583 Ferntree Gully Road Glen Waverley

Sustainability Management Plan

Issued: 13 Aug 2021
Status: Final

Contents

Issue and change log

Date	Purpose of issue and changes	Status	Author
19 Mar 2021	For design team to comment and action	Draft	PG
26 Mar 2021	For planning approval	Final	PG
13 Aug 2021	For planning approval	Final	PG

1 Executive summary

1.1 Sustainability Management Plan (SMP) Introduction

This Sustainability Management Plan (SMP) provides a detailed sustainability assessment of the project at the planning stage. It addresses 10 sustainable design criteria and demonstrates that a detailed and holistic ESD (environmentally or ecologically sustainable development) review has been undertaken. This document also identifies responsibilities for the implementation of the various ESD aspects through the life of the project (design through construction to operation and maintenance).

This SMP sets out how the project achieves ESD best practice. Achievement of the best practice target is assessed using BESS (Built Environment Sustainability Scorecard). The following key sustainable building categories have been addressed:

1. Management
2. Water
3. Energy
4. Stormwater
5. Indoor environment quality (IEQ)
6. Transport
7. Waste
8. Urban ecology
9. Innovation
10. Materials

This document defines the ESD aspirations of the development and shows that these extend well beyond the minimum regulatory requirements.

1.2 BESS (Built Environment Sustainability Scorecard) assessment

BESS assesses energy and water efficiency, thermal comfort, and overall environmental sustainability performance of new buildings or alterations. It was created to assist builders and developers to demonstrate that they meet sustainability information requirements as part of a planning permit applications. BESS supports the SDAPP framework.

The BESS tool assesses projects against a benchmark in nine environmental categories (refer to bullet items 1 to 9 above). Within each category, points are available for various design strategies relevant to that category. There are four mandatory categories with minimum pass rates:

- Water
- Energy
- Stormwater
- Indoor Environment Quality (IEQ)

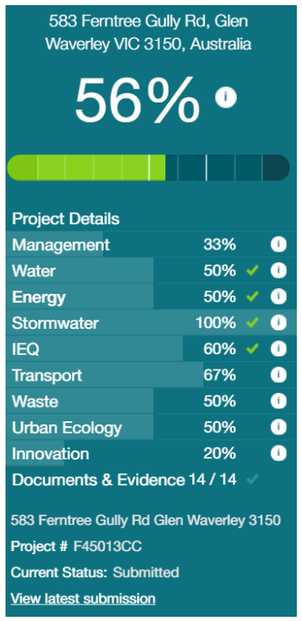
The overall BESS score is shown as a percentage figure, which represents a percentage improvement over a benchmark project.

- A score of 50% and higher equates to ”best practice” and is an effective pass of the BESS tool.
- A score of 70% and higher equates to BESS ”excellence” and exists as a higher benchmark in the tool.

This SMP has a target best practice rating using the BESS rating tool. The adjacent table shows the outcomes of the assessment. Further details including the measures needed to achieve the target rating are identified in Section 3 and Appendix A.

The BESS score of 56 exceeds the target score of 50.

The project therefore achieves the target best practice rating.



1.3 Key ESD attributes of the development

The development will meet the requirements of the Monash City Council Planning Scheme with enhanced ESD attributes as outlined in this SMP. This will ensure an appropriate level of sustainability for the development; and, in doing so, will: provide community benefits; manage environmental impact; improve the indoor environment; and facilitate the efficient use of existing energy, water and transportation infrastructure.

Key ESD attributes of the project include:

• A best practice rating on the BESS assessment tool.
• Water efficient products.
• Rainwater harvesting and reuse enables potable water use reductions.
• Water efficient landscaping.
• Efficient lighting systems, air conditioning systems, heated water and appliances.
• Average dwelling energy rating of 6.5 stars for improved comfort and energy savings.
• Best practice water sensitive urban design (WSUD).
• The design exceeds the NCC requirements for daylight (avoids habitable rooms with borrowed light).
• Low-VOC products mean lower health risks associated with indoor pollutants.
• Reduced obtrusive effects of lighting to neighbours and the night sky.

1.4 Council Planning Scheme

Following is a summary of the relevant Monash City Council Planning Scheme objectives and the project response in relation to ESD aspects of these objectives.

Clause	Objective	Project response
21.13	Sustainability and environment	The project includes a best practice ESD approach that includes: water efficient products and rainwater capture and reuse for toilet flushing and irrigation (Section 3.2); energy efficiency (6.5 star average dwellings and efficient lighting, airconditioning and appliances - Section 3.3); waterway protection via best practice WSUD (Section 3.4); best practice indoor environment quality (IEQ) assessed by the BESS tool and low volatile organic compound (low VOC) materials (Section 3.5); sustainable transport options (close proximity to Brandon Park Shopping Centre, cycling, electric vehicles - Section 3.6); waste management; and, urban ecology (35% of the site is vegetated - Sections 3.7 and 3.8) with a large open communal space. The project is a redevelopment (does not take up new land) with appropriate density for the locality.
22.13	Environmentally sustainable development policy	A best practice ESD response as noted under clause 21.13. Best practice is determined by the BESS assessment tool. Best practice WSUD assessed via MUSIC modeling.

2 Introduction

2.1 Description of the project

The proposed development is located at 583 Ferntree Gully Road Glen Waverley.

Key project data includes:

- Site area 16478 m^2
- Gross floor area 16200 m^2

The development affords good access to Brandon Park Shopping Centre and local facilities that provide a wide range of commercial, retail and service facilities within 500m of the development.

The development location achieves a Somewhat walkable 68 points out of 100 on walkscore.com.

A train station is nearby: Glen Waverley station (3km). Bus routes are located nearby: 693 immediately outside the development providing access from Oakleigh to Belgrave, 724 (200m) on the route from Chadstone Shopping Centre to Ringwood and 902 (400m) SmartBus service from Chelsea in the South via the Eastern Suburbs and Westfield Doncaster through the northern suburbs to Tullamarine. These and other services nearby provide excellent bus infrastructure.

Two bicycle trails on the Principle Bicycle Network are accessible: Scotchmans Creek Trail (1km) providing good access to the Principal Cycle Network toward the CBD and Dandenong Creek Trail (3km) through the outer eastern suburbs and beyond.

Figure 1: Site location map

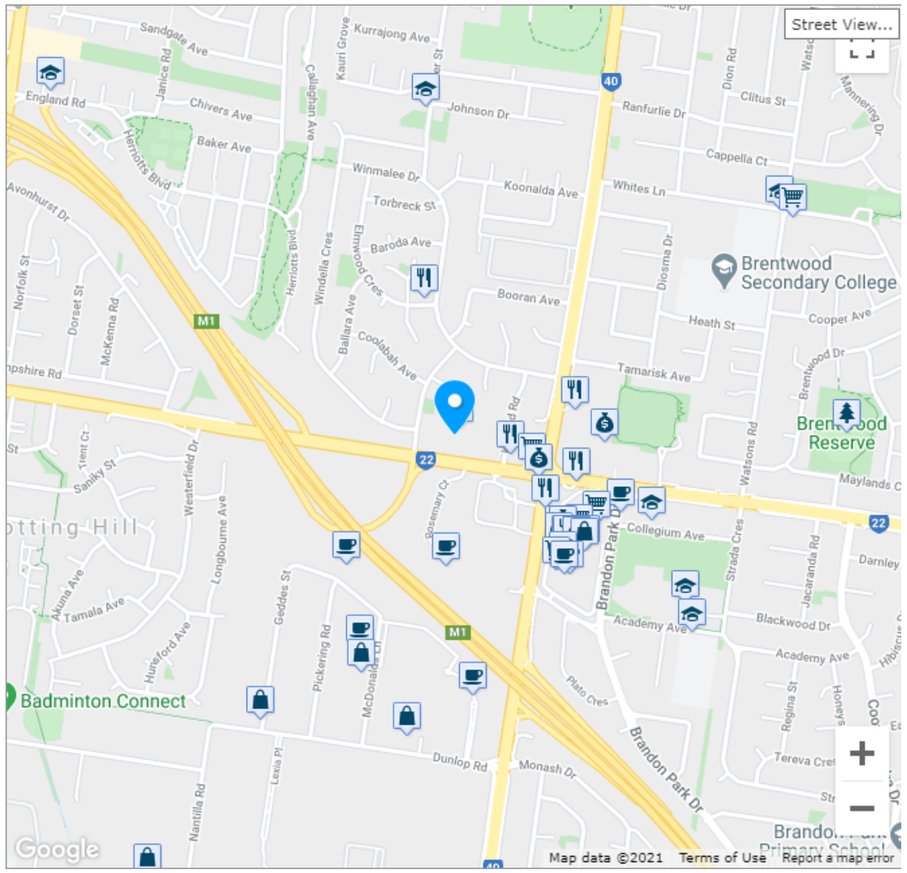


Figure 2: Walkability score

3 ESD design responses

3.1 Management

Objective: Ensure that sustainability is integrated from concept design through the construction process and into operations. Good decisions made early will always deliver the maximum benefit for the lowest cost. Best practice building management also means giving future occupants the information they need to be able to run their buildings in the most efficient way.

Table 1: Management

ID	Category/Item	Project Response	Responsibility
mgt-1	Thermal performance modelling	Energy calculations have been performed to inform the planning and early design stages of the project. A selection of dwellings has been assessed using energy rating software. The assessment has confirmed that star ratings are an improvement on the NCC requirements. Annual cooling and heating loads also achieve the NCC requirements. Refer to Appendix B for details.	Design: - PM - ESD - Arch Construction: - Builder Operation: - N/A
mgt-2	Utility metering	Utility meters are to be provided for the following: • Electrical: - Site meter - Each dwelling • Water: - Site meter - Each dwelling • Gas: - Site meter - Each dwelling	Design: - Elec-Des - Hyd-Des Construction: - Elec-Inst - Hyd-Inst Operation: - N/A
mgt-3	Construction Management Plan (CMP)	A Construction Management Plan will be prepared as required by the relevant Authorities. The CMP will manage and monitor that activities are undertaken in such a way that: contaminated run-off is not discharged into drains or waterways; the site is managed to reduce impacts on neighbours such as noise, traffic, etc; the handover process is properly managed and waste is minimised.	Design: - Arch Construction: - Bldr Operation: - N/A

3.2 Water

Objective: To ensure the efficient use of water, to reduce total operating potable water consumption and to encourage the appropriate use of alternative water sources.

Table 2: Water

ID	Category/Item	Project Response	Responsibility
wat-1	Potable Water Use Reduction (Interior Uses)	New fittings and fixtures will be water efficient types as nominated below: - Basin taps: 5 stars - Dishwashers: 4 stars - Kitchen taps: 4 stars - Other taps: 4 stars - Showers: 3 stars (>6.0 but <=7.5 lpm) - Toilets: 4 stars All air conditioning systems in the building will be air-cooled. No water-based heat rejection systems will be installed.	Design: - Arch Construction: - Bldr - Hyd-Inst Operation: - N/A
wat-2	Rainwater Collection & Reuse	Initiatives include rainwater harvesting as follows. ”Clean” roof catchment: Average of 60sqm per townhouse Total volume of rainwater tanks: 2,000 litres per townhouse Connect to all toilets and landscape irrigation within each lot. Refer to the stormwater management section for further information.	Design: - Arch - Hyd-Des - L’scape-Des Construction: - Bldr - Hyd-Inst - L’scape-Inst Operation: - Hyd-Maint - L’scape-Maint
wat-3	Water Efficient Landscaping	Reduce water demand from landscaped areas by: - At least one water efficient garden area that has no irrigation system and does not require watering after an initial period when plants are getting established. - Other landscaped areas should have water efficient irrigation including: mulching and drip irrigation to garden beds; timers and rain sensors for all irrigated areas (or more water efficient method appropriate for the garden type and use).	Design: - L’scape Des Construction: - L’scape Cont Operation: - L’scape Maint

3.3 Energy

Objective: To ensure the efficient use of energy to reduce total operating greenhouse gas emissions and to reduce energy peak demand.

Table 3: Energy

ID	Category/Item	Project Response	Responsibility
ene-1	Passive design	Passive design features include: • A combination of window shading and blinds allow for summer solar radiation to be reduced. • Manually operated windows allow for natural ventilation.	Design: - Arch Construction: - Bldr Operation: - Occupants
ene-2	Energy efficient lighting	Dwelling lighting designs will a achieve a maximum illumination power density of 4W/sqm or less. This will be through the correct design of lighting levels and the selection of energy efficient lamps such as: LED lighting (predominately).	Design: - Elec-Des Construction: - Elec-Inst Operation: - Occupants - Elec-Maint
ene-3	Efficient lighting control	All rooms/spaces are to include local switching. Additional/alternate lighting controls are to include: - WC and bathrooms: occupancy sensing.	Design: - Elec-Des Construction: - Elec-Inst Operation: - Occupants - Elec-Maint
ene-4	Efficient air conditioning equipment	Airconditioning systems are to be within one star of the best available, or coefficient of performance (cop) & energy efficiency ratios (eer) 85% or better than the most efficient equivalent unit / capacity.	Design: - Mech-Des Construction: - Mech-Inst Operation: - Mech-Maint
ene-5	Energy efficient water heating	Gas fired continuous flow hot water systems will be selected from amongst the most efficient units available (≥ 6 star efficiency). This will reduce greenhouse emissions by 8% when compared to typical gas storage systems. Showering is expected to account for around up to 50% of hot water consumption. Shower heads will be selected as nominated in the Water Section; this will reduce the greenhouse emissions by a further 5%.	Design: - Hyd-Des Construction: - Hyd-Inst Operation: - N/A
ene-6	Energy efficient appliances	All appliances installed by the Developer will have an energy efficiency rating within 1 star of the best available equivalent appliance (an exception is where appliance types do not have energy ratings), in this case consider energy efficiency in the selection process).	Design: - Arch Construction: - Bldr Operation: - N/A

... continued on next page

Table 3: Energy

ID	Category/Item	Project Response	Responsibility
ene-7	Building envelope, layout and orientation	The project targets a NatHERS energy rating of 6.5 stars. Note that NCC methodology also takes into consideration dwelling orientation, glazing performance, insulation, draft proofing and thermal mass. Efficient glazing to dwelling will be required and this will include double glazing to achieve the energy rating requirements. The additional strategies in this section highlight features of the development that in aggregate, extend well beyond the NCC to best practice.	Design: • Arch: Specify building envelope • ESD: Advice building envelope req'ts Construction: • Bldr: Implement requirements Operation: • N/A

3.4 Stormwater

Objective: To reduce the impact of stormwater runoff, to improve the water quality of stormwater runoff, to achieve best practice stormwater quality outcomes and to incorporate the use of water sensitive urban design.

Table 4: Stormwater

ID	Category/Item	Project Response	Responsibility
sto-1	Urban Stormwater Best Practice Water Sensitive Urban Design	Best practice WSUD will be achieved through the following initiatives. Rainwater harvesting: ”Clean” roof catchment: Average of 60sqm per townhouse Total volume of rainwater tanks: 2,000 litres per townhouse Connect to all toilets and landscape irrigation within each lot. Include mains backup of the system. WSUD initiatives (other than rainwater harvesting): Rain gardens: 55sqm (min) with 5,430sqm (approx) catchment. Rain gardens should be positioned to capture and treat external car park and driveway areas. In addition, the best practice WSUD concept includes a proprietary stormwater filtration system to treat a portion of the flow for total nitrogen and total phosphorus before stormwater is discharged from the site. Refer to Appendix C for further details.	Design: • Arch: Rainwater tank location • Arch: Liaise/document downpipes to tank • Hyd-Des: Liaise/document downpipes to tank • Hyd-Des: Rainwater tank documentation • Hyd-Des: Rainwater distribution system • Civil-Eng: Liaise and integrate the rain gardens • L’scape-Des: Liaise and integrate the rain gardens Construction: • Bldr • Hyd-Inst • Bldr • L’scape-Inst Operation: • Hyd-Maint: Rainwater system maintenance • L’scape-Maint: Maintain the rain gardens
sto-2	Management of peak stormwater flows	Monash City Council requires that there is no net increase in stormwater discharged into their drainage network caused by new developments. Pre and post development flows and the required onsite detention is detailed in the separate Stormwater Management Strategy Report by Cardno.	Design: • Civil-Eng: Peak discharge calcs and designs Construction: • Bldr Operation: • N/A

3.5 Indoor environment quality

Objective: Improving the indoor environment quality at home and in the workplace will generally enhance well-being and reduce the likelihood of ill-health. Through the implementation of passive design principles, good indoor environment quality also leads to energy savings due to reduced energy demands for heating, cooling and artificial lighting.

Table 5: Indoor environment quality (IEQ)

ID	Category/Item	Project Response	Responsibility
ieq-1	Daylight	63% of living areas are oriented to the north. The daylighting design of the project extends well beyond best practice and is an excellent result.	Design: - Arch - ESD Construction: - Bldr Operation: - N/A
ieq-2	Thermal comfort	Note that BCA compliance also ensures reasonable levels of insulation and therefore moderated indoor surface temperatures that improve indoor comfort. Natural ventilation is also assessed via the BCA methodology to ensure a degree of natural cooling of the apartments.	Design: - Arch - ESD Construction: - Bldr Operation: - N/A
ieq-3	Daylight	Direct access to natural daylight for all bedrooms and kitchen/living rooms has been provided; this daylight access is in excess of the BCA requirements.	Design: - Arch Construction: - Bldr Operation: - N/A
ieq-4	Low volatile organic compound (VOC) content	The design is to meet the Total Volatile Organic Compound (TVOC) content limits outlined in the Green Star Technical Manual for internal painted surfaces, adhesives, sealants, floor/wall/ceiling coatings, floor coverings and engineered wood products. Refer to Appendix D for further information.	Design: - Arch Construction: - Bldr Operation: - N/A

3.6 Transport

Objective: To reduce car dependency and to ensure that the built environment is designed to promote the use of public transport, walking and cycling.

Table 6: Transport

ID	Category/Item	Project Response	Responsibility
trn-1	Reduced car dependency	The development affords good access to Brandon Park Shopping Centre and local facilities that provide a wide range of commercial, retail and service facilities within 500m of the development. The development location achieves a Somewhat walkable 68 points out of 100 on walkscore.com. A train station is nearby: Glen Waverley station (3km). Bus routes are located nearby: 693 immediately outside the development providing access from Oakleigh to Belgrave, 724 (200m) on the route from Chadstone Shopping Centre to Ringwood and 902 (400m) SmartBus service from Chelsea in the South via the Eastern Suburbs and Westfield Doncaster through the northern suburbs to Tullamarine. These and other services nearby provide excellent bus infrastructure. Two bicycle trails on the Principle Bicycle Network are accessible: Scotchmans Creek Trail (1km) providing good access to the Principal Cycle Network toward the CBD and Dandenong Creek Trail (3km) through the outer eastern suburbs and beyond.	
trn-2	Bicycle facilities	Bicycle parking exceed the objectives of the Monash Planning Scheme. All townhouses have ample parking space for at least one or two bikes in the garage and it is expected that additional bikes will also be readility accomodated on each premises if needed.	Design: - Arch Construction: - Bldr Operation: - N/A
trn-3	Electric Vehicle Infrastructure	Electric vehicle charging infrastructure including GPO charging within each garage.	Design: - Arch - Elec-Des - Traff-Des Construction: - Bldr - Elec-Inst Operation: - Occupants - Elec-Maint

3.7 Waste

Objective: To ensure waste avoidance, reuse and recycling during the construction and operation stages of the development.

Table 7: Waste

ID	Category/Item	Project Response	Responsibility
was-1	Construction waste manag't plan	Specifications will include a target minimum recycling rate of 80% of demolition and construction waste.	Design: - Arch Construction: - Bldr Operation: - N/A
was-2	Operational waste	Recycling and waste collection occurs within the townhouse with manual transfer to the waste room conveniently located. Recycling facilities should be designed so that they have the same level of convenience for occupants as facilities for landfill waste. A Waste Management Plan (WMP) will be prepared for Authority approval	Design: - Arch - Waste-Des Construction: - Bldr Operation: - Waste-Collect

3.8 Urban Ecology

Objective: Improve the urban ecosystem through the incorporation of vegetation through landscaping.

Table 8: Urban Ecology

ID	Category/Item	Project Response	Responsibility
eco-1	Light pollution	No external light fitting has an upward light output ratio that exceeds 5% (noting that upward lighting that illuminates a surface within the development is not included in the 5% rule). Lighting design is to comply with AS4284 “Control of the Obtrusive Effects of Outdoor Lighting”.	Design: - Elec-Des Construction: - Elec-Inst Operation: - N/A
eco-2	Vegetation	A significant percentage of the total site area (35%) is covered with vegetation.	Design: - L’scape-Des Construction: - L’scape-Inst Operation: - L’scape Maint

3.9 Innovation

Objective: Improve sustainable building performance (e.g. reduced energy and water consumption; reduced pollution and waste; improved and more resilient communities and economies) through innovative design solutions such as: exceeding best practice standards; passive, site and climate responsive design; and identifying synergies.

0. Meeting the aims of an existing credit using a technology or process that is considered innovative.
0. Implementing a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development.
0. Delivering a substantial improvement on the benchmark required to achieve full points.
0. Addressing an Innovation Challenge as defined by the Green Building Council of Australia.
1. Addressing a ‘global sustainability’ issue as covered by other international sustainability rating systems.

Table 9: Innovation

ID	Category/Item	Project Response	Responsibility
inn-1	Materials	Innovation credit points are claimed on BESS for materials because this ESD commitment addresses a ’global sustainability’ challenge covered by other international sustainability rating systems (as per the Green Star approach to innovation as noted in bullet 1 in the introduction to this Section).	Refer to Section 2.10.
inn-2	Construction waste recycling target	Innovation credit points are claimed on BESS for the construction and demolition waste target of 80% because this ESD commitment addresses a ’global sustainability’ challenge covered by other international sustainability rating systems (as per the Green Star approach to innovation as noted in bullet 1 in the introduction to this Section).	Refer to Section 2.07.

3.10 Materials

Objective: To reduce the environmental impacts of materials used by encouraging the use of materials with a favourable lifecycle assessment.

Table 10: Materials

ID	Category/Item	Project Response	Responsibility
mat-1	Sustainable materials	Specify sustainably certified (recycled and plantation) timber only. All timber should be certified through an accredited certification scheme such as the Forrest Stewardship Council (FSC) or the Programme for the Endorsement of Forest Certification (PEFC).	Design: - Arch - Str-Des - Civil-Des - L'scape Des Construction: - Bldr - Civil-Inst - L'scape Inst Operation: - N/A
mat-2	Responsible selection of materials	Materials are to be durable and of low toxicity. Preference should be given to products with recycled content where these meet requirements for efficacy, durability, etc. (e.g. insulation such as fibreglass, recycled aggregate for non-structural applications). Refrigerant ODP to be zero. Insitu concrete to target a minimum of 20% replacement cementitious material such as fly ash or blast furnace slag. These replacement materials are waste products and reduce the embodied energy and CO2 emissions of conventional concrete that uses only Portland cement. This commitment is subject to availability of the replacement material, structural requirements and project management constraints.	Design: - All Construction: - All Operation: - N/A

Appendices

A BESS Report

The BESS printout report follows in this appendix.

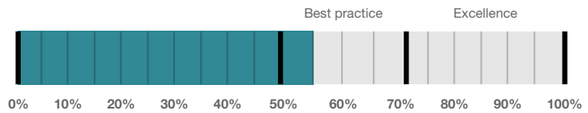
BESS Report

Built Environment Sustainability Scorecard

This BESS report outlines the sustainable design commitments of the proposed development at 583 Ferntree Gully Rd Glen Waverley VIC 3150. The BESS report and accompanying documents and evidence are submitted in response to the requirement for a Sustainable Design Assessment or Sustainability Management Plan at Monash City Council.

Note that where a Sustainability Management Plan is required, the BESS report must be accompanied by a report that further demonstrates the development's potential to achieve the relevant environmental performance outcomes and documents the means by which the performance outcomes can be achieved.

Your BESS Score

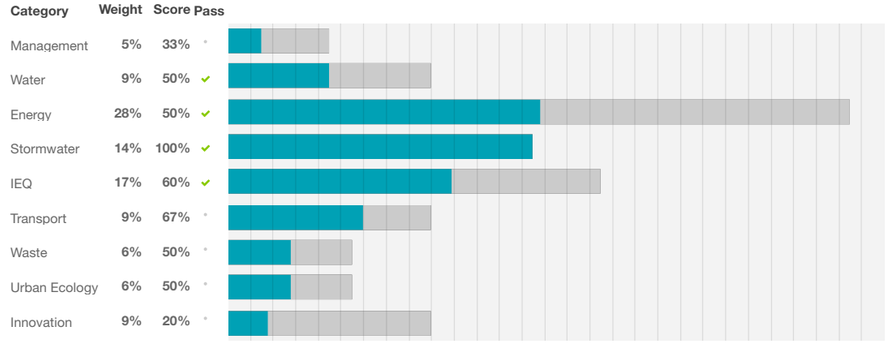


56%

Project details

Address	583 Ferntree Gully Rd Glen Waverley VIC 3150
Project no	F45013CC-R2
BESS Version	BESS-5
Site type	Multi dwelling (dual occupancy, townhouse, villa unit etc)
Account	admin@co-perform.com.au
Application no.	
Site area	16,478 m²
Building floor area	15,027.2 m²
Date	13 August 2021
Software version	1.7.0-B.366

Performance by category



Dwellings & Non Res Spaces

Dwellings

Name	Quantity	Area	% of total area
Townhouse			
Type B4	16	228 m²	24%
Type B6	13	207 m²	17%
Type C1	10	200 m²	13%
Type B1	7	203 m²	9%
Type A3	8	178 m²	9%
Type C2	6	202 m²	8%
Type A1	7	161 m²	7%
Type A2	4	166 m²	4%
Type C2v	4	100 m²	2%
Type C3	2	225 m²	2%
Total	**77**	**15,027 m²**	**100%**

Supporting information

Floorplans & elevation notes

Credit	Requirement	Response	Status
Water 3.1	Water efficient garden annotated	To be printed Refer to landscape plans	✔
Energy 3.4	Clothes line annotated (if proposed)	To be printed Refer to Architectural Ground Floor plans.	✔
Stormwater 1.1	Location of any stormwater management systems used in STORM or MUSIC modelling (e.g. Rainwater tanks, raingarden, buffer strips)	To be printed Refer to Cardno Stormwater Management Report and Architectural Ground Floor plans for tank locations.	✔
IEQ 3.1	Glazing specification to be annotated	To be printed Refer to Appendix B energy Rating Report.	✔
IEQ 3.3	North-facing living areas	To be printed Refer to Architectural Floor Plans.	✔
Transport 1.1	All nominated residential bicycle parking spaces	To be printed Refer to Architectural Ground Floor plans.	✔
Transport 2.1	Location of electric vehicle charging infrastructure	To be printed In garages. To be nominated in detailed design.	✔
Waste 2.1	Location of food and garden waste facilities	To be printed Refer to Architectural Ground Floor plans. 4 bin locations nominated per dwelling.	✔
Urban Ecology 2.1	Vegetated areas	To be printed Refer to Landscape Plans.	✔

Supporting evidence

Credit	Requirement	Response	Status
Management 2.2	Preliminary NatHERS assessments	To be printed Energy Rating Report. Refer to Appendix B energy Rating Report.	✔
Energy 3.5	Provide a written description of the average lighting power density to be installed in the development and specify the lighting type(s) to be used.	To be printed SMP Refer to Section 3.3 item ene-2.	✔
Stormwater 1.1	STORM report or MUSIC model	To be printed Cardno Stormwater Management Report Refer to Cardno Stormwater Management Report	✔
IEQ 3.1	Reference to floor plans or energy modelling showing the glazing specification (U-value and Solar Heat Gain Coefficient, SHGC)	To be printed Architectural Floor Plans Refer to Architectural Floor Plans and Appendix B energy Rating Report. U-values and SHGCs are to be calculated during the design phase.	✔
IEQ 3.3	Reference to the floor plans showing living areas orientated to the north.	To be printed Architectural Floor Plans Refer to Architectural Floor Plans.	✔

Credit summary

Management Overall contribution 4.5%

		33%
1.1 Pre-Application Meeting		0%
2.2 Thermal Performance Modelling - Multi-Dwelling Residential		100%
4.1 Building Users Guide		0%

Water Overall contribution 9.0%

		Minimum required 50%	50% ✔ Pass
1.1 Potable water use reduction			40%
3.1 Water Efficient Landscaping			100%

Energy Overall contribution 27.5%

		Minimum required 50%	50% ✔ Pass
1.2 Thermal Performance Rating - Residential			17%
2.1 Greenhouse Gas Emissions			100%
2.2 Peak Demand			0%
2.3 Electricity Consumption			100%
2.4 Gas Consumption			100%
2.5 Wood Consumption			N/A ⊖ Scoped Out
			No wood heating system present
3.2 Hot Water			100%
3.3 External Lighting			0%
3.4 Clothes Drying			100%
3.5 Internal Lighting - Residential Single Dwelling			100%
4.4 Renewable Energy Systems - Other			N/A ⊘ Disabled
			No other (non-solar PV) renewable energy is in use.
4.5 Solar PV - Houses and Townhouses			N/A ⊘ Disabled
			No solar PV renewable energy is in use.

Stormwater Overall contribution 13.5%

		Minimum required 100%	100% ✔ Pass
1.1 Stormwater Treatment			100%

IEQ Overall contribution 16.5%

		Minimum required 50%	60% ✔ Pass
2.2 Cross Flow Ventilation			0%
3.1 Thermal comfort - Double Glazing			100%
3.2 Thermal Comfort - External Shading			0%
3.3 Thermal Comfort - Orientation			100%

Transport Overall contribution 9.0%

		67%
1.1 Bicycle Parking - Residential		100%
1.2 Bicycle Parking - Residential Visitor		0%
2.1 Electric Vehicle Infrastructure		100%

Waste **Overall contribution 5.5%**

	50%
1.1 - Construction Waste - Building Re-Use	0%
2.1 - Operational Waste - Food & Garden Waste	100%

Urban Ecology **Overall contribution 5.5%**

	50%
2.1 Vegetation	100%
2.2 Green Roofs	0%
2.3 Green Walls and Facades	0%
2.4 Private Open Space - Balcony / Courtyard Ecology	0%
3.1 Food Production - Residential	0%

Innovation **Overall contribution 9.0%**

	20%
1.1 Innovation	20%

Credit breakdown

Management Overall contribution 1%

1.1 Pre-Application Meeting		0%
Score Contribution	This credit contributes 50.0% towards the category score.	
Criteria	Has an ESD professional been engaged to provide sustainability advice from schematic design to construction? AND Has the ESD professional been involved in a pre-application meeting with Council?	
Question	Criteria Achieved ?	
Project	No	
2.2 Thermal Performance Modelling - Multi-Dwelling Residential		100%
Score Contribution	This credit contributes 33.3% towards the category score.	
Criteria	Have preliminary NatHERS ratings been undertaken for all thermally unique dwellings?	
Question	Criteria Achieved ?	
Townhouse	Yes	
4.1 Building Users Guide		0%
Score Contribution	This credit contributes 16.7% towards the category score.	
Criteria	Will a building users guide be produced and issued to occupants?	
Question	Criteria Achieved ?	
Project	No	

Water Overall contribution 4% Minimum required 50%

Water Approach	
What approach do you want to use Water?:	Use the built in calculation tools
Project Water Profile Question	
Do you have a reticulated third pipe or an on-site water recycling system?:	No
Are you installing a swimming pool?:	No
Are you installing a rainwater tank?:	Yes
Water fixtures, fittings and connections	
Showerhead:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	3 Star WELS (>= 6.0 but <= 7.5)
Type C2v	-
Bath:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	Scope out
Type C2v	-
Kitchen Taps:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	>= 4 Star WELS rating
Type C2v	-

Bathroom Taps:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	>= 5 Star WELS rating
Type C2v	-
Dishwashers:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	>= 4 Star WELS rating
Type C2v	-
WC:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	>= 4 Star WELS rating
Type C2v	-
Urinals:	
Type A1 Type A2 Type A3 Type B1 Type B4 Type B6 Type C1 Type C2 Type C3	Scope out
Type C2v	-

Washing Machine Water Efficiency:	
Type A1	>= 4 Star WELS rating
Type A2	
Type A3	
Type B1	
Type B4	
Type B6	
Type C1	
Type C2	
Type C3	
Type C2v	-
Which non-potable water source is the dwelling/space connected to?:	
Type A1	Individual dwellings
Type A2	
Type A3	
Type B1	
Type B4	
Type B6	
Type C1	
Type C2	
Type C3	
Type C2v	-
Non-potable water source connected to Toilets:	
Type A1	Yes
Type A2	
Type A3	
Type B1	
Type B4	
Type B6	
Type C1	
Type C2	
Type C3	
Type C2v	-
Non-potable water source connected to Laundry (washing machine):	
Type A1	No
Type A2	
Type A3	
Type B1	
Type B4	
Type B6	
Type C1	
Type C2	
Type C3	
Type C2v	-

Non-potable water source connected to Hot Water System:	
Type A1	No
Type A2	
Type A3	
Type B1	
Type B4	
Type B6	
Type C1	
Type C2	
Type C3	
Type C2v	-
Rainwater Tank	
What is the total roof area connected to the rainwater tank?: Individual dwellings	4,770 m²
Tank Size: Individual dwellings	164,000 Litres
Irrigation area connected to tank: Individual dwellings	2,600 m²
Is connected irrigation area a water efficient garden?: Individual dwellings	No
Other external water demand connected to tank?: Individual dwellings	-

1.1 Potable water use reduction		40%
Score Contribution	This credit contributes 83.3% towards the category score.	
Criteria	What is the reduction in total potable water use due to efficient fixtures, appliances, rainwater use and recycled water use? To achieve points in this credit there must be >25% potable water reduction.	
Output	Reference	
Project	17172 kL	
Output	Proposed (excluding rainwater and recycled water use)	
Project	13165 kL	
Output	Proposed (including rainwater and recycled water use)	
Project	10600 kL	
Output	% Reduction in Potable Water Consumption	
Project	38 %	
Output	% of connected demand met by rainwater	
Project	84 %	
Output	How often does the tank overflow?	
Project	Often	
Output	Opportunity for additional rainwater connection	
Project	4745 kL	

3.1 Water Efficient Landscaping		100%
Score Contribution	This credit contributes 16.7% towards the category score.	
Criteria	Will water efficient landscaping be installed?	
Question	Criteria Achieved ?	
Project	Yes	

Energy

Overall contribution 14% Minimum required 50%

Dwellings Energy Approach	
What approach do you want to use for Energy?:	Use the built in calculation tools
Project Energy Profile Question	
Are you installing a solar photovoltaic (PV) system?:	No
Are you installing any other renewable energy system(s)?:	No
Gas supplied into building:	Natural Gas
Dwelling Energy Profiles	
Below the floor is: All	Ground or Carpark
Above the ceiling is: All	Outside
Exposed sides:	
Type A1 Type A2 Type B1 Type B6 Type C2	2
Type A3 Type B4 Type C1 Type C3 Type C2v	3
NatHERS Annual Energy Loads - Heat:	
Type A1	83.1 MJ/sqm
Type A2	98.0 MJ/sqm
Type A3	107 MJ/sqm
Type B1	81.9 MJ/sqm
Type B4	91.7 MJ/sqm
Type B6	89.3 MJ/sqm
Type C1	85.9 MJ/sqm
Type C2	79.4 MJ/sqm
Type C3	93.1 MJ/sqm
Type C2v	87.3 MJ/sqm
NatHERS Annual Energy Loads - Cool:	
Type A1	20.3 MJ/sqm
Type A2	19.0 MJ/sqm
Type A3	17.9 MJ/sqm
Type B1	12.9 MJ/sqm
Type B4	18.0 MJ/sqm
Type B6	13.1 MJ/sqm
Type C1	12.5 MJ/sqm
Type C2	17.0 MJ/sqm
Type C3	21.0 MJ/sqm
Type C2v	18.7 MJ/sqm

NatHERS star rating:	
Type A1 Type B6	6.6
Type A2	6.2
Type A3	6.0
Type B1 Type C2	6.8
Type B4	6.4
Type C1	6.7
Type C3	6.3
Type C2v	6.5
Type of Heating System: All	D Reverse cycle space
Heating System Efficiency: All	2 Star
Type of Cooling System: All	Refrigerative space
Cooling System Efficiency: All	2 Stars
Type of Hot Water System: All	J Gas Instantaneous 6 star
% Contribution from solar hot water system: All	0 %
Is the hot water system shared by multiple dwellings?: All	No
Clothes Line: All	F Other permanent indoor in dwelling with 4 metres/bedroom
Clothes Dryer: All	G Clothes dryer 2 stars

1.2 Thermal Performance Rating - Residential		17%
Score Contribution	This credit contributes 30.0% towards the category score.	
Criteria	What is the average NatHERS rating?	
Output	Average NATHERS Rating (Weighted)	
Townhouse	6.5 Stars	

2.1 Greenhouse Gas Emissions		100%
Score Contribution	This credit contributes 10.0% towards the category score.	
Criteria	What is the % reduction in annual greenhouse gas emissions against the benchmark?	
Output	Reference Building with Reference Services (BCA only)	
Townhouse	724,774 kg CO2	
Output	Proposed Building with Proposed Services (Actual Building)	
Townhouse	260,807 kg CO2	
Output	% Reduction in GHG Emissions	
Townhouse	64 %	

2.2 Peak Demand		0%
Score Contribution	This credit contributes 5.0% towards the category score.	
Criteria	What is the % reduction in the instantaneous (peak-hour) demand against the benchmark?	
Output	Peak Thermal Cooling Load - Baseline	
Townhouse	1,044 kW	
Output	Peak Thermal Cooling Load - Proposed	
Townhouse	1,019 kW	
Output	Peak Thermal Cooling Load - % Reduction	
Townhouse	2 %	

2.3 Electricity Consumption		100%
Score Contribution	This credit contributes 10.0% towards the category score.	
Criteria	What is the % reduction in annual electricity consumption against the benchmark?	
Output	Reference	
Townhouse	640,592 kWh	
Output	Proposed	
Townhouse	209,354 kWh	
Output	Improvement	
Townhouse	67 %	

2.4 Gas Consumption		100%
Score Contribution	This credit contributes 10.0% towards the category score.	
Criteria	What is the % reduction in annual gas consumption against the benchmark?	
Output	Reference	
Townhouse	1,388,535 MJ	
Output	Proposed	
Townhouse	919,556 MJ	
Output	Improvement	
Townhouse	33 %	

2.5 Wood Consumption		N/A ✧ Scoped Out
This credit was scoped out	No wood heating system present	

3.2 Hot Water		100%
Score Contribution	This credit contributes 5.0% towards the category score.	
Criteria	What is the % reduction in annual hot water system energy use (gas and electricity) against the benchmark?	
Output	Reference	
Townhouse	385,704 kWh	
Output	Proposed	
Townhouse	258,909 kWh	
Output	Improvement	
Townhouse	32 %	

3.3 External Lighting		0%
Score Contribution	This credit contributes 5.0% towards the category score.	
Criteria	Is the external lighting controlled by a motion detector?	
Question	Criteria Achieved ?	
Townhouse	No	
3.4 Clothes Drying		100%
Score Contribution	This credit contributes 5.0% towards the category score.	
Criteria	Does the combination of clothes lines and efficient dryers reduce energy (gas+electricity) consumption by more than 10%?	
Output	Reference	
Townhouse	57,412 kWh	
Output	Proposed	
Townhouse	19,462 kWh	
Output	Improvement	
Townhouse	66 %	
3.5 Internal Lighting - Residential Single Dwelling		100%
Score Contribution	This credit contributes 5.0% towards the category score.	
Criteria	Does the development achieve a maximum illumination power density of 4W/sqm or less?	
Question	Criteria Achieved ?	
Townhouse	Yes	
4.4 Renewable Energy Systems - Other		N/A ⊘ Disabled
This credit is disabled	No other (non-solar PV) renewable energy is in use.	
4.5 Solar PV - Houses and Townhouses		N/A ⊘ Disabled
This credit is disabled	No solar PV renewable energy is in use.	

Stormwater Overall contribution 14% Minimum required 100%

Which stormwater modelling are you using?:	MUSIC or other modelling software	
1.1 Stormwater Treatment		100%
Score Contribution	This credit contributes 100.0% towards the category score.	
Criteria	Has best practice stormwater management been demonstrated?	
Question	Flow (ML/year)	
Project	15.0 % Reduction	
Question	Total Suspended Solids (kg/year)	
Project	85.4 % Reduction	
Question	Total Phosphorus (kg/year)	
Project	49.0 % Reduction	
Question	Total Nitrogen (kg/year)	
Project	63.4 % Reduction	

IEQ Overall contribution 10% Minimum required 50%

2.2 Cross Flow Ventilation		0%
Score Contribution	This credit contributes 20.0% towards the category score.	
Criteria	Are all habitable rooms designed to achieve natural cross flow ventilation?	
Question	Criteria Achieved ?	
Townhouse	No	
3.1 Thermal comfort - Double Glazing		100%
Score Contribution	This credit contributes 40.0% towards the category score.	
Criteria	Is double glazing (or better) used to all habitable areas?	
Question	Criteria Achieved ?	
Townhouse	Yes	
3.2 Thermal Comfort - External Shading		0%
Score Contribution	This credit contributes 20.0% towards the category score.	
Criteria	Is appropriate external shading provided to east, west and north facing glazing?	
Question	Criteria Achieved ?	
Townhouse	No	
3.3 Thermal Comfort - Orientation		100%
Score Contribution	This credit contributes 20.0% towards the category score.	
Criteria	Are at least 50% of living areas orientated to the north?	
Question	Criteria Achieved ?	
Townhouse	Yes	

BESS, 583 Ferntree Gully Rd Glen Waverley 3150

Transport Overall contribution 6%

1.1 Bicycle Parking - Residential	100%
Score Contribution	This credit contributes 33.3% towards the category score.
Criteria	Is there at least one secure bicycle space per dwelling?
Annotation	There appears to be an anomaly in the BESS tool. There are 2 columns: townhouse and townhouse. BESS requires 1 bicycle park per dwelling, there are 81 dwellings but each of the "townhouse" columns has a target of 81 spaces. So it is considered that BESS is duplicating here and we have placed the total number of bike parks (81) in both columns; if we don't do this then BESS penalises the rating and that is inaccurate.
Question	Bicycle Spaces Provided ?
Townhouse	81
Output	Min Bicycle Spaces Required
Townhouse	77

1.2 Bicycle Parking - Residential Visitor	0%
Score Contribution	This credit contributes 33.3% towards the category score.
Criteria	Is there at least one visitor bicycle space per 5 dwellings?
Question	Visitor Bicycle Spaces Provided ?
Townhouse	0

2.1 Electric Vehicle Infrastructure	100%
Score Contribution	This credit contributes 33.3% towards the category score.
Criteria	Are facilities provided for the charging of electric vehicles?
Question	Criteria Achieved ?
Project	Yes

Waste Overall contribution 3%

Section Notes:

1.1 - Construction Waste - Building Re-Use	0%
Score Contribution	This credit contributes 50.0% towards the category score.
Criteria	If the development is on a site that has been previously developed, has at least 30% of the existing building been re-used?
Question	Criteria Achieved ?
Project	No

2.1 - Operational Waste - Food & Garden Waste	100%
Score Contribution	This credit contributes 50.0% towards the category score.
Criteria	Are facilities provided for on-site management of food and garden waste?
Annotation	The municipality has FOGO collection. The plans
Question	Criteria Achieved ?
Project	Yes

BESS, 583 Ferntree Gully Rd Glen Waverley 3150

Urban Ecology Overall contribution 3%

2.1 Vegetation	100%
Score Contribution	This credit contributes 50.0% towards the category score.
Criteria	How much of the site is covered with vegetation, expressed as a percentage of the total site area?
Question	Percentage Achieved ?
Project	35 %

2.2 Green Roofs	0%
Score Contribution	This credit contributes 12.5% towards the category score.
Criteria	Does the development incorporate a green roof?
Question	Criteria Achieved ?
Project	No

2.3 Green Walls and Facades	0%
Score Contribution	This credit contributes 12.5% towards the category score.
Criteria	Does the development incorporate a green wall or facade?
Question	Criteria Achieved ?
Project	No

2.4 Private Open Space - Balcony / Courtyard Ecology	0%
Score Contribution	This credit contributes 12.5% towards the category score.
Criteria	Is there a tap and floor waste on every balcony / in every courtyard?
Question	Criteria Achieved ?
Townhouse	No

3.1 Food Production - Residential	0%
Score Contribution	This credit contributes 12.5% towards the category score.
Criteria	Is there at least 0.25m² of space per resident dedicated to food production?
Question	Food Production Area
Townhouse	0.0 m²
Output	Min Food Production Area
Townhouse	65 m²

The Built Environment Sustainability Scorecard is an initiative of the Council Alliance for a Sustainable Built Environment (CASBE).
For more details see **www.bess.net.au**

Innovation Overall contribution 2%

Innovations		
Description:		
Materials	Innovation credit points are claimed on BESS for materials because this ESD commitment addresses a 'global sustainability' challenge covered by other international sustainability rating systems (as per the Green Star approach to innovation).	
Demolition and construction waste target	Innovation credit points are claimed on BESS for the construction and demolition waste target of 80% because this ESD commitment addresses a 'global sustainability' challenge covered by other international sustainability rating systems (as per the Green Star approach to innovation	
Points Targeted:		
Materials	1	
Demolition and construction waste target	1	
1.1 Innovation		20%
Score Contribution	This credit contributes 100.0% towards the category score.	
Criteria	What percentage of the Innovation points have been claimed (10 points maximum)?	

Disclaimer

The Built Environment Sustainability Scorecard (BESS) has been provided for the purpose of information and communication. While we make every effort to ensure that material is accurate and up to date (except where denoted as 'archival'), this material does in no way constitute the provision of professional or specific advice. You should seek appropriate, independent, professional advice before acting on any of the areas covered by BESS.

The Municipal Association of Victoria (MAV) and CASBE (Council Alliance for a Sustainable Built Environment) member councils do not guarantee, and accept no legal liability whatsoever arising from or connected to, the accuracy, reliability, currency or completeness of BESS, any material contained on this website or any linked sites

B Green Star scorecard

C Energy Rating Report

Energy Rating Analysis Report

1. Introduction

This report outlines the energy rating analysis assessment prepared at the planning approval stage.

This report only relates to the energy ratings of the townhouses as per section 3.12.0 of the Building Code of Australia (BCA). The analysis has targeted BCA compliant energy ratings and, if applicable, any other energy rating objectives of the project as specifically noted in this introduction. This report does not include BCA compliance related to sections other than 3.12.0. This report does not advise on issues such as: fire ratings or combustibility, aesthetics, acoustics, structural integrity, condensation or Australian Standard compliance (e.g. with respect to windows). Referral is recommended to the relevant parties for advice on all aspects other than the BCA section J0.2 energy ratings. If there are changes from the information utilised (section 2) and assumptions used then the energy ratings stated in this report will be invalidated.

An energy rating analysis has been performed on a representative sample of dwellings with the intention of assessing whether the development can meet the project's energy rating objectives as follows:

- ❏ The National Construction Code Volume 1 (Building Code of Australia 2019) Section J Energy Efficiency. Specifically, the following deemed to satisfy provisions:
  - ❏ "Section 3.12.0 - A building must achieve an energy rating, including the separate heating and cooling load limits, using house energy rating software, of greater than or equal to—

    (a)(i) 6 stars; or

    (b) The heating and cooling load limits in (a) are specified in the ABCB Standard for NatHERS Heating and Cooling Load Limits.

This energy rating analysis has utilised First Rate (Version 5) software, which complies with the ABCB Protocol for House Energy Rating Software.

2. Information utilised

This report is based on the following documents prepared by Rothe Lowman Architects:

- ❏ Town Planning Drawing Set.
- ❏ Shading from external structures is included if shown in the above noted documents or if available from internet sources (i.e. Google Maps) as at the date of this report. If not shown in the documents, provisional values have been included as nominated in NatHERS Technical Note version June 2019 (if provisional values are used, then this may adversely affect the energy ratings).

3. Dwelling unit envelope[1] details assumed

Construction details and the related thermal properties plus details of the ventilation and lighting systems are assumed, noting that at the planning stage the architectural information is only conceptual and there is no resolution on lighting and ventilation systems. All details of the thermal performance of construction elements, ventilation and lighting systems will be resolved and confirmed during the design stage, therefore the energy ratings are subject to change.

Assumed construction, ventilation and lighting in order to achieve the minimum requirements defined in section 1 are as follows:

- ❏ Glazing:
  - ❏ All glazing: high efficiency double glazed in aluminium frames.
- ❏ Floors:
  - ❏ Concrete slab on ground.
- ❏ Roofs, terraces and balconies over:
  - ❏ Ceiling below with typical insulation to the ceiling void.
  - ❏ Metal roof with non ventilated roof space and including a roof blanket under the roof sheet and/or insulation at ceiling level.
  - ❏
- ❏ Walls:
  - ❏ All building envelope walls to incorporate R2.5 bulk insulation.
- ❏ Ventilation:
  - ❏ Sealed ventilation fans for the range hood in the kitchen and one fan for the bathroom, ensuite and laundry as applicable.
  - ❏ No unsealed wall vents (generic vents).
- ❏ Downlights:
  - ❏ All downlights that penetrate ceiling insulation are to be sealed against airflow from the dwelling to the ceiling void and are to be certified as suitable for normal use when covered in building insulation (IC4).
- ❏ Weather strips:
  - ❏ All windows and doors to outside are to include weather strips.

4. Results

The energy ratings have been performed on a representative sample of dwellings only in order to test the individual lowest ratings, the collective average and the maximum heating and cooling loads. Therefore, future ratings including additional dwellings may result in the identification of additional dwellings with low ratings and adjustment to the collective average.

[1] This report relates only to the "dwellings" as defined by the BCA. The "envelope" is also defined in the BCA as "the parts of a building's fabric that separate a conditioned space or habitable room from the exterior of the building or a non-conditioned space ..."

The preliminary analysis has resulted in the following ratings:

	Heating MJ	Cooling MJ	Star rating
A1	83.1	20.3	6.6
A2	98.0	19.0	6.2
A3	106.8	17.9	6.0
B1 (average)	81.9	12.9	6.8
B4 (average)	91.7	18.0	6.4
B6 (average)	89.3	13.1	6.6
C1 (average)	85.9	12.5	6.7
C2 (average)	79.4	17.0	6.8
C3 (average)	93.1	21.0	6.3
C2v (average)	87.3	18.7	6.5

In summary, the results are:

- **Collective average energy rating: 6.5 stars.**
- **Individually lowest energy rating: 6.0 stars.**

5. Conclusion and the next step

Conclusion

Based on the preliminary analysis performed and the assumptions noted in section 3, the building concept should be able to meet the requirements detailed in the introduction. That is:

- **All dwellings individually should be able to achieve an energy rating of not less than 6 stars.**

Furthermore, as noted in section 4, the development aims to achieve a collective average energy rating of 6.5 stars.

It is noted that close attention will be required during the design in order to maintain the energy rating performance level to those noted above. Particular items to manage include window areas, glazing system thermal performance, blinds and wall insulation.

D Best practice water sensitive urban design (WSUD)

The following pages show the proposed best practice WSUD and rainwater harvesting concept.
Best practice WSUD has been assessed using the MUSIC (model for urban stormwater improvement conceptualisation) tool. Best practice WSUD will be achieved through the following initiatives.
Rainwater harvesting:

”Clean” roof catchment: Average of 60sqm per townhouse
Total volume of rainwater tanks: 2,000 litres per townhouse
Connect to all toilets and landscape irrigation within each lot.Include mains backup of the system
Complete design, installation, operation and maintenance of the rain water catchment, roof plumbing, storage, pumping, filtration and reticulation systems are to be in accordance with all regulations and industry standards such as (but not limited to): Victorian Building Authority; HB 230-2008 Rainwater Tank Design and Installation Handbook; and all manufacturer recommendations.

WSUD initiatives other than rainwater harvesting:

Rain gardens: 55sqm (min) with 5,430sqm (approx) catchment. Rain gardens should be positioned to capture and treat external car park and driveway areas.
In addition, the best practice WSUD concept includes a proprietary stormwater filtration system to treat a portion of the flow for total nitrogen and total phosphorus before stormwater is discharged from the site.

WSUD extract from Cardno Stormwater Management Report

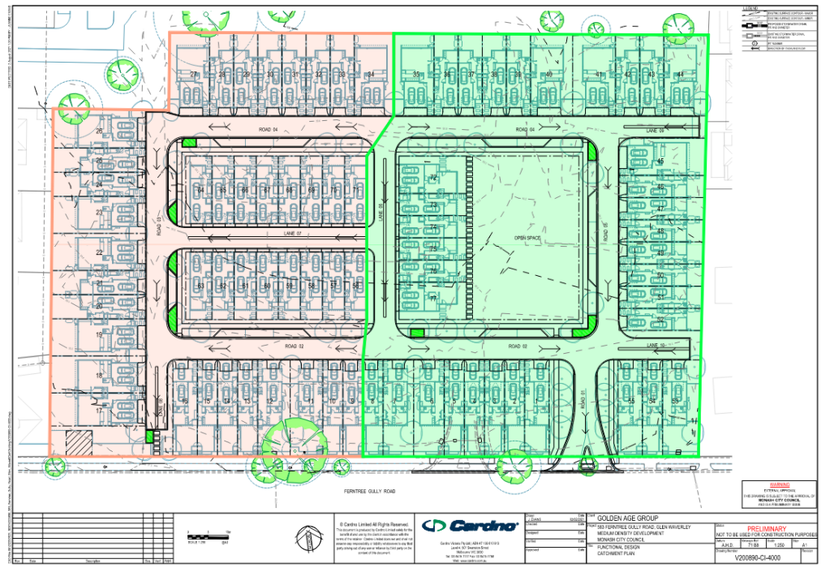


Figure 4: Stormwater Catchment Plan

Based on preliminary road gradings of internal high points and flow paths and development has been divided into two catchments and tabulated below.

	West Catchment	East Catchment	Total
Area	7854 sqm	8624 sqm 8636	16478 sqm
Percentage	47.6%	52.4%	100%

Table 3: Internal Catchments

Water Sensitive Urban Design

The objective of the treatment is to meet best practice Water Sensitive Urban Design as per Clause 53.18 – Stormwater Management in Urban Development planning scheme set down by the Department of Environment, Land, Water and Planning. This is in accordance with Melbourne Water's publication "WSUD Engineering Procedures" which stipulates the following water quality standards as tabulated below.

Pollutant	Target Reduction (of typical urban annual load)
Suspended Solids	80%
Total Nitrogen (TN)	45%
Total Phosphorus (TP)	45%
Typical urban annual litter load	70%

Table 1: Best Practice Water Quality Targets

WSUD extract from Cardno Stormwater Management Report

MUSIC Modelling

A MUSIC analysis (Model for Urban Stormwater Improvement Conceptualisation) was undertaken to estimate the residual pollutant loads generated by the site with the intention of meeting 'Best Practice' water quality objectives. The stormwater treatment devices include:

- Rainwater tanks from roof runoff to reuse onsite for toilet flushing and gardening/landscape irrigation.
- Raingardens to filter contaminants collected from road pavements areas before being discharged
- A proprietary filtration system to treat Total Nitrogen and Total Phosphorus before stormwater is discharged from the site

A typical section of a Raingarden is shown in Figure 5 below.

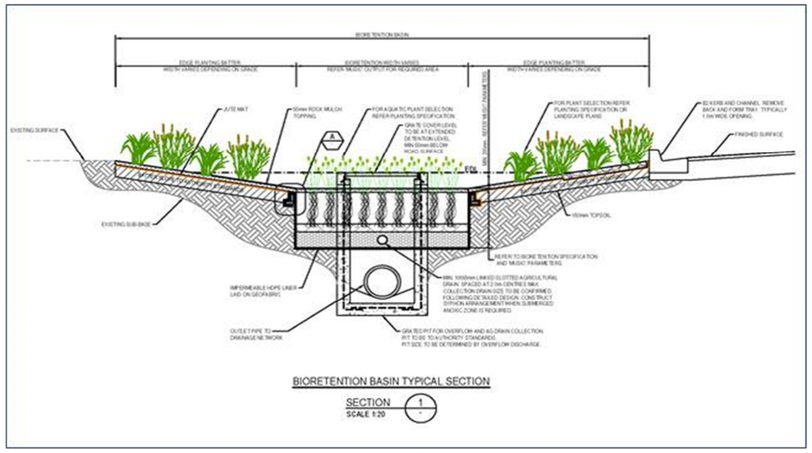


Figure 5: Raingarden Typical Section

The location and order of these proposed treatment devices are shown in the MUSIC model layout below. The model is a concept of the proposed strategy and the exact locations and alignment of these devices will be finalised during detailed design. The outfall node is for computation purposes only and is not reflective of the actual ultimate stormwater discharge point.

WSUD extract from Cardno Stormwater Management Report

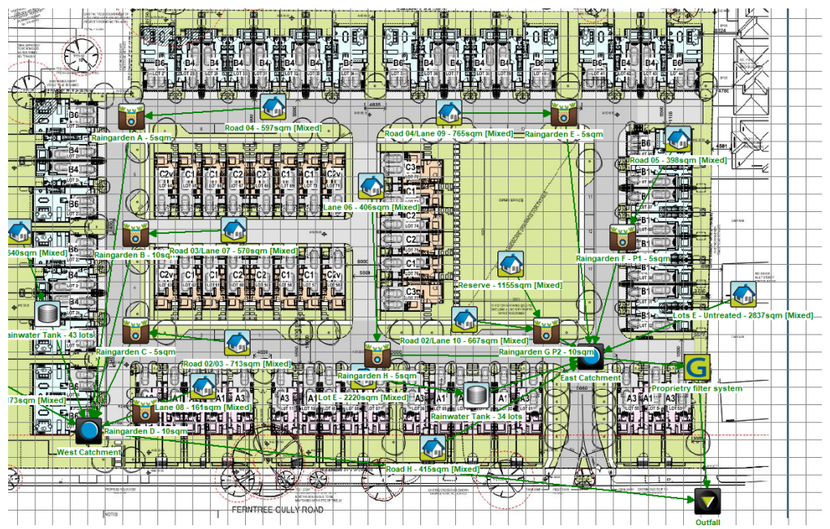


Figure 6: MUSIC Model

In an effort to reduce the demand placed upon mains supply, improve water reuse and reduce outbound pollutant loads, rainwater storage tanks are proposed to capture roof runoff from 77 dwellings. The harvested rainwater shall be used to supplement potable water supply for toilet flushing and irrigation.

The predicted overall annual pollutant residual loading and reduction that will be achieved is shown in figure 7. The MUSIC model confirms that best practice stormwater treatment objectives can be achieved with the proposed stormwater treatment measures described and analysed in this report.

WSUD extract from Cardno Stormwater Management Report

Treatment Train Effectiveness - Outfall

	Sources	Residual Load	% Reduction
Flow (ML/yr)	9.95	8.46	15
Total Suspended Solids (kg/yr)	1420	206	85.4
Total Phosphorus (kg/yr)	3.33	1.36	59
Total Nitrogen (kg/yr)	26.4	9.67	63.4
Gross Pollutants (kg/yr)	258	14.3	94.4

Figure 7: MUSIC Treatment Train Effectiveness

The main parameters used in the MUSIC model are described below:

> Rainfall and Evaporation - A 1990-1999 6 minute time-step data from the Croydon rainfall gauge was used for the model.

> Rainfall Runoff Parameters – The standard rainfall-runoff parameters associated with urban commercial nodes were used in the MUSIC model setup.

> Contributing Catchment Areas inputted as source nodes in MUSIC are as follows:
East Catchment Lot area – 2220m² West Catchment Lot Area – 2640m²
East Catchment Road area – 2412m² West Catchment Road area – 2041m²
East Catchment Untreated area - 2837m² West Catchment untreated area - 3173m²
East Catchment Reserve area - 1155m²

> Rainwater tank Demand Loads – Annual rainwater usage calculated at 22750 litres per dwelling
Monthly dwelling rainwater demand for MUSIC model

Jan	16%	Jul	6%
Feb	13%	Aug	6%
Mar	10%	Sep	6%
Apr	6%	Oct	6%
May	6%	Nov	8%
Jun	6%	Dec	11%

To meet these objectives while adhering to space and logistical limitations of the proposed development, a Stormwater Strategy Plan has been procured to illustrate the proposed treatment devices and locations within the subject site. The stormwater strategy plan incorporates a range of WSUD treatment devices to capture, reuse and treat stormwater run-off. This includes the implementation of a 2kL rainwater tank for each allotment, eight raingardens with a combined surface area of 55m² and on-site stormwater detention. The Plan has been included below in Figure 8.

WSUD extract from Cardno Stormwater Management Report

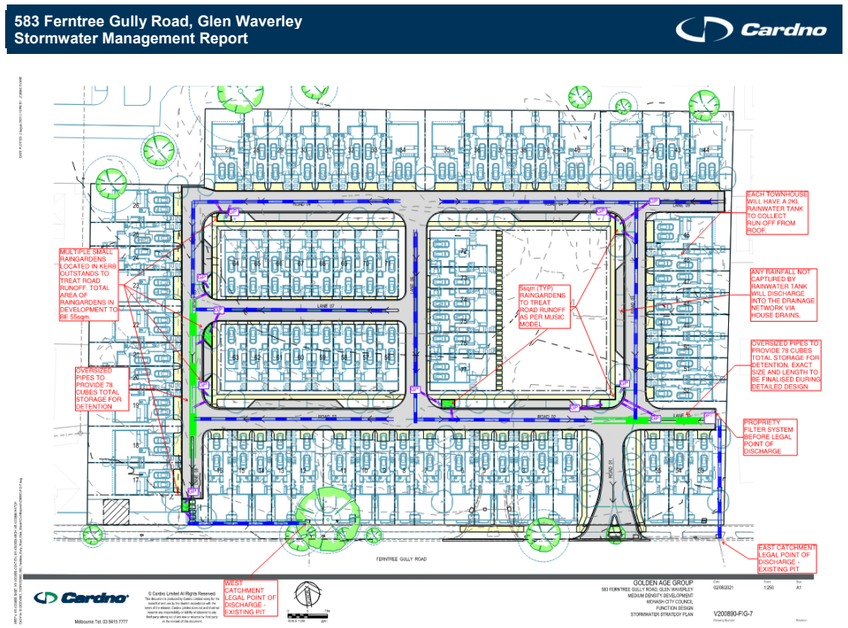


Figure 8: Stormwater Strategy Plan

Rainwater Tanks

A 2kL tank is proposed for each of the 77 townhouses. The ESD consultant Co-Perform has undertaken analysis to determine the level of the tank throughout the year based on typical rainfall. Based on the full roof area (approx. 60sqm) being captured into a 2,000-litre tank, with 1.1 people per bedroom, four toilet flushes per day and also assuming landscape watering the tank annual profile looks like the graph in figure 9 which has been provided by Co-Perform.

WSUD extract from Cardno Stormwater Management Report

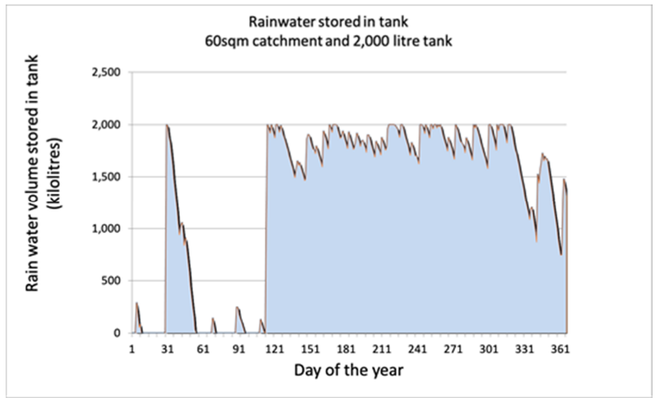


Figure 9: Graph of storage volume in Rainwater tank over a year – Co-Perform Consultants

This indicates that the tank is drained down quickly during periods of low rainfall and especially during the summer months when there is also a demand for landscape watering. This indicates that it is not appropriate to utilise the rainwater tanks for detention system as they are fully utilised for the retention and reuse requirement. The entire detention volume required (78 cubes) will be provided by oversized pipes and not the rainwater tanks.

Recommendations

- To meet the Best Practice Environmental Guidelines (BPEG), bio retention systems totalling 65m² along with a 2kL rainwater tank for every townhouse must be used to provide water quality treatment.
- Incorporate over-sized underground pipes to store 78 cubic metres of volume for on-site detention beneath the road pavement to maintain the pre-development flow into Council's drainage network.
- Council adopts this report as part of the planning permit and accepts the strategy of using two pits as discharge points along the southern boundary to assist in stormwater conveyance and avoid removing a mature tree in the frontage of Ferntree Gully Road.

Conclusion

This report is to support the application for a planning permit with Council to facilitate the development at 583 Ferntree Gully Road for seventy seven medium density townhouses. These dwellings will each have a 2000L rainwater tank for toilet flushing and irrigation but is not suitable for detention storage. The detention volume has been calculated as 78 cubic metres based on the pre-development and post-development flows which have been calculated using OSD4 software and the rational method. Run off from road surfaces shall mainly be treated via raingardens. The stormwater from the eastern portion of the site will also pass through a proprietary filtration system to treat total nitrogen and total phosphorus.

The site falls from north to the south and preliminary road gradings shows no trapped low points within the development, and the strategy is to split the site into two catchments which safely conveys stormwater downstream to the two existing pits nominated as the LPOD.

E Low VOC materials

The maximum TVOC content and emissions limits shall be followed when selecting indoor paints, sealants, adhesives, wall and ceiling coverings.

Maximum TVOC content limits for indoor paints and varnishes

Product type	Max TVOC Content (g/l of ready-to-use product)
Walls and ceilings – interior gloss	75
Walls and ceilings – interior semi gloss	16
Walls and ceilings – interior low sheen	16
Walls and ceilings- interior flat washable	16
Ceilings – interior flat	14
Timber and binding primers	30
Trim – gloss, semi gloss, satin, varnishes and wood stains	75
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors	140
Any indoor solvent-based coatings whose purpose is not covered in this table	200

Maximum TVOC content limits for indoor adhesives and sealants

Product type	Max TVOC Content (g/l of product)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Drywall and panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

Indoor wall and ceiling covering TVOC emissions limits

Product type	Max TVOC Emission Limit (mg/m2 per hour)
TVOC at 3 days	5
TVOC at 28 days	0.5

Engineered Wood Products

The term ”engineered wood products” includes composite wood products and includes raw/ unfinished as well as finished products. Items not covered by these limits include products used in exterior applications, formwork, internal car park applications, reused products, and raw timber. All emission levels must be established by a NATA or ISO/IEC 17025 registered laboratory as per the testing methodologies in the table below.

Formaldehyde emission limit values for engineered wood products

Test Protocol	Emission Limit / Unit of Measurement	Additional Notes
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	< 1.0 mg/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	< 1.0 mg/L	
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	< 1.0 mg/L	
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	< 1.0 mg/L	
JIS A1901 (not applicable to Plywood)	< 1.0 mg/L	
ASTM D5116	<0.1 (+/- 0.0005) mg/m^2hr	Equivalent unit $mg/m^2/hr$.
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	<0.1 (+/- 0.0005) mg/m^2hr	Equivalent unit $mg/m^2/hr$.
ASTM D6007	$0.12mg/m^3$*	
ASTM E1333	$0.12mg/m^3$**	
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)	$3.5\ mg/m^2hr$	Equivalent unit $mg/m^2/hr$.

*The test report must confirm that the conditions of Table 1 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.

**The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

F Glossary and nomenclature

Term	Explanation
Alternative water sources	Alternative sources of use other than high quality potable water deliver delivered to site by the respective water authority. Examples include: rain water harvesting, stormwater harvesting and grey water re-use.
BCA	Building Code of Australia.
BESS	Built Environment Sustainability Scorecard.
COP	Coefficient of Performance. An efficiency measure for cooling based on thermal capacity out versus energy capacity in.
EER	Energy Efficiency Ratio. An efficiency measure for heating based on thermal capacity out versus energy capacity in.
ESD	Ecologically Sustainable Development.
Green Star	Green Star is a national, voluntary environmental rating system that evaluates the environmental design and construction of buildings and communities. For buildings, the Green Star rating tools assess against a number of categories to determine the environmental impact of a project's site selection, design, construction, maintenance, etc. The nine categories include: management, indoor environment quality, energy, transport, water, materials, land use & ecology, emissions, and innovation. In this report, "Green Star" refers to the Green Star – Design & As Built v1.3.
N/A	Not applicable
ODP	Ozone depletion potential
Potable water	Suitable for human consumption, whether used as drinking water or in the preparation of food.
RCM	Resource Conservation Measure
Rain garden	A rain garden is a water saving garden that is similar to a regular garden bed, but is designed specifically to capture stormwater from hard surfaces such as driveways, patios and roofs via downpipes after it rains and to treat the water via bioremediation before it enters the civic drainage system.
SDA	Sustainable Design Assessment.
SDAPP	Sustainable Design Assessment in the Planning Process.
SMP	Sustainability Management Plan
SOU	Sole Occupancy Unit
STORM	Melbourne Water has developed the STORM Calculator as a method of simplifying the analysis of stormwater treatment methods to calculate the amount of treatment that is required to meet best practice targets, using WSUD treatment measures.
VOC	Volatile organic compound.
lpm	Litres per minute.

Term	Explanation
Arch	Architect
Bldr	Builder
Civil-Des	Civil Designer
Civil-Eng	Civil Engineer
ESD	ESD Consultant
Elec-Des	Electrical Designer / Engineer
Elec-Inst	Electrical Installation Contractor
Elec-Maint	Electrical Maintenance Contractor
Hyd-Des	Hydraulic Designer / Engineer
Hyd-Inst	Hydraulic Installation Contractor
Hyd-Maint	Hydraulic Maintenance Contractor
L'scape-Des	Landscape Designer / Consultant
L'scape-Inst	Landscape Installation Contractor
L'scape-Maint	Landscape Maintenance Contractor
Mech-Des	Mechanical Designer / Engineer
Mech-Inst	Mechanical Installation Contractor
Mech-Maint	Mechanical Maintenance Contractor
Occupants	Building occupants
PM	Project Manager
Traff-Des	Traffic Engineer
Waste-Collect	Waste Collection Contractor
Waste-Des	Waste Designer / Consultant