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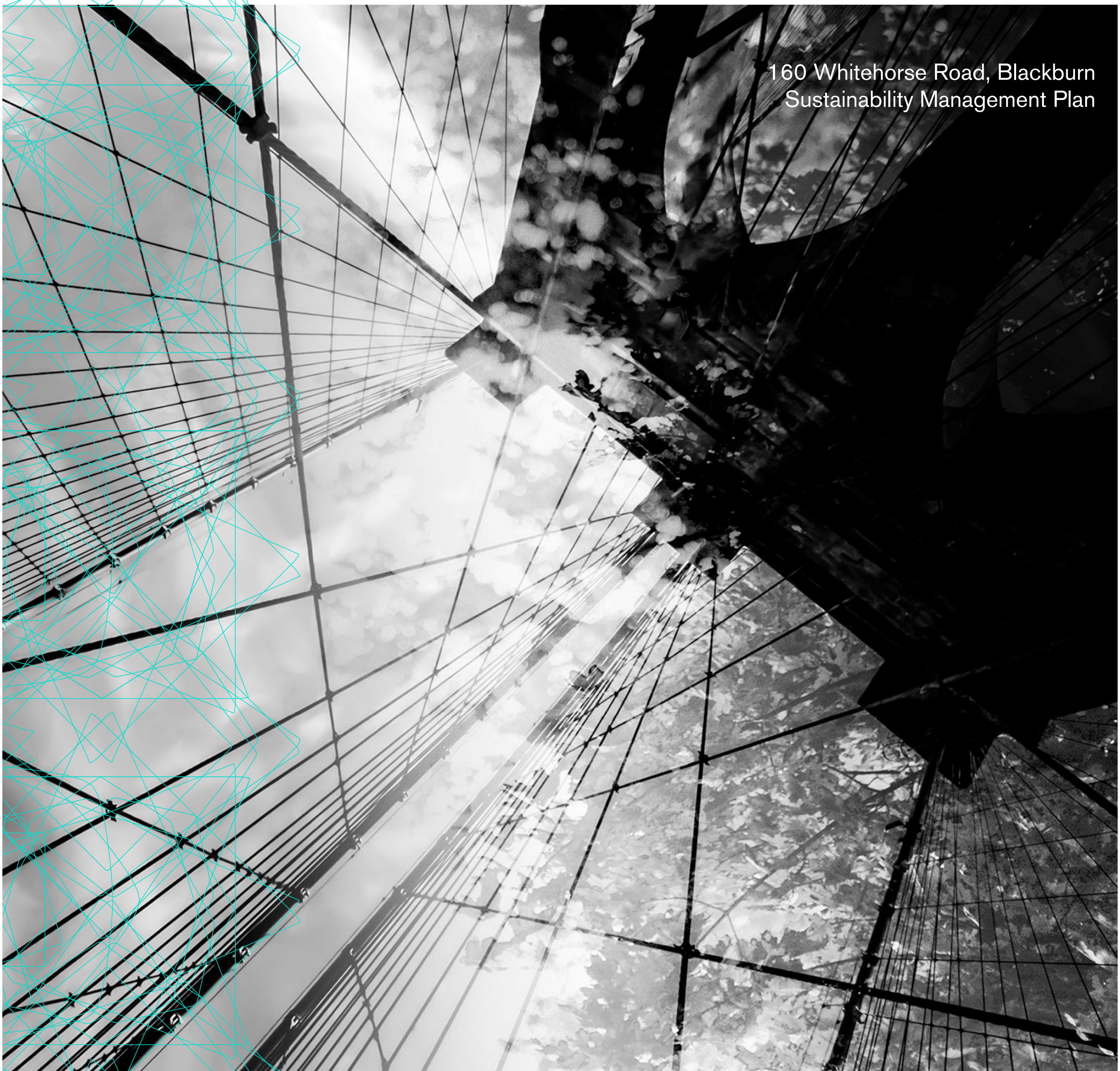

# 160 Whitehorse Road, Blackburn
# Sustainability Management Plan

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# Proposed Mixed-Use Development
# 160 Whitehorse Road, Blackburn

Sustainability Management Plan

April 2019

S3593 SMP.V1a

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| Version | Date of Issue | Description | Author | Approved |
|---|---|---|---|---|
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## Executive Summary

The proposed mixed development at 160 Whitehorse Road, Blackburn demonstrates 'Best Practice' with a benchmark 4 Star rating in Green Star Design & As Built v1.2 which assessed the overall ESD features of the development.

The thermal efficiency of the building fabric for residential spaces scored a weighted average energy score of 6.7 Stars where sample apartments were modelled with the thermal modelling software, FirstRate5. High-performance double-glazed windows were used in the modelling, which helped to reduce the energy demand.

The building envelope of non-residential spaces has been designed to achieve a 7% improvement on BCA minimum energy efficiency requirements for building fabric and an overall improvement on total energy use when compared to the reference building of over 30%. A BCA JV3 modelling exercise has been conducted to demonstrate the energy use improvement when compared to a standard BCA reference building.

Best practice Stormwater Management is demonstrated by percentage of load reductions through MUSIC assessment. This is achieved with the use of 180,000L rainwater tank(s) which captures the entire roof area of 4,935m$^2$ where stored rainwater will serve all commercial toilets of the development.

## 1. Introduction

This Sustainability Management Plan (SMP) has been prepared to assist the design, construction and operation of the proposed mixed-use development at 160 Whitehorse Road, Blackburn to achieve a range of best-practice sustainable development objectives. Sustainable Development Consultants have assessed the proposed plans and provided input to the design team.

This SMP includes initiatives necessary to ensure that the development meets the sustainability requirements of the City of Whitehorse, in particular the ESD requirements of Local Planning Policy Clause *22.10 Environmentally Sustainable Development* and relevant ESD items within Clause 58 *Apartment Developments*.

### 1.1 Site Description

The proposed development is located at 160 Whitehorse Road, Blackburn on the corner of Railway Road and Whitehorse Road, approximately 16km east of the Melbourne CBD. The site is currently used as car parking.

The proposed development will consist of four new mixed-use building which will contain 15 retail tenancies, six office tenancies and 188 residential apartments with hi-end common areas. The development will also include a five-level basement carpark.

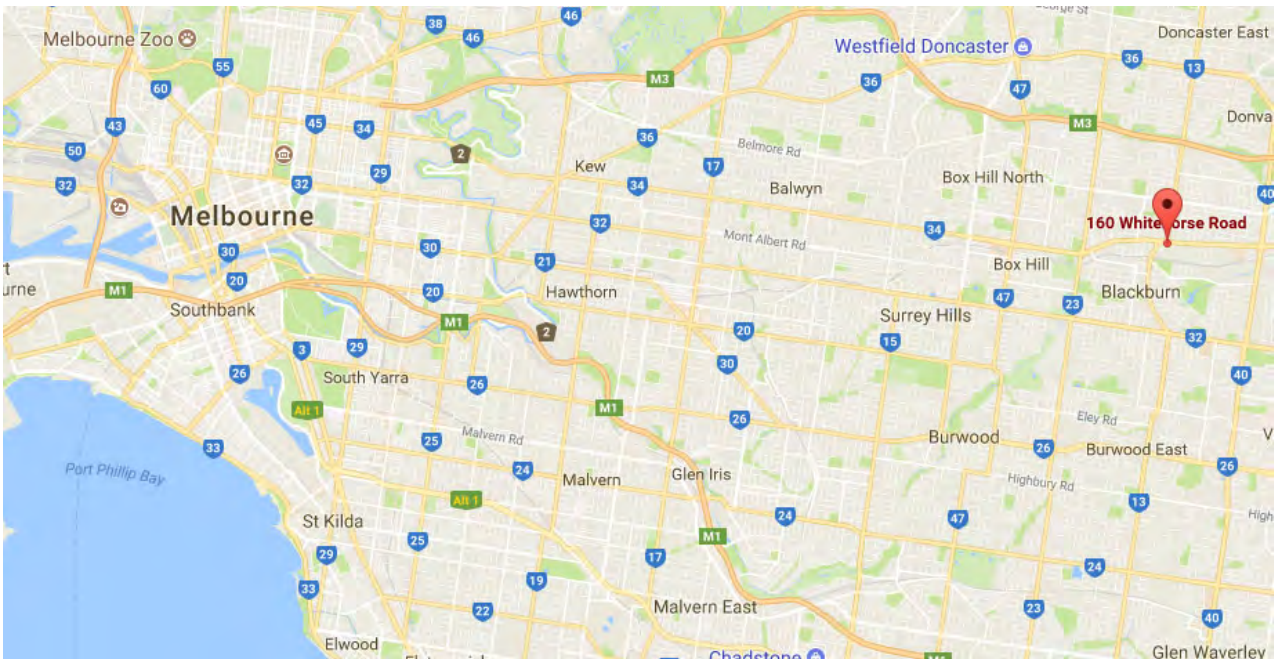


Figure 1: Location of the 160 Whitehorse Road, Blackburn in relation to the Melbourne CBD (source: Google Maps)

The development summary is as follows:

| Development Summary | |
|---|---|
| Site Area | 8,760m$^2$ |
| Commercial Tenancies | • 15 x retail tenancies – combined NLA of 4,000m$^2$<br>• 6 x office tenancies – combined NLA of 11,964m$^2$ |
| Residential Dwellings | • 50 x one-bedroom apartments<br>• 126 x two-bedroom apartments<br>• 12 x three-bedroom apartments<br>Total 188 Apartments (338 Bedrooms) |
| Vehicle Storage | 731 car parking spaces, distributed as follows:<br>• 204 x residential;<br>• 13 x resident visitors;<br>• 25 x retail staff;<br>• 65 x retail customers;<br>• 69 x Aldi customers; and<br>• 355 x office staff. |

Figure 2: 160 Whitehorse Road, Blackburn development site (Source: Nearmap)

## 1.2 Whitehorse City Council Requirements

As part of the Local Planning Policy Clause 22.10 *Environmentally Sustainable Development*, Whitehorse City Council requires large mixed-use projects with a residential component of 10 or more dwellings within their municipality to include, as part of the town planning application, a Sustainability Management Plan (SMP).

The SMP needs to establish how the proposed development will address the objectives of the Local Policy Clause 22.10 and achieve best-practice standards from the building design stage through to construction and operation.

Key Council Nominated Objectives from the Environmentally Sustainable Design Policy Clause 22.10 are as follows:

| | |
|---|---|
| Energy performance: | • Improve the efficient use of energy, by ensuring development demonstrates design potential for ESD initiatives at the planning state;<br>• Reduce total operating greenhouse gas emissions; and<br>• Reduce energy peak demand through particular design measures (e.g. appropriate building orientation, shading to glazed surfaces, optimise glazing to exposed surfaces, space allocation for solar panels and external heating and cooling systems). |
| Water resources and stormwater management: | • Improve water efficiency;<br>• Reduce total operating potable water use;<br>• Encourage collection and reuse of stormwater;<br>• Achieve best practice stormwater quality outcomes;<br>• Incorporate water sensitive urban design, including stormwater re-use;<br>• Reduce stormwater run-off impacts; and<br>• Improve water quality. |
| IEQ: | • Healthy indoor environmental quality for wellbeing of natural occupants;<br>• Achieve thermal comfort levels with minimised need for mechanical heating, ventilation and cooling;<br>• Reduce indoor air pollutants by encouraging use of materials with low toxic chemicals; and<br>• Minimise noise levels and noise transfer within and between buildings. |
| Waste Management: | • Promote waste avoidance, reuse and recycling during the design, construction and operation stages of development;<br>• Ensure durability and long term reusability of building materials; and<br>• To ensure sufficient space is allocated for future change in waste management needs, including (where possible) composting and green waste facilities. |
| Transport: | • Ensure that the built environment is designed to promote the use of walking, cycling and public transport and minimise car dependency. |
| Urban Ecology | • Protect and enhance biodiversity within the municipality;<br>• Provide environmentally sustainable landscapes and natural habitats, and minimise the urban heat island effect;<br>• Encourage the retention of significant trees;<br>• Encourage the planting of indigenous vegetation; and<br>• Encourage the provision of space for productive gardens. |

Clause 58 *Apartment Developments*, which applies to the proposed development, also contains a number of relevant ESD items, such as 58.03-1 *Energy Efficiency Objectives* and 58.03-8 *Integrated Water and Stormwater Management Objectives*, which should also be addressed within the SMP.

## 1.3 ESD Assessment Tools

There are a number of calculators and modelling programs available in Victoria to assess proposed developments against benchmarks set by the Victorian government, local councils and the Building Code of Australia. Different tools are used to assess different aspects of the development including the:

- Green Building Council of Australia's (GBCA) Design & As-built tool, which covers the overall sustainability of the development;
- FirstRate 5 which covers the energy efficiency performance of the building fabric; and
- Model for Urban Stormwater Improvement Conceptualisation (MUSIC), which addresses stormwater quality considerations for the development.

All tools have minimum compliance requirements. FirstRate 5 and MUSIC have requirements that are mandatory for Victoria. Green Star is typically used to demonstrate how a "best practice" level of compliance has been achieved.

### 1.3.1 GREEN STAR DESIGN & AS-BUILT V.1.2 BENCHMARK

The Green Star Design & As-built tool was created by the Green Building Council of Australia (GBCA) to help assess and benchmark new developments against a thorough set of criteria, specifically designed to reward best practice and innovative sustainable design approaches. The tool includes nine (9) different elements which cover all areas of building design and some ongoing operation. These are:

- Management;
- Indoor Environmental Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions; and
- Innovation.

The levels of achievement in this tool are defined as: 4 Stars Green Star being "Best Practice", 5 Stars being "Australian Excellence", and 6 Stars being "World Leader". This project is aiming to achieve an "equivalent 4-star Green Star rating".

The 160 Whitehorse Road development is not presently pursuing a certified rating through the Green Building Council of Australia (GBCA), but regardless, practices and initiatives identified within this report will be monitored and followed through to construction to ensure the building is not only designed to the "Best Practice" standard but will also be constructed that way.

The results of the Green Star preliminary assessment can be found in Appendix 1 of this report.

### 1.3.2 FIRSTRATE 5

The energy efficiency of the dwellings' thermal envelopes has been assessed using FirstRate 5, which is an energy modelling software program to rate dwellings on a 10-Star scale. The tool uses the AccuRate engine (as a nationally recognised energy benchmarking) to rate dwellings based on climate zone, materials used in a structure, positioning, orientation and building sealing. Higher scores are achieved primarily through better material selection, improvements in glazing, and insulation. It is noted that the 2016 BCA (Building Code of Australia) will apply to this development. A representative sample of dwellings has been modelled to predict the average heating and cooling energy use of the development. The results of the FirstRate assessments can be found in Appendix 2.

### 1.3.3 MODEL FOR URBAN STORMWATER IMPROVEMENT CONCEPTUALISATION V6.2

Stormwater runoff treatment quality evaluation was conducted using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) V6.3. Developed by the Catchment Hydrology Cooperative Research Centre, this tool is capable of simulating stormwater runoff, its treatment and quality during a rainfall event for catchment areas up to 100km$^2$. The addition of treatment measures and processes that address the stormwater flow from a catchment is called the "treatment train". This is in reference to the various measures the stormwater flow will undergo prior to its discharge out of the catchment and into the receiving body of water. The results of the MUSIC assessment can be found in Appendix 3.

## 2. Sustainability Initiatives

The following sections outline the initiatives which will be included in the development and implemented throughout the design and construction process. Those that go towards meeting the Green Star benchmark include the credit reference code associated with the initiative. Other initiatives that contribute towards the project's sustainability performance, that address other Council requirements, but that do not contribute towards the benchmark Green Star rating do not have this credit suffix.

The following sections, as well as nominating the sustainability initiatives, also identify the party/parties responsible for implementation of the initiative, and the stage at which implementation will be demonstrated. The following are the broad project stages[1]:

| | | |
|---|---|---|
| 1 | Design Development | • Consultants develop conceptual design drawing to a detailed stage suitable as a basis for preparing working drawings - Integration of architectural, services, structure and site attributes<br>• Checking compliance with all statutory requirements, codes and standards<br>• Arranging special surveys or reports as required |
| 2 | Construction Documentation | • Architectural and services drawing sets completed<br>• All specialist reports completed<br>• All necessary planning and building consents obtained as required by authorities |
| 3 | Construction | • All work carried out onsite – site preparation, construction, alteration, extension, demolition<br>• Purchase of all materials / certification<br>• Evidence gathering from subcontractors<br>• Commissioning |
| 4 | Post Occupancy | • Operation and Maintenance<br>• Education – Building Users Guides |

### 2.1 Building Management

Initiatives included in management promote adoption of environmental initiatives at different stages of the project – not just in the project's design stage.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Green Star Accredited Professional (GSAP) (1.0)** | | |
| One of the project's consultants will be a Green Star Accredited Professional (GSAP). A GSAP will advise the project team through the design and construction phases of the project. | ESD Consultant | Design Development |
| **Environmental Performance Targets (2.0)** | | |
| Documented targets will be set for the environmental performance of the building (energy and water). These targets will be monitored and reported on. | ESD Consultant | Design Development |
| **Services and Maintainability Review (2.1)** | | |
| A person responsible for maintenance will review the design with respect to access, ongoing maintenance and ongoing cleaning of building services and external building features. | Builder | Design Development |
| **Building Commissioning (2.2)** | | |
| Comprehensive pre-commissioning, commissioning and quality monitoring will be contractually required, and building knowledge transferred from the design team and contractor to building manager and staff. | Builder | Commissioning |

[1] A Guide to Construction Projects - http://aca.org.au/wp-content/uploads/2009/12/a_guide_to_construction_projects_2006-publication_issue.pdf

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Building Systems Tuning (2.3) | | |
| Following the completion of the buildings' construction and prior to the buildings' occupation, a tuning process for all nominated building systems will be committed to by the owner. The tuning process will require data from the monitoring systems to be analysed in addition to an assessment of occupant feedback regarding building conditions. | Owner/ Services Engineer | Commissioning |
| Building Information (4.0) | | |
| Building Operations and Maintenance Information (4.1) | | |
| A Building Management Guide will be developed, and made available to the facilities management team, which will describe systems/actions for the operation and maintenance of both building services and building fabric.<br>Additionally, a user-friendly Building User Guide will be produced with all relevant information geared towards the specific building occupant- i.e. tenancy staff, apartment owners/occupants. The guide will include descriptions of systems installed in the building, sustainable transport in the area as well as sustainable building operation suggestions relevant to building users. | ESD Consultant/ Services Consultant | Post Occupancy<br><br>Construction Documentation |
| Commitment to Performance (5.0) | | |
| Environmental Building Performance (5.1) | | |
| A commitment to set targets of performance in energy and water use, and a commitment to measure and report on results will be made for at least two of the following environmental building performance metrics:<br>- Greenhouse gas emissions – commitment in kg/ $CO_2/m^2$;<br>- Potable water usage- kL/person;<br>- Operational waste – kg/person; and<br>- Indoor Environment Quality – complete occupant comfort surveys, HVAC systems targets and thermal and lighting comfort. | Building Operator | Construction Documentation |
| End of Life Waste Performance (5.2) | | |
| A commitment to reduce demolition waste at the end of life of an interior retrofit will be set. This is applicable for at least 80% of the project's GFA. | Building Owner/ Operator | Construction Documentation |
| Metering and Monitoring (6.0) | | |
| Monitoring Systems (6.1) | | |
| The design will include electronic metering systems that will be integrated into the building to monitor and report on energy and water consumption and control the central building services.<br>Energy and water consumption are to be monitored and reported against set performance targets for the building. In addition, a monitoring system, capable of capturing and processing the data generated by the installed meters, will be provided. The monitoring system should be able to report consumption trends. | Services Engineers | Design Development |
| Construction Environmental Management (7.0) | | |
| Environmental Management (Req.) | | |
| As part of the construction process, the main contractor will implement a project specific Best Practice Environmental Management Plan – this must be in line with *NSW EMS Guidelines*. This will be in place before starting works and throughout the construction process. | Builder | Construction Documentation |

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Formalised Environmental Management System (7.1) | | |
| The EMS created for the site should be certified by a third-party organisation that provides compliance to ISO14001 Standards. | Builder | Construction Documentation |
| High Quality Staff Support (7.2) | | |
| During construction, high quality staff support practices will be put in place that promote positive mental and physical health outcomes of site activities and culture of site workers, such as healthy eating, active living and/or understanding depression, and enhance site workers' knowledge on sustainable practices relevant to the proposed development. | ESD Consultant/ Builder | Construction |
| Operational Waste (8B) | | |
| The development will include separate collection bins and storage containers for general waste and recycling. Facilities for the collection and storage of a third waste stream (e.g. e-waste, organics, etc.) will also be provided.<br><br>The development will be provided with three dedicated waste storage rooms on Basement 1 which will be appropriately sized to accommodate the required waste bins and will ensure clear access for collection. Commercial waste will be separated from residential waste and clearly labelled.<br><br>Residents will be able to dispose of their waste via waste chutes, conveniently located on every level. | Architect | Design Development |


Figure 3: Waste chutes on Building B Level 1

## 2.2 Indoor Environment Quality

Indoor Environment Quality (IEQ) credits address initiatives which help to create a healthy indoor environment free from toxins with ample supply of daylight and outside air. IEQ initiatives aim to improve the comfort and wellbeing of building occupants.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Indoor Air Quality (9.0)** | | |
| Ventilation System Attributes (9.1) | | |
| All air handling equipment in the project will meet the following conditions:<br>• Full compliance with ASHRAE Standard 62.1:2013 (to mitigate entry of outdoor pollutants);<br>• Will be easily maintained and cleaned; and<br>• Will be cleaned prior to use and occupation. | Services Consultant | Design Development |
| Exhaust or Elimination of Pollutants (9.3) | | |
| Pollutants, such as those arising from cooking processes and equipment and vehicle exhaust will be discharged directly from the building; there will be no recirculation component. | Services Consultant | Design Development |
| **Acoustic Comfort (10.0)** | | |
| Acoustic Separation (10.3) | | |
| All partitions between spaces will be constructed to achieve a weighted sound reduction index ($R_w$) of at least 45. | Architect/ Acoustic Consultant | Design Development |
| **Lighting Comfort (11.0)** | | |
| Minimum Lighting Comfort (11.0) | | |
| All luminaires will be installed with high frequency ballast, will be flicker free and will have a Colour Rendering Index (CRI) > 80 to adequately address the perception of colour in the space. | Electrical Engineer | Construction Documentation |
| Surface Illuminance (11.2) | | |
| The apartments will be provided with at least one wall in each living space, kitchen and bedrooms with specific wall-washing or wall mounted light fittings. | Architect | Design Development |
| Lighting Controls (11.3) | | |
| Localised lighting controls will be provided for each zone within the proposed retail and office tenancies. This will allow staff/occupants to control the lighting levels in their immediate environment. Switches will be clearly labelled and easily accessible. Lighting zoning (in large rooms) should include perimeter and internal zones to enable lights to be switched off during times of ample daylight.<br>Each apartment will be provided with sufficient power outlets for future task lights/lamps around the predicted furniture layouts in each space. Appropriate task lighting will be provided to workspaces in kitchens and bathrooms (e.g. benchtop and vanity). | Electrical Engineer | Construction Documentation |
| **Visual Comfort** | | |
| Glare Reduction (12.0) | | |
| Blinds with visual light transmittances (VLT) of less than 10% will be provided to all apartments. | Architect | Design Development |
| Views (12.2) | | |
| At least 60% of all primary spaces will have a clear line-of-sight to a high quality external or internal view (e.g. sky, vegetation, animals, and frequent movement of people). | Architect | Design Development |

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Daylight** | | |
| A minimum of 80% of living rooms and 97.5% of bedrooms within the apartments will achieve high levels of daylight in line with SDAPP IEQ best practice guidelines.<br>Increased daylight to internal spaces helps to provide a more natural and pleasant indoor environment and reduces artificial lighting requirements.<br>Please see the daylight modelling report for further information. | Architect | Design Development |
| **Indoor Pollutants (13.0)** | | |
| Volatile Organic Compounds (13.1) | | |
| At least 95% of paints, adhesives and sealants, flooring, and wall and ceiling coverings will not exceed limits outlined in Appendix 5. Alternatively, products will be selected with no VOCs. | Architect | Construction Documentation |
| Formaldehyde Minimisation (13.2) | | |
| At least 95% of engineered wood products will have 'low' formaldehyde, certified as E0 or better. Alternatively, products will be specified with no formaldehyde. | Architect | Construction Documentation |
| **Thermal Comfort (14.0)** | | |
| Thermal Comfort (14.1) | | |
| The apartments will achieve an average NatHERS rating of at least 6.0-Stars with no apartments rating less than 5.0-Stars. Preliminary energy ratings for the proposed development achieved a weighted average of 6.7-Stars. Please refer to Appendix 2 for further detail. | Architect | Design Development |
| **Natural Ventilation** | | |
| In accordance with Standard D27 of Clause 58.07-4 Natural Ventilation Objectives of the Whitehorse Planning Scheme, at least 40% of apartments are designed to be effectively naturally ventilated. | Architect | Design Development |

## 2.3 Energy

The development will minimise energy use through a best practice building envelope, efficient hot water system, heating & air conditioning, and lighting.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Greenhouse Gas Emissions (15E.0)** | | |
| Lighting (15E.0) | | |
| Energy consumption from artificial lighting within the development will be reduced by using LED lighting and by optimising the daylight diffusion.<br>Lighting power densities to retail and office areas of the development will be reduced by at least 30% relative to the maximum allowed, as per Part J6 of the 2016 BCA.<br>Lighting levels within apartments will be reduced by at least 10% relative to the BCA maximum (see Appendix 4). | Electrical Engineer | Design Development |
| Hot Water (15E.0) | | |
| Hot water for the development will be provided via a central gas condensing boiler(s) with a minimum efficiency of 90%. | Services Consultant | Design Development |

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Energy Efficient Appliances (15E.0)** | | |
| All appliances (fridges, dishwashers, washing machines and dryers), which are provided in the development as part of the base building work, will be selected within one energy efficiency star of the best available.<br>Where not provided, a purchaser option complying with these requirements will be offered. | Developer | Construction Documentation |
| **Building Sealing (15E.0)** | | |
| All windows, doors, exhaust fans and pipe penetrations will be constructed to minimise air leakage as required by the provisions outlined in Section J3 of the 2016 BCA. This will include the use of seals around operable windows and doors as well as caulking to pipe penetrations, and the addition of self-closing louvers or dampers to exhaust fans. | Architect | Design Development |
| **Energy Efficient Lift (15E.0)** | | |
| The lifts will be specified that include:<br>▪ Suspension specifically designed to reduce friction;<br>▪ Adjustable speed motors;<br>▪ Gearless or planet drive gears to reduce drive losses;<br>▪ Measures to specifically reduce stand-by consumption such as:<br>o Switching off control devices when the lift is not in motion & using efficient power supply units (e.g. Switched units, transformers); and<br>o LED lights and displays. | Services Consultant | Design Development |
| **Unoccupied Areas (15E.0)** | | |
| Lighting in common areas and retail tenancies will be controlled by time clocks, daylight and/or motion sensors. This will reduce the time that common area lighting is on whilst not required, thus reducing the energy consumption of this service. | Electrical Engineer | Construction Documentation |
| **Building Envelope (15E.1)** | | |
| All commercial area building envelope material R-values will be specified to ensure that the energy model demonstrates an improvement when compared to the deemed to satisfy building by at least 7%. This will result in an improvement in energy consumption relative to a reference building (see Appendix 4).<br>The sample energy ratings for the apartments achieve an average 6.7-Star rating. These results are achieved with the selection of appropriate building fabric elements that are outlined within the preliminary sample energy report provided as Appendix 2.<br>The weighted average cooling energy for the apartments is predicted at 12.9MJ/$m^2$ which meets the energy efficiency objectives of Clause 58.03-1 of the Whitehorse Planning Scheme. | Architect | Design Development |
| **Peak Electricity Demand Reduction (16B)** | | |
| The use of on-site renewable energy, such as PV Panels, will reduce the peak electricity demand within the development by at least 10%. | | |
| **Heating and Cooling Systems** | | |
| Heating and cooling within the development will be provided by energy efficient air conditioners (with an EER≥3.2 and COP≥3.5). | Mechanical Engineer | Design Development |
| **Solar Photovoltaic (PV) Panels** | | |
| The development will include a 60kW solar PV system (240 x 250W panels, typically 1.0m x 1.6m each in size) for renewable energy generation. | Electrical Engineer | Construction Documentation |

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| This will offset a portion of greenhouse gas emissions and energy use from central services for the development (lighting, pumps etc.) by producing over 78,685kWh of green electricity per year[2]. | | |


Figure 4: Proposed locations of 60kW solar PV systems located on the roof of each building providing over 78,685kWh of solar power for the development per year

## 2.4 Transport

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Transport (17.0) | | |
| Access by Public Transport (17B.1) | | |
| The site location of the development will provide all building occupants with a number of public transport options as an alternative to car use. This includes:<br>• Train – Blackburn Railway Station, located within 10 mins walking distance, will provide building occupants with access to the Lilydale and Belgrave Lines; and<br>• Bus – access to Bus Routes:<br>o 271: Box Hill – Ringwood via Park Orchards<br>o 279: Box Hill – Doncaster SC via Middleborough Rd<br>o 703: Middle Brighton – Blackburn<br>o 736: Mitcham – Knox City<br>o 765: Mitcham – Box Hill<br>o 969 (Smart Bus): City – Caulfield – Fentree Gully Rd – Rowville – Wantrina – Ringwood | N/A - Inherent in Location | |
| Motorbikes | | |
| The project is provided with 12 motorbike parking spaces on Basement 3 and 2. This will encourage residents, staff and visitors to use a more sustainable transport option. | Architect | Design Development |

[2] Energy generation estimate obtained via National Renewable Energy Laboratory (NREL) PV Watts Calculator: https://pvwatts.nrel.gov/pvwatts.php

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Motorbikes use less fuel than cars and can provide many of the individual freedoms associated with them. | | |
| Active Transport Facilities (17B.4) | | |
| The development features a total of 213 bicycle spaces distributed on the Ground Floor and Basement 1.<br>These active transport facilities are complemented with the following end-of-trip facilities:<br>• 10 showers (5 x female showers and 5 x male showers), with their respective changing facilities; and<br>• 52 lockers (26 x female lockers and 26 x male lockers). | Architect | Design Development |
| Walkable Neighbourhoods (17B.5) | | |
| The project's site has been assessed using the "Walk Score" locational performance tool which assesses locations according to the number of facilities within close proximity and provides a score between 1 and 100.<br>The proposed development achieves a score of 85 out of 100, which is considered '*Very Walkable'.* | N/A - Inherent in Location | |

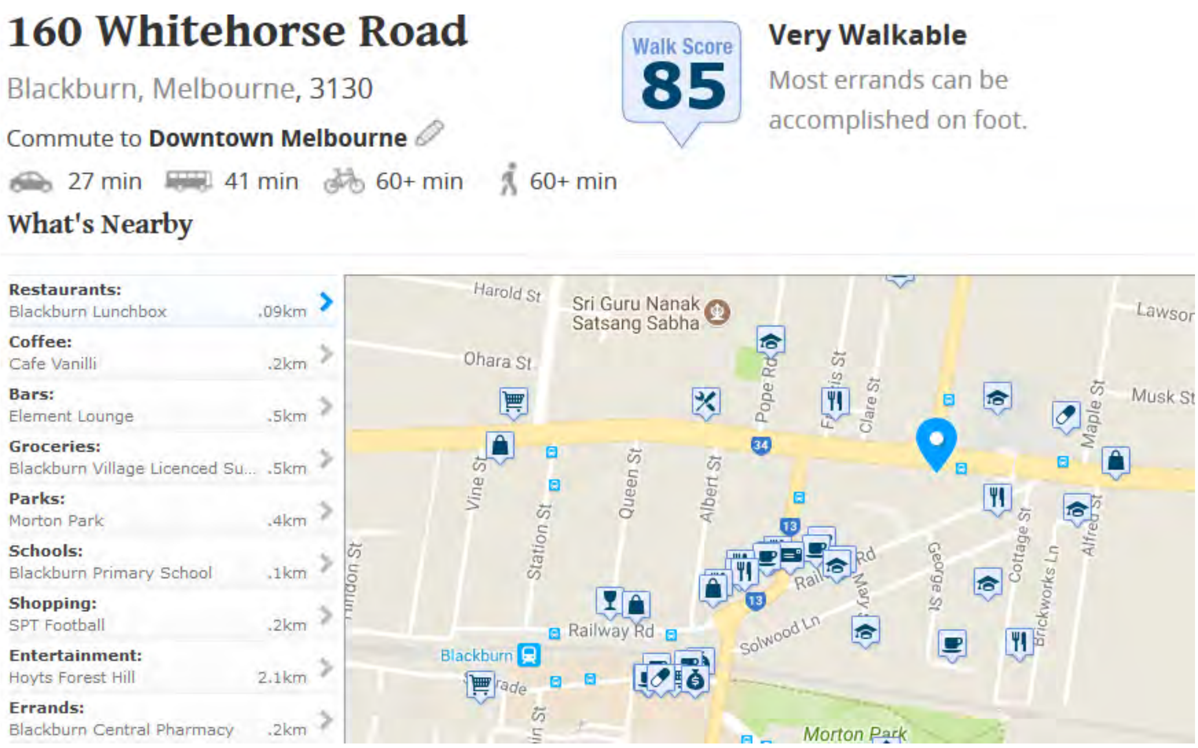


Figure 5: Walk Score map for the 160 Whitehorse Road development site (Source: Walk Score)

## 2.5 Water Efficiency

Water will be used efficiently in the development through efficient fixtures and fittings, and collection and reuse of rainwater which helps to reduce mains water requirements and diverts stormwater.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Potable Water (18.0)** | | |
| Sanitary Fixture Efficiency (18B.1) | | |
| The development will include efficient fittings and fixtures to reduce the volume of mains water used in the development. The following minimum WELS star ratings will be specified:<br>• Toilets – 4 Star;<br>• Urinals – 6 Star or waterless;<br>• Taps – 6 Star;<br>• Showerheads – not to exceed 7.5L/min;<br>• Dishwashers – 5 Star (or within one star of best available for the size, where provided by the developer); and<br>• Clothes Washers – 4 Star (or within one star of best available for the size, where provided by the developer). | Architect / Developer | Design Development |
| Rainwater Reuse (18B.2) | | |
| A minimum effective roof catchment area of 4,935m$^2$ will be used to harvest stormwater into a rainwater tank(s) with an effective storage of 180,000L. Collected water will be used for toilet flushing in the retail and office tenancies at Ground Floor and Basement 1 of the development.<br>Overflow from the impervious areas will be discharged from the site. The rainwater tank(s) will help to reduce the mains water demand of the development.<br>Please refer to Appendix 3 for detailed STORM assessment results. | Hydraulics Consultant | Design Development |
| Heat Rejection (18B.3) | | |
| HVAC systems proposed for the development will not use water for heat rejection. | Services Consultant | Design Development |
| Landscape Irrigation (18B.4) | | |
| Landscaped areas will be designed with native/indigenous plant species and/or in accordance with Xeriscape principles (which emphasise drought tolerance and grouping plants with similar water demand characteristics together).<br>Irrigated areas will be designed with an efficient subsurface drip irrigation.<br>All garden beds will be sufficiently mulched to a depth of 75mm. | Landscape Architect | Design Development |
| Fire System Test Water (18B.5) | | |
| If a fire protection system is required; the fire system will not expel water for testing, or the fire system will include temporary storage for 80% of the routine fire protection system test water and maintenance drain-downs for reuse on site (e.g. irrigation).<br>If sprinkler systems are installed, each floor will be fitted with isolation valves for floor-by-floor testing. | Architect / Fire Engineer | Design Development |

## 2.6 Materials

Materials initiatives help to reduce the use of virgin materials, reduce waste, and promote the use of materials with lower embodied energy.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Life Cycle Impacts (19.0)** | | |
| Steel (19B.2) | | |
| A 5% reduction in the mass of steel used for concrete reinforcing will be achieved when compared to standard practice. This will be achieved with the use of higher strength steel which allows the same performance with less material. | Builder / Structural Engineer | Construction |
| **Responsible Building Materials (20.0)** | | |
| Structural and Reinforcing Steel (20.1) | | |
| At least 95% of all steel used in the building's structure will be sourced from an environmentally Responsible Steel Maker[3]. | Builder | Construction |
| Timber Products (20.2) | | |
| At least 95% of timber used in the development will be Forest Stewardship Council (FSC) or Program for the Endorsement of Forest Certification (PEFC) certified or recycled / reused. | Builder | Construction |
| Permanent Formwork, Pipes, Flooring, Blinds and Cables (20.3) | | |
| At least 90% of all cable, pipe, floor and blind products installed in the building (by cost) will not contain PVC or will comply with the Best Practice Guidelines for PVC in the Built Environment by being procured from a manufacturer with an ISO14001 certified EMS for manufacturing processes. | Builder | Construction |
| **Non-Toxic & Durable Building Materials** | | |
| External building materials will be specified as non-toxic and durable, ideally requiring little maintenance. | Architect | Construction Documentation |
| **Insulation** | | |
| All thermal bulk insulation will be sourced with 20% minimum recycled content. | Architect | Construction Documentation |

Figure 6: Examples of approved environmental labels which may be incorporated for the development

[3] A Responsible Steel Maker must have facilities with a currently valid and certified ISO 14001 Environmental Management System (EMS) in place, and be a member of the World Steel Association's (WSA) Climate Action Program (CAP).

## 2.7 Waste Management

Waste management initiatives help to reduce the waste associated with the project both during construction and operation of the building.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Waste Management (22B)** | | |
| A Construction Environmental Management Plan (CEMP) will be prepared and implemented for the development. This will identify all environmental risks and include relevant management strategies, including the need to:<br>• Maintain effective erosion and sediment control measures during construction and operation;<br>• Ensure appropriate staging of earthworks to avoid bare earthworks in high-risk areas of the site during dominant rainfall periods, and the area and duration of bare earthworks is minimised during construction; and<br>• Minimise noise, disruption and other amenity impacts on neighbouring and nearby residential properties.<br>As part of the CEMP by the contractor, an appropriate Construction Waste Management Plan (CWMP) shall be included.<br>The CWMP will require the contractor to commit to a 90% (by mass) target for diversion from landfill/recycling of all construction and demolition waste. | Builder | Construction |

## 2.8 Land Use & Ecology

Land use and ecology initiatives seek to improve the ecology of the development site and utilise the land in a way that provides the most benefits for the environment and the building occupants.

| Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| **Ecological Value (23.0)** | | |
| Ecological Value (23.1) | | |
| The inclusion of planted native vegetation for the proposed landscaping will provide an increase in ecological value when compared to the presently existing site. | Inherent in Location | |
| **Sustainable Sites (24.0)** | | |
| Reuse of Land (24.1) | | |
| The land has been previously built on; therefore, there is no environmental degradation of environmental attributes due to the development of the site. | Inherent in Location | |
| **Communal Space** | | |
| A number of communal and gathering spaces, such as a residential lounge/plaza, courtyards and pool facilities, will be incorporated into the development and easily accessible from all occupants. These spaces provide areas for social exchange and facilitate interaction between building occupants which helps to form a sense of community within the development. | Architect | Design Development |

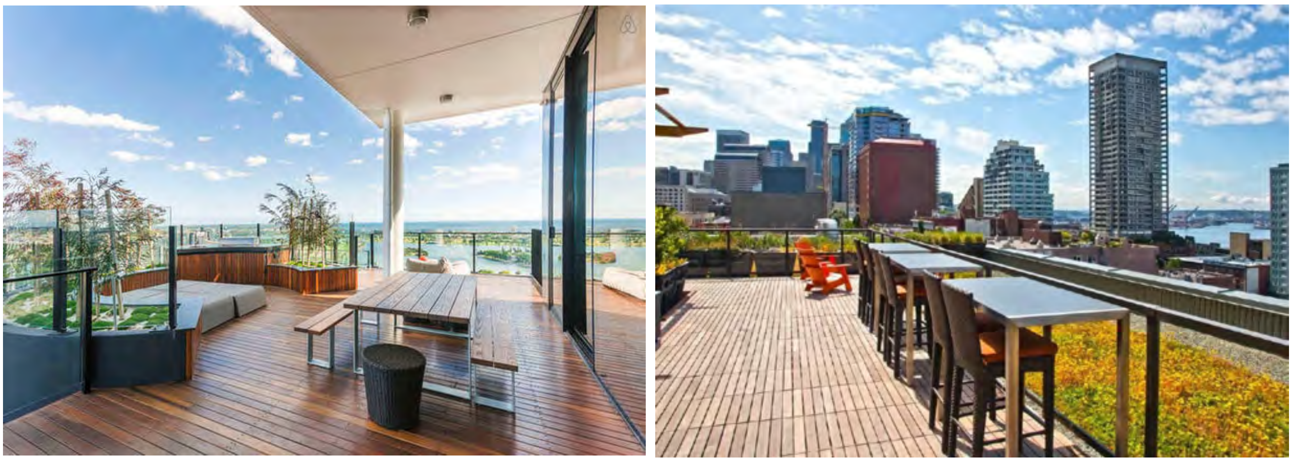


Figure 7: Examples of communal terrace fit-outs (Source: Google Images)

## 2.9 Emissions

The development will address various emission reduction requirements, thereby reducing its overall impact on the surrounding environment.

| Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Stormwater (26.0) | | |
| Stormwater Peak Discharge (26.1) and Pollution Targets (26.2) | | |
| Stormwater discharged from the site will not exceed the pre-development peak event discharge. This will be achieved via a number of Water Sensitive Urban Design (WSUD) initiatives such as rainwater capture (180,0000L tank(s)) and reuse and bioretention system. These initiatives will also allow the development to achieve pollution reduction targets as set out in the Best Practice Environmental Management Guidelines, in accordance with Standard D13 within Clause 58.03-8 of the Whitehorse Planning Scheme.<br>Please refer to Appendix 3 for details. | Civil Consultant | Design Development |
| Light Pollution (27.0) | | |
| Light Pollution to the Sky (27.1) | | |
| Lighting design will comply with AS 4282 and no external light will have an upward light output ratio (ULOR) greater than 5%. | Electrical Engineer | Construction Documentation |
| Microbial Control (28.0) | | |
| Legionella impacts from cooling systems will be minimised by avoiding water-based heat rejection systems. If proposed, the water-based heat rejection systems installed will be designed to mitigate risks from legionella. A Legionella Risk Management Plan will be provided as part of the Building Users Guide. | Services Consultants | Construction Documentation |

## 2.10 Innovation

Innovation initiatives aim to demonstrate that the project is applying sustainability principles in a broader sense than just on a project scale. The initiatives demonstrate a beyond best practice commitment to sustainability principles.

| Design Requirements | Responsibility & Implementation | Project Stage |
|---|---|---|
| Innovative Technology or Process (30A) | | |
| The development will be provided with an onsite renewable technology, which will reduce the peak electricity demand by producing over 78,685kWh of green electricity per year. | Owner / Developer | Construction Documentation |

# 3. Conclusion

As set out in this SMP, the proposed development at 160 Whitehorse Road, Blackburn will meet the Whitehorse Planning Scheme requirements through implementation of a number of initiatives, such as a range of energy efficiency initiatives, inclusion of rainwater tank(s) and use of low to zero VOC content materials; as well as reduced environmental impacts during the construction stage.

The initiatives that have been included within this SMP all have a proven track record of serving their individual purpose and can be easily maintained with any failures obvious to the occupants of the development. This helps to ensure the ongoing sustainability of the development as the systems installed in the beginning are maintained for purpose throughout the life of the building.

The implementation of this SMP requires a clear process that will include:

- Full integration with architectural and building services plans and specifications;
- Endorsement of the SMP Report with town planning drawings; and
- SMP Report initiatives to be included in plans and specifications for building approval.

# Appendix 1 – Green Star Design & As-Built

## Green Star - Design & As Built Scorecard

| | |
|---|---|
| **Project:** | 160 Whithorse Road |
| **Targeted Rating:** | 4 Star - Best Practice |

| Core Points Available | Total Score Targeted |
|---|---|
| 100 | 47.8 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Management** | | | | 14 | |
| Green Star Accredited Professional | To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended. | 1.0 | Accredited Professional | 1 | 1 |
| Commissioning and Tuning | To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential. | 2.0 | Environmental Performance Targets | - | Complies |
| | | 2.1 | Services and Maintainability Review | 1 | 1 |
| | | 2.2 | Building Commissioning | 1 | 1 |
| | | 2.3 | Building Systems Tuning | 1 | 1 |
| | | 2.4 | Independent Commissioning Agent | 1 | |
| Adaptation and Resilience | To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters. | 3.1 | Implementation of a Climate Adaptation Plan | 2 | |
| Building Information | To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance. | 4.1 | Building Information | 1 | 1 |
| Commitment to Performance | To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way. | 5.1 | Environmental Building Performance | 1 | 1 |
| | | 5.2 | End of Life Waste Performance | 1 | 1 |
| Metering and Monitoring | To recognise the implementation of effective energy and water metering and monitoring systems. | 6.0 | Metering | - | Complies |
| | | 6.1 | Monitoring Systems | 1 | 1 |
| Responsible Building Practices | To reward projects that use best practice formal environmental management procedures during construction. | 7.0 | Environmental Management Plan | - | Complies |
| | | 7.1 | Formalised Environmental Management System | 1 | 1 |
| | | 7.2 | High Quality Staff Support | 1 | 1 |
| Operational Waste | Prescriptive Pathway | [illegible] | [illegible] | | |
| | | 8B | Prescriptive Pathway - Facilities | 1 | 1 |
| **Total** | | | | 14 | 11 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Indoor Environment Quality** | | | | 17 | |
| **Indoor Air Quality** | To recognise projects that provide high air quality to occupants. | 9.1 | Ventilation System Attributes | 1 | 1 |
| | | 9.2 | Provision of Outdoor Air | 2 | |
| | | 9.3 | Exhaust or Elimination of Pollutants | 1 | 1 |
| **Acoustic Comfort** | To reward projects that provide appropriate and comfortable acoustic conditions for occupants. | 10.1 | Internal Noise Levels | 1 | |
| | | 10.2 | Reverberation | 1 | |
| | | 10.3 | Acoustic Separation | 1 | 1 |
| **Lighting Comfort** | To encourage and recognise well-lit spaces that provide a high degree of comfort to users. | 11.0 | Minimum Lighting Comfort | - | Complies |
| | | 11.1 | General Illuminance and Glare Reduction | 1 | |
| | | 11.2 | Surface Illuminance | 1 | 1 |
| | | 11.3 | Localised Lighting Control | 1 | 1 |
| **Visual Comfort** | To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants. | 12.0 | Glare Reduction | - | Complies |
| | | 12.1 | Daylight | 2 | |
| | | 12.2 | Views | 1 | 1 |
| **Indoor Pollutants** | To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels. | 13.1 | Paints, Adhesives, Sealants and Carpets | 1 | 1 |
| | | 13.2 | Engineered Wood Products | 1 | 1 |
| **Thermal Comfort** | To encourage and recognise projects that achieve high levels of thermal comfort. | 14.1 | Thermal Comfort | 1 | 1 |
| | | 14.2 | Advanced Thermal Comfort | 1 | |
| **Total** | | | | 17 | 9 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Energy** | | | | **22** | |
| **Greenhouse Gas Emissions** | E. Modelled Performance Pathway | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | [illegible] | [illegible] | | |
| | | 15E.0 | Conditional Requirement: Reference Building Pathway | - | Complies |
| | | 15E.1 | Comparison to a Reference Building Pathway | 20 | 5.34 |
| **Peak Electricity Demand Reduction** | Performance Pathway | [illegible] | [illegible] | | |
| | | 16B | Performance Pathway - Reference Building | 2 | 0.99 |
| **Total** | | | | **22** | **6.33** |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Transport** | | | | 10 | |
| **Sustainable Transport** | Prescriptive Pathway | 17A.1 | Performance Pathway | 0 | |
| | | 17B.1 | Access by Public Transport | 3 | 1 |
| | | 17B.2 | Reduced Car Parking Provision | 1 | |
| | | 17B.3 | Low Emission Vehicle Infrastructure | 1 | |
| | | 17B.4 | Active Transport Facilities | 1 | 1 |
| | | 17B.5 | Walkable Neighbourhoods | 1 | 1 |
| **Total** | | | | 7 | 3 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Water** | | | | 12 | |
| **Potable Water** | Prescriptive Pathway | [illegible] | [illegible] | [illegible] | |
| | | 18B.1 | Sanitary Fixture Efficiency | 1 | 1 |
| | | 18B.2 | Rainwater Reuse | 1 | 1 |
| | | 18B.3 | Heat Rejection | 2 | 1 |
| | | 18B.4 | Landscape Irrigation | 1 | 1 |
| | | 18B.5 | Fire System Test Water | 1 | 1 |
| **Total** | | | | 6 | 5 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Materials** | | | | 14 | |
| **Life Cycle Impacts** | Prescriptive Pathway - Life Cycle Impacts | [illegible] | [illegible] | [illegible] | |
| | | [illegible] | [illegible] | [illegible] | |
| | | 19B.1 | Concrete | 3 | |
| | | 19B.2 | Steel | 1 | 1 |
| | | 19B.3 | Building Reuse | 4 | |
| | | 19B.4 | Structural Timber | 4 | |
| **Responsible Building Materials** | To reward projects that include materials that are responsibly sourced or have a sustainable supply chain. | 20.1 | Structural and Reinforcing Steel | 1 | 1 |
| | | 20.2 | Timber Products | 1 | 1 |
| | | 20.3 | Permanent Formwork, Pipes, Flooring, Blinds and Cables | 1 | 1 |
| **Sustainable Products** | To encourage sustainability and transparency in product specification. | 21.1 | Product Transparency and Sustainability | 3 | |
| **Construction and Demolition Waste** | Percentage Benchmark | [illegible] | [illegible] | | |
| | | 22B | Percentage Benchmark | 1 | 1 |
| **Total** | | | | 12 | 5 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Land Use & Ecology** | | | | 6 | |
| **Ecological Value** | To reward projects that improve the ecological value of their site. | 23.0 | Endangered, Threatened or Vulnerable Species | - | Complies |
| | | 23.1 | Ecological Value | 3 | 1.5 |
| **Sustainable Sites** | To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land. | 24.0 | Conditional Requirement | - | Complies |
| | | 24.1 | Reuse of Land | 1 | 1 |
| | | 24.2 | Contamination and Hazardous Materials | 1 | |
| **Heat Island Effect** | To encourage and recognise projects that reduce the contribution of the project site to the heat island effect. | 25.0 | Heat Island Effect Reduction | 1 | |
| **Total** | | | | 6 | 2.5 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Emissions** | | | | 5 | |
| **Stormwater** | To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure. | 26.1 | Stormwater Peak Discharge | 1 | 1 |
| | | 26.2 | Stormwater Pollution Targets | 1 | 1 |
| **Light Pollution** | To reward projects that minimise light pollution. | 27.0 | Light Pollution to Neighbouring Bodies | - | Complies |
| | | 27.1 | Light Pollution to Night Sky | 1 | 1 |
| **Microbial Control** | To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems. | 28.0 | Legionella Impacts from Cooling Systems | 1 | 1 |
| **Refrigerant Impacts** | To encourage operational practices that minimise the environmental impacts of refrigeration equipment. | 29.0 | Refrigerants Impacts | 1 | |
| **Total** | | | | 5 | 4 |

| CATEGORY / CREDIT | AIM OF THE CREDIT / SELECTION | CODE | CREDIT CRITERIA | POINTS AVAILABLE | POINTS TARGETED |
|---|---|---|---|---|---|
| **Innovation** | | | | 10 | |
| **Innovative Technology or Process** | The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world. | 30A | Innovative Technology or Process | 10 | 2 |
| **Market Transformation** | The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in | 30B | Market Transformation | | |
| **Improving on Green Star Benchmarks** | The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points. | 30C | Improving on Green Star Benchmarks | | |
| **Innovation Challenge** | Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools. | 30D | Innovation Challenge | | |
| **Global Sustainability** | Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of | 30E | Global Sustainability | | |
| **Total** | | | | 10 | 2 |

| TOTALS | AVAILABLE | TARGETED |
|---|---|---|
| CORE POINTS | 100 | 45.8 |
| CATEGORY PERCENTAGE SCORE | | 45.8 |
| INNOVATION POINTS | 10 | 2.0 |
| TOTAL SCORE TARGETED | | 47.8 |

## Green Star Greenhouse Gas Emissions Calculator


User Input Cells

*This calculator addresses criterion '15B GHG Emissions Reduction - NaTHERS Pathway' and '16A Prescriptive Pathway - Onsite Energy Generation'.*

### 15B NatHERS Pathway

| | | |
|---|---|---|
| **Conditional Requirement** | | |
| **Targeted Green Star Rating** | **4 Star** | Stars |
| **Project input** | | |
| **Legislated Minimum Development Average Rating** | 6 | star |
| **Legislated Minimum Worst-Case Apartment Rating** | 5 | star |
| **Project Average Energy Intensity** | 98.1 | MJ/m² |
| **Project Worst-Case Energy Intensity** | 142.1 | MJ/m² |
| **NatHERS Climate Zone** | 62 | |
| **Ventilation and Comfort strategy** | Mechanical Heating/Cooling | |
| **Which is provided? Heating, cooling or both?** | Both | |
| **If Mixed, proportion of apartments with nat vent** | | |
| **Building total nominal occupancy** | 526 | |
| **Benchmark Building Information** | | |
| **Minimum Average Benchmark** | **6.5** | **star** |
| **Minimum Worst-Case Benchmark** | **5.5** | **star** |
| **Benchmark Energy Intensity** | **108.0** | **MJ/m²** |
| **Worst Case Energy Intensity Benchmark** | **144.0** | **MJ/m²** |
| **Energy Intensity at NatHERS 10-star** | **1.0** | **MJ/m²** |
| **Energy Intensity Conditional Requirement met?** | **PASS** | |
| **Worst Case Unit Conditional Requirement met?** | **PASS** | |
| **Performance Improvement** | **9%** | |

| BUILDING SERVICES SPECIFICATION | | |
|---|---|---|
| **Lighting** | | |
| Lighting power density is reduced by at least 10% below the requirement of BCA Part J6 for sole-occupancy units of Class 2 buildings, and in all communal areas accessible by residents | Yes | |
| Independent light switching to each room of each sole-occupancy unit (including separation of kitchen and living area in open-plan living/dining areas). | Yes | |
| All common area lighting with automatic lighting control | Yes | |
| **Ventilation and Air-Conditioning** | | |
| **Mechanical cooling** | **Yes** | |
| Minimum cooling system Energy Star rating | 3 | star |
| Installed equipment capacity no more than 10% greater than design cooling capacity | Yes | |
| **Mechanical heating provided? (only assessed if cooling is not provided)** | **Yes** | |
| Minimum heating system Energy Star rating | 3 | star |
| Installed equipment capacity no more than 20% greater than design heating capacity | Yes | |
| **Natural Ventilation** | **No** | |
| Compliance is achieved with IEQ Indoor Air Quality credit | No | |
| Cross ventilation pathway in all naturally ventilated apartments | No | |
| Ceiling fan installed in all naturally ventilated apartments | No | |
| **Domestic Hot Water** | | |
| DHW non-renewable fuel source | Natural Gas | |
| Installed solar thermal heating system capacity (total RECs) | | |
| **Appliances and Equipment** | | |
| Refrigerators achieve a minimum Energy Rating of 1 star below the maximum available rating | NA | |
| Washing machines achieve a minimum Energy Rating of 1 star below the maximum available rating | NA | |
| Clothes dryers achieve a minimum Energy Rating of 1 star below the maximum available rating | NA | |
| Dishwashers achieve a minimum Energy Rating of 1 star below the maximum available rating | NA | |
| **Accredited GreenPower®** | | |
| Percentage GreenPower® | | |
| Length of GreenPower contract period (in years) | | |

| CREDIT SCORE | |
|---|---|
| Energy Intensity Reduction | 0.7 |
| HVAC | 2.0 |
| Lighting | 1.3 |
| Domestic Hot Water | 0.5 |
| Appliances and Equipment | 0.0 |
| Accredited GreenPower® | 0.0 |
| **TOTAL POINTS ACHIEVED** | **4.6** |
| **TOTAL POINTS AVAILABLE** | **16.0** |

# Green Star
# Design & As Built
Greenhouse Gas Emissions Calculator

User Input Cells

*This calculator addresses criterion '15E GHG Emissions Reduction - Modelled Performance Pathway' and '16B Modelled Performance Pathway: Reference Building.'*

## 15E Modelled Performance Pathway

### Conditional Requirement

| | |
|---|---|
| **Targeted Green Star Rating** | |

### Project input

| | |
|---|---|
| **BUILDING LOCATION** | VIC |
| **Using Shared Services Utilities** | No |

| **GHG Emission Intensity Factors** | | **Units** |
|---|---|---|
| Grid Electricity | 1.3200 | $kgCO_2e/kWh$ |
| Natural Gas | 0.0552 | $kgCO_2e/MJ$ |
| LPG | 0.0649 | $kgCO_2e/MJ$ |
| Diesel | 0.0748 | $kgCO_2e/MJ$ |
| Coal | 0.0930 | $kgCO_2e/MJ$ |
| Biomass | 0.0018 | $kgCO_2e/MJ$ |
| Liquid Biofuels | 0.0003 | $kgCO_2e/MJ$ |
| District CHW | 0.0611 | $kgCO_2e/MJ$ |
| District HHW | 0.0732 | $kgCO_2e/MJ$ |
| District DHW | 0.0732 | $kgCO_2e/MJ$ |
| District Electricity (inc GreenPower) | 1.3200 | $kgCO_2e/kWh$ |

| **District Energy Systems** | | **Units** | **Contract** | | **Building** | |
|---|---|---|---|---|---|---|
| Contract emission rate: CHW | | $kgCO_2e/MJ$ | TPPA term | | Building capacity | |
| Contract emission rate: HHW | | $kgCO_2e/MJ$ | TPPA term | | Building capacity | |
| Contract emission rate: DHW | | $kgCO_2e/MJ$ | TPPA term | | Building capacity | |
| Contract emission rate: District Electricity | | $kgCO_2e/kWh$ | PPA term | | | |

| | REFERENCE BUILDING | | | INTERMEDIATE BUILDING | | PROPOSED BUILDING | | | Improvement | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Source | Annual Energy Consumption | GHG Emissions | Annual Energy Consumption | GHG Emissions | Source | Annual Energy Consumption | GHG Emissions | | | |
| **HVAC** | | | | | | | | | | | |
| **Heating** | Grid Electricity | 15686 | 20,706 | 22593 | 29,823 | Grid Electricity | 17235 | 22,750 | -10% | | |
| **Heating** | | | | | | | | | | | |
| **Cooling** | Grid Electricity | 255827 | 337,692 | 236387 | 312,031 | Grid Electricity | 159498 | 210,537 | 38% | | |
| **Cooling** | | | | | | | | | | | |
| **Heat Rejection** | | | | | | | | | | | |
| **Air Conditioning Fans** | Grid Electricity | 80137 | 105,781 | 65681 | 86,699 | Grid Electricity | 59431 | 78,449 | 26% | | |
| **Mechanical Ventilation Fans** | | | | | | | | | | | |
| **Pumps** | | | | | | | | | | | |
| **Services** | | | | | | | | | | | |
| **Domestic Hot Water** | | | | 0 | | | | | | | |
| **DHW Circulators and Controls** | | | | 0 | | | | | | | |
| **DCW Pumps and Controls** | | | | 0 | | | | | | | |
| **Lifts** | | | | 0 | | | | | | | |
| **Artificial Lighting - Internal** | Grid Electricity | 583687 | 770,467 | 583687 | 770,467 | Grid Electricity | 392532 | 518,142 | 33% | | |
| **Artificial Lighting - External** | | | | 0 | | | | | | | |
| **Appliances (Class 2 only)** | | | | 0 | | | | | | | |
| **Swimming Pools** | | | | 0 | | | | | | | |
| <Other 1 - user to specify> | | | | 0 | | | | | | | |
| <Other 2 - user to specify> | | | | 0 | | | | | | | |
| <Other 3 - user to specify> | | | | 0 | | | | | | | |
| <Other 4 - user to specify> | | | | 0 | | | | | | | |
| <Other 5 - user to specify> | | | | 0 | | | | | | | |
| TOTALS | | **3,367,213** | **1,234,646** | **3,270,053** | **1,199,019** | | **2,263,306** | **829,879** | | | |

| Renewable Energy | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Photovoltaic | | | | | | Grid Electricity | -78685 | -103,864 | | |
| Wind Turbines | | | | | | | | | | |
| **Co/Trigeneration** | | | | | | | | | | |
| Fuel Input | | | | | | | | | | |
| Electricity Output | | | | | | | | | | |
| **External Energy Services** | | | | | | | | | | |
| Electricity Supply | | | | | | | | | | |

| Subtotal GHG Emissions | REFERENCE BUILDING | | INTERMEDIATE BUILDING | | | PROPOSED BUILDING | | |
|---|---|---|---|---|---|---|---|---|
| | Annual Energy Consumption | GHG Emissions | Annual Energy Consumption | GHG Emissions | | Annual Energy Consumption | GHG Emissions | GHG Emissions (excl offsite |
| Grid Electricity | 935337 | 1234644.84 | 908348 | 1199019.36 | | 550011 | 726014.52 | 726014.52 |
| Natural Gas | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| LPG | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| Diesel | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| Coal | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| Biomass | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| Liquid Biofuels | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| District CHW | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| District HHW | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| District DHW | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| District Electricity (inc GreenPower) | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| TOTAL | | | | | | 550011 | 726014.52 | 726014.52 |
| TOTAL RENEWABLE | | | | | | -78685 | -103864.2 | |

| Peak Electricity Demand Reduction | Reference Building | | Proposed Building | | Improvement | Day of Peak Demand |
|---|---|---|---|---|---|---|
| Peak Demand (kW) | Grid Electricity | 523 | Grid Electricity | 334 | 36% | |

## RESULTS

### Energy Consumption Reduction

| | | |
|---|---|---|
| Reference Building Energy | 3367213.2 | MJ/annum |
| Intermediate Building Energy | 3270052.8 | MJ/annum |
| Improvement | 3% | |
| **Energy Consumption Reduction Points** | **0.577096811** | |

### Greenhouse Gas Emissions Reduction

| | | |
|---|---|---|
| Benchmark Building GHG | 1111180.356 | kgCO2e/annum |
| Proposed Building GHG (excluding off-site supply) | 726014.52 | kgCO2e/annum |
| Proposed Building GHG | 726014.52 | kgCO2e/annum |

| | |
|---|---|
| Conditional Requirement | PASS |
| Improvement | 35% |
| Off-site supply max points | 5.55 |
| **GHG Emissions Reduction Points** | **5.55** |

| | |
|---|---|
| Percentage GreenPower® as stipulated within the building's power supply contract | |
| Length of GreenPower contract period (in years) | |

| | |
|---|---|
| Renewable GHG Reduction (excluding GreenPower) | 0.125155878 |
| Innovation - Renewable Energy | 2 |

| | |
|---|---|
| 15.0 Conditional Requirement for Minimum points threshold | **Conditional Requirement not met** |

| | |
|---|---|
| **Total Points Achieved** | **6.1** |
| **Total Points Available** | **20.0** |
| **Innovation Points Achieved** | **2.0** |

# 16B PEAK ELECTRICITY DEMAND REDUCTION

## Results

| | |
|---|---|
| Peak electricity demand reduction | 36% |

| | |
|---|---|
| Total Points Achieved | 2.0 |
| Total Points Available | 2.0 |


User Input Cells

### Multiple Pathways Calculator

**1 Fill out each individual tab that represents the composition of your project.**
**2 Then, allocate the Gross Floor Area of each NCC Class type that are included in your Green Star project and area-weighted points will be calculated.**

| | | Energy/GHG Reduction | | | Peak Demand Reduction | | |
|---|---|---|---|---|---|---|---|
| | Gross Floor Area (m²) | Maximum Points | Achieved Points | Area-Weighted Points | Maximum Points | Achieved Points | Area-Weighted Points |
| **15A Prescriptive Path** | | 10 | 0.0 | 0.0 | 1 | 0 | 0 |
| **15B NatHERS Path** | 16721 | 16 | 4.6 | 2.3 | 1 | 0 | 0 |
| **15C BASIX Path** | | 16 | 0.0 | 0.0 | 1 | 0 | 0 |
| **15D NABERS Energy Path** | | 20 | 0.0 | 0.0 | 1 | 0 | 0 |
| **15E Modelled Path** | 16265 | 20 | 6.1 | 3.0 | 2 | 2 | 0.986175953 |
| TOTAL | **32986** | | | **5.34** | | | **0.986175953** |

| | |
|---|---|
| Targeted Green Star Rating - Please enter the targeted Green Star Rating of the project. | 4 Star |
| 15.0 Conditional Requirement for Minimum points threshold | Conditional Requirement Met |

## Green Star Access by Public Transport Calculator


| | | |
|---|---|---|
| **Location** | Address | CALCULATE |
| **Address** | 160 Whitehorse Road, Blackburn | |
| **Latitude** | [illegible] | |
| **Longitude** | [illegible] | |
| **ABS GCCSA Region** | Greater Melbourne | |
| **ABS GCCSA Population** | 3,999,968 | |
| **Public Transport Population Catchment** | 277,290 | |
| **Percentage Achieved** | 6.9% | |
| **Points** | **1 / 3** | |
| **Car Parking Accessibility Index** | Accessibility Rating 1 | |
| **Browser link for map** | No outputs or mapping available for Victorian addresses | |

**100 % complete**

## Appendix 2 – Preliminary FirstRate 5 Energy Rating Results

The FirstRate energy rating program is the primary modelling method used in Victoria to indicate the required energy for heating and cooling based on the building's thermal envelope. It does not take into account any heating or cooling systems installed; it only assesses walls, roof and floor materials; levels of insulation, building orientation, glazing and the area layout. The proposed development is located in Climate Zone 62 (Moorabbin) and is required by the BCA to meet a minimum 6.0-Star average rating (125MJ/m$^2$) for the development. In addition, the development is required to adhere to a maximum cooling load of 21MJ/m$^2$ per annum as per the energy efficiency objectives of Clause 58.03-1 of the Whitehorse Planning Scheme.

A weighted average energy rating for the development has been determined by grouping dwellings with thermally similar properties (i.e. same dwelling type, orientation, number of exposed sides, etc.) together.

Table 1: Sample Energy rating scores for 160 Whitehorse Road, Blackburn

| Apartment | Star Rating | Energy Use (MJ/m$^2$) | Heating Energy (MJ/m$^2$) | Cooling Energy (MJ/m$^2$) | Net Conditioned Floor Area (m$^2$) |
|---|---|---|---|---|---|
| Building D | | | | | |
| 101 D – Type G | 7.8 | 66.0 | 56.9 | 9.1 | 59.7 |
| 104 D – Type K | 7.6 | 72.7 | 60.6 | 12.0 | 96.0 |
| 108 D – Type Y | 5.6 | 138.5 | 117.8 | 20.7 | 63.1 |
| 202 D – Type D | 8.7 | 35.3 | 23.4 | 12.0 | 66.7 |
| 205 D – Type Q | 6.2 | 119.8 | 108.5 | 11.3 | 65.8 |
| 307 D – Type L | 6.7 | 101.7 | 91.2 | 10.6 | 67.4 |
| 309 D – Type F | 6.8 | 96.6 | 83.5 | 13.1 | 44.0 |
| 401 D – Type U | 7.3 | 82.2 | 61.6 | 20.6 | 47.0 |
| 403 D – Type V | 7.7 | 66.8 | 57.2 | 9.6 | 61.8 |
| 404 D – Type S | 6.8 | 97.4 | 84.6 | 12.8 | 66.8 |
| 506 D – Type Z | 6.7 | 99.6 | 90.0 | 9.6 | 64.1 |
| 701 D – Type X | 6.7 | 101.3 | 86.9 | 14.5 | 61.2 |
| 703 D – Type D | 7.0 | 91.0 | 79.3 | 11.6 | 63.0 |
| 704 D – Type K | 6.6 | 103.3 | 87.8 | 15.5 | 95.3 |
| 707 D – Type R | 6.2 | 118.2 | 103.4 | 14.8 | 46.8 |
| 708 D - Type M | 6.4 | 112.3 | 100.1 | 12.2 | 45.3 |
| 709 D - Type N | 6.2 | 119.4 | 98.6 | 20.9 | 44.3 |
| 710 D - Type F | 5.9 | 127.8 | 110.8 | 17.0 | 44.2 |
| Building C | | | | | |
| 102 C – Type I | 6.8 | 96.1 | 84.7 | 11.4 | 84.9 |

| Apartment | Star Rating | Energy Use (MJ/m²) | Heating Energy (MJ/m²) | Cooling Energy (MJ/m²) | Net Conditioned Floor Area (m²) |
|---|---|---|---|---|---|
| 108 C – Type A | 7.0 | 89.6 | 71.0 | 18.6 | 61.7 |
| 203 C – Type H | 6.5 | 106.4 | 94.9 | 11.5 | 48.1 |
| 210 C – Type A | 7.3 | 81.2 | 72.2 | 9.1 | 61.6 |
| 308 C – Type O | 6.7 | 99.7 | 87.4 | 12.2 | 49.5 |
| 309 C – Type A | 6.7 | 99.9 | 85.3 | 14.6 | 62.1 |
| 408 C – Type T | 6.4 | 112.9 | 91.9 | 20.9 | 45.7 |
| 505 C – Type E | 6.7 | 100.1 | 86.5 | 13.6 | 54.1 |
| 507 C – Type E | 6.8 | 96.8 | 82.3 | 14.5 | 55.0 |
| 602 C – Type C | 5.6 | 140.2 | 122.8 | 17.4 | 44.6 |
| 603 C – Type J | 5.8 | 133.8 | 119.9 | 13.9 | 93.9 |
| 604 C – Type E | 6.3 | 116.4 | 98.6 | 17.7 | 53.8 |
| 607 C – Type E | 6.2 | 116.8 | 99.5 | 17.4 | 55.0 |
| 608 C – Type B | 5.9 | 125.8 | 106.8 | 19.0 | 49.6 |
| 609 C – Type C | 6.2 | 117.8 | 102.6 | 15.2 | 44.0 |
| Building B | | | | | |
| 202 B – Type A | 6.9 | 93.2 | 75.3 | 17.9 | 60.8 |
| 203 B – Type EE | 7.1 | 87.1 | 70.5 | 16.5 | 63.8 |
| 205 B – Type A | 6.9 | 95.5 | 88.3 | 7.3 | 61.9 |
| 206 B – Type A | 7.3 | 80.5 | 68.4 | 12.2 | 60.3 |
| 210 B – Type FF | 6.9 | 92.6 | 75.3 | 17.4 | 41.8 |
| 211 B – Type GG | 6.3 | 113.7 | 98.6 | 15.2 | 67.1 |
| 402 B – Type E | 6.3 | 113.6 | 94.1 | 19.5 | 45.7 |
| 403 B – Type HH | 6.4 | 110.9 | 92.9 | 18.0 | 43.8 |
| 409 B – Type JJ | 5.6 | 142.1 | 125.1 | 17.0 | 56.7 |
| 410 B – Type KK | 5.7 | 137.7 | 117.7 | 20.0 | 63.8 |
| 602 B – Type E | 5.9 | 127.2 | 106.7 | 20.5 | 46.0 |
| 603 B – Type CC | 6.7 | 101.3 | 87.4 | 13.9 | 61.2 |
| 605 B – Type E | 6.2 | 117.7 | 103.6 | 14.1 | 54.0 |
| 606 B – Type E | 6.2 | 118.1 | 102.8 | 15.3 | 54.7 |

| Apartment | Star Rating | Energy Use (MJ/m²) | Heating Energy (MJ/m²) | Cooling Energy (MJ/m²) | Net Conditioned Floor Area (m²) |
|---|---|---|---|---|---|
| 609 B – Type DD | 5.9 | 126.6 | 110.9 | 15.7 | 63.0 |
| 610 B – Type BB | 5.6 | 141.7 | 125.8 | 15.9 | 68.1 |
| Weighted Average | 6.7 | 98.1 | 85.2 | 12.9 | - |

Table 2: Thermal groups and their justification

| Apartment | Similar Units | Justification | Star Rating |
|---|---|---|---|
| Building D | | | |
| 101 D – Type G | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 7.8 |
| 104 D – Type K | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 7.6 |
| 108 D – Type Y | 6 | Same orientation, number of exposed sides with other occupancies above and below. | 5.6 |
| 202 D – Type D | 6 | Same orientation, number of exposed sides with other occupancies above and below. | 8.7 |
| 205 D – Type Q | 7 | Same orientation, number of exposed sides with other occupancies above and below. | 6.2 |
| 307 D – Type L | 6 | Same orientation, number of exposed sides with other occupancies above and below. | 6.7 |
| 309 D – Type F | 10 | Same orientation, number of exposed sides with other occupancies above and below. | 6.8 |
| 401 D – Type U | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 7.3 |
| 403 D – Type V | 6 | Same orientation, number of exposed sides with other occupancies above and below. | 7.7 |
| 404 D – Type S | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 6.8 |
| 506 D – Type Z | 7 | Same orientation, number of exposed sides with other occupancies above and below. | 6.7 |
| 701 D – Type X | 1 | Upper level unit, thermally unique. | 6.7 |
| 703 D – Type D | 2 | Upper level units with same orientation, number of exposed sides and with other occupancies below. | 7.0 |
| 704 D – Type K | 1 | Upper level unit, thermally unique. | 6.6 |
| 707 D – Type R | 1 | Upper level units with same orientation, number of exposed sides and with other occupancies below. | 6.2 |

| Apartment | Similar Units | Justification | Star Rating |
|---|---|---|---|
| 708 D - Type M | 1 | Upper level units with same orientation, number of exposed sides and with other occupancies below. | 6.4 |
| 709 D - Type N | 1 | Upper level unit, thermally unique. | 6.2 |
| 710 D - Type F | 1 | Upper level unit, thermally unique. | 5.9 |
| Building C | | | |
| 102 C – Type I | 5 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.8 |
| 108 C – Type A | 2 | Same orientation, number of exposed sides with other occupancies above and below. | 7.0 |
| 203 C – Type H | 5 | Same orientation, number of exposed sides with other occupancies above and below. | 6.5 |
| 210 C – Type A | 10 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 7.3 |
| 308 C – Type O | 1 | Same orientation, number of exposed sides with other occupancies above and below. | 6.7 |
| 309 C – Type A | 3 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.7 |
| 408 C – Type T | 2 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.4 |
| 505 C – Type E | 18 | Same orientation, number of exposed sides with other occupancies above and below. | 6.7 |
| 507 C – Type E | 2 | Same orientation, number of exposed sides with other occupancies above and below. | 6.8 |
| 602 C – Type C | 1 | Upper level unit, thermally unique. | 5.6 |
| 603 C – Type J | 1 | Upper level unit, thermally unique. | 5.8 |
| 604 C – Type E | 3 | Upper level units with same orientation, number of exposed sides and with other occupancies below. | 6.3 |
| 607 C – Type E | 1 | Upper level unit, thermally unique. | 6.2 |
| 608 C – Type B | 1 | Upper level unit, thermally unique. | 5.9 |
| 609 C – Type C | 2 | Upper level units with same orientation, number of exposed sides, with other occupancies below and shaded by neighbour. | 6.2 |
| Building B | | | |
| 202 B – Type A | 3 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.9 |

| Apartment | Similar Units | Justification | Star Rating |
|---|---|---|---|
| 203 B – Type EE | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 7.1 |
| 205 B – Type A | 24 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.9 |
| 206 B – Type A | 10 | Same orientation, number of exposed sides with other occupancies above and below. | 7.3 |
| 210 B – Type FF | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 6.9 |
| 211 B – Type GG | 3 | Same orientation, number of exposed sides with other occupancies above and below. | 6.3 |
| 402 B – Type E | 2 | Same orientation, number of exposed sides with other occupancies above and below and shaded by neighbour. | 6.3 |
| 403 B – Type HH | 2 | Same orientation, number of exposed sides with other occupancies above and below. | 6.4 |
| 409 B – Type JJ | 2 | Same orientation, number of exposed sides with other occupancies above and below. | 5.6 |
| 410 B – Type KK | 2 | Same orientation, number of exposed sides with other occupancies above and below. | 5.7 |
| 602 B – Type E | 1 | Upper level unit, thermally unique. | 5.9 |
| 603 B – Type CC | 1 | Upper level unit, thermally unique. | 6.7 |
| 605 B – Type E | 4 | Upper level units with same orientation, number of exposed sides and with other occupancies below. | 6.2 |
| 606 B – Type E | 1 | Upper level unit, thermally unique. | 6.2 |
| 609 B – Type DD | 1 | Upper level unit, thermally unique. | 5.9 |
| 610 B – Type BB | 1 | Upper level unit, thermally unique. | 5.6 |
| **Total / Weighted Average** | **188** | - | **6.7** |

This has been completed with the following building fabric elements for all dwellings:

| Building Fabric Element | Description |
|---|---|
| External Walls | All external walls (Concrete & Lightweight) will require an additional R2.5 insulation to be added.<br>Some options include:<br>• CSR Bradford Gold Wall Batts (R2.5)<br>• Knauf Earthwool External Wall Batts HD (R2.5)<br>Insulation material with minimum 20% recycled material content will be selected. The options recommended above go beyond this requirement. |
| Party Walls | Party walls separating neighbouring apartments are assumed as double stud walls with R2.0 insulation added to both studs.<br>Party walls separating apartments from common corridors are assumed as stud walls with R2.0 insulation added.<br>Party walls separating apartments from the stairwell, lift and service shafts are assumed as concrete with R2.0 insulation added to the apartment side. |
| Internal Apartment Walls | Internal walls do not require additional insulation. |
| Floors | Floors are assumed as suspended concrete slab. Additional R1.2 (e.g. Kingspan Kooltherm® 25mm) insulation is to be added when the floor overhangs open air or is located above car park. |
| Floor Coverings | Floor coverings are assumed as carpet for bedrooms, tiles for bathrooms / ensuite and floating timber for the living room and kitchen. |
| Roof Insulation | Suspended concrete slab roofs which are shared with balcony area above require a minimum R2.5 insulation to be added.<br>All roof areas in the upper level units will require an additional R5.0 insulation to be added at the ceiling level. |
| Windows and Glazing | Awning windows are required to have window system thermal performance values of:<br>• Glazing Properties - U value = 3.5, SHGC =0.47.<br>Fixed and sliding windows/doors are required to have window system thermal performance values of:<br>• Glazing Properties - U value = 3.5, SHGC =0.64. |
| Building Sealing | All doors, windows, exhaust fans and openings will be sealed so as to not allow for air infiltration into the apartments. |
| Downlights | All recessed down light fittings that have openings allowing air to pass through to a ceiling cavity (e.g. Adjustable down lights) shall be fitted with a cover that allows for ceiling insulation to closely enclose the sides and top of the down light. |

Note: The above building elements may vary as the plans are refined for building approval, however the overall building energy rating performance will not be less than 6.7 Stars (average), with no apartment rating less than 5.5 Stars.

# Appendix 3 – Water Sensitive Urban Design (WSUD) Report

## Objectives

Part of this SMP includes addressing how the proposed development responds to the principles and requirements of Stormwater Management (Water Sensitive Urban Design - WSUD). The main objectives for WSUD are:

- To promote the use of water sensitive urban design, including stormwater re-use.
- To mitigate the detrimental effect of development on downstream waterways, by the application of best practice stormwater management through water sensitive urban design for new development.
- To minimise peak stormwater flows and stormwater pollutants to improve the health of water bodies, including creeks, rivers and bays.
- To reintegrate urban water into the landscape.

To achieve these objectives, new developments must comply with the best practice performance targets for suspended solids, total phosphorous and total nitrogen, as set out in the Urban Stormwater Best Practice Environmental Management Guidelines, Victoria Stormwater Committee 1999. Currently, these water quality performance targets require:

- Suspended Solids - 80% retention of typical urban annual load.
- Total Nitrogen - 45% retention of typical urban annual load.
- Total Phosphorus - 45% retention of typical urban annual load.
- Litter - 70% reduction of typical urban annual load.

New developments must also incorporate treatment measures that improve the quality of water and reduce flow of water discharged into waterways (such as collection and reuse of rainwater/stormwater on site). The proposed development has addressed these requirements by identifying the impervious surfaces within the site and implementing treatments to mitigate the impacts of stormwater leaving the site. To assess these initiatives, the MUSIC tool – which is an industry accepted tool – was used to score these initiatives.

## Development Characteristics

For the purposes of the stormwater assessment, the Whitehorse Road site has been delineated into basic surface types listed below:

- Total site area of 8,760m$^2$
- Building D and C catchment area of 1,900m$^2$, made up of the roof area above the main building (red);
- Building B catchment area of 3,035m$^2$, made up of the roof area above the main building (blue);
- Landscaped area of 1,084m$^2$ (green), considered 100% permeable;
- Remaining Impervious areas of 2,741m$^2$ (unshaded).


Figure 8: Site delineation for 160 Whitehorse Road, Blackburn

## Stormwater Management Initiatives

Stormwater treatment initiatives will need to be implemented. The following section presents the different surfaces that have been identified for treatment, and the required treatment. The initiatives to manage stormwater flows for the building area will underpin the overall performance of the building and its ability to meet stormwater management objectives.

Table 3: List of areas and their stormwater treatment measures.

| Surfaces | Topographic Area | Required Treatment |
|---|---|---|
| Building D and C Roofs (red) | 1,900m$^2$ | Runoff will drain to a rainwater storage system with a minimum effective capacity of 70,000L. The stored water will be connected to all toilets within the office / retail tenancies on the Ground Floor and Basement 1 of Building D and C as well as irrigation for the site. Any overflow will be directed to the Legal Point of Discharge (LPD) on site. |
| Building B Roof (blue) | 3,035m$^2$ | Runoff will drain to a rainwater storage system with a minimum effective capacity of 110,000L. The stored water will be connected to all toilets within the office / retail tenancies of Building B. Any overflow will be directed to the LPD on site. |
| Landscaping (green) | 1,084m$^2$ | Assumed to be 100% permeable, no further treatment proposed.<br>Landscape areas will be designed to ensure it does not turn into a flood zone with appropriate drainage provided to remove excess water from the areas.<br>Any excess runoff will be diverted to the LDP. |

| | | |
|---|---|---|
| Remaining Impervious Areas (unshaded) | 2,741m$^2$ | Runoff from min. 70% of impervious areas will be designed to divert to nearby raingarden(s) with a minimum combined effective surface area totalling 80m$^2$ (min. 64m$^2$ of filter area) for the site. This can be incorporated as either a single raingarden or multiple smaller raingardens spread evenly across the length of the site. The raingarden(s) will help treat the stormwater runoff before it is discharged at the LPD.<br>The remaining 30% of impervious areas will be designed so that 100% of stormwater runoff sheds into its adjacent landscaped area. |

## Stormwater Quality Modelling Results

The MUSIC model of the treatment measures demonstrates that all minimum pollutant load reductions are met.

Table 4: Comparison of pollutant load reduction from the stormwater treatment systems against the best practice targets.

| Pollutant Load | Required Load Reduction | Calculated Load Reduction |
|---|---|---|
| Total Suspended Solids | 80% | 89.7% |
| Total Phosphorus | 45% | 57.3% |
| Total Nitrogen | 45% | 57.5% |
| Gross Pollutants/Litter | 80% | 100% |

## MUSIC Input

Listed in the tables below are the basic inputs used for the MUSIC model. All low and high-flow bypass volumes were left at default (0m$^3$/s and 100m$^3$/s respectively). Modelling was completed in version 6.3 of MUSIC. The following guideline was used in the creation of the model:

- MUSIC Guidelines: Input parameters and modelling approaches for MUSIC users in Melbourne Water's service area (Melbourne Water 2016)


Figure 9: MUSIC interface layout of the stormwater treatment network and rainwater reuse system. All flows will subsequently discharge to the LPD onsite

Weather

| Rainfall Reference Station | Reference Year | Time Step |
|---|---|---|
| Koo Wee Rup | 1971-1980 | 6 Min |

Source Node: Urban

| Parameter | Input |
|---|---|
| Node Name | Building D and C Roofs |
| Total Area | 0.190Ha |
| Fraction Impervious | 1.00 |
| Zoning/Surface Type | Roof |
| Pollutant Flow Concentration Parameters | MUSIC Default |

Source Node: Urban

| Parameter | Input |
|---|---|
| Node Name | Building B Roof |
| Total Area | 0.303Ha |
| Fraction Impervious | 1.00 |
| Zoning/Surface Type | Roof |
| Pollutant Flow Concentration Parameters | MUSIC Default |

Source Node: Urban

| Parameter | Input |
|---|---|
| Node Name | Landscaping |
| Total Area | 0.108Ha |
| Fraction Impervious | 0.00 |
| Zoning/Surface Type | Revegetated land |
| Pollutant Flow Concentration Parameters | MUSIC Default |

Source Node: Urban

| Parameter | Input |
|---|---|
| Node Name | Remaining Impervious |
| Total Area | 0.274Ha |
| Fraction Impervious | 0.70 |
| Zoning/Surface Type | Mixed |
| Pollutant Flow Concentration Parameters | MUSIC Default |

Treatment Node: Rainwater Tank

| Parameter | Input |
|---|---|
| Node Name | Rainwater Tank Building D and C |
| **Total Tank System Properties** | |
| Volume below overflow pipe | 70.0kL |
| Depth above overflow | 0.20m |
| Surface Area | 47m$^2$ |
| Initial Volume | 0.00kL |
| **Outlet Properties** | |
| Overflow Pipe Diameter | 50.00 mm |
| **Advanced Properties** | |
| Orifice Discharge Coefficient | 0.600 (MUSIC Default) |
| Number of CSTR Cells | 2 |
| Pollutant k & C* Values | MUSIC Default |
| **Re-use** | |
| Max Drawdown Height | 1.30m |
| Annual Demand | 0kL/day |
| Daily Demand | 0.618kL/day |

### Treatment Node: Rainwater Tank

| Parameter | Input |
|---|---|
| Node Name | Rainwater Tank Building B |
| **Total Tank System Properties** | |
| Volume below overflow pipe | 110.0kL |
| Depth above overflow | 0.20m |
| Surface Area | $74m^2$ |
| Initial Volume | 0.00kL |
| **Outlet Properties** | |
| Overflow Pipe Diameter | 50.00 mm |
| **Advanced Properties** | |
| Orifice Discharge Coefficient | 0.600 (MUSIC Default) |
| Number of CSTR Cells | 2 |
| Pollutant k & C* Values | MUSIC Default |
| **Re-use** | |
| Max Drawdown Height | 1.90m |
| Annual Demand | 0kL/day |
| Daily Demand | 2.368kL/day |

### Daily Demand

Demand for toilet flushing, for the purpose of estimating rainwater usage, was based on the values and calculation methodology within the Green Star Potable Water Calculator Guide[4] whereby an equivalent number of hours per day that each space is occupied at maximum design occupancy is established based on the BCA occupancy profiles for each space type (BCA Section J, Tables 2a-g). This is combined with the expected maximum occupancy for each space (as per BCA Table D1.13) and an assumed usage rate of toilets of 0.24 uses per person-hour to provide an estimated water demand for toilets.

[4] "Potable Water Calculator Guide", Green Star, December 2015.

# Potable Water, Performance Pathway (18A)

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Weighted Points Achieved | | 3 |
| Links to - Building and climate data: | Building input, areas and operation | 10-year rainfall data | | | | |
| Links to - Water demand: | Fittings | Whitegoods | Heat Rejection | Washdown | Landscape Irrigation | |
| | Swimming pools | Fire Protection System | Process Cooling | | | |
| Links to - Reclaimed water supply: | Reclaimed water use | Rainwater collection | Greywater collection | Blackwater collection | Stormwater and off-site reclaimed water supply | |
| Links to - Results: | Checklist | Demand summary | Results for Performance Pathway (18A) only | Results for Domestic hot water | Results for Sewerage | |

**Instructions:** Enter information into light blue cells

For details on what information is required and how this information is used to calculate the reduction in potable water consumption against the Standard Practice Benchmark, please refer to the Green Star - Potable Water Calculator Guide, available from the GBCA website.

## 0. GENERAL

### BUILDING OCCUPANCY, AREAS AND OPERATION

| Space type description | Area (m²) | Peak days of operation (remaining days assumed off-peak) | Occupancy profile | Maximum design occupancy used in water use: Proposed Building design occupancy (m2/person) | Maximum design occupancy used in water use: Default design occupancy (Not applicable for residential areas) | Percentage of building users who occupy the space continually for periods greater than one hour. |
|---|---|---|---|---|---|---|
| Retail Tenancy - Basement | 177 | 7 days a week | NCC Table 2c (Class 6 shop or shopping centre) | | Retail / Showroom (5m2/person) | |
| Retail Tenancies - Ground Floor | 1548 | 7 days a week | NCC Table 2c (Class 6 shop or shopping centre) | | Retail / Showroom (5m2/person) | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| Non occupied areas | 0 | n/a | n/a | | | |
| TOTAL AREA | 1725 | | | | | |

## 1. SANITATION FIXTURE EFFICENCY

**WATER DEMAND FROM FIXTURES AND FITTINGS:** (Annual water demand from fixtures and fittings is calculated using assumed usage r... en Star

| | Water efficiency: Manual entry from manufacturer's data sheet (l/min, or L/flush for toilets) | Water efficiency: WELS Star Rating selection | Resulting water efficiency used in calculator (l/min, except for toilets, L/flush) | Percentage of each type | Proposed Building water demand (kL/year) | Standard Practice Building water demand (kL/year) | |
|---|---|---|---|---|---|---|---|
| **Toilets** | | | | | | | |
| Toilets | | 4 Star | 3.5 | 100% | | | |
| <enter description> | | Select star rating | | | | | |
| <enter description> | | Select star rating | | | | | |
| <enter description> | | Select star rating | | | | | (The Standard Practice Benchmark is based on 3 StarWELS rated toilets) |
| | | | Total | 100% | 197.4 | 225.6 | |

Figure 10: Results from the Green Star Potable Water Calculator providing an estimated water demand for toilets (retail spaces only) for Building D and C

# Potable Water, Performance Pathway (18A)

| | |
|---|---|
| Weighted Points Achieved | 3 |

| | | | | | |
|---|---|---|---|---|---|
| Links to - Building and climate data: | Building input, areas and operation | 10-year rainfall data | | | |
| Links to - Water demand: | Fittings | Whitegoods | Heat Rejection | Washdown | Landscape Irrigation |
| | Swimming pools | Fire Protection System | Process Cooling | | |
| Links to - Reclaimed water supply: | Reclaimed water use | Rainwater collection | Greywater collection | Blackwater collection | Stormwater and off-site reclaimed water supply |
| Links to - Results: | Checklist | Demand summary | Results for Performance Pathway (18A) only | Results for Domestic hot water | Results for Sewerage |

**Instructions:** Enter information into light blue cells

For details on what information is required and how this information is used to calculate the reduction in potable water consumption against the Standard Practice Benchmark, please refer to the Green Star - Potable Water Calculator Guide, available from the GBCA website.

## 0. GENERAL

**BUILDING OCCUPANCY, AREAS AND OPERATION**

| Space type description | Area ($m^2$) | Peak days of operation (remaining days assumed off-peak) | Occupancy profile | Maximum design occupancy used in water use: Proposed Building design occupancy (m2/person) | Maximum design occupancy used in water use: Default design occupancy (Not applicable for residential areas) | Percentage of building users who occupy the space continually for periods greater than one hour. |
|---|---|---|---|---|---|---|
| Retail Tenancy - Basement (Aldi) | 1683 | 7 days a week | NCC Table 2c (Class 6 shop or shopping centre) | | Retail / Showroom (5m2/person) | |
| Retail Tenancies - Ground Floor (Retail) | 615 | 7 days a week | NCC Table 2c (Class 6 shop or shopping centre) | | Retail / Showroom (5m2/person) | |
| Office Tenancies - Ground Floor | 2350 | 5 days a week | NCC Table 2b (Class 5, Class 8 or Class 9a) | | Office (10m2/person) | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| | | Please Select | Please Select | | Please select | |
| Non occupied areas | 0 | n/a | n/a | | | |
| TOTAL AREA | 4648 | | | | | |

## 1. SANITATION FIXTURE EFFICENCY

**WATER DEMAND FROM FIXTURES AND FITTINGS:** (Annual water demand from fixtures and fittings is calculated using assumed usage ... en Star

| | Water efficiency: Manual entry from manufacturer's data sheet (l/min, or L/flush for toilets) | Water efficiency: WELS Star Rating selection | Resulting water efficiency used in calculator (l/min, except for toilets, L/flush) | Percentage of each type | Proposed Building water demand (kL/year) | Standard Practice Building water demand (kL/year) | |
|---|---|---|---|---|---|---|---|
| **Toilets** | | | | | | | |
| Toilets | | 4 Star | 3.5 | 100% | | | |
| <enter description> | | Select star rating | | | | | |
| <enter description> | | Select star rating | | | | | |
| <enter description> | | Select star rating | | | | | |
| | | | Total | 100% | 756.2 | 864.2 | (The Standard Practice Benchmark is based on 3 StarWELS rated toilets) |

Figure 11: Results from the Green Star Potable Water Calculator providing an estimated water demand for toilets (office / retail spaces only) for Building B

### Treatment Node: Bioretention

| Parameter | Input |
|---|---|
| Node Name | Bioretention |
| **Inlet Properties** | |
| Low Flow By-pass | $0m^3/s$ (MUSIC Default) |
| High Flow By-pass | $100m^3/s$ (MUSIC Default) |
| **Storage Properties** | |
| Extended detention depth | 0.20m |
| Surface Area | $80.0m^2$ |
| **Filter and Media Properties** | |
| Filter Area | $64.0m^2$ |
| Unlined Filter Media Perimeter | 36.0m |

| Parameter | Input |
|---|---|
| Saturated Hydraulic Conductivity | 100.0mm/hour (MUSIC Default) |
| Filter Depth | 0.m |
| TN Content of Filter Media | 800mg/kg (MUSIC Default) |
| Orthophosphate Content of Filter Media | 55.0mg/kg (MUSIC Default) |
| **Infiltration Properties** | |
| Exfiltration Rate | 0.00mm/hour (MUSIC Default) |
| **Lining Properties** | |
| Is Base Lined? | Yes |
| Vegetation Properties | Vegetated with Effective Nutrient Removal Plants |
| **Outlet Properties** | |
| Overflow Weir Width | 2.0m |
| Underdrain Present? | Yes |
| Submerged Zone with Carbon Present? | No (MUSIC Default) |

## Stormwater Runoff Treatment during the Construction Stage

### Treatment – Various

Stormwater management in the construction stage will include measures which will be put in place to minimise the likelihood of contaminating stormwater discharge from the site as well as reduce the velocity of the flows generated from the building as it is being constructed. This will mean ensuring buffer strips are in place, and the site will be kept clean from any loose rubbish. More information is available from "*Keeping Our Stormwater Clean – A Builder's Guide*" by Melbourne Water[5]. The diagram below is an illustration of the various objectives which assist in minimising the impacts of stormwater runoff typical during the construction phase. Typical pollutants that are generated from a construction site during a rainfall event include:

- Dust
- Silt
- Mud
- Gravel
- Stockpiled materials
- Spills/oils
- Debris/litter

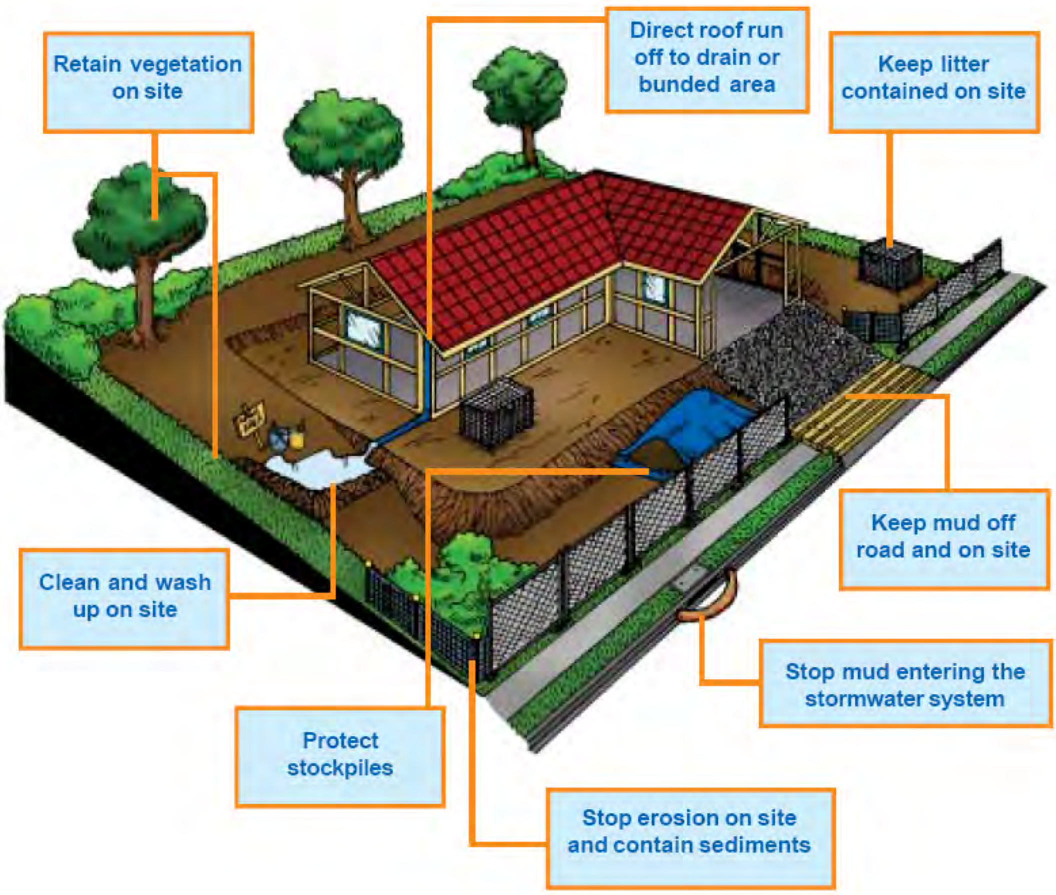
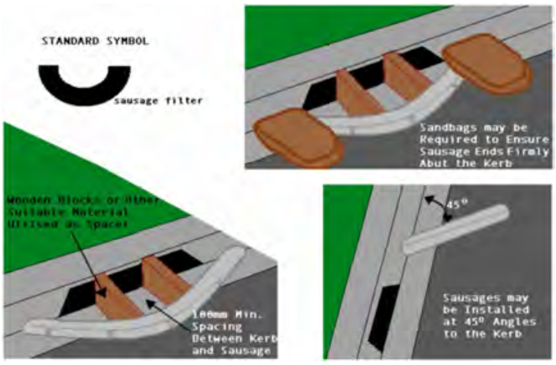



Figure 12: Stormwater will be effectively managed during construction phase according to the requirements listed in "Keeping Our Stormwater Clean – A Builder's Guide".

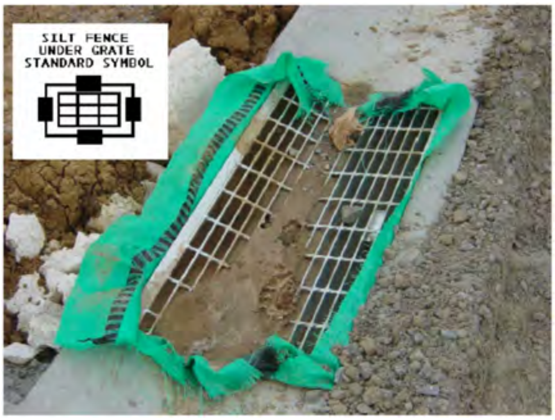
[5] For copies please contact Melbourne Water on 131 722.

To reduce the impacts and minimise the generation of these pollutants the following measures are proposed. The symbols embedded within each image are typically used for Construction Environmental Management Plans.

Gravel Sausage filters – to be placed at the entrance of pits/side stormwater inlets. These permeable sacks will filter the suspended soils and sediments and any other litter carried by the stormwater to prevent the pollutants entering the system.




Silt Fences Under Grates - Silt fence material may be placed under the grate of surface-entry inlets to prevent sediment from entering the stormwater system.




Temporary Rumble Grids – these are designed to open the tread on tires and vibrate mud and dirt off the vehicle (in particular the chassis). This will heavily minimise the amount of soil/dirt deposited on local roads where it can be washed (by rainfall or other means) into the stormwater drains.

## Appendix 4 – BCA Section J Energy Compliance Advice

This Consultant Advice Notice relates to the proposed mixed-use development at 160 Whitehorse Road, Blackburn, and outlines what is required in order to comply with the Building Code of Australia (BCA) energy efficiency requirements.

This Notice in Appendix 4 is issued in relation to BCA Performance Requirement JP1 and prepared in accordance with Verification Method JV3, Verification using a reference building, where a Building Solution is proposed as an Alternative Solution to the Deemed-to-Satisfy Provisions. This notice is only relevant to BCA Section J, parts J1 (Building Fabric), J2 (Glazing) and J3 (Building Sealing).

The proposed commercial and common areas of the building underwent a preliminary energy modelling assessment - both as a deemed-to-satisfy designed building and as currently proposed on plans and specifications (available to this point). It has been found that at present the proposed design can meet the requirements of Verification Method JV3 of the 2016 BCA, assuming the following parameters are met.

The modelling parameters used in the preliminary assessment are outlined in the table below:

| Element | Comments / Conditions |
|---|---|
| External Walls | External walls modelled as heavyweight (concrete) and lightweight construction with added insulation, to achieve a minimum total system R-value of R2.8. This includes external walls to basement entry and covered carpark. |
| Internal Walls | Internal walls separating conditioned spaces from unconditioned spaces modelled as internal stud wall or concrete with added insulation, to achieve a minimum total system R-value of R1.8.<br><br>All other internal walls modelled with no added insulation. |
| Floors | Suspended slab floors of conditioned spaces above basement carpark and open spaces modelled with added insulation, to achieve a minimum total system R-value of R2.0.<br><br>All other floors modelled as suspended concrete slab with no added insulation. |
| Roof & Ceiling | A minimum total system R-value of R3.2 is required to be installed in all exposed roofs above conditioned spaces.<br><br>All remaining roof & ceiling systems over conditioned spaces modelled as suspended concrete slab with no added insulation. |
| Windows and Glazed Doors | External glazing (windows and doors) modelled with the following thermal performance values:<br>• U-Value = 4.4, SHGC = 0.57 (Retail Spaces / Lobbies – Basement 1 and Ground Level)<br>• U-Value = 4.4, SHGC = 0.38 (Office Spaces – Ground Floor and Levels 1-5)<br>• U-Value = 4.4, SHGC = 0.33 (Office Spaces – Levels 1-5)<br><br>These values are found respectively with EVantage Clear single glazing in aluminium frames; EVantage Grey single glazing in aluminium frames; and EVantage SuperBlue single glazing in aluminium frames.<br><br>The window system (windows and frames) specified for the development must, as a minimum, meet the modelled thermal performance values above.<br><br>All internal glazing can remain clear single glazing in aluminium frames. |
| Please check with the glazing contractor for products which may meet the above energy efficiency requirements along with any specific considerations to other project requirements such as structural adequacy, safety, wind loads, acoustics etc. | |

| | |
|---|---|
| Shading | Structural overhangs and incidental building shading modelled as shown on the architectural plans. |
| Sealing | A seal to restrict air infiltration must be fitted to each edge of a door and operable window in accordance with Provision J3.4, other than glazed elements which comply with AS 2047.<br><br>All entry doors to leading to conditioned area must have a self-closing device.<br><br>Exhaust fans serving any conditioned spaces must be fitted with self-closing dampers.<br><br>Roofs, ceilings, walls, floors and any opening such as a window frame, door frame, roof light frame or the like will be constructed to minimise air leakage via the enclosure by internal lining systems or sealed by caulking, skirting, architraves, cornices or the like.<br><br>Part J1.2 for general thermal construction & installation must be followed.<br><br>Part J1.3(c) for compensation for a loss of ceiling insulation must be followed if ceiling insulation is used instead of that proposed and downlights are provided. |
| Insulation | Insulation must comply with AS/NZS 4859.1 and be installed so that it forms a continuous barrier and installed with required air space. The insulation must maintain its position and thickness. Insulation must be installed to comply with the requirements of BCA J1.2 (a), (b) and (c). |
| Artificial Lighting | The lighting (W/m$^2$) values for each space must be reduced by at least 30% from maximum wattages listed in Table 6.2a of the BCA, as per requirements of the Sustainability Management Plan issued by Sustainable Development Consultants. |
| Heating, Ventilation & Air-Conditioning (HVAC) | Generic packaged air conditioning systems were used as the HVAC system.<br><br>The systems were zoned as outlined in Appendix A below.<br><br>The systems must be selected to meet DTS requirements of Part J5.<br><br>The systems must be selected with COP/EER values of 3.9, as per requirements of the Sustainability Management Plan issued by Sustainable Development Consultants.<br><br>If alternative HVAC zoning or equipment type is proposed, please notify SDC of the proposed system types and zoning so that we can update the energy model and confirm that the building fabric advice provided is still relevant. |
| Access & Monitoring | Access must be provided to all plant, equipment and components of services that require maintenance.<br><br>The development must have the facility to record consumption of gas and electricity, as well as record individually the energy consumption of the following:<br><br>• HVAC equipment;<br>• Artificial lighting;<br>• Appliance power;<br>• Central hot water (if provided); and<br>• Other ancillary plant. |

To achieve compliance with BCA Section J (based on Verification Method JV3) the proposed building must have energy consumption less than or equal to the DTS building.

If you wish to discuss these results further, please feel free to give SDC a call. If you would like SDC to look into other optimisation measures for the project to try and achieve compliance such as allowing different glazing types / colours, we would be happy to sit down and discuss these options prior to proceeding down that path.

## HVAC Zone Layout

Coloured area mark-ups indicate assumed HVAC zones. Grey areas indicate assumed non-conditioned spaces.

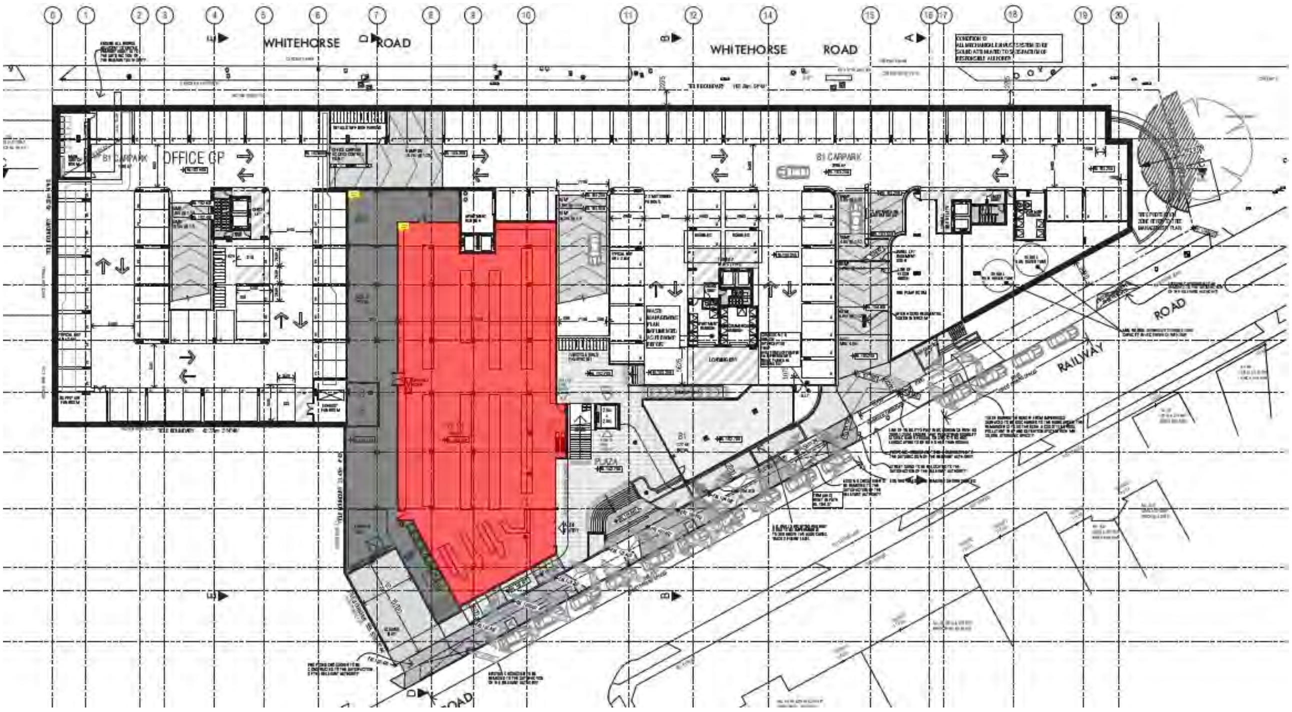



Figure 13: Basement 1


Figure 14: Ground Floor


Figure 15: Level 1


Figure 16: Level 2


Figure 17: Level 3


Figure 18: Level 4


Figure 19: Level 5

## BCA DTS Glazing Calculator

Please note the values in the table above are provided for comparative purposes only. Please see the glazing information in the main body of Appendix 4 for the required thermal performance of the glazing suites.

### NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: 160 Whitehorse Road, Blackburn

Application: other

Climate zone: 6

Storey: Basement 1

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | | | 83.3m² | 54.1m² | | | | | |
| Option B | | | | | | | | | n/a |
| Glazing area (A) | | | 70m² | 54.1m² | | | | | |

Number of rows preferred in table below 5 (as currently displayed)

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating ($S_H$) | Cooling ($S_C$) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | E | | 3.40 | 11.80 | | 1.0 | 0.13 | | | | 0.00 | 1.00 | 1.00 | 40.12 | 57% of 98% |
| 2 | D01 | E | | 3.40 | 3.30 | | 1.0 | 0.13 | | | | 0.00 | 1.00 | 1.00 | 11.22 | 16% of 98% |
| 3 | W02 | E | | 3.40 | 5.50 | | 1.0 | 0.13 | | | | 0.00 | 1.00 | 1.00 | 18.70 | 27% of 98% |
| 4 | W03 | SE | | 3.40 | 15.90 | | 1.1 | 0.28 | | | | 0.00 | 1.00 | 1.00 | 54.06 | 100% of 100% |
| 5 | | | | | | | | | | | | | | | | |

*if inputs are valid* ✓

## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: 3

Application: other

Climate zone: 6

Storey: Ground Floor

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 302m² | | 200m² | 88.4m² | 232m² | | 297m² | | |
| Option B | | | | | | | | | n/a |
| *Glazing area (A)* | 157m² | ............ | 141m² | 66.3m² | 101m² | ............ | 84.5m² | | |

Number of rows preferred in table below 25 *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating (S_H) | Cooling (S_C) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 3.00 | 5.30 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 15.90 | 10% of 100% |
| 2 | D01 | N | | 3.00 | 0.95 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 2.85 | 2% of 100% |
| 3 | W02 | N | | 3.00 | 0.60 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 1.80 | 1% of 100% |
| 4 | W03 | N | | 3.00 | 4.70 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 14.10 | 9% of 100% |
| 5 | D02 | N | | 3.00 | 0.95 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 2.85 | 2% of 100% |
| 6 | W04 | N | | 3.00 | 0.70 | | 2.5 | 0.23 | 1.200 | 3.900 | 0.31 | 0.90 | 0.99 | 0.94 | 2.10 | 1% of 100% |
| 7 | D03 | N | | 5.10 | 4.75 | | 2.5 | 0.23 | *1.200* | 7.000 | *0.00* | *1.90* | *1.00* | *1.00* | 24.23 | 17% of 100% |
| 8 | W05 | N | | 3.00 | 0.60 | | 2.5 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 1.80 | 1% of 100% |
| 9 | D04 | N | | 3.00 | 0.95 | | 2.5 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 2.85 | 2% of 100% |
| 10 | W06 | N | | 3.00 | 6.70 | | 2.5 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 20.10 | 14% of 100% |
| 11 | W07 | N | | 3.00 | 11.80 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 35.40 | 21% of 100% |
| 12 | D05 | N | | 3.00 | 0.95 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 2.85 | 2% of 100% |
| 13 | W08 | N | | 3.00 | 0.90 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 2.70 | 2% of 100% |
| 14 | W09 | N | | 3.00 | 5.75 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 17.25 | 10% of 100% |
| 15 | D06 | N | | 3.00 | 0.95 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 2.85 | 2% of 100% |
| 16 | W10 | N | | 3.00 | 2.50 | | 2.5 | 0.23 | 1.600 | 4.000 | 0.40 | 1.00 | 0.99 | 0.91 | 7.50 | 5% of 100% |
| 17 | W11 | E | | 3.00 | 7.50 | | 1.1 | 0.17 | | | | 0.00 | 1.00 | 1.00 | 22.50 | 17% of 99% |
| 18 | W12 | E | | 3.00 | 5.00 | | 1.1 | 0.17 | | | | 0.00 | 1.00 | 1.00 | 15.00 | 11% of 99% |
| 19 | D07 | E | | 3.00 | 0.85 | | 1.1 | 0.17 | | | | 0.00 | 1.00 | 1.00 | 2.55 | 2% of 99% |
| ## | W13 | E | | 3.00 | 6.60 | | 1.1 | 0.17 | 1.500 | 4.000 | 0.38 | 1.00 | 0.97 | 0.95 | 19.80 | 14% of 99% |
| 21 | W14 | E | | 3.00 | 27.00 | | 1.1 | 0.17 | 1.500 | 4.000 | 0.38 | 1.00 | 0.97 | 0.95 | 81.00 | 56% of 99% |
| ## | W15 | SE | | 3.00 | 14.50 | | 1.5 | 0.40 | 1.500 | 4.000 | 0.38 | 1.00 | 0.96 | 0.95 | 43.50 | 65% of 100% |
| ## | W16 | SE | | 3.00 | 7.60 | | 1.5 | 0.40 | | | | 0.00 | 1.00 | 1.00 | 22.80 | 35% of 100% |
| ## | W17 | S | | 4.10 | 24.60 | | 3.4 | 0.50 | | | | 0.00 | 1.00 | 1.00 | ##### | 100% of 100% |
| ## | W18 | W | | 4.10 | 20.60 | | 2.7 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 84.46 | 100% of 99% |

**IMPORTANT NOTICE AND DISCLAIMER IN RESPECT OF THE GLAZING CALCULATOR**

The Glazing Calculator has been developed by the ABCB to assist in developing a better understanding of glazing energy efficiency parameters.
While the ABCB believes that the Glazing Calculator, if used correctly, will produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all.
Your use of the Glazing Calculator is entirely at your own risk and the ABCB accepts no liability of any kind.

*if inputs are valid* ✓



## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: 160 Whitehorse Road, Blackburn

Application: other

Climate zone: 6

Storey: Level 1

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 161m² | | | | 169m² | | 128m² | | |
| Option B | | | | | | | | | n/a |
| Glazing area (A) | 74.1m² | ............ | ............ | ............ | 52.4m² | ............ | 43.5m² | | |

Number of rows preferred in table below 6 *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating (S_H) | Cooling (S_C) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 2.70 | 21.90 | | 1.6 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 59.13 | 80% of 100% |
| 2 | W02 | N | | 1.40 | 3.80 | | 1.6 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 5.32 | 7% of 100% |
| 3 | W03 | N | | 1.00 | 9.60 | | 1.6 | 0.23 | | | | 0.00 | 1.00 | 1.00 | 9.60 | 13% of 100% |
| 4 | W04 | S | | 2.10 | 21.60 | | 4.6 | 0.66 | | | | 0.00 | 1.00 | 1.00 | 45.36 | 87% of 99% |
| 5 | W05 | S | | 2.70 | 2.60 | | 4.6 | 0.66 | | | | 0.00 | 1.00 | 1.00 | 7.02 | 13% of 99% |
| 6 | W06 | W | | 2.70 | 16.10 | | 1.9 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 43.47 | 100% of 100% |

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*if inputs are valid* ✓

## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: 160 Whitehorse Road, Blackburn

Application: other

Climate zone: 6

Storey: Level 2

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 161m² | | 20.5m² | | 169m² | | 128m² | | |
| Option B | | | | | | | | | |
| *Glazing area (A)* | *95.9m²* | *...........* | *12.2m²* | *...........* | *86.7m²* | *...........* | *43.5m²* | | |

Number of rows preferred in table below: 8 *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating ($S_H$) | Cooling ($S_C$) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 2.70 | 3.60 | | 1.3 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 9.72 | 11% of 100% |
| 2 | W02 | N | | 2.70 | 8.60 | | 1.3 | 0.19 | 0.600 | 2.700 | 0.22 | 0.00 | 0.94 | 0.80 | 23.22 | 19% of 100% |
| 3 | W03 | N | | 2.70 | 13.60 | | 1.3 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 36.72 | 41% of 100% |
| 4 | W04 | N | | 2.70 | 9.70 | | 1.3 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 26.19 | 29% of 100% |
| 5 | W05 | E | | 2.70 | 4.50 | | 1.2 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 12.15 | 100% of 97% |
| 6 | W06 | S | | 2.70 | 29.90 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 80.73 | 93% of 99% |
| 7 | W07 | S | | 2.70 | 2.20 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 5.94 | 7% of 99% |
| 8 | W08 | W | | 2.70 | 16.10 | | 1.9 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 43.47 | 100% of 100% |

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*if inputs are valid* ✓



## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: 160 Whitehorse Road, Blackburn

Application: other

Climate zone: 6

Storey: Level 3

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 161m² | | 22.4m² | | 169m² | | 130m² | | |
| Option B | | | | | | | | | |
| *Glazing area (A)* | *95.9m²* | *...........* | *12.2m²* | *...........* | *86.7m²* | *...........* | *43.5m²* | | |

Number of rows preferred in table below: 8 *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating ($S_H$) | Cooling ($S_C$) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 2.70 | 3.60 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 9.72 | 12% of 100% |
| 2 | W02 | N | | 2.70 | 8.60 | | 1.0 | 0.20 | 1.500 | 2.700 | 0.56 | 0.00 | 0.66 | 0.52 | 23.22 | 13% of 100% |
| 3 | W03 | N | | 2.70 | 13.60 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 36.72 | 44% of 100% |
| 4 | W04 | N | | 2.70 | 9.70 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 26.19 | 31% of 100% |
| 5 | W05 | E | | 2.70 | 4.50 | | 1.1 | 0.22 | | | | 0.00 | 1.00 | 1.00 | 12.15 | 100% of 98% |
| 6 | W06 | S | | 2.70 | 29.90 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 80.73 | 93% of 99% |
| 7 | W07 | S | | 2.70 | 2.20 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 5.94 | 7% of 99% |
| 8 | W08 | W | | 2.70 | 16.10 | | 1.9 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 43.47 | 100% of 98% |

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*if inputs are valid* ✓

## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

| Building name/description | Application | Climate zone |
|---|---|---|
| 160 Whitehorse Road, Blackburn | other | 6 |

Storey: Level 4

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 161m² | | 22.4m² | | 169m² | | 130m² | | |
| Option B | | | | | | | | | n/a |
| *Glazing area (A)* | *95.9m²* | ............ | *12.2m²* | ............ | *86.7m²* | ............ | *43.5m²* | | |

Number of rows preferred in table below **8** *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating ($S_H$) | Cooling ($S_C$) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 2.70 | 3.60 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 9.72 | 12% of 100% |
| 2 | W02 | N | | 2.70 | 8.60 | | 1.0 | 0.20 | 1.500 | 2.700 | 0.56 | 0.00 | 0.66 | 0.52 | 23.22 | 13% of 100% |
| 3 | W03 | N | | 2.70 | 13.60 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 36.72 | 44% of 100% |
| 4 | W04 | N | | 2.70 | 9.70 | | 1.0 | 0.20 | | | | 0.00 | 1.00 | 1.00 | 26.19 | 31% of 100% |
| 5 | W05 | E | | 2.70 | 4.50 | | 1.1 | 0.22 | | | | 0.00 | 1.00 | 1.00 | 12.15 | 100% of 98% |
| 6 | W06 | S | | 2.70 | 29.90 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 80.73 | 93% of 99% |
| 7 | W07 | S | | 2.70 | 2.20 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 5.94 | 7% of 99% |
| 8 | W08 | W | | 2.70 | 16.10 | | 1.9 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 43.47 | 100% of 98% |

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*if inputs are valid* ✓



## NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

| Building name/description | Application | Climate zone |
|---|---|---|
| 160 Whitehorse Road, Blackburn | other | 6 |

Storey: Level 5

Facade areas

| | N | NE | E | SE | S | SW | W | NW | internal |
|---|---|---|---|---|---|---|---|---|---|
| Option A | 156m² | | 22.4m² | | 166m² | | 130m² | | |
| Option B | | | | | | | | | n/a |
| *Glazing area (A)* | *95.9m²* | ............ | *12.2m²* | ............ | *86.7m²* | ............ | *43.5m²* | | |

Number of rows preferred in table below **8** *(as currently displayed)*

| GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS | | | | | | | | | SHADING | | CALCULATED OUTCOMES OK (if inputs are valid) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glazing element | | Facing sector | | Size | | | Performance | | P&H or device | | Shading | | Multipliers | | Size | Outcomes |
| ID | Description (optional) | Option A facades | Option B facades | Height (m) | Width (m) | Area (m²) | Total System U-Value (AFRC) | Total System SHGC (AFRC) | P (m) | H (m) | P/H | G (m) | Heating ($S_H$) | Cooling ($S_C$) | Area used (m²) | Element share of % of allowance used |
| 1 | W01 | N | | 2.70 | 3.60 | | 1.0 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 9.72 | 11% of 100% |
| 2 | W02 | N | | 2.70 | 8.60 | | 1.0 | 0.19 | 1.100 | 2.700 | 0.41 | 0.00 | 0.81 | 0.62 | 23.22 | 15% of 100% |
| 3 | W03 | N | | 2.70 | 13.60 | | 1.0 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 36.72 | 43% of 100% |
| 4 | W04 | N | | 2.70 | 9.70 | | 1.0 | 0.19 | | | | 0.00 | 1.00 | 1.00 | 26.19 | 31% of 100% |
| 5 | W05 | E | | 2.70 | 4.50 | | 1.1 | 0.22 | | | | 0.00 | 1.00 | 1.00 | 12.15 | 100% of 98% |
| 6 | W06 | S | | 2.70 | 29.90 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 80.73 | 93% of 100% |
| 7 | W07 | S | | 2.70 | 2.20 | | 3.5 | 0.62 | | | | 0.00 | 1.00 | 1.00 | 5.94 | 7% of 100% |
| 8 | W08 | W | | 2.70 | 16.10 | | 1.9 | 0.85 | | | | 0.00 | 1.00 | 1.00 | 43.47 | 100% of 98% |

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*if inputs are valid* ✓

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## Appendix 5 – Green Star VOC and Formaldehyde Limits

Table 5: Maximum Volatile Organic Compound Levels for construction materials (Source: Green Building Council Australia – Green Star Design and As Built v1.2 2017 Manual)

| Product Type/Sub Category | Max TVOC Content (g/L of ready-to-use-product) |
|---|---|
| Paints, Adhesives and Sealants | |
| 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 |
| Carpets | |
| Total VOC limit | 0.5 $mg/m^2$ per hour |
| 4-PC (4-Phenylcyclohexene) | 0.05$mg/m^2$ per hour |
| ISO 16000 / EN 13419 - TVOC at three days | 0.5 $mg/m^2$ per hour |
| ISO 10580 / ISO/TC 219 (Document N238) - TVOC at 24 hours | 0.5 $mg/m^2$ per hour |

Table 6: Maximum Formaldehyde levels for processed wood products. (Source: Green Building Council Australia – Green Star Design and As Built v1.2 2017 Manual)

| Formaldehyde emission limit values for different testing methods | |
|---|---|
| Test Method | Emission Limit/ Unit of Measurement |
| AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood | ≤1mg/ L |
| AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16 | ≤1.5 mg/L |
| AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16 | ≤1mg/ L |
| AS/NZS 4357.4 - Laminated Veneer Lumber (LVL) | ≤1mg/ L |
| Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL | ≤1mg/ L |
| JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460 | ≤1mg/ L |
| JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460 | ≤1mg/ L |
| JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates) | ≤0.1 $mg/m^2hr$ |
| ASTM D5116 (applicable to high pressure laminates and compact laminates) | ≤0.1 $mg/m^2hr$ |
| ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates | ≤0.1 $mg/m^2hr$ (at 3 days) |
| ASTM D6007 | ≤0.12$mg/m^3$ |
| ASTM E1333 | ≤0.12$mg/m^3$ |
| EN 717-1 (also known as DIN EN 717-1) | ≤0.12$mg/m^3$ |
| EN 717-2 (also known as DIN EN 717-2) | ≤3.5$mg/m^2hr$ |