61-77 Hall St Bondi
DA ESD Report

Toga Group

29 May 2008

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Prepared for

Toga Group

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Executive Summary

This report outlines ESD strategies under consideration for the commercial, residential, hotel and retail components of the 61-77 Hall St, Bondi development. A detailed overview of ESD strategies under consideration for the development is contained in the body of this Report.

The following table outlines each of the relevant Sustainability Indicators for this development and the mandatory requirements of the relevant authorities (Waverley Council, NSW Government) and voluntary options within each. Where a rating scheme is available for that aspect, it is indicated below. Where there are opportunities for good practice within an Indicator, suggestions have been developed based on Bassett's ESD expertise.

	Residential	**Retail**	**Hotel**
Land Use and Ecology			
Mandatory	N/A	N/A	N/A
Voluntary	Green wall	Green wall	Green wall
Water Efficiency			
Mandatory	BASIX	BCA Section J – fixture efficiencies	BCA Section J – fixture efficiencies
Voluntary	Grey water, roof garden	re-use rainwater for WCs	re-use rainwater for WCs
Thermal Performance/Building Fabric			
Mandatory	BASIX + part of BCA Section J	BCA Section J	BCA Section J
Voluntary	N/A	N/A	N/A
Energy Efficiency/Greenhouse			
Mandatory	BASIX + part of BCA Section J	BCA Section J	BCA Section J
Voluntary	External lighting/lifts	External lighting/lifts	External lighting/lifts
Waste			
Mandatory	Waverley Council DCP	Waverley Council DCP	Waverley Council DCP
Voluntary	Kitchen design for waste sorting	N/A	N/A
Materials			
Mandatory	None	None	None
Voluntary	low impact materials	impact materials	impact materials
Pollutants			
Mandatory	None	None	None
Voluntary	Low VOC/Formaldehyde materials	Low VOC/Formaldehyde materials	Low VOC/Formaldehyde materials
Transport			
Mandatory	Bicycle parking	Bicycle parking	Bicycle parking
Voluntary	N/A	N/A	N/A

Sustainability Indicator	Key Sustainability Measures
Water Efficiency	• Rainwater capture, storage and reuse for toilet flushing • Water efficient appliances • Grey water being investigated for hotel laundry
Thermal Performance/Building Fabric	• Exceeds BASIX Thermal Comfort requirements – for cooling by 29% • Well insulated and shaded, cross ventilation for coastal sea breeze, use of performance glass to improve comfort and reduce a/c use
Energy Efficiency/Greenhouse	• Meets BASIX Energy requirements • Solar boosted gas hot water system • High efficiency air conditioning including variable speed drive motors • High efficiency mechanical ventilation system • Energy efficient lighting • Sophisticated Building Management System that minimises energy use • Energy efficient fixtures and fittings including compact fluorescent lamps to utility rooms, hallways and kitchens of residential apartments.
Waste	• Waste reduction during construction • Waste sorting facilities to improve recycling rates for occupants
Materials	• Currently investigating sustainable timber opportunities
Pollutants	• Currently investigating low toxicity materials and refrigerants
Transport	• Excellent proximity to public transport and local amenities • Onsite bicycle storage for residents and hotel guests • Currently investigating an onsite Shared Car arrangement to reduce the need for residents to own a car.

1.0 Introduction

This Environmentally Sustainable Design (ESD) design report provides an outline of some of the ESD and low energy initiatives which will be considered by the design team when developing the design for the 61-77 Hall St Bondi project.

Over the last few years world public opinion has increased significantly at concern over the state of the environment. Buildings are responsible for a significant portion of the developed world's energy consumption and as such, more and more clients and designers are recognising the need for designing ecologically sustainable buildings which reduce the impact on our planet.

This ESD design report aims to provide a template which will be updated as the design develops to assist the design team in ensuring that the facility will achieve the environmental performance targets and provide high occupancy comfort levels through the use of passive and active measures.

The report highlights areas which should be reviewed for further consideration as the design progresses and options for achieving compliance with the various sustainability policies. It reviews issues associated with the site as a whole, the building on the site including passive design measures such as building shading and glass performance and active measures involving air conditioning and lighting services.

Each strategy in this report will be developed to determine its direct economic benefits as the design progresses. Voluntary strategies may be discarded during the process based on their identified benefits.

2.0 Sustainability Indicators and Environmental Performance Ratings

It is common for Environmentally Sustainable Design to be broken down in to Sustainability Indicators to assess the performance of buildings in detail. Governments have regulations that apply to some indicators for some building types. There are rating schemes that are available to assess performance for some or all indicators. Where there are no minimum regulatory requirements or rating schemes for an Indicator, Bassett has applied its expertise to suggest options to improve the sustainability of the development.

This section:

- outlines each of the sustainability indicators – Land Use and Ecology, Water, Thermal Performance/Building Fabric, Energy Efficiency/Greenhouse, Waste, Materials, Pollutants, Transport,
- explains the mandatory requirements within that Indicator and provides options for compliance
- Suggests options for voluntary over compliance within that Indicator for consideration by the client.

2.1 Description of Rating Schemes

Rating Schemes appropriate to this development:

Residential component – BASIX and parts of BCA Section J: Energy Efficiency
Retail and Hotel components – BCA Section J: Energy Efficiency

The Australian Building Greenhouse Rating (ABGR) Scheme only applies to commercial office buildings and there is no Green Star tool currently available for this mixed use development.

2.1.1 BASIX (Building Sustainability Index) Rating Scheme

Scheme managed/introduced by: NSW Government, Department of Planning

Brief Description: BASIX is an online sustainability tool that ensures residential dwellings are designed to use less potable water and be responsible for fewer greenhouse gas emissions by setting energy and water reduction targets for house and units. Since October 1st 2005 the BASIX Scheme has applied to all new residential dwellings, including single dwellings, villas, townhouses and low-rise, mid-rise and high-rise developments and alterations to dwellings in NSW.

The residential component of the proposed development must achieve the required BASIX targets of:

- 40% less potable water per person than the NSW average
- Up to 40% less greenhouse per person than the NSW average depending on the number of storeys and type of residential development.
- Compliance with the thermal comfort targets.

The details of the development are entered in to the BASIX website. Changes are made to ensure the targets are met and a BASIX Certificate is generated which summarises the sustainability features which must be incorporated in to the design and the final building.

Mandatory?: Yes, BASIX is given legal effect by the NSW Environmental Planning and Assessment Regulation.

Stage of Development process: BASIX Certificate must be submitted with the DA, CC and OC. The BASIX Certificate can be updated at each stage if the design and/or specification of the development changes.

Accreditation required?: For the Thermal Comfort section, an Accredited Assessor is required to conduct thermal simulations using approved software, e.g. NatHERS, AccuRate, BERS. Bassett is accredited to conduct these simulations and the cost is included in the consulting fees.

2.1.2 Building Code of Australia (BCA) Section J (Energy Efficiency)

Scheme managed/introduced by: Australian Building Codes Board with input from States and Territories.

Brief Description: The Building Code of Australia (BCA) Section J (Energy Efficiency) applies in full to the carpark, retail, hotel components of the development and partially to the residential components to complement BASIX. The BCA has the following options:

- Deemed-to-Satisfy option with prescriptive requirements for each component (primarily used for small buildings or parts of buildings)
- Verification Method option where the thermal performance and energy use of the building is simulated using approved software. The BCA sets maximum for the predicted energy use. There are minimum standards for the performance of the fabric to ensure the building will perform to a reasonable standard regardless of future changes to plant and equipment.
- Alternative Solution – for unusual designs and strategies that cannot use either of the above methods. This option includes the use of other evidence and expert opinion.

The Deemed-to-Satisfy Provisions are divided in to sections with minimum standards in each:

- J1 Building Fabric - Minimum thermal performance for constructions according to climate zone for roofs, ceilings, roof lights, walls, and floors.
- J2 External Glazing – Minimum standards for glazing and shading to control heat loss and gain
- J3 Building Sealing - Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- J4 Air Movement – Not applicable in NSW.
- J5 Air-Conditioning and Ventilation Systems – Minimum efficiency standards for equipment.
- J6 Artificial Lighting and Power – Minimum efficiency standards for lighting.
- J7 Hot Water Supply – Minimum fixture efficiency, design of hydraulic systems and pipework insulation.
- J8 Access for Maintenance

Mandatory?: BCA Section J provisions became mandatory in NSW from November 1st 2006. The BCA is given legal effect by the NSW Environmental Planning and Assessment Regulation.

Stage of Development process: Construction Certificate (CC). The completed building must comply with the approved CC. Bassett will provide a report at CC stage demonstrating compliance with BCA Section J.

Accreditation required?: If the Verification Method is used, the energy simulation must be conducted by 'an appropriately qualified person' using approved software. Bassett's engineers are appropriately qualified and use approved software – we use the IES software for non-residential buildings.

2.2 Other Relevant ESD Guidelines

In addition to the above, several other design guideline sources will be used in assessing appropriate ESD strategies:-

- CIBSE Guidelines;

- ASHRAE Guidelines;
- Various Expert Sources.

2.3 Related Regulations

The following local, State and Commonwealth regulations may have an influence on the selection of ESD strategies for the development:

- Waverley Council Development Control Plan (DCP);
- Waverley Council Local Environment Plan (LEP);
- Other requirements of the BCA (including referenced Standards) that may influence ESD recommendations, e.g. fire safety.
- SEPP65 - Residential Flat Design Code for New South Wales.

3.0 Indicator – Land Use and Ecology

There are no mandatory landscaping or ecology ESD requirements for the site. The following voluntary suggestions are made for the whole of the site relating to all components of the building.

3.1.1 Landscaping and Microclimates – all components

Landscaping can be used to provide more desirable microclimates around buildings. Microclimates can be achieved through the use of effective landscaping and shading. The form of the landscape, the use of vegetation around buildings and the arrangement of buildings can reduce the occurrence of suntraps and promote comfortable microclimates. It can also be used to prevent wind tunnel effects around buildings. Open spaces between buildings can promote wind distribution and reduce wind restrictions.

The use of vegetation, aside from the shading benefit of larger vegetation, can have a cooling effect on internal temperatures. If reasonable volumes of vegetation (ie more than a few pot plants) are used in the form of 'green walls', transpiration from the vegetation will cool surrounding air, thereby improving comfort. While there will be some benefit from a green wall in the Bondi climate, the benefits will be marginal compared to the reliable cooling sea breeze. Green walls or vegetation have a significantly greater benefit in inland areas where the are no sea breezes and humidity is lower.

Refer to 4.2.2 for information on the thermal and stormwater runoff benefits of roof gardens.

4.0 Indicator – Water Efficiency

4.1 Residential Component Mandatory

The residential component must comply with the requirements of the BASIX Water Index. Refer to the attached BASIX Certificate for full details of the design and specifications requirements to comply with BASIX. The key elements are described below.

4.1.1 Fixtures and Fittings

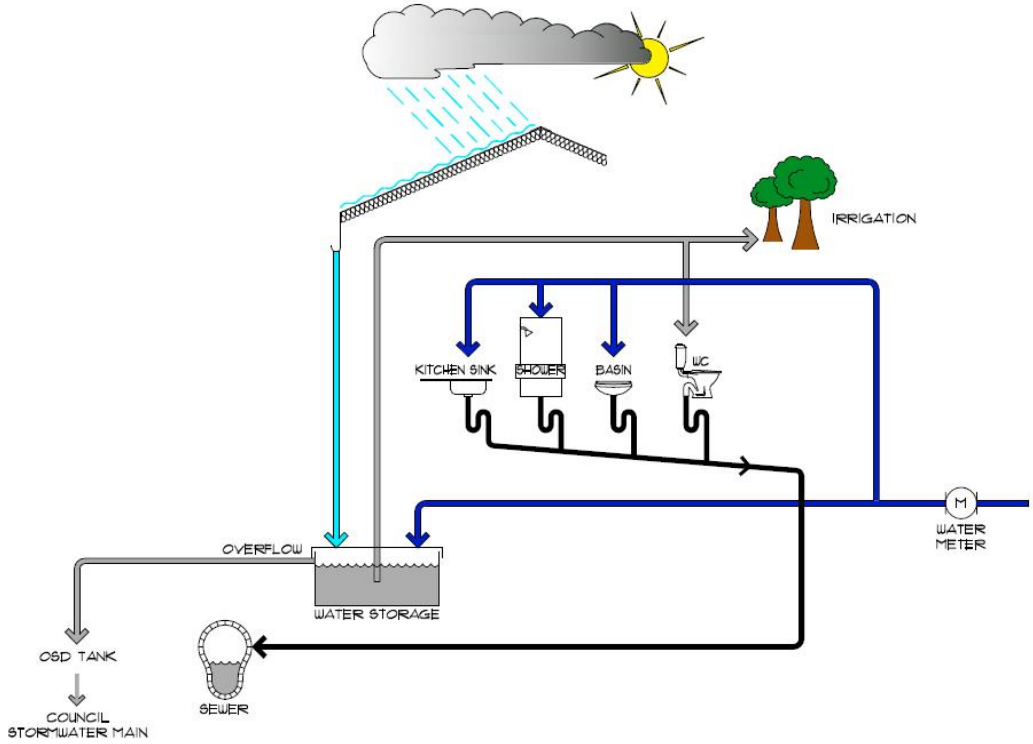
The BCA Section J7 - Hot Water Supply requires 3 star or greater water efficiency ratings for showerhead and kitchen/bathroom taps under the WELS rating scheme. The development will also have dual flush toilets and 3 star dishwashers.

4.1.2 Rainwater Harvesting

Rainwater harvesting systems collect rainwater from the site roof diverts it from the stormwater system and sends it to storage tanks for later use in the building. Rainwater harvesting can be used in

conjunction with grey water systems to significantly reduce water usage. It can be also be used for toilet flushing and use cooling tower water.

The following diagram demonstrates the concept of the rainwater harvesting system when operating with a conventional hydraulic installation.



The 61-77 Hall St project has the potential to incorporate rainwater harvesting to provide toilet flushing, and cooling tower water make-up. The system would involve a 90kl tank in the basement, stormwater overflow connection, post and pre-fliters pumps to circulate the water and pipework connecting the tank to the WCs.

A tank supplying at least 1100kl/day to flush WCs in the apartments is required to meet the BASIX water savings targets. The proposed 90kl tank would be sufficient to supply this amount averaged out over a typical rainfall year.

4.2 Residential – Voluntary

The following voluntary measures may be considered for inclusion in the development.

4.2.1 Grey Water Reuse

Grey water systems reuse laundry, shower, bath and hand basin water. If treated, the water can be reused for flushing toilets and in laundries. The requirement to treat the water increases the costs compared to rainwater harvesting, however they have the benefit of not relying on local rainfall for a regular supply of grey water.

This option is more expensive than rainwater harvesting, however it can result in water savings of over 50% compared to standard practice.

4.2.2 Roof Garden

Roof gardens provide excellent insulation properties for both heating and cooling. Roof gardens also reduce rainwater run-off to stormwater, increases the ecological value of the building and provides a

pleasant space for occupants. This option may be considered for the building's rooftops. Consideration should be given to the Kalzip system (pictured).

4.3 Retail and Hotel – Mandatory

4.3.1 Fixtures and Fittings

The BCA Section J7 - Hot Water Supply requires 3 star or greater water efficiency ratings for showerhead and kitchen/bathroom taps. The development will also have dual flush toilets and 3 star dishwashers.

4.3.2 Waverley Council Requirements – Water efficiency

Council's DCP requires that:

1) New or replacement bathroom and kitchen taps are to be AAA rated as defined by the Australian Standard AS 6400 Water efficient products – Rating and labelling.
2) New or replacement toilets(s) are to be dual flush as defined by the Australian Standard AS 6400 Water efficient products – Rating and labelling.
3) New or replacement urinals are to be AAA rated.
4) Clothes washing machines are to be AAA rated as defined by the Australian Standard AS 6400 Water efficient products – Rating and labelling.
5) Dishwashers are to be AAA rated as defined by the Australian Standard AS 6400 Water efficient products – Rating and labelling.

The A rating scheme has been replaced by the WELS star rating scheme. The development will meet or exceed these requirements for fixtures and products installed by the developer.

4.4 Retail and Hotel – Voluntary

4.4.1 Rainwater Harvesting

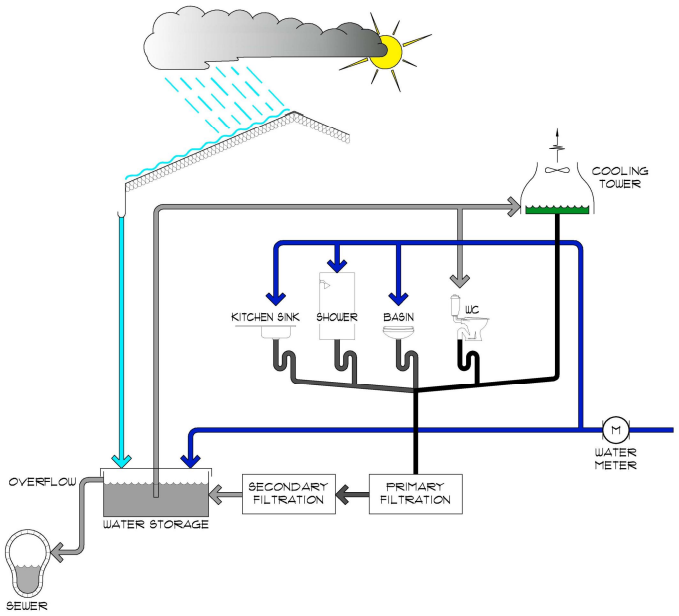
It is proposed that the 90kl tank and rainwater reuse system will be used to flush toilets in the retail and hotel components of the development.

4.4.2 Grey water

A grey water system is currently being investigated to collect waste grey water from basins in a number of the hotel apartments, treated and reused for washing in the hotel laundry and landscaping.

4.4.3 Black Water System for Toilet Flushing

Black water systems collect and treat waste water from dishwashers, showers and washing machines, toilets and cooling towers for use in flushing of toilets and irrigation of landscapes. Black water systems require storage tank facilities and treatment systems incurring additional capital cost and maintenance costs. The benefits of black water systems are the significant reduction in water consumption.



If a black water treatment system is to be included in the design, the water from the rainwater tank would be used for connection to laundries.

Based on the number of apartments and hotel suites, a black water system could be considered for this development however, the marginal savings above the collection and re-use of rainwater may not justify its use.

Refer to 4.2.1 for information on Grey Water systems.

5.0 Indicator - Thermal Performance/Building Fabric

5.1 Residential Component Mandatory

The residential component must comply with the requirements of the BASIX Thermal Comfort Index. Each apartment must meet minimum standards to ensure appropriate levels of comfort for summer and winter.

Refer to the attached BASIX Certificate and ABSA Assessor Certificate (provided for final version of this report) for full details of the design and specifications requirements to comply with BASIX. The key elements are described below.

5.1.1 Design

There are no changes to the design required to comply with BASIX. The relatively high glass areas are contributing to the need for performance glass to control heat loss and gain.

5.1.2 Insulation

The table below provides the total system (R-value of the system and any installed insulation) requirements for BASIX compliance.

Table 1: Residential component Insulation requirements

Area	Added R-value m^2K / W (does not include construction)
Walls (assumed 200mm block with	R1.5

internal plasterboard on 90mm frame)	
Ceiling/Roof (assume concrete ceiling with tiles or pebbles above and suspended pb ceiling)	R3.0

5.1.3 Glazing

The following table provides the glazing that was required for the apartments to comply with the BASIX Thermal Comfort requirements. Note, it may be possible for double glazing to be sourced that is cheaper than low-e glazing depending on the glazing supplier. If this is found to be the case, compliance using double glazing may be possible and can be explored at a future stage.

Table 2: Residential Glazing requirements

Glazing Section	U-value required	SHGC required	Typical Glazing systems that can meet these requirements
Apartments 401,501, 509,510,519,601 and 602	4.32	0.47	Likely to need to be Double Glazing, aluminium frame – it may be possible to source low-e single glazed windows and doors that achieve these values.
Apartments 701	3.58	0.68	Will need to be double glazing with aluminium frame
All other apartments	7	0.81	Single Glazed (clear), aluminium frame

5.1.4 Shading

The shading specified in the drawings, i.e. overhangs, balconies was sufficient to achieve a pass. The frosted glass at the edge of the balcony on Levels 4-7 is required to a sun blocking factor of at least 40%.

5.2 Retail and Hotel - Mandatory

Retail - Given the size of the retail component, it is recommended that the BCA DTS option be used as it is a more cost effective assessment method than the Verification Method (which involves software modelling).

Hotel – while this component is larger in floor area, the DTS method is again likely to be the most cost effective assessment method to demonstrate compliance.

A full BCA Section J compliance report will be provided for the CC, however the major issues and influences on the design and construction of the building are provided below.

5.2.1 BCA J1 – Building Fabric

External walls, ceilings with roof above, ceilings with plant rooms above will require total system insulation to the levels specified below:

Table 3: Retail/Hotel components Insulation requirements

Area	Total systems R-value m^2K / W
Walls	Hotel R1.5, Retail R1.8
Ceiling/Roofs	R2.7
Ceiling below plant room or store	R1.35

These values include the R-value of the construction as the BCA requirements are expressed in these terms. The construction selections and added insulation will be confirmed during design development prior to the application for a Construction Certificate. Consideration should be given at the DA stage to selecting a wall construction system that will allow at least 90mm of insulation batts to be included in the construction; internal plasterboard directly fixed to the wall or fixed to standard furring channels will not provide adequate space for insulation.

5.2.2 Waverley Council Requirements

Council's DPC requires that 'Roofs and/or ceilings are to be insulated with a minimum R3.0 rating.'

Insulation will be specified to meet both BCA J1 requirements described above and to meet these requirements set by Waverley Council.

5.2.3 J2 – External Glazing

To enable an understanding of the potential design impacts of BCA compliance, Level 00 Ground Floor retail and four individual hotel suites were evaluated against the glazing and shading requirements in the BCA. The BCA glazing requirements assess orientation, glazing area, glazing type and shading. There is some capacity to adjust individual components (e.g. increase shading to have glass with worse performance) in order to achieve compliance.

Lower Ground – O'Brien St entry
As the area of the retail component on this floor is greater than 500m2, the BCA requires the use of the calculation method described under J2.4. This method has allowances for each façade, there is no capacity to trade between the performance of each façade to achieve an overall compliance. This level has been modelled using the J2.4 Glazing Calculator.

It may be possible to rely on the definition of building within the BCA to argue that each tenancy can be modelled separately using J2.3 which allows more flexibility to trade between the facades. This will be investigated in subsequent stages to determine whether compliance can be achieved at a lower glazing cost.

Initial results using J2.4 based on the drawings provided, indicate that some performance glass is likely to be required. These results are indicative only and are not final results for BCA certification. Table 4 below gives indicative performance criteria for each glazing section in the ground floor retail component and typical glazing systems that can meet those criteria. It will be necessary at subsequent stages in the design process to confirm with glazing suppliers that these values can be met.

The use of higher performance systems for areas where lower performance glass is permissible may be desirable to reduce the number of glass types used in the development.

Table 4: Ground floor retail glazing for BCA Section J compliance

Glazing Section	U-value required	SHGC required	Typical Glazing systems that can meet these requirements
SW to Hall St	4.5	0.58	Single Glazed Low-E (clear), aluminium frame
N Gym and Retail	7	0.81	Single Glazed (clear), aluminium frame
NW restaurant and gym facing pool	7	0.81	Single Glazed Low-E (clear), aluminium frame
NW G05 facing corridor	7	0.81	Single Glazed Low-E (clear), aluminium frame
SE retail facing walk through	4.5	0.47	Single Glazed Low-E (tint), aluminium frame
NE retail facing pool	6.2	0.64	Single Glazed Low-E (clear), aluminium frame – note tinted glass will also pass, however single

			clear glass will not
S small area of gym facing pool area	4.2	0.58	Single Glazed Low-E (clear), aluminium frame, potentially double glazed, aluminium frame depending on the values that can be achieved by the glazing contractor
W (Sec 13-14)	4.2	0.58	Single Glazed Low-E (clear), aluminium frame, potentially double glazed, aluminium frame depending on the values that can be achieved by the glazing contractor

Hotel Suites on level 01

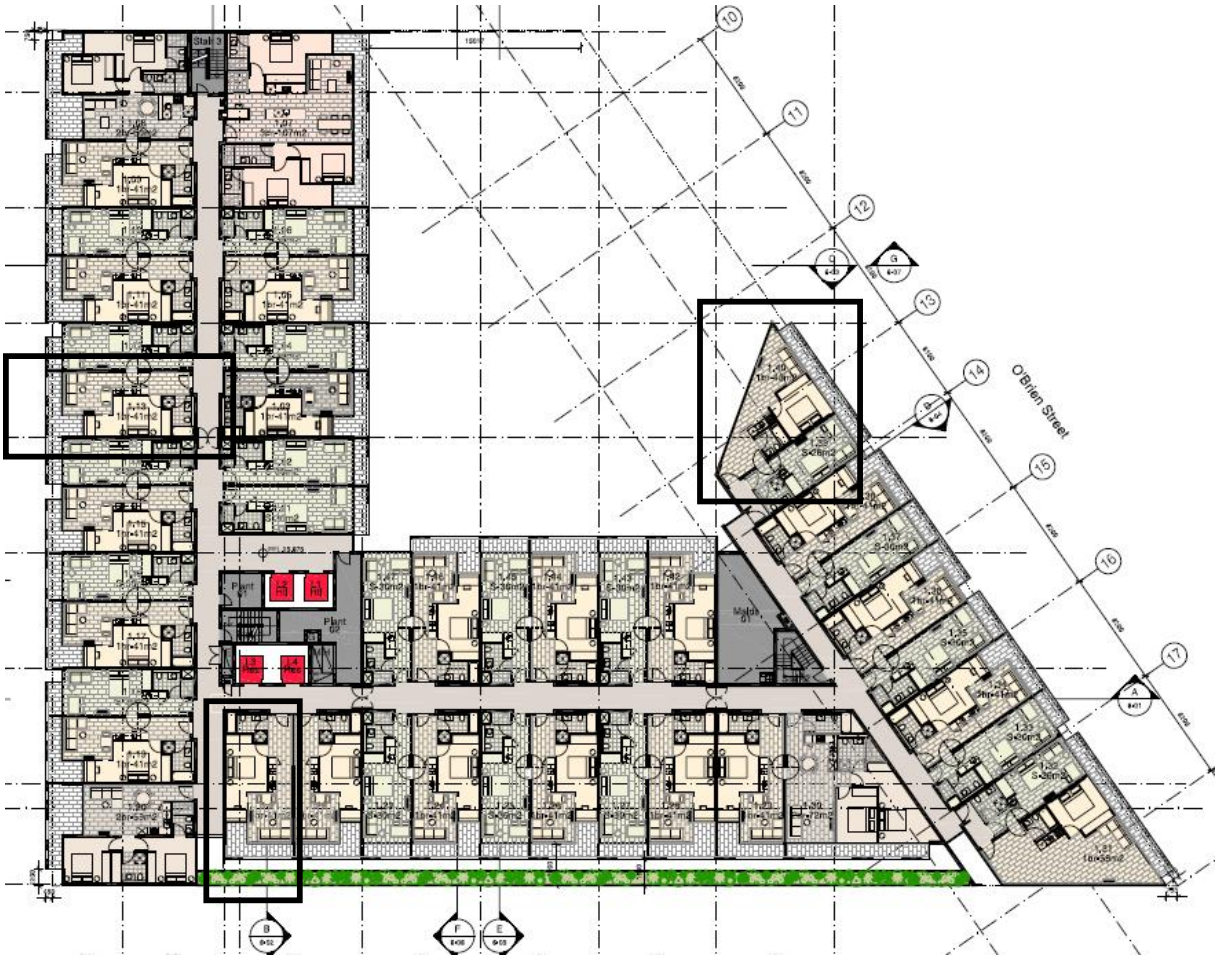
Hotel suites have a BCA Classification of Class 3 buildings. Each individual suite is required to comply with the glazing requirements. 3 suites have been selected to explore the likely glass required to comply.

Table 5: Level 01 typical suites glazing requirements

Glazing Section	U-value required	SHGC required	Typical Glazing systems that can meet these requirements
Suite 1.13	5.2	0.81	Single Glazed Low-E (clear), aluminium frame
Suite 1.21	4.8	0.81	Single Glazed Low-E (clear), aluminium frame
Suite 1.40	4.2	0.81	Extent of glazing to West to be limited to 1.5m x full height

Most suites will readily comply with the cooling requirements based on the shading and orientation, however to comply with the heating requirements a glass with a lower U-value than standard glass with an aluminium frame (around 7.0-7.9) was required. For Suite 1.40, the area of west facing glass will need to be limited to 1.5m x 2.85m in order to achieve compliance with BCA J2.

Figure 1: Selected typical suites for glazing analysis



6.0 Indicator - Energy Efficiency/Greenhouse

6.1 Residential Component Mandatory

The residential component must comply with the requirements of the BASIX Energy Index and Sections J5, J6 and J7 of the BCA also apply to the mechanical, lighting and hot water systems of the residential component and any services shared between the residential, retail and hotel components of the development.

Refer to the attached BASIX Certificate for full details of the design and specifications requirements to comply with BASIX. The key elements are described below.

6.1.1 Fixtures and Fittings

The development will comply with the mandatory BCA Section J7 – Hot water supply energy efficient fixtures and fittings and exceed the pipework insulation requirements. These requirements are recognised by BASIX in calculating the Energy score for the residential component.

6.1.2 Air Conditioning and Ventilation

The BASIX Energy Index assesses the energy use for the air conditioning and ventilation system used for the residential component. The following information details selections made in BASIX relating to HVAC to contribute to achieving the Energy target.

6.1.2.1 High Efficiency A/C to individual dwellings

The apartments will be supplied with high efficiency water cooled package units with reverse cycle operation to ensure heating and cooling is only provided where required by a dwelling. High efficiency systems ensure that cooling is provided in an energy efficient manner and heating is provided by a combination of efficient reverse cycle and gas heating.

A high efficiency condensing boiler has been specified to supply hot water for heating. These provide efficiencies of up to 90% over the conventional gas fired boiler performance of 80%. Condensing boilers require a maximum return water temperature of 50ºC and supply temperature of 72ºC. Higher temperatures require a second booster boiler which can be installed in a modular arrangement.

A COP efficiency of greater than 4.5 is required for the heating and cooling a/c to comply with BASIX.

6.1.2.2 Variable Speed Pumping

Where the building load is cyclical due to the solar load, air temperature or occupancy, the condenser and boiler load will vary. Variable speed pumping is required in certain systems by the BCA under J5.

6.1.2.3 High Efficiency Fan Motors

High efficiency motors can provide in the order of 3% improved efficiency over conventional motors. High efficiency motors should be incorporated into mechanical services to reduce the energy consumed by fans. Minimum fan motor efficiency is required in certain systems by the BCA under J5.

6.1.2.4 Demand Controlled Carpark Ventilation

Carbon Monoxide (CO) sensors have been specified carpark ventilation system to only operate the ventilation when required thereby significantly reducing the energy use associated with carpark ventilation. This will also contribute to compliance with the BASIX Energy Index.

6.1.2.5 Demand Controlled Ventilation for Plant rooms

For plant rooms, energy consumption from fans providing mechanical ventilation can be reduced through thermostat controls or connecting the fan operation to the use of light switches. These measures have been used to achieve the BASIX Energy target. For plant rooms on the roof, consideration should be given to providing natural ventilation to plant rooms.

6.1.3 Hot Water Supply

6.1.3.1 Fixtures, Fittings and Pipework

The fixtures and fittings will comply with the 3 star WELS rating required by BCA Section J7 – Hot water supply. Pipework insulation and design will be provided to comply with the levels required by the BCA Section J7 – Hot water supply.

6.1.3.2 Gas boiler hotwater system with solar boosting

The hot water system specified to achieve compliance with the BASIX Energy Index is a greenhouse friendly gas hot water system with pre-heating from at least 60m^2 of solar hot water panels. When taking into account distribution losses from the fuel source, gas fired hot water boilers can provide

efficiencies of up to 88% over thermal electricity generation efficiencies of 46%. Recent advances in boiler technology have developed condensing boilers with efficiencies of 98% when used in a modular boiler configuration.

6.1.3.3 Avoid Dead Legs in Hot Water System

The central hot water system should be designed to avoid dead legs which increase energy consumption through the loss of standing heat over time.

6.1.3.4 Hot Water Storage Insulation

Improved hot water storage insulation reduces heat losses and energy consumption levels due to standing losses. Consideration should be given to increasing the level of insulation on all hot water storage tanks above the levels required by the BCA.

6.1.4 Artificial Lighting and Power

6.1.4.1 Light fittings

In order to achieve the required BASIX target, the dwellings have been specified as either compact fluorescent or LED energy efficient lights to bathrooms, kitchens, hallways and laundries.

In common areas such as hallways and lift cars compact fluorescent lights with high light output ratio have been specified.

In the common carpark, fluorescent lights have been specified. The carpark will be required to comply with the BCA requirement of 3 W/m^2 for the general area and 25W/m^2 for the entry zone. Application of white paint to carpark walls, columns and ceilings can further reduce the energy intensity of the carpark lighting design.

6.1.4.2 Occupancy Sensors

Infrared motion detectors will be employed in common area halls, utility rooms, lifts and carparks which are infrequently inhabited such as corridors or to shut off lighting when not required.

6.1.4.3 Lift specifications

Gearless traction lifts with variable frequency drives have been specified for the lifts to contribute to achieving the BASIX Energy target. The introduction of variable frequency drive control provides approximately 5% energy savings over a modern two speed lift.

6.1.4.4 Power Factor Optimisation

Power factor correction equipment increases the capacity of the electrical utility infrastructure network. Consequently the size of transformers, high voltage reticulation equipment and consumer's submains can be reduced to achieve the same capacity. Apart from a utility requirement to achieve a certain power factor limit, power factor correction assists in the reduction of material and equipment for electrical utility infrastructure.

6.2 Residential – Voluntary

The following strategies are not part of the BASIX assessment, however they may be considered to achieve further energy savings.

6.2.1 Integrated Daylight / Electric Lighting Control

Where external lighting is provided, additional energy saving features can be employed through the use of photo electric sensors. These controls operate the lighting when the ambient natural light levels are adequate.

6.2.2 Exterior Lighting

Exterior lighting energy consumption can be reduced through optimum lighting design and use of low energy fittings such as plasma, high pressure sodium or LED fittings. Exterior lighting controls using photoelectric cells will reduce the occurrence of exterior lights operating when not required.
Further energy consumption reductions can be made through minimising the design of the external lighting system. The provision of greater numbers of compact fluorescent lights illuminating smaller specific areas is recommended.

6.2.3 Out of Hours Lift Parking

Parking of lifts during out of hours periods will allow the saving of energy during these out of hours periods. When in parked mode, lifts will turn off lights and be disabled. A standby lift will always be active for low population levels.

6.2.4 Photovoltaic Cells (PV Cells)

Photovoltaics generate electricity directly from sunlight using layers of silicon compounds. There are generally four types of photovoltaic types including:

- Monocrystalline Silicon Cells
- Polycrystalline Silicon Cells
- Amorphous solar cells
- Semi transparent

The efficiencies of photovoltaic cells range from 4% to approximately 20%, however the return on investment is still difficult to justify in most cases. Consideration may be given to installing photovoltaic cells if funding from government or non governments grants is available or the motive for incorporating photovoltaics is purely for public relations reasons.

Photovoltaics could have a future carbon credit trading benefit and the electricity generated can be sold back into the grid. However consideration should be given as to whether power generation is a core business of the building owner or tenant. Despite the benefits of photovoltaics as a demonstration of environmental commitment, the current payback period for photovoltaics is over 20 years. For this reason, PV is not recommended unless there is a desire to use it for promotional purposes. The other energy efficiency measures recommended in this report have far better payback periods.

6.2.5 Lift Motor Drive Regeneration

Lift motors are often in braking mode which generates energy. Harnessing of this energy can be achieved through regenerating electricity through the alternator and feeding the electricity back into the grid.
The benefit of lift regeneration is reduced energy consumption and electrical demand.

6.3 Retail and Hotel - Mandatory

- BCA Section J – DTS most cost effective.

Given the mixed use nature of the building, it is essential to understand compliance with BASIX for the residential component and compliance with the BCA for the carpark, retail and hotel components. The

energy use systems (HVAC, lighting, lifts, etc) have been considered in an integrated manner to ensure compliance with both and that each component has the most appropriate systems for the occupants of each.

6.3.1 Air Conditioning and Ventilation

The development will comply with the mandatory BCA Section J5 – Air Conditioning and Ventilation requirements that set minimum equipment efficiencies, require thermostats and other settings to ensure the air-conditioning system is energy efficient and does not waste energy.

The same water cooled package unit system will be used for the residential, retail and hotel components of the building. Mechanical ventilation specifications for areas shared with the residential component (e.g. carpark and plant rooms) have been configured to ensure compliance with BASIX. Mechanical ventilation systems not shared with the residential component will be designed to comply with the BCA Section J5 requirements.

Refer to 6.1.2 for further information on the A/C and Ventilation system.

6.3.1.1 Waverley Council requirements – Air Conditioning

Council's DCP requires that:

1) New or replacement air conditioning units are to have a minimum 4-star rating for cooling only. Reverse cycle air conditioning units are to have a minimum of 4-star rating on one cycle and 3-star rating on the alternate cycle.
2) New and replacement electrical appliances must be rated 5-star.
3) Hot water systems must have a minimum 3.5-star Greenhouse rating.
4) Dehumidification from air conditioning systems must be harvested and reused on site provided it is treated to an adequate level suitable for the reuse application, otherwise:
    a. A piped connection to Council's stormwater drainage system is required.
    b. There is to be no discharge to the footpath.

The specifications for these systems required to comply with BASIX exceed these requirements or the requirements are not applicable to this development.

6.3.2 Artificial Lighting and Power

The development will be designed to comply with the BCA J6 – Artificial Lighting and Power requirements. A calculation of the required lighting levels will be completed for the Construction Certificate application. The calculation will only apply to carpark and hotel component only as the retail tenancies will be the subject of separate DAs with their own lighting specifications.

6.3.2.1 Light fittings

For areas that are 'shared' with the residential component such as carparks and plant rooms, efficient lighting such as fluorescent fittings have been specified to achieve the BASIX Energy target and comply with the BCA.

The hotel and retail components are required to comply with the BCA lighting energy efficiency measures. These allow some flexibility in determining the actual fittings used, however the requirements are difficult to achieve without predominant use of fluorescent or LED lights.

The most energy efficient light source for general interior lighting is the linear T8 fluorescent lamp triphosphor coating on electronic control gear (2 x 36W). T5 lamps are less efficient than T8 lamps as a light source however when installed in an office ceiling grid, the size and arrangement of the T5 luminaire array results in an overall increase in efficiency.

The following table of luminous efficacies shows which lamps are the most efficient. This information is a guide only and should not be used as the only selection criteria. Some other criteria important in achieving the best result include the effect of the luminaire housing and reflector and having the appropriate light source to provide the ambience essential to the specific environment.

In common areas with no suspended ceilings, it is recommended that T8 triphospher fittings be considered.

TABLE - LAMP LUMEN EFFICACY

Lamp	Lumen output (1m)	Control Gear	Circuit Power (w)	Efficacy (/m/W)
60W Incandescent lamp (frosted)	720	none	60	12.0
Tungsten halogen				
50W 12V	1200	electronic	54	22.2
50W 12V	1200	iron core	58	20.7
T8 halophosphate (colour 33)		on core low		
2 x 36	5700	loss	83	68.7
2 x 36	5700	electronic	70	81.4
T8 triphosphor (colour 840)				
2 x 36	6700	iron core low	83	80.7
2 x 36	6700	loss	70	95.7
2 x 18	2700	electronic	39.6	68.2
2 x 58	10400	electronic	111	93.7
T5 triphosphor (colour 840)				
2 x 28 W	5200	electronic	62.5	83.2
2 X 54W	8900	electronic	117.5	75.7
1 X 80W	6150	electronic	86	71.5
Compact fluorescent				
1 x 42W	3200	electronic	46	69.6
1 x 18W	1200	electronic	20.5	58.5
T8 Cyanosis Observation Index lamp to AS1680.2.5-1997				
2 x 37W	4480	electronic	70	64.0
Mercury Vapour 80W	4000	iron core	93.5	42.8
Metal halide				
CDM 35W	3300	electronic	44.5	74.2
CDM 70W	6600	electronic	79.5	83.0
High Pressure Sodium 250W	25000	iron core	275	90.9

6.3.2.2 Power Factor Optimisation

Power factor correction assists in the reduction of material and equipment for electrical utility infrastructure and is a requirement of Energy Australia. Power factor correction equipment increases the capacity of the electrical utility infrastructure network. Consequently the size of transformers, high voltage reticulation equipment and consumer's submains can be reduced to achieve the same capacity.

6.3.3 Hot Water Supply

The development will be designed to comply with the BCA Section J7 requirements for Hot Water Supply.

6.3.3.1 Fixtures, Fittings and Pipework

The fixtures and fittings will comply with the 3 star WELS rating required by BCA Section J7 – Hot water supply. Pipework and hot water storage insulation and design will be provided to comply with the levels required by the BCA Section J7 – Hot water supply.

6.3.4 J8 – Access for Maintenance

The building services will be specifically designed for compliance with access for maintenance requirements for all classifications of the development.

6.4 Retail and Hotel – Voluntary

The following provides additional recommendations regarding energy efficiency for the retail and hotel components of the building.

6.4.1 Artificial Light and Power

6.4.1.1 Lighting Comfort Levels

Where electric lighting is required, lighting levels will be reviewed and scrutinized for over design. The over design of lighting levels will incur increased capital cost and material consumption as well as increased energy consumption. Energy consumption will be reduced through not only the reduction of light fittings but also the reduced heat load affecting the air conditioning system.

6.4.1.2 Lighting Control System

Lighting control systems are required in areas shared with the residential component to meet the requirements of BASIX. It is recommended that the retail and hotel components of the building also use these control systems to reduce energy use. An integrated system turns lights on and off in accordance with a time schedule can provide significant overall savings for a building. The integrated lighting control system should be linked to occupancy and daylighting controllers to assist in optimising the building lighting system operation.

6.4.1.3 Electronic Ballasts

Electronic ballasts are more efficient than conventional ballasts and incorporate benefits such as low flicker or start-up delay. Electronic ballasts allow fluorescent lights to be dimmed which in-turn provides energy cost savings.

6.4.1.4 Occupancy Sensors

Infrared motion detectors should be employed in rooms which are infrequently inhabited such as corridors or utility rooms to shut off lighting. This method of control is useful in automatically disabling light when the rooms are not occupied.

6.4.1.5 Integrated Daylight / Electric Lighting Control

Where external lighting is provided additional energy saving features can be employed through the use of photo electric sensors. These controls operate the lighting when the ambient light levels are adequate. Where natural lighting is promoted at the building facades additional energy saving features can be employed through the use of photo electric sensors. These controls operate the lighting at the facade through dimming or shutting off lights when the ambient light levels are adequate.

Dimming of lights is preferred to turning lights on and off as the abrupt change in lighting level caused with the latter method of control can cause distractions to the occupants. Due to the potential limited use of light shelves to only the northern façade, daylight sensors would only be incorporated to the northern internal zones.

6.4.1.6 Out of Hours Lift Parking

Parking of lifts during out of hours periods will allow the saving of energy during these out of hours periods. When in parked mode, lifts will turn off lights and be disabled. A standby lift will always be active for low population levels.

6.4.1.7 Lift Lighting

Energy reduction can be achieved through the use of high efficiency lighting in lieu of decorative dichroic down lights. Occupancy sensors in lifts to switch lights off when not occupied will assist in reducing lift light energy consumption further.

6.4.1.8 Out of Hours Control

The provision of out-of-hours occupant control of lighting can be linked to scheduled lighting control system and provide occupants with central control system override. Out-of-hours occupant controllers should be set with a run-on-timer to limit the amount of time the lights operate after initiated.
The out of hours operation of the lighting system should be incorporated into the integrated lighting control system.

6.4.1.9 Lift Motor Variable Frequency Drive Control

While not required for BCA compliance, it is recommend that the energy saving lift specifications required for BASIX compliance be also applied to the hotel lifts.

6.4.1.10 Lift Motor Drive Regeneration

Lift motors are often in braking mode which generates energy. Harnessing of this energy can be achieved through regenerating electricity through the alternator and feeding the electricity back into the grid. The benefit of lift regeneration is reduced energy consumption and electrical demand.

6.4.2 Hot Water Supply

6.4.2.1 Gas boiler hotwater system with solar boosting

While not mandatory, it is recommended that the gas hot water with solar boosting system specified for the residential component also be specified for the retail and hotel component to provide additional energy savings and cost savings due to the economies of scale from using one hot water system for the whole development.

6.4.2.2 Avoid Dead Legs in Hot Water System

If a central hot water system is proposed then dead legs should be avoided. Dead legs in the hot water system will increase energy consumption through the loss of standing heat over time. Dead legs should be minimised to reduce energy consumption and water consumption.

7.0 Indicator - Waste

7.1 All Components Mandatory

7.1.1 Construction and Demolition waste

Waverley Council's DCP requires that waste streams be stored separately on the site during construction and demolition. A Waste Management Plan should be prepared for the demolition of the existing building on the site to maximise the potential for the building components to be reused.

Waste sorting facilities should be provided on site by the builder to ensure construction waste can be reused and recycled where possible.

A target to recycle 60-80% of construction waste should be achievable for this development. Generally, in Melbourne, the cost of disposing waste to landfill is less cost effective than recycling, thereby providing an incentive to recycle construction waste.

7.2 All Components – Voluntary

7.2.1 Post occupancy waste

Kitchens should be designed to allow for waste recycling facilities. Recycling facilities will be provided in the garbage room in the basement to facilitate the removal of recycled materials off site.

8.0 Indicator - Materials

8.1 All Components Mandatory

There are no materials sustainability requirements for the building.

8.2 All Components – Voluntary

8.2.1 Sustainable Timber

Sourcing sustainable timber with reliable evidence of it being sustainably managed is still very difficult in Australia. There is no one framework that allows the specification of sustainable timber. Timber sourced through the available sustainability frameworks is not always readily available at a reasonable price. However, there are a number of options that can be considered:

- The use of recycled timber
- Forest Stewardship Council (FSC) certification – an international standard for sustainable timber
- Plantation timber – sourced from a plantation established on a site from which native forest was cleared prior to 1994 or the plantation was established on cleared land such as agricultural land.
- Timber recommended by the EcoSpecifier library – www.ecospecifier.org.

It is recommend that any timber used in the building should be sourced according to one or more of these guidelines.

8.2.2 Other Materials

The following materials should be sourced where possible. Similar to timber, obtaining these materials in the quanity required with appropriate certification can be difficult.

Cement with Fly Ash content

A by-product from burning coal, fly ash can be used as a sand replacement. Fly ash performs very well as part of cement, but requires the full 28 days curing time to gain its full strength.

Ceramic tiles

Glass and clay content tiles, inherently inert, and no VOC emissions; seventy percent of post-industrial and post-consumer recycled glass bottles are recyclable. Recycled glass tiles are becoming increasingly available.

Fibreboard

Medium density MDF manufactured without formaldehyde; pre-consumer recycled wood residual and recyclable.

Gypsum wall board

Post industrial recycled gypsum content, 100% recycled content paper face fibre and recyclable.

Masonry wall with render

Cement render colour impregnated using natural materials such as earth dye. Masonry block work cold process is not energy intensive and produces blockwork of ranging sizes and is fire resistant.

Steel Sheet roofing

Steel sheeting cold rolled to shape preferred over hot rolling process.

In general the materials proposed in this section are readily available from local manufacturers and should be considered in preference to selecting virgin materials.

9.0 Indicator – Pollutants

9.1 All Components – Mandatory

There are no mandatory pollutant requirements for the development other than the usual hazardous materials regulations.

9.2 All Components – Voluntary

Materials should be selected to minimise release of harmful pollutants both internally for indoor air quality and externally for global warming potential.

9.3 Refrigerants

Non-ozone depleting refrigerants with minimal global warming potential should be specified. R134a provides zero ozone depletion potential.

Packaged units serving the residential units should be selected to operate on R407C in lieu of R22.

Insulation used in building fabric and services should have an Ozone Depletion Potential of zero.

9.4 Volatile Organic Compounds (VOCs) and Formaldehyde

9.4.1 Paints, Carpets and Sealants

All paints, carpets and sealants should have low VOC and formaldehyde levels where products are readily available. The Green Star program has specifications for VOC and formaldehyde levels which should be used as a quantitative benchmark for evaluating selected products.

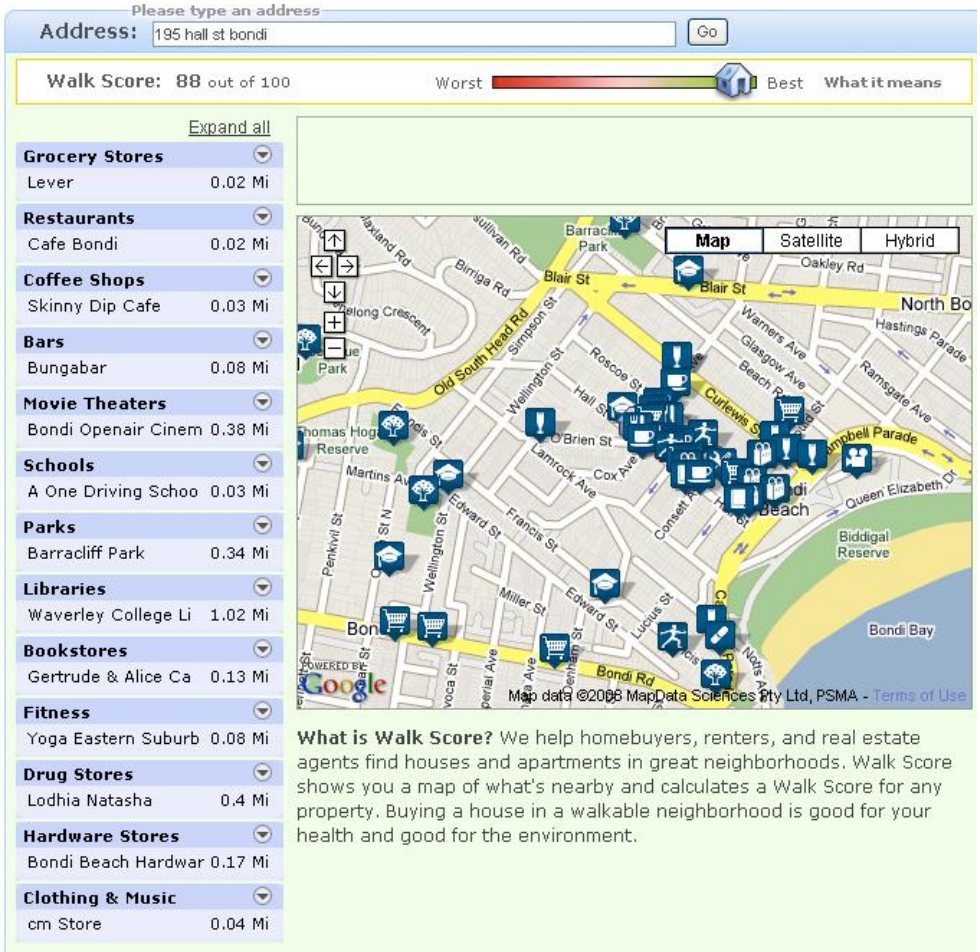
9.4.2 Plumbing and Electrical Cables

If available at a reasonable price, plumbing pipework and electrical cables that would generally be PVC should be replaced with HDPE pipework and cables.

10.0 Indicator – Transport

The site within several hundred metres of the Campbell Parade bus stops which has regular bus services to the city and Bondi Junctions. The site also proposed a mixed use development, including retail and recreation, which provides amenities for the residents and visitors/hotel guests on site thus reducing the need for travel.

For other amenities, the website www.walkscore.com can be used to locate amenities such as shops, bars, parks, libraries etc. The walkscore website scores the ability to walk to these amenities for a given site, the score for 61-77 Hall St is 88 out of 100 indicating very good access to local facilities and amenities.



10.1 All Components Mandatory

10.1.1 Bicycle Parking Facilities

Waverley Council DCP Part I requires that bicycle parking for both residents and visitors is to be included in the development.

Use	Rate	Conditions
Ground floor dwellings	Resident 0.25 per dwelling Visitor 0.25 per dwelling	Resident bicycle parking: is to be provided by way of a secure, lockable area or bike locker, at ground or car park level.
Other dwellings	Resident 1.00 per dwelling Visitor 0.25 per dwelling	Visitor bicycle parking: is to be provided by way of bicycle racks and located in convenient locations, be clearly visible and accessible to pedestrian entries so as to encourage their use.
Commercial, retail & industrial	1 per 10 car parking spaces	Bicycle parking: is to be provided by way of either secure lockable area(s), bike lockers or bicycle racks, located within the ground floor foyer or adjacent to any forecourt, or within the car parking area. One-wheel racks are not acceptable.
Community, educational & recreational facilities	1 per 10 car parking spaces	

Table 3. Bicycle parking rates.

10.2 All Components Voluntary

10.2.1 Car Sharing

The applicant is currently considering the inclusion of a 'car-share' car in the basement for hire by residents, other local residents nearby and hotel visitors. The applicant is considering the company GoGet (www.goget.com.au) to provide a car in a dedicated car space. Users then join with GoGet and book online to use the car on an hourly or daily basis.

11.0 References

Water Efficiency Labelling and Standards (WELS) Scheme - http://www.waterrating.gov.au/

Waverley Council DCP 2006 - http://www.waverley.nsw.gov.au/council/pes/dcp/index.asp