,500	**Estimated Simple payback period (marketable benefit)** Short: 0 – 3 yrs Med: 3 – 5 yrs Long: 5 – 7 yrs Extended: > 7 yrs	**Operational cost savings**	**Revenue generation potential**	**Improved asset value** **(for occupant – improved rate of sale / lease uptake)**
1. PASSIVE DESIGN					
Selection of Glazing products with VLT of 60%	Nominal	Short	✓		✓
Optimised internal finishes to enhance DL diffusion:	Nominal	Short	✓		✓
Shading	Medium	Medium	✓		✓
2. REDUCED CARBON FOOTPRINT					

Lighting - efficiency, controls & timing schedules	Low	Short	✓		
Approach **Design Item / element**	**Capital Cost premium:** **Residential (per apartment):** Nominal - $1 - $500 Low - $500 -$2,000 Medium - $2,000 -$5,000 High - $5,000 - $7,500 Extended - > $7,500	**Estimated Simple payback period** Short: 0 – 3 yrs Med: 3 – 5 yrs Long: 5 – 7 yrs Extended: > 7 yrs	**Operational savings (Cabramatta East Precinct)**	**Revenue Generation potential**	**Improved Asset value** **(for occupant – improved rate of sale / lease uptake)**
Embedded Network (Origin)	Medium	Medium	✓	✓	
Rooftop solar	Low	Medium	✓	✓	
3. COMMUNITY & LIVABILITY					
Community gardens on communal roof terraces	Nominal	Short			✓
Wayfinding	Low	Short	✓		✓
4. HEALTH & WELLBEING					
Low VOC's and low formaldehyde	Nominal	NA			✓
5. WATER MANAGEMENT					
Rainwater harvesting & reuse	NA	Long	✓		
Sprinkler test water reuse	NA	Medium	✓		
Fire Hydrant test water reuse	NA	Medium	✓		
6. WASTE MANAGEMENT					
Construction waste diversion from landfill – define project targets	Nominal	Short			
Waste segregation	Nominal	Short	✓		
Waste compactors	Nominal	Short	✓		
Unified bin design throughout the building and common areas	Nominal	Short	✓		
Waste Education Programs	Nominal	NA			✓
7. SUSTAINABLE TRANSPORT					
Bike share (and helmet) facilities	Low	Medium		✓	✓
Electric Vehicle charging stations	Nominal	Medium			✓
8. ECOLOGICAL FOOTPRINT					
Native vegetation	Nominal	Short			
Non obtrusive outdoor lighting	Nominal	Short	✓		
Urban Heat Island Effect Mitigation: - For roof pitched <15°– a three year SRI >64; or - For roof pitched >15°– a three year SRI >34.	Nil	Short	✓		
Approach **Design Item / element**	**Capital Cost premium:** **Residential (per apartment):** Nominal - $1 - $500 Low - $500 -$2,000 Medium - $2,000 -$5,000 High - $5,000 - $7,500 Extended - > $7,500	**Estimated Simple payback period** Short: 0 – 3 yrs Med: 3 – 5 yrs Long: 5 – 7 yrs Extended: > 7 yrs	**Operational savings (Cabramatta East Precinct)**	**Revenue Generation potential**	**Improved Asset value** **(for occupant – improved rate of sale / lease uptake)**
Rooftop gardens	Low	Extended			✓
9. SMART HOMES					
Smart Meters	Medium	NA			

Option 1: Basic Control	Low	Short	✓		

The initiatives for consideration to be pursued have been detailed in this report.

ESD REPORT

Activity Schedule

Date	Revision	Issue	Prepared By	Approved By
14.06.2019	A	Preliminary Issue	J. Caparrotta	A. Girgis
08.02.2024	B	DA Issue	H. Javed	A. Girgis

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1. INTRODUCTION

Northrop Consulting Engineers have been engaged to develop an ESD Report for Plus Architects for the new mixed-use development known as Cabramatta East Precinct located on the corner of Broomefield Street and Cabramatta Road, Cabramatta NSW 2166.

The intent of this report is to provide a guiding document that addresses the design requirements in order to meet the following project planning objectives:

- Building Sustainability Index (BASIX) Minimum Code Compliance
- Fairfield City Council Development Control Plan (DCP) ESD Objectives
- Aspirations of the development

Cabramatta is expanding the mixed-use development in the region as part of Cabramatta East Precinct's proposed masterplan. Soon to be home to thousands of new residents, Moon Developments are planning to build communities ready for the future, which are able to adapt to changing lifestyle conditions and evolving technologies.

The sustainability initiatives proposed within this report, have been considered to ensure that Cabramatta East Precinct meets the associated planning requirements, whilst minimising the environmental impact of the development. As a result, reducing resources used in the development, improving asset value of the building and minimising building levies for future residents.

This report covers the following nine environmental performance categories:

1. Passive Design
2. Reduced Carbon Footprint
3. Community and Liveability
4. Health and Wellbeing
5. Water Management
6. Waste Management
7. Sustainable Transport
8. Ecological Footprint
9. Smart Homes

The sustainability initiatives listed in the subsequent sections of this Report have been suggested as pragmatic and cost-effective solutions for the project. Northrop have also provided indicative costing and payback periods alongside recommendations around the suggested initiatives.

1.1 Building Characteristics

The proposed mixed-use development is located at the corner of Cabramatta Rd and Broomefield Street, referred to as "Cabramatta East Precinct", adjacent to Cabramatta Railway Station. Cabramatta East Precinct serves to act as an iconic gateway to the new town centre and urban renewal aimed to attract tourism and young family demographic in the property market while celebrating diversity in the Fairfield Local Government Area (LGA).

The proposed mixed-use development consists of four residential tower buildings, one of 17 storeys, one of 16 storeys, one of 19 storeys (above ground level) for Stage 1 & 2 of the development, with another tower to be confirmed at Stage 3 of the development. The proposed mixed-use development for Stage 1 & 2 has a total site area of 8,138 square metres, consists of circa 367 residential apartments, 4 basement levels for residential, retail and casual parking and several retail podium and terrace style and rooftop communal spaces throughout.

Figure 1: Artist Impression of proposed Broomfield St Streetscape activation, Planning Proposal Item#98

1.2 Planning Requirements

The proposed Cabramatta East Precinct site is located within the Fairfield City Council LGA. The development approval for the proposal building is subject to current proposed amendments to the Fairfield City Council LEP 2013 and in general guidance by Fairfield Citywide Development Control Plans (DCP 2013) and is to meet the following ESD objectives:

1. Apply the precautionary principle where development is likely to cause short or long-term irreversible or serious threats to the environment;
2. The proposal must not adversely impact upon the recreational, ecological, aesthetic or utilitarian use of the waterway corridors, and where possible, should provide for their enhancement, in accordance with ESD principles;
3. A landscape design should improve the amenity of open space, contribute to the streetscape character, improve the energy efficiency and solar efficiency of the public domain, contribute to the sites characteristics, contribute to water and stormwater efficiency, provide a sufficient depth of soil for planting and minimise maintenance. Landscape reinforces the architectural character of the street and softens the impact of buildings and car parking areas as well as providing screening;
4. To maximise greenhouse gas emission reduction in new development;

5. To promote the following during the design, construction and operation of development:
    - the use of energy efficient materials and designs;
    - utilisation of renewable energy & materials; and;
    - energy efficient technology; and
    - To follow the principles of the 'Waste Hierarchy' (reduce, reuse, recycle) in the use of materials and the design of waste recovery and disposal systems throughout the development process;
6. To protect neighbourhood amenity and safety in the design and construction and operation of the development;
7. To encourage the long-term economic viability and health of the community in the development process;
8. To encourage the use of public transport, bicycles and pedestrian trips in the development and design process.

This report aims to highlight proposed design initiatives to address the nine ESD objectives listed above.

1.3 Referenced Documentation

- Development Application Drawings (02.05.2023)
- Cabramatta East Precinct Planning Proposal - Proposed Amendment to Fairfield LEP 2013
- Fairfield Citywide Development Control Plan – Amendment 20 (2013)
- Cabramatta Town Centre DCP No.5/2000 – Amendment No.2 (2014)

1.4 Limitations of the Report

Due care and skill has been exercised in the preparation of this report.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Northrop for detailed advice, which will take into account that party's particular requirements.

2. MINIMUM CODE COMPLIANCE

2.1 BASIX Targets

To achieve BASIX compliance, the benchmarks specified in table 2 below are to be met which are specific to high rise multi-unit residential developments (Class 2) located in West Sydney Climate Zone 28. Note, actual BASIX Benchmarks results are to be updated at time of Final BASIX Certification.

Project BASIX benchmarks achieved are identified in Table 1 below.

Table 2 BASIX benchmarks to achieve minimum compliance and actual benchmarks achieved

Category	Minimum Compliance	Draft BASIX Results
Water (%)	40	40
Energy (%)	25	28
Thermal Comfort (MJ/m^2)	Cooling Load 63.7 (max) Heating Load 63.2 (max)	Cooling Load 63.7 (max) Heating Load 63.2 (max)

Refer to draft BASIX report in Appendix A for further details of the project compliance pathway.

2.2 Water Efficiency

The intent of the water efficiency section of BASIX is to reduce the overall potable water consumption of the site. The benchmark to achieve minimum compliance is based on a water reduction of 40 percent, compared to a typical development potable water consumption of 90,340 litres of water per person per year of a pre-BASIX home. The subsequent sections detail the water efficiency initiatives to be implemented to achieve BASIX compliance.

2.2.1 Central Systems

2.2.1.1 Rainwater Reuse

A 10,000L rainwater system is to be installed with the tank located in the basement car park. Rainwater from roof area of at least 1,559m^2 is to be collected and stored for reuse, supplying irrigation system for common area landscaping on the ground floor of at least 2264m^2.

2.2.1.2 Common Areas

No provisions for common area showers. All common area toilets are to have a minimum of 4 star WELS rating. Communal areas that have taps are to have a minimum 5 star WELS rating. The fire sprinkler test water is contained in a closed system and conductivity controller is to be installed to cooling towers.

2.2.2 Dwellings

2.2.2.1 Fixtures and Fittings

All fixtures and fittings installed in all dwellings are to have the following WELS specifications:

Table 3 Fixtures and Fitting Requirements for All Dwellings within the Proposed Development

Fixtures and Fittings	Requirement
Showerhead	4 star WELS rated (>6 but <= 7L/min)
Toilets	4 Star WELS rated
Kitchen taps	5 Star WELS Rated
Bathroom taps	5 Star WELS Rated
Dishwashers	4 Star WELS Rated

2.2.2.2 Appliances

Dishwashers and clothes washers have not been specified in modelling and the WELS rating of these appliances are to be at the residents' discretion.

2.3 Energy Efficiency

Energy efficiency targets have been developed in effort to reduce greenhouse gas emissions for all new residential developments in NSW. The benchmark is based on 3,292 kilograms of carbon dioxide per person per year as defined by an assessment undertaken for homes pre-BASIX.

2.3.1.1 Alternative Energy Supply

A central solar photovoltaic (PV) system with at least 10 kW peak rated electrical output is to be mounted on available roof space. The PV system out size has been calculated conservatively for the BASIX requirements and is further detailed later in the report for potential maximum output.

The PV system will support the energy demand of the site which will offset the energy load of common areas including: common area lighting, hydraulic pump sets, electrical services equipment and mechanical equipment for exhaust systems.

2.3.1.2 Lifts

All lifts are to be a gearless traction lift type with AC Variable Voltage Variable Frequency (VVVF) drive motors.

2.3.2 Common Areas

2.3.2.1 Ventilation

The following ventilation systems are required for each building:

Table 4 Common Area Ventilation Requirements

Common Area	Ventilation System
Switch Rooms	Ventilation supply only
Garbage Rooms	Ventilation exhaust only
Hydrant Pump Rooms	Ventilation exhaust and supply
Plant & Service Rooms	Ventilation exhaust only

Storage Rooms	No mechanical ventilation
Undercover Car Park	Mechanical supply and exhaust ventilation with carbon monoxide monitor and VSD fan
Comms Rooms	Ventilation supply only
Ground Floor lobby	Air conditioned that is time-clock or BMS controlled
Tower corridors	Ventilation supply only
Fire Stairwells	Mechanical supply and exhaust ventilation that is time-clock or BMS controlled

2.3.2.2 Lighting

All common areas on site are to contain light-emitting diode (LED) lamp fittings with efficiency controls. No BMS system has been considered for the proposed development.

The following lighting systems are required as part of the BASIX compliance pathway:

Table 5 Common Area Lighting Requirements

Common Area	Light System Type	Efficiency Measure
Lift Cars	LED	Connected to Lift Call Button
Switch Rooms	LED	Motion Sensors
Garbage Rooms	LED	Motion Sensors
Hydrant Pump Room	LED	Motion Sensors
Plant & Service Rooms	LED	Motion Sensors
Storage Rooms	LED	Motion Sensors
Undercover Car Park	LED	Motion sensors
Comms Rooms	LED	Motion Sensors
Ground Floor Lobby	LED	Motion Sensors
Tower Corridors	LED	Motion Sensors
Communal Areas	LED	Motion Sensors

2.3.3 Dwellings

2.3.3.1 HVAC Systems

Cooling and heating will be supplied by a central water-based heat rejection Variable Refrigerant Volume system (VRV) with cooling tower COP 3.5-4.5. Each dwelling has individual fan ducted to the roof or façade for bathrooms, laundries and kitchen exhausts.

Domestic Hot Water (DHW)

A central gas-fired boiler system with manifold is proposed to supply domestic hot water to all apartments. No external pipe work and all internal pipework with R0.6 insulation applied.

2.3.3.2 Lighting

Dedicated LED light fittings are to be installed for all living spaces within the apartments including; living areas, kitchens, bathrooms and hallways.

2.3.3.3 Appliances

Gas cooktops and electric ovens are provided to kitchens for all dwellings in the development.

Dwellings appliances to be procured as per the table below.

Table 6: Appliance Energy Rating Requirements

Appliance	Minimum Energy Rating
Dishwasher	4.5 Star
Clothes Dryer	2.5 Star
Refrigerators	Not specified
Clothes Washer	Not specified

Sufficient ventilated fridge space is to be included in the spatial design provisions of the development.

2.3.3.4 Indoor Clothes Lines

Provision for indoor clothes lines (on balconies) have not been provided within the BASIX compliance pathway.

2.4 Thermal Comfort

The BASIX thermal comfort assessment aims to ensure the thermal comfort for the building occupants is appropriate for the climate conditions of the site, in effort to minimise the amount of artificial heating and cooling required for the space. Thus resulting in a greenhouse gas emission reduction per dwelling.

The BASIX thermal comfort section was assessed via the simulation method pathway, as such NatHERS accredited modelling software was used to determine the thermal comfort performance of the development.

2.4.1 NatHERS targets

NatHERS modelling provides a MJ/m^2 value for heating and cooling loads across the year to maintain a comfortable space. This measurement assumes that a space is both heated and cooled when occupied on a standardised schedule and that the building fabric as specified in the modelling.

BASIX compliance for thermal comfort for multi-unit residential developments in Climate Zone 28 is as per table 2 shown above.

2.4.2 NatHERS Modelling

Thermal comfort modelling was undertaken using BERS Pro v4.4 software, which is one of the NatHERS approved computer software used to assess the residential thermal comfort. Extracts from the modelling software can be seen in Figure 2 below, where different coloured rooms represent functional space types and the schedules associated.

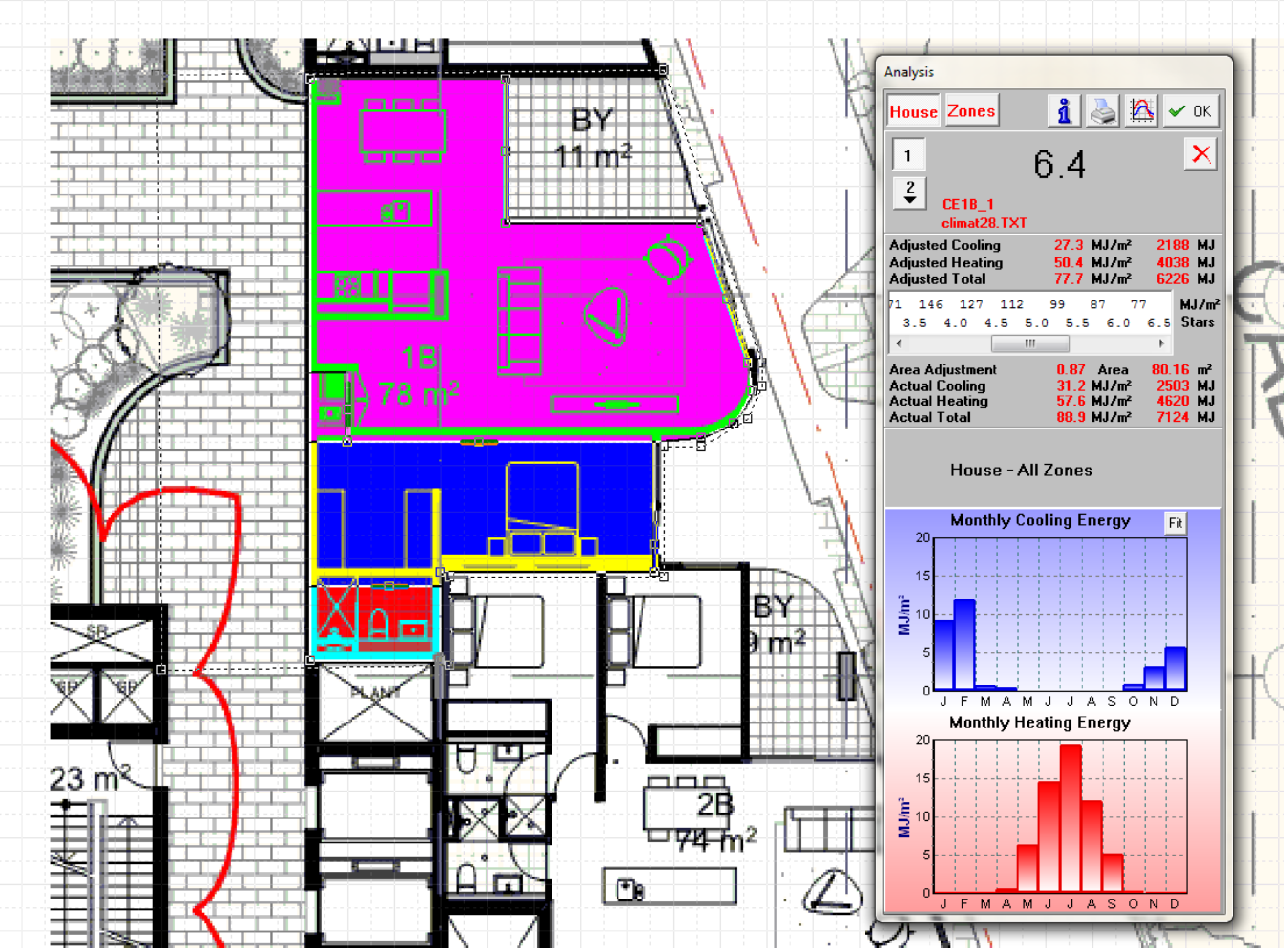


Figure 2 Example of NatHERS Modelling Software Output

2.4.3 Thermal Comfort Assumptions

Heating and cooling loads were modelled for a worst case scenario dwelling in the development using the building fabric input assumptions as seen in table 7 to achieve compliance with the thermal comfort requirements for BASIX Certification. Note, actual thermal comfort results will be confirmed as the façade development progresses.

Table 7 Building Fabrics

Element	Material	Detail
External Walls	Level 1 and 2: Brick Veneer Metal Clad cavity; Direct fix panel	R2.0 bulk insulation; Rt2.24 total wall system R2.0 bulk insulation; Rt2.06 total wall system

Element	Material	Detail
	(solar absorptance = 0.50 medium colour)	
Internal Walls	Cavity Wall, 10mm Plasterboard on stud	Nil Insulation Rt0.28 total wall system
Party Walls/Intertenancy walls	100mm Concrete panel/Filled concrete blocks	Nil insulation Rt0.19 total wall system
Windows	Glazing Type 1 (all units, except specified in Type 2 and 3)	• Awnings, Bifold, Casement, Hinged: U-Value of 4.3 and SHGC of 0.46 • Sliding, Fixed, Double Hung: U-Value of 4.6 and SHGC of 0.46
	Glazing Type 2 - Applicable to • Tower A: A101, A307, A707, A801, A901, A1001, A1101, A1201, A1301, A1401, A1501, A1502, A1503, A1504, A1505. • Tower C: C204, C207.	• Awnings, Bifold, Casement, Hinged: U-Value of 2.6 and SHGC of 0.50 • Sliding, Fixed, Double Hung: U-Value of 3.1 and SHGC of 0.49
	Glazing Type 3 - Applicable to • Tower A: A109, A407, A507, A607, A806, A906, A1006, A1106, A1206, A1306, A1406. • Tower C: C408, C1601.	• Single glazed Awnings, Bifold, Casement, Hinged: U-Value of 2.6 and SHGC of 0.5. • Double glazed Sliding, Fixed, Double Hung: U-Value of 3.1 and SHGC of 0.49
	Window Operability	Balcony windows: 45% (sliding) Awning Windows: 10% openable sash
	Shading Device	Sliding screens with perforated metal infills. Assumed to be between 50-75% opacity
Roof/ Exposed Ceiling	Concrete Roof above plasterboard (solar absorptance = 0.50, medium colour)	R3.5 bulk insulation Rt3.56 total roof system
Internal Ceiling	Concrete slab, Plasterboard	Nil Insulation
Floor	Concrete Slab with floor finish.	Floor finish: • Living – Timber/engineered wood • Wet Areas – Tiled • Bedrooms – Carpet

Element	Material	Detail
		R2.0 bulk insulation (in contact with floor) for all exposed suspended slabs (above carpark and to external)

3. SUSTAINABILITY STRATEGY

In addition to the above code compliance requirements, Northrop have assessed the design potential of the building and its ability to minimise resource consumption and costs to residents. This process has resulted in the number of effective green building solutions to be considered throughout the design, construction and operational stages of the building. These initiatives and actions help to minimise the use of natural resources, improve waste minimisation and recycling of occupants, reduce adverse environmental impacts of the project and allow for the development of a resilient apartment building.

The following sections outline the initiatives proposed for implementation and consideration for the Cabramatta East Precinct.

3.1 Passive Design

The first step towards an energy resourceful building starts with its shell and as such passive design is a key element when designing low energy buildings. Good passive design reduces the need for auxiliary heating or cooling by taking advantage of varying climate to achieve thermal comfort. The following initiatives will play a significant role in ensuring that the building's annual energy performance is lower that the set thresholds.

Key considerations include thermal performance of envelope, glazing selection and extent, external shading, daylight direction devices, thermal mass, surface properties and possible natural ventilation openings.

3.1.1 Enhanced daylight

3.1.1.1 High VLT Glazing

Figure 3 Indication of VLT glazing tints

Selecting a glazing that provides a high transmittance of visual light, while still meeting the thermal performance needs of the code, will allow a greater level of daylight into dwellings and improve tenant visual comfort within the space.

The selection of glazing with a VLT of 60% within the residential spaces should not present a significant premium as it will largely involve the provision for daylighting within the BASIX modelling to find an optimal balance between daylight and thermal comfort.

3.1.1.2 Internal finishes

The use of pale internal finishes will help to maximise light propagation through the space and minimise the energy used for lighting spaces throughout daylight hours.

The cost implications of doing this should be minimal given colour of materials is generally non determinant of price.

3.1.2 Optimised Shading

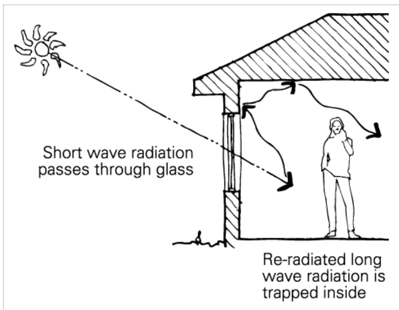


Figure 4 shading prevents the entry of solar radiation in summer but should allow warmth to enter in winter

Direct solar radiation entering a residence can act as a heater in winter however can drastically increase air-conditioning loads throughout summer. As such optimised shading will allow the entry of warmth in winter and block this in summer. It is suggested that fixed horizontal shading devices be provided on the north facing facades and vertical shading with louvers or blades on the east and west. Adjustable shading systems such as louvers or external blinds will also allow residents to alter the solar heat gains in their apartments to adjust for their personal requirements.

Furthermore planting of deciduous trees around the buildings lower levels will allow shading of the lower floors throughout summer and promote solar access throughout winter.

3.2 Reduced Carbon Footprint

3.2.1 Alternative Energy

3.2.1.1 Rooftop Solar Photovoltaics

Rooftop solar power within the development has the potential to provide a portion of the building energy use across the year. Using a system connected to the base building systems will offset energy used by the central services such as lifts and common area lighting. Rooftop solar will also provide a benefit to the projects BASIX compliance levels. Using solar power to reduce common area energy costs will significantly reduce ongoing costs and will minimise strata levies.

If there was a desire to maximise the amount of solar PV to be installed this could be incorporated with an embedded network to allow the use of the output electricity within dwellings. This will allow onsite generation to reduce resident's energy costs rather than simply reducing their building levies.

The rooftop area has the capacity to host circa 1300 solar PV panels, equating to an approximate peak output of 370 kW. The cost of such a system will be in the ballpark of $640,000.00 with a payback period of 3-5 years.

3.2.2 Embedded Networks

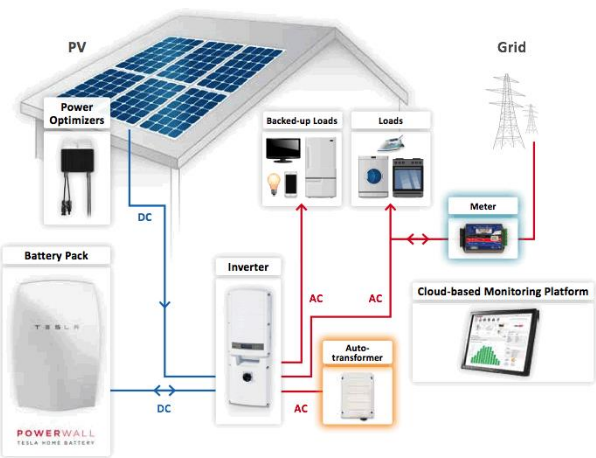


Figure 5 Example of connectivity of an embedded network

An embedded network is basically a private electricity network for the development. It would serve each of the dwellings within the building and connect these to a central connection point. Electricity can then be purchased in bulk at a lower cost than is available to individual residents. Billing is then provided by either the building or through a third party (Origin, OC Energy, WIN Energy etc).

These system are attractive as they can often provide reduced energy costs for residents and can assist in the distribution of onsite energy generation and storage.

Overall the use of an embedded network would allow further exploration of PV generation and the installation of battery storage to provide lower electricity bills for residents.

3.3 Community and Liveability

3.3.1 Community gardens and spaces

The provision of urban agriculture and wellbeing spaces that promotes education and community through the use of roof top garden facilities, and spaces for booking and hire will promote community cohesion within the residents of Cabramatta East Precinct. The provision for productive landscapes within the project site, combined with any existing community food gardens, should result in no less than 100sqm of productive landscape being accessible, per 1000 residential occupants of the project.

The community gardens should be incorporated in to the space design with the overall aim of creating a self-sustaining community initiative managed by the residents of the building. Initially there will need to be a commitment of time and financing for the construction of the physical gardens and wellness spaces and for the education of residents regarding the effective management of these facilities. Opportunities exist to optimise the terrace space on level 4 of the south-east building and level 4 west building.

Overall the benefits of providing the provision for urban agricultural facilities will include;

- Providing residents with access to fresh food,
- Reducing household waste going to landfill though the provision of composting facilities
- Reducing the need to provide private “backyard” space
- Promoting community engagement
- Educating residents about food production; and
- Providing biological diversity across the site.

Figure 6 Community gardens would promote social cohesion and a sense of community

3.3.2 Way finding

Figure 7 Wayfinding example within residential buildings

At its essence, wayfinding is the science of understanding how people perceive the environment and make decisions while navigating unfamiliar spaces and then responding with intuitive signage and information layouts.

A high-functioning way finding system makes the environment “unique” and enhances the visitors’ experience as it increases their comfort, builds their confidence, and encourages them to discover unique events, attractions and destinations on their own.

Way Finding can also be utilised to direct occupants to key facilities and amenities in fun and creating ways.

3.4 Health and Wellbeing

3.4.1 Indoor Environment Quality

3.4.1.1 Low VOC's and low formaldehyde

The idea of improving indoor environment quality helps to ensure that building occupants are comfortable within a space and reduce exposure to internal pollutants. Through the provision of sufficient outside air, sufficient lighting levels and good visual access to outside the project will help to promote good indoor environment quality.

To assist with improved indoor environmental quality of the building occupants, 50% of materials (by cost) used on site are proposed to contain low Volatile Organic Compounds (VOCs) including paints, flooring, sealants and adhesives and all engineered wood products used in the development are to be low formaldehyde or formaldehyde free.

Paints are required to have a VOC of less than 5g/L. All other paints, adhesives, sealants and carpets used in the building shall meet the requirements within each of the following criterion. Emissions for each application must be acquired through recognised testing methods and reported through a recognised datasheet. In the case of paints and adhesives and sealants, theoretical TVOC calculations are also acceptable.

The following items are excluded:

- Glazing film, tapes, and plumbing pipe cements;
- Products used in car parks;
- Paints, adhesives and sealants used off-site, for example applied to furniture items in a manufacturing site and later installed in the fitout; and
- Adhesives and mastics used for temporary formwork and other temporary installations

At least 95% (by volume) of all internally applied paints and adhesives, sealants shall meet stipulated 'Total VOC Limits' as per table below:

Table 8: VOC content limits - interior finishes

Product Category	Max TVOC content in grams per litre (g/L) of ready to use product.
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250

Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

At least 95% of all internally applied carpets shall meet stipulated 'Total VOC Limits' as per table below, Carpet Test Standards and TVOC Emissions Limits:

Table 9: VOC content limits - carpets

Test protocol	**Limit**
ASTM D5116 - Total VOC limit	0.5mg/m2 per hour
ASTM D5116 - 4-PC (4-Phenylcyclohexene)	0.05mg/m2 per hour
ISO 16000 / EN 13419 - TVOC at three days	0.5mg/m2 per hour
ISO 10580 / ISO/TC 219 (Document N238) - TVOC at 24 hours	0.5mg/m2 per hour

3.5 Water Management

3.5.1 Rainwater harvesting and reuse

The capture and reuse of rain water for use in buildings for irrigation and internal uses will both reduce site run off and potable water demand. The installation of rainwater tanks within the basements of the precinct would attract a minimal additional project cost as these systems could be coupled with the onsite detention tanks for stormwater drainage systems.

The proposed rainwater tank has the capacity to collect 10kL of rainwater from the building rooftops. A water balance for the site should be investigated to determine the non-potable water demand required for irrigation to the common landscaping and potential green walls (vegetated facades) proposed for the development.

3.5.2 Sprinkler test water reuse

Sprinkler test water reuse involves recycling water from sprinkler system tests to minimise waste. By capturing and treating the water used during testing, valuable resources are conserved while ensuring the safety and functionality of fire protection systems.

3.5.3 Fire hydrant test water reuse

Similar to sprinkler test water reuse, the maintenance of fire protection systems and equipment requires the checking of the water supplies. This is carried out in a number of tests aimed at proving water supplies, ensuring the required flows and pressures are achieved, and to ensure that equipment such as pump sets operate as intended. It is proposed that cooling water used in the fire hydrant system is captured, which would otherwise be discharged to the sewer or stormwater system, by redirecting it to the rainwater tank.

3.6 Waste Management

3.6.1 Construction and demolition waste

Building materials account for approximately half of all materials used and about half the solid waste generated worldwide incurring significant environmental impacts at each process interval. It is proposed that at least 80% of construction and demolition waste is to be recycled, to reduce the carbon footprint of the site. This commitment could be incorporated in to the head contractors' Environmental Management Plan for the site. Reclamation of high value building materials should be considered first preference. Where reclamation is not viable, materials such as asphalt, bricks, timber, plastics (including PVC) and concrete should be recycled accordingly.

3.6.2 Dual waste segregation

Providing isolated chutes located centrally within the building to dispose of general waste and comingled recycling will improve the waste outcomes for the development. The use of source separation of waste will drastically improve environmental outcomes as post collections segregation takes longer, costs more and increases cross contamination. Overall the separation of general waste and comingled recycling will reduce waste disposal costs for the development and therefore help to minimise waste levies payable by residents. Furthermore and for example, source separation for Paper and Cardboard with an on-site compactor to process both residents and retailers paper based recycling, will likely result in a notable operational cost savings because this resource stream attracts either low cost, nil charge or pay-back for its collection.

3.6.3 Waste compactors

Waste compaction is being considered for the development as a way to reduce the number of traffic movements on site, reduce vermin and rodents and improve cleanliness and sanitation on site.

The Elephants Foot compaction systems offer several options which have the potential to reduce waste services costs up to 75 percent. This would allow the reduction in size of waste rooms, help to minimise the number of collections that are required by the waste contractor and should reduce the waste disposal costs and therefore help to minimise costs to the apartment owners.

3.6.4 Unified bin design and source separation

Unified bin design and source separation throughout Cabramatta East Precinct can form part of a waste management strategy to create a waste sortation culture in the building. Not only should each be a different colour e.g. Red for general waste, yellow for co-mingled recycling, blue for paper and green for organics but should be consistent throughout the site. This is to assist with clarity and develop effective waste sortation prior to disposal. The waste strategy should be as part of the Waste Management Plan and considered during the early stages of e development to ensure appropriate design integration across all building uses.

Figure 8 Unified bin design and source sortation (www.wasteoptions.com.au)

Providing integrated bins into the projects kitchen would both improve the aesthetic of kitchens and help to promote the effective use of the onsite sortation facilities.

3.6.5 Waste education

Waste education in terms of effective signage displays or collaboration with community programs would have a positive benefit to the community as part of a wide approach to community participation

Collaborating with Nalawal Sustainability Hub, located at Fairfield Showground on residential waste minimisation and recycling education could be coupled with the digital signage

Figure 9 Nalawala Sustainability Hub, Fairfield Showground

in the common areas as a way of informing residents of different waste management practices and/or other useful Fairfield City Council initiatives.

3.7 Sustainable Transport

The Cabramatta Train Station greatly benefits the economic growth of the precinct and local community and provides connectivity to Sydney, Liverpool and Parramatta CBD areas, especially as Sydney metropolis takes form with these three cities in the coming decade.

The following initiatives complement the train station and further encourage the reduction of personal vehicles in the precinct development, working toward less congestion on the roads and minimising the environmental footprint of the site by targeting reduced vehicle related greenhouse gas emissions.

Figure 10 Site Context to Cabramatta Train Station. Planning Proposal Item#98

3.7.1 Bicycle share facilities

Figure 11 Hybrid bike rack and bench

The practice of cycling assists the environment and human health by reducing pollutants that would otherwise have been release by other transport options. According to the ABS over one third of daily car trips are less than 3km in length. Most of these trips could be replaced with cycling. Providing secure bike storage facilities for residents will promote the use of bicycles as a form of transport.

Providing secure storage either as a communal storage cage in the basement or a nook adjacent to dwelling entries assist in encouraging cycling though the precinct as will the provision of bike racks outside of the main building entries across the site. As seen in figure 14, there is potential to provide creative public places, symbolic of the type of residents targeted for Cabramatta East Precinct.

Overall the cost of providing bike storage will be nominal with the most expensive component being the provision of additional space for this facility.

3.7.2 Electric vehicle charging stations

The provision of electric vehicle charging station or provisioning for these to be installed in future would improve asset value to the development. The provision of 5% of parking (excluding car-share) is dedicated to electric vehicles and charging infrastructure.

Figure 12 Example of electric vehicle car charging station

Installation of EV charging infrastructure and provisioning for slow-charging points would also likely provide an uptick in asset value at a significantly lower cost to Cabramatta East Precinct (compared with fast charging systems). These systems would likely still require some form of either demand management or supply augmentation to provide the required current supply.

Further investigation is required to determine the feasibility of this initiative with current sub-station capacities for the site.

3.8 Ecological Footprint

3.8.1 Non obtrusive outdoor lighting

Light pollution revealing up into the night sky (sky glow) or spilling on to neighbouring properties can harm the environment in many ways including effects on:

- Migratory birds – nocturnal birds use the moon and stars for navigation and can become disoriented by lights shining upwards into the sky;
- The disruption of biological rhythms and other effects on the behaviour of nocturnal animals and insects;
- Greenhouse gas emissions are emitted to unnecessarily light the night sky.

Ensuring that nil outdoor lights are up-facing into the night sky would not attract any additional costs and would provide ongoing operational and maintenance savings and reduce the sites impact on the natural environment.

3.8.2 Urban heat island effect

3.8.2.1 Solar Reflectance

Selection of roof colour has minimal impact on the architectural aesthetic or cost for the development however can have a substantial influence on the overall impact of the site in terms of heat island effect.

A provision of at least 75% of all external façade, pavement and roof surfaces follow the Solar Reflectance Index (SRI) guideline:

- For roof pitched <15°– a three year SRI >64; or
- For roof pitched >15°– a three year SRI >34.

The use of pale coloured roofs and facades will have marginal cost implications and would assist in the propagation of daylight through areas that are shadowed by adjacent buildings.

3.8.2.2 Rooftop or Terrace Gardens

Figure 13 M-Central – Green Roof – Ultimo (City of Sydney Green Roofs and Walls Policy Implementation Plan)

Plants have the ability to reduce the overall heat absorption of the building which in-turn reduces the energy used by the precincts active cooling systems. The primary cause of the urban heat island effect in urbanised areas is absorbed direct solar radiation by roads and building materials. These construction materials store the suns radiation and later release with changed wavelength that cannot penetrate back through the lower atmosphere. This phenomenon creates a heat bubble over urbanised areas.

By installing roof or terrace gardens Cabramatta East Precinct may create a passive cooling solution to this heat bubble issue by planting native vegetation and tree canopy. Plants in effect cool the ambient environment by direct shading and by the process of transpiration, which is the evaporation of water from plant leaves. Rooftop and terrace gardens have the potential to minimise temperature in the immediate atmosphere by approximately 3-4°C, improving the ambient temperature conditions within the building and minimising the buildings effect on urban heat islands.

3.9 Smart Homes

3.9.1 Smart Energy Meters

Figure 14 Smart Meters www.energymatters.com.au

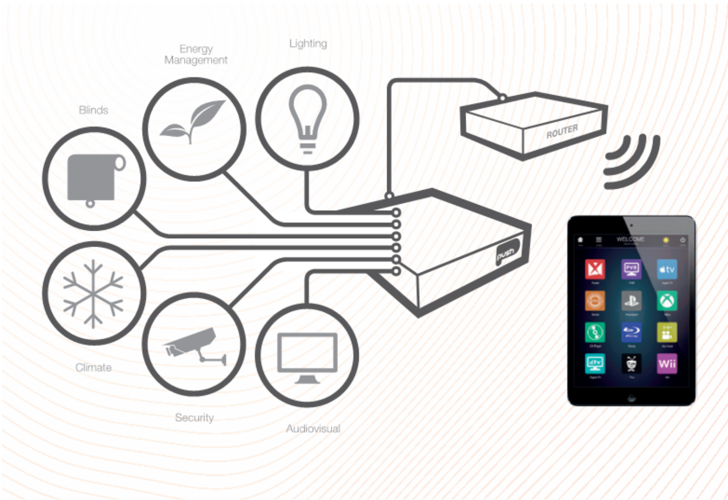
Implementing smart metering and an integrated metering strategy within the residential components of the development will help to educate residents about the connection between energy use and energy service. These meters will assist in energy auditing, fault detection and root cause analysis. Overall the provision of this service has been shown to reduce the consumption of electricity within dwellings by over 15%.

3.9.2 Smart Front End Controls

An average household has around 24 electronic devices connected to the network and is continuing to increase. The "Smart Homes" concept relies on front end equipment implemented within the apartment spaces to link all the devices together via one control point, currently including; lighting, automated blinds, security, thermostat controls, energy monitoring, television and sound systems. These systems therefore must present a uniform, intuitive and integrated system that is simple to use if it is to be used extensively.

All of these systems take information provided by devices or control systems installed within switches and GPOs back to a central point and distribute this information via an app or interface to the end user.

The level of connectivity in the home is dependent on the level of control desired and the purpose of the intended use of the resident. As it stands today, there are several options for Cabramatta East Precinct to integrate smart home technologies into the development.



The intent of incorporating smart home technology into the development is to set up the provisions for the future residents as a plug and play solution, whereby the resident would bring their own technology as part of their home and connect to the building infrastructure, integrated with Wi-Fi network.

There are a number of integration products readily available across the market ranging from Samsung's Smart home Products, Apple Home, Nest's Connected Home, Quantify Technology integrated home offerings and Push by Schneider Electric products that offer various levels of smart front end controls and devices.

Figure 15 – Smart Homes- Basic Control

3.9.2.1 Option 1 - Basic Control

Smart home technology in its most basic form, would allow for a centralised switch (on/off) solution with minimal functions i.e. remote access to turn off all lighting or the air conditioning system.

This level of control is suitable for residents that would like the option to turn household devices off and on remotely as a cross checking exercise for example. Typical functions for a basic smart home automation set up could include:

- On/off energy switches for devices connected to smart plugs
- Energy consumption monitoring (based on devices connected to smart plugs)
- SMS or email alerts

This system would cost in the order of $1,500 - $3,000 per apartment and would require the installation of several sensors and smart plugs as the way to connect devices.

4. RECOMMENDATIONS

The sustainability initiatives proposed in this Report have been further assessed against indicative costs in terms of capital cost per apartment and predicted payback period.

Potential operational savings, revenue generation and improved asset value have been realised and indicated in the table below.

Table 10 Summary of Proposed Initiatives

Approach **Design Item / element**	**Capital Cost premium:** **Residential (per apartment):** Nominal - $1 - $500 Low - $500 -$2,000 Medium - $2,000 -$5,000 High - $5,000 - $7,500 Extended - > $7,500	**Estimated Simple payback period (marketable benefit)** Short: 0 – 3 yrs Med: 3 – 5 yrs Long: 5 – 7 yrs Extended: > 7 yrs	**Operational cost savings**	**Revenue generation potential**	**Improved asset value** **(for occupant – improved rate of sale / lease uptake)**
1. PASSIVE DESIGN					
Selection of Glazing products with VLT of 60%	Nominal	Short	✓		✓
Optimised internal finishes to enhance DL diffusion:	Nominal	Short	✓		✓
Shading	Medium	Medium	✓		✓
2. REDUCED CARBON FOOTPRINT					
Embedded Network (Origin)	Medium	Medium	✓	✓	
Rooftop solar	Low	Medium	✓	✓	
3. COMMUNITY & LIVABILITY					
Community gardens on communal roof terraces	Nominal	Short			✓
Interactive display screens	Nominal	NA		✓	✓
Wayfinding	Low	Short	✓		✓
4. HEALTH & WELLBEING					
Low VOC's and low formaldehyde	Nominal	NA			✓
5. WATER MANAGEMENT					
Rainwater harvesting & reuse	NA	Long	✓		
Sprinkler test water reuse	NA	Medium	✓		
Approach **Design Item / element**	**Capital Cost premium:** **Residential (per apartment):** Nominal - $1 - $500 Low - $500 -$2,000 Medium - $2,000 -$5,000 High - $5,000 - $7,500 Extended - > $7,500	**Estimated Simple payback period** Short: 0 – 3 yrs Med: 3 – 5 yrs Long: 5 – 7 yrs Extended: > 7 yrs	**Operational cost savings**	**Revenue generation potential**	**Improved asset value** **(for occupant – improved rate of sale / lease uptake)**
Fire Hydrant test water reuse	NA	Medium	✓		
6. WASTE MANAGEMENT					
Construction waste diversion from landfill – define project targets	Nominal	Short			
Waste segregation	Nominal	Short	✓		
Waste compactors	Nominal	Short	✓		

Unified bin design throughout the building and common areas	Nominal	Short	✓		
Waste Education Programs	Nominal	NA			✓
7. SUSTAINABLE TRANSPORT					
Bike share (and helmet) facilities	Low	Medium		✓	✓
Electric Vehicle charging stations	Nominal	Medium			✓
8. ECOLOGICAL FOOTPRINT					
Non obtrusive outdoor lighting	Nominal	Short	✓		
Selection of roofing materials, including shading structures, having the following Solar Reflectance Index (SRI): - For roof pitched <15°– a three year SRI >64; or - For roof pitched >15°– a three year SRI >34.	Nil	Short	✓		
Rooftop gardens	Low	Extended			✓
9. SMART HOMES					
Smart Meters	Medium	NA			
Option 1: Basic Control	Low	Short	✓		