PROPOSED MIXED USE DEVELOPMENT

139-149 Boundary Road, North Melbourne

SUSTAINABLE MANAGEMENT PLAN

&

WATER SENSITIVE URBAN DESIGN RESPONSE

FOR

BEG DEVELOPMENTS PTY LTD

28 March 2023

File 701BO

ark resources

CONTENTS

APPENDICES

Issue	Date	Prepared	Approved	Status
A	4 December 2019	LD / MT / DC	JT	Draft
B	9 December 2019	LD / MT / DC	JT	Draft
C	10 December 2019	LD / MT / DC	JT	Draft
D	16 December 2019	LD / MT / DC	JT	Final
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1. Executive Summary

The proposed mixed-use development at 139-149 Boundary Road, North Melbourne has been designed to meet the objectives of the City of Melbourne's Energy, Water & Waste Efficiency and Water Sensitive Urban Design Policies (Clauses 22.19, 22.23 and 53.18 of the Planning Scheme).

The analysis set out in this report demonstrates that the proposed development achieves a Best Practice environmental design standard and is consistent with the City of Melbourne's Eco City goals for residents in relation to the reduction of operational greenhouse emissions & water consumption.

This report confirms that a combination of sustainable building management practices, design initiatives, fixtures, systems, appliances, materials and finishes will be integrated into the building in order to attain a 5 star Green Star Design & As Built performance standard.

The standard achieved is defined as Australian Excellence in terms of environmental design and is consistent with the City of Melbourne's Eco City goals for residents in relation to the reduction of operational greenhouse emissions & water consumption.

The development also meets the Best Practice standard for Urban Stormwater Quality and is therefore also consistent with the City of Melbourne's Water Sensitive Urban Design objectives.

The performance outcomes achieved by the proposed development demonstrate that the proposed development meets the sustainable design objectives of Clauses 22.19, 22.23 and 53.18 of the Melbourne Planning Scheme, as well as Condition 30 of the Planning Permit [No. PA1900753-1].

2. Introduction

Ark Resources has been engaged by BEG Developments Pty Ltd to provide advice in relation to environmentally sustainable development outcomes from the proposed mixed-use development at 139-149 Boundary Road, North Melbourne.

This report contains a summary of:

- Environmental objectives adopted for the development; and
- Sustainable design initiatives integrated into the design of the project.

Performance outcomes in this report are based on:

- Architectural plans prepared CHT Architects set out below, and landscape plans prepared by Tract Consultants dated 2nd March 2023.

Description	Drawing No.	Revision	Date
COVER SHEET	TP0.00	F	24/11/2022
DEVELOPMENT SUMMARY 01	TP0.01	G	3/12/2021
DEVELOPMENT SUMMARY 02	TP0.02	F	22/09/2021
SITE PLAN	TP1.01	E	22/09/2021
BASEMENT 02	TP2.00	F	24/11/2022
BASEMENT 01	TP2.01	F	24/11/2022
LOWER GROUND FLOOR PLAN	TP2.03	F	24/11/2022
UPPER GROUND FLOOR PLAN	TP2.04	F	24/11/2022
LEVEL 01	TP2.05	F	24/11/2022
LEVEL 02	TP2.06	F	24/11/2022
LEVEL 03	TP2.07	F	24/11/2022
LEVEL 04	TP2.08	F	24/11/2022
LEVEL 05	TP2.09	F	24/11/2022
LEVEL 06	TP2.10	F	24/11/2022
LEVEL 07	TP2.11	F	24/11/2022
LEVEL 08	TP2.12	F	24/11/2022
LEVEL 09	TP2.13	F	24/11/2022
LEVEL 10	TP2.14	F	24/11/2022
LEVEL 11	TP2.15	F	24/11/2022
ROOF	TP2.16	F	24/11/2022
BOUNDARY ROAD FACADE - DETAIL PLAN - A	TP2.17A	F	24/11/2022
BOUNDARY ROAD FACADE - DETAIL PLAN - B	TP2.17B	F	24/11/2022
BOUNDARY ROAD FACADE - DETAIL ELEVATION	TP2.18A	E	24/11/2022
BOUNDARY ROAD FACADE - DETAIL ELEVATION	TP2.18B	E	24/11/2022
APARTMENT DESIGN GUIDELINES 01 - TOWNHOUSES	TP2.20	F	24/11/2022
APARTMENT DESIGN GUIDELINES 02 - APARTMENTS	TP2.21	F	24/11/2022
APARTMENT DESIGN GUIDELINES 03 - APARTMENTS	TP2.22	F	24/11/2022
APARTMENT DESIGN GUIDELINES 04 - APARTMENTS	TP2.23	F	24/11/2022
APARTMENT DESIGN GUIDELINES 05 - APARTMENTS	TP2.24	F	24/11/2022

Description	Drawing No.	Revision	Date
APARTMENT DESIGN GUIDELINES 06 - APARTMENTS	TP2.25	F	24/11/2022
APARTMENT DESIGN GUIDELINES 07 - APARTMENTS	TP2.26	F	24/11/2022
APARTMENT DESIGN GUIDELINES 08 - APARTMENTS	TP2.27	F	24/11/2022
APARTMENT DESIGN GUIDELINES 09 - APARTMENTS	TP2.28	F	24/11/2022
APARTMENT DESIGN GUIDELINES 10 - APARTMENTS	TP2.29	F	24/11/2022
APARTMENT DESIGN GUIDELINES 11 - APARTMENTS	TP2.30	F	24/11/2022
APARTMENT DESIGN GUIDELINES 12 - APARTMENTS	TP2.31	F	24/11/2022
APARTMENT DESIGN GUIDELINES 13 - APARTMENTS	TP2.32	F	24/11/2022
APARTMENT DESIGN GUIDELINES 14 - APARTMENTS	TP2.33	F	24/11/2022
APARTMENT DESIGN GUIDELINES 15 - APARTMENTS	TP2.34	F	24/11/2022
APARTMENT DESIGN GUIDELINES ASSESSMENT	TP2.35	F	24/11/2022
APARTMENT DESIGN GUIDELINES ASSESSMENT	TP2.36	F	24/11/2022
ELEVATIONS	TP3.00	F	24/11/2022
ELEVATIONS	TP3.01	F	24/11/2022
ELEVATIONS	TP3.02	F	24/11/2022
ELEVATIONS	TP3.03	F	24/11/2022
ELEVATIONS	TP3.05	F	24/11/2022
ELEVATIONS	TP3.06	F	24/11/2022
SECTION A-A	TP4.01	F	24/11/2022
SECTION B-B	TP4.02	F	24/11/2022
SECTION C-C	TP4.03	F	24/11/2022
SECTION D-D	TP4.04	F	24/11/2022
SECTION E-E	TP4.05	F	24/11/2022
SECTION F-F	TP4.06	F	24/11/2022
EQUITABLE DEVELOPMENT RIGHTS	TP5.01	D	22/09/2021
SHADOW DIAGRAMS	TP6.00	D	22/09/2021
SHADOW DIAGRAMS	TP6.01	D	22/09/2021
POWERLINE SAG & SWAY	TP7.00	F	24/11/2022

3. Relevant Policy Requirements

Clause 22.19 Energy, Water and Waste Efficiency of the Melbourne Planning Scheme is applicable to permit applications that propose the construction of new residential buildings. Clause 22.19-2 cites the following relevant policy objectives:

- *To ensure buildings achieve high environmental performance standards at the design, construction and operation phases.*
- *To minimise the city's contribution to climate change impacts by reducing greenhouse gas emissions.*
- *To improve the water efficiency of buildings and encourage the use of alternative water sources.*
- *To minimise the quantity of waste going to landfill and maximise the recycling and reuse of materials.*
- *To minimise the impacts of waste on the community.*
- *To encourage the connection of buildings to available or planned district energy, water and waste systems in urban renewal areas on order to achieve additional energy, water and waste efficiency arising from a precinct-wide approach to infrastructure where appropriate.*

In the context of these objectives, Clause 22.19-3 states that it is policy to:

- *Minimise greenhouse gas emissions and maximise energy efficiency.*
- *Minimise mains potable water consumption and encourage the use of alternative water sources, such as rainwater and grey water.*
- *Provide the facilities that will enable building users and occupants to reduce waste sent to landfill maximise the recycling and reuse of materials and support the municipality's progress towards becoming a resource and material-efficient city.*

Clause 22.19-5 also states that it is policy to assess proposals against a suite of performance measures. In relation to proposals for accommodation over 5,000m^2 of gross floor area, the performance measures are the same minimum energy, water and waste requirements as for a building under 5,000m^2 and a 5 star rating under a current version of Green Star – Multi Unit Residential rating tool or equivalent.

The supporting notes in Clause 22.19 also state that:

- *Applications for development may use alternative rating tools or assessment methods provide that equivalence of the development to the performance measures listed in the table can be demonstrated.*

And that:

- *Proposals that do not meet these performance measures may still meet the objectives of this policy.*

Clause 22.19-6 relates to Urban Renewal Areas, with the relevant policy requirement that:

- *Land developments within the urban renewal area must be able to connect to available or future alternative water and energy supplies, and waste collection and treatment systems.*

This development is not considered to be at precinct scale and therefore the alternative district measures in Clause 22.19-6 are not applicable.

Clauses 53.18-5 and 53.18-6 are relevant to this development and the objectives and standards are met through the demonstration of Best Practice standards for Urban Stormwater Quality through MUSIC modelling and the inclusion of a Site Management Plan.

4. Site Description

The proposed development comprises:

- 271 residential apartments with 440 bedrooms, and 5 three bedroom townhouses;
- Retail tenancies with a total NLA of approximately 243m^2; and
- Communal residents' facilities, gardens and amenities

The building comprises the following uses:

Level	Use
Basement 02	• Carparking, bicycle parking, storage, waste rooms, car wash and dog wash
Basement 01	• Carparking, bicycle parking, storage
Lower ground	• 5 townhouses (15 bedrooms), Japanese garden, carparking, bicycle parking, services
Ground Floor	• 4 Apartments (8 bedrooms), Retail tenancies & Cafe, residential lobby, resident's facilities, communal gardens, Japanese garden, public plaza, visitor bicycle parking
First Floor	• 26 Apartments (42 bedrooms)
Second Floor	• 27 Apartments (44 bedrooms)
Third Floor	• 27 Apartments (44 bedrooms)
Fourth Floor	• 27 Apartments (44 bedrooms)
Fifth Floor	• 27 Apartments (44 bedrooms)
Sixth Floor	• 23 Apartments (39 bedrooms)
Seventh Floor	• 23 Apartments (39 bedrooms)
Eight Floor	• 23 Apartments (39 bedrooms)
Ninth Floor	• 23 Apartments (39 bedrooms)
Tenth Floor	• 23 Apartments (39 bedrooms)
Eleventh Floor	• 12 Apartments (20 bedrooms), roof garden, solar PV system
Roof	• Roof plant

The site is located within the City of Melbourne.

The development has a site area of approximately 4,548 m^2 and currently contains a single single-storey commercial building and carpark. The surrounding buildings are a mix of residential and commercial uses.

An image of the site and the surrounding locale is shown below.

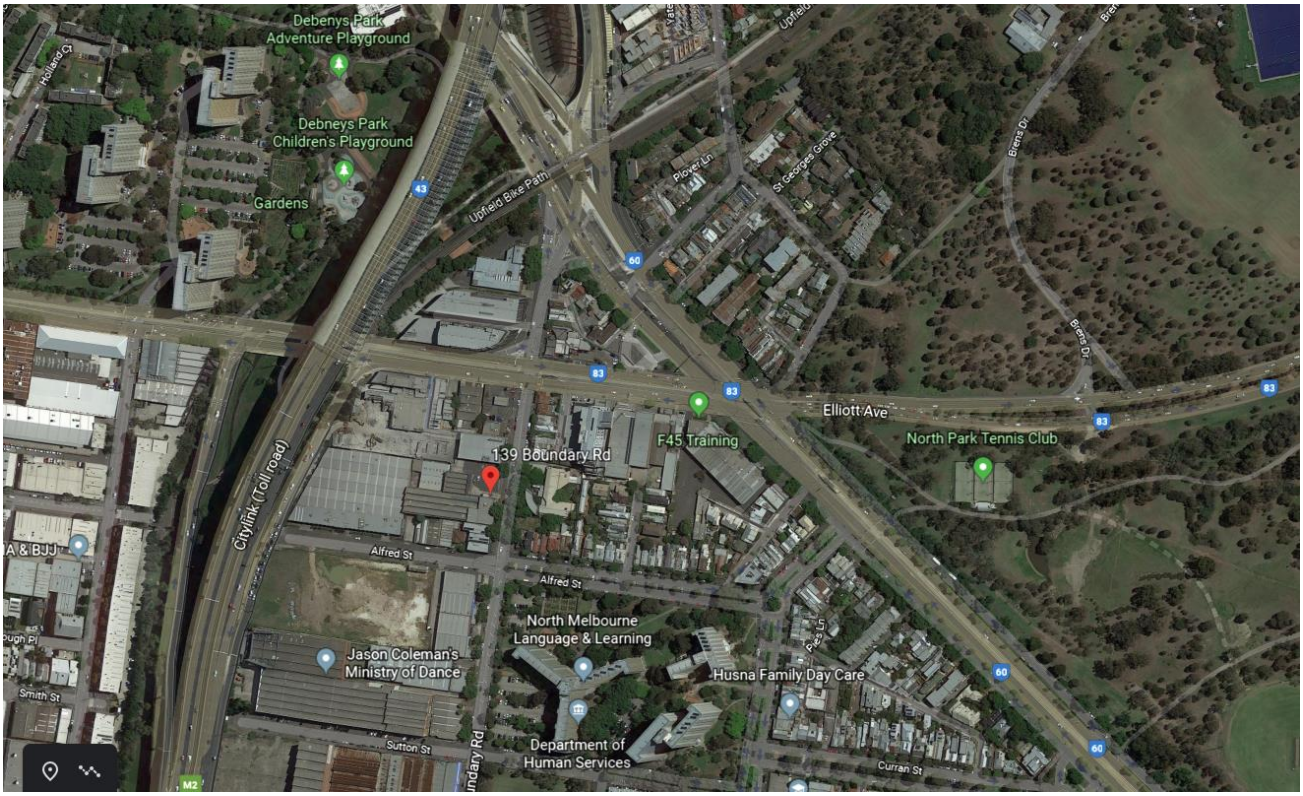


Image ©Google Earth™ (accessed November 2019)

5. Summary of Key ESD Initiatives

The following key sustainable design initiatives have been incorporated into this development:

- Rainwater harvesting system for toilet flushing and irrigation;
- 30kWp rooftop solar photovoltaic system;
- Integrated planter boxes;
- Sustainable transport options;
- Communal spaces;
- High-performance glazing and energy efficient building services, appliances and fixtures; and
- Environmentally preferable internal finishes.

An assessment of sustainable design outcomes of the proposed development has been undertaken with Green Star Design & As Built, MUSIC and FirstRate 5 benchmarking tools based on the proposed architectural design and building services initiatives considered feasible at this stage of the design process.

The information presented in this report demonstrates that:

- The combination of design features and services initiatives specified will result in a 35% reduction in operating greenhouse emissions on a per capita basis based on the Green Star residential greenhouse gas calculator benchmark;
- The development will achieve a minimum average NatHERS energy rating of 6.5 stars
- The development achieves 1 point in the Green Star Multi Residential Wat-1 credit;
- The development meets the Best Practice standard for stormwater quality.

6. MUSIC Modelling

To assess the quality of stormwater runoff from the site, an analysis has been undertaken using MUSIC Modelling software.

The MUSIC rating achieved indicates that the proposed development meets the best practice performance objectives outlined in the Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO 1999) for Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorus (TP) and Gross Pollutants (GP).

The following reductions from typical urban loads will be achieved:

- Reduction in Total Suspended Solids (TSS) load: 85.0%
- Reduction in Total Phosphorus (TP) load: 51.1%
- Reduction in Total Nitrogen (TN) load: 49.1%
- Reduction in Gross Pollutants (GP) load: 99.0%

In addition to the harvesting and re-use of rainwater, the following features will be incorporated into the proposed design to facilitate treatment of stormwater runoff:

- Landscape areas that promote infiltration and reduce runoff during storm events.
- A Rocla CDS Nipper gross pollutant trap (or equivalent primary treatment device) located near stormwater Legal Point of Discharge to capture suspended solids and litter generated onsite.

The proposed development exceeds the pollutant load reduction targets set out in the Best Practice Environmental Management Guidelines (BPEMG) for Total Suspended Solids (TSS), Total Phosphorus (TP), Total Nitrogen (TN) and Gross Pollutants (GP).

Refer to Appendix B for the MUSIC rating results and Appendix E for the WSUD Maintenance Manual.

Note that the preliminary MUSIC modelling undertaken to confirm achievable stormwater quality results is based on best information currently available relating to the technical and commercial feasibility of the WSUD strategy proposed. Further investigation will be undertaken during design development which may result in minor variations to the strategy described above to meet the best practice stormwater quality targets.

7. Urban Renewable Area

A connection point will be provided for a future ‘third pipe’ precinct wide recycled water supply. The connection point will enable direct connection of the third pipe supply to non-potable uses including toilets and irrigation.

Future alternative energy supplies and waste management systems should be capable of integrating with existing technologies and systems within the development.

8. Green Star

The Green Star Design & As Built (Version 1.2) tool has been used as a benchmarking framework for the proposed scheme and demonstrates that the development has the preliminary design potential to achieve a 5 star standard[1].

A detailed Green Star assessment has been undertaken to confirm the credits achievable by the proposed scheme.

Please note that this analysis is based on the best information currently available in relation to the technical and commercial feasibility of the initiatives proposed. Further investigation will be undertaken during design development which may result in change to the package of initiatives specified in order to meet the 5 star Green Star standard.

The initiatives which contribute to the 5 star Green Star rating are detailed in Section 8.1 below.

8.1. Green Star Criteria

The key design elements and processes which underpin the preliminary Green Star rating are summarised in the table below. The design attributes will be incorporated into the design in accordance with the technical criteria for each credit set out in the Green Star Design & As Built v1.2 Technical Manual.

Further information in relation to key performance outcomes is provided in the Appendices to this report as referenced in the right hand column of the table.

Green Star Element	Design Attribute	Reference
Management	• **Design Intent Report prepared** • **Provide floor-by-floor metering; plus independent metering for all loads >5% of annual building energy use or 100kW; and metering for common water use consuming 10% of development's water use** • **Comprehensive project-specific environmental management plan implemented during construction**	**Conditional Requirements**
	• Green Star Accredited Professional involved from outset to completion • Comprehensive commissioning and tuning of building systems • Comprehensive tuning of building systems • Independent Commissioning Agent engaged directly by PDG • Climate adaptation plan prepared • Detailed Operations and Maintenance Manual prepared • Detailed guide to building systems provided to council and residents • Measurement and reporting of building performance metrics by Owners Corporation • Contractual agreement to reduce demolition waste at end of fitout life	

[1] Note that a minimum of 60% of available points must be achieved for a 5-Star Green Star rating to be achieved. The development will attain a 5-Star Green Star standard however certification of the rating with the Green Building Council will not be undertaken. A working buffer of additional points (initially up to 10% above those ultimately required) will be targeted.

Green Star Element	Design Attribute	Reference
	• Head contractor to have current ISO 14001 certification • Implementation of policies and programs which promote on-site health and wellbeing • Operational Waste Management Plan prepared including targets and monitoring	
Indoor Environmental Quality	• **Lighting systems comprise flicker free luminaires and a Colour Rendering Index (CRI) greater than 80** • **Strategies to reduce glare incorporated into the design**	**Conditional Requirements**
	• Ventilation systems to comply with ASHRAE 62.1, and pre-cleaned prior to handover • Ventilation system designed to provide high volume of outside air • Exhaust systems to directly exhaust pollutants to exterior • Internal noise in nominated areas no more than 5dBA above 'Satisfactory' levels from Table 2 of AS/NZS 2107:2016 • Reverberation times in nominated areas must be below maximum stated in Table 1 of AS/NZ 2107:2016 • Lighting in apartments (except decorative fittings) to have a rated colour variation which does not exceed 3 MacAdam Ellipses • Apartments to have wall mount or wall wash fittings to one wall in each living and bedroom space • Lighting systems designed for task lighting • 60% of primary spaces to have high quality views • Specification of low VOC paints, adhesives, sealants and carpets • Specification of low formaldehyde engineered wood products	
Energy	• **Attain a development NatHERS area-weighted energy rating average of 6.5 stars and a minimum individual NatHERS energy rating of 5.5 stars for each apartment**	**Conditional Requirement**
	• Development NatHERS energy rating average 6.5 stars • Reverse cycle heat pumps with minimum energy rating of 3* heating & 3* cooling and rated capacities within 10%/20% of design capacities. • Energy efficient lighting systems with 10% improvement on NCC requirements • Energy efficient gas domestic hot water system • Energy efficient appliances within 1 star of best available at time of tender • 30kW solar PV system	Appendix A Appendix B

Green Star Element	Design Attribute	Reference
Transport	• 234 carparks provided • A total of 12 Electric Vehicle charging points (to 24 spaces) • A minimum 32A electric vehicle charging circuit to enable the future installation of fast charge units to a further 20% of car spaces (48 total) • 3 shared e-bikes for residents with horizontal bike storage • Bicycle parking with 194 resident and staff racks, plus 71 visitor racks. 20% parking as horizontal rails, installed at grade • A WalkScore® of 80 out of 100 points – defined as 'Very Walkable'	

Water	• Water efficient fixtures and appliances with WELS ratings:
	  ○ Taps 5 star
	  ○ Toilets 4 star
	  ○ Showers 4 star (<= 7.5 l/m)
	  ○ Washing machines 4 star
	  ○ Dishwashers 5 star
	• Rainwater harvesting from all roofs over Ground Floor and Levels 05, 10 and 11 (area approx. 2,308m^2):
	  ○ Filtration and treatment of all rainwater prior to draining into the tank
	  ○ Total storage volume of 80kL rainwater tank
	  ○ Re-use of captured water for toilet flushing in a all apartments up to and including level 5
	  ○ Re-use of captured water for irrigation
	• Cooling towers not used
	• Water efficient sub-soil drip irrigation system with moisture sensors and timers using harvested rainwater
	• Fire test system water storage and re-use
		Appendix C
		
		Appendix D

Materials	• Life Cycle Assessment undertaken, with 40% improvement over reference building • 5 impact categories reported in Life Cycle Assessment • 60% of steel reinforcement manufactured using energy reducing process • Specification of common use PVC products that meet Best Practice Guidelines for PVC in the Built Environment • Structural timber using FSC or PEFC certified timber • Documentation provided on product sustainability credentials for 3% of materials used on the project • Demolition and construction waste sent to landfill to be less than 5kg per square meter of GFA	

Green Star Element	Design Attribute	Reference
Land Use & Ecology	• **No endangered or vulnerable species on site at time of purchase** • **Site does not contain old growth forest or wetland of High National Importance**	**Conditional Requirements**
	• Native planting used on at least 2½% of the site • At least 75% of the total project site area comprises building or landscaping elements that reduce impact of heat island effect	
Emissions	• **All outdoor lighting to comply with AS4282:1997 for light spill to inhabited boundaries.**	**Conditional Requirement**
	• No increase in stormwater discharge to result from re-development • MUSIC modelling has been undertaken to confirm the development attains the Best Practice standard for urban stormwater quality • External lighting design to have an upward light output ratio <5% • Strategies to minimise Legionella impacts from cooling systems implemented • Refrigerants to have Ozone Depletion Potential of zero and a Global Warming Potential of 10 or less	Appendix D Appendix E Appendix F
Innovation	• Site-wide leak detection system installed to prevent risk of ongoing potable water wastage • Battery recycling pipe, alongside dual waste chutes • Smart control systems for EV charging • 50% of internal paints to be ultra-low VOC type (<5g/litre) • Air-tightness testing to achieve good practice level • Embodied impacts of PV modules will be further reduced by procurement from a manufacturer with an above average rating on the current version Silicon Valley Toxics Coalition Solar Scorecard • Demolition and construction waste sent to landfill to be less than 5kg per square meter of GFA	

8.2. Green Star Preliminary Design Rating

Based on the design attributes and performance outcomes set out above, the following Green Star pathway has been prepared which confirms that the development has the preliminary design potential to achieve a 5 star Green Star standard.

Green Star - Design & As Built v1.2

Project:	139-149 Boundary Road, North Melbourne	TP stage - Preliminary Advice 15/02/2023 REVISION E	**Points Available**	**Total Score Targeted**
Current Rating:	5 Star - Australian Excellence		100	65.0

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	Points Available	5* pathway
Management				14	
Green Star Accredited Professional	To recognise appointment and active involvement of Green Star AP to ensure 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	1
Adaptation and Resilience	To encourage and recognise projects resilient to impacts of changing climate & natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2
Building Information	Information facilitating understanding of building systems, O&M requirements and targets to optimise performance.	4.1	Building Information	1	1
Commitment to Performance	To recognise practices that encourage building owners, building occupants and FM 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	Performance Pathway	8A	Performance Pathway - Specialist Plan	1	1
Total				14	14

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	1
		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	1
		10.2	Reverberation	1	1
		10.3	Acoustic Separation	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	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
		12.2	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
Total				**17**	**11**

Energy					
				22	
Greenhouse Gas Emissions Max.5pts achievable via Credit 15A - Prescriptive Pathway.	B. NatHERS Pathway	15B.0	Conditional Requirement: NatHERS Pathway	-	Complies
		15B.1	NatHERS Pathway	16	5
Total				**17**	**5**

Transport					
				10	
Sustainable Transport	Prescriptive Pathway	17B.1	Access by Public Transport	3	2
		17B.3	Low Emission Vehicle Infrastructure	1	1
		17B.4	Active Transport Facilities	1	1
		17B.5	Walkable Neighbourhoods	1	1
Total				**7**	**5**

Water					
				12	
Potable Water	Prescriptive Pathway	18B.1	Sanitary Fixture Efficiency	1	1
		18B.2	Rainwater Reuse	1	1
		18B.3	Heat Rejection	2	2
		18B.4	Landscape Irrigation	1	1
		18B.5	Fire System Test Water	1	1
Total				**6**	**6**

Materials				14	
Life Cycle Impacts Points from operational energy reductions capped at 3 out of the 6 points available for 19A.1.	Performance Pathway - Life Cycle Assessment	19A.1	Comparative Life Cycle Assessment	6	3
		19A.2	Additional Life Cycle Impact Reporting	4	1
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	1
Construction and Demolition Waste	Percentage Benchmark	22B	Percentage Benchmark	1	1
Total				**14**	**9**

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
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
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	1
Total				**6**	**3**

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 implementation of systems to minimise 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	1
Total				**5**	**5**

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	3
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation		1
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks		3
Total				**10**	**7**

		5* pathway
CORE POINTS	100	58.0
CATEGORY PERCENTAGE SCORE		58.0
INNOVATION POINTS	10	7.0
TOTAL SCORE TARGETED		65.0
Green Star rating		5 Star

9. Conclusion

This report provides details of a comprehensive package of sustainable design features which will be integrated into the design and specification of the proposed development in order to improve environmental outcomes during occupation.

In terms of performance outcomes, the analysis presented in this report demonstrates that the proposed development will:

- attain a 5 star Green Star standard based on the Design & As Built v1.2 rating tool;
- Achieve 1 point for the potable water calculator (equivalent to the Green Star Multi Residential Wat-1 credit)
- attain the *Best Practice* standard for urban stormwater quality; and
- attain a minimum development NatHERS energy rating of 6.5 stars.

Please note that this analysis is based on the best information currently available in relation to the technical and commercial feasibility of the initiatives proposed. Further investigation will be undertaken during design development which may result in change to the package of initiatives specified in order to meet the 5 star Green Star standard (60 points minimum).

The performance outcomes set out above confirm that the proposed development meets the relevant performance measures set out in Clauses 22.19, 22.23 and 53.18 of the Melbourne Planning Scheme, as well as Condition 30 of the Planning Permit [No. PA1900753-1].

Accordingly, the sustainable design outcomes from the proposed development are considered to be consistent with the objectives of the City of Melbourne's Energy Water and Waste Efficiency and Water Sensitive Urban Design Policies (Clauses 22.19, 22.23 and 53.18 of the Melbourne Planning Scheme).

Jan Talacko
Director

Appendix A. NatHERS Energy Ratings

FirstRate5 Version 5.3.2b (3.21) energy ratings have been undertaken for a representative sample of the apartments and are summarised in the table below.

Apartment	Star Rating	Energy Demand (MJ/m2)		
		Total	Heating	Cooling
TH01	6.9	83.8	81.3	2.5
TH05	7.2	77.1	71.8	5.3
G.03	7.8	59.4	47.2	12.2
G.04	7.7	61.3	42.5	18.8
1.07	6.9	85.7	71.6	14.1
1.20	7.2	75.8	48.3	27.5
1.25	6.3	103.7	85.2	18.5
2.05	6.7	91.0	79.6	11.4
2.10	6.7	92.7	76.1	16.6
2.12	7.6	65.4	50.8	14.6
2.13	7.1	78.9	58.1	20.8
2.18	7.7	63.4	49.1	14.3
2.22	7.7	61.9	40.4	21.5
4.20	7.4	68.1	41.7	26.4
4.25	7.0	82.7	65.8	16.9
5.25	6.2	106.7	85.1	21.6
9.01	6.0	113.7	98.3	15.4
9.04	6.7	91.3	71.7	19.6
9.06	6.4	98.4	71.1	27.3
9.07	6.7	92.8	65.8	27.0
10.01	5.6	126.3	103.6	22.7
10.02	6.7	92.3	76.4	15.9
10.03	5.6	128.8	100.3	28.5
10.04	5.9	115.3	86.7	28.6
10.06	5.7	123.0	93.2	29.8
10.07	6.1	111.2	82.5	28.7
10.11	6.6	95.4	68.4	27.0
10.14	6.1	110.8	90.0	20.8
10.15	6.4	98.5	76.0	22.5

Apartment	Star Rating	Energy Demand (MJ/m2)		
		Total	Heating	Cooling
10.16	6.6	93.5	64.1	29.4
10.17	7.2	78.4	55.2	23.2
10.19	7.0	81.8	63.2	18.6
10.20	6.8	87.7	66.2	21.5
10.22	6.8	87.9	74.2	13.7
10.23	5.5	130.4	112.4	18.0
11.01	6.9	84.4	57.3	27.1
11.03	5.6	127.4	102.8	24.6
11.04	5.8	119.5	91.8	27.7
11.05	5.9	117.1	88.7	28.4
11.06	6.4	101.5	73.9	27.6
11.08	6.3	105.6	81.6	24.0
11.09	6.2	109.1	82.1	27.0
11.11	5.9	114.8	93.6	21.2
11.12	5.7	125.3	98.6	26.7
Estimated Development Average	**6.5**	**95.9**	**74.6**	**26.7**

The results of the modelling confirm that a cooling load average of less than 30 MJ/m^2 has been met [NatHERS Climate Zone 21 Melbourne] and therefore meet the energy efficiency objectives set out in clause 58.03-1 of the Planning Scheme.

The results of the modelling confirm that the average heating load of less than 88 MJ/m^2 and the average cooling load of less than 36 MJ/m^2 for the development has been met [NatHERS Climate Zone 21 Melbourne]. The heating load does not exceed 120 MJ/m^2 and the cooling load does not exceed 62 MJ/m^2 for each apartment. Therefore, the development meets the energy efficiency objectives set out in NCC 2019 for Class 2 dwellings.

Energy Rating Assumptions

Building Materials

Element	Description	Added R Value
Floor Type	Concrete slab on ground (Basement) Suspended concrete slab (All other levels)	
Floor Insulation	50mm Kingspan Kooltherm: Underside of level ground floors shared with car park and outside	**R 2.3**
	50mm Kingspan Kooltherm: Underside of all other level floors shared with outside below	**R 2.35**
Wall Insulation	Lightweight party walls: Insulation R 1.5	**R 1.5**
	Lightweight corridor walls: Insulation R 1.5	**R 1.5**
	Precast concrete Lift & stairwell walls: Insulation R1.5	**R 1.5**
	Precast concrete external walls: Insulation R 2.5	**R 2.5**
	Lightweight clad walls: Insulation R 2.5	**R 2.5**
	Glass spandrel walls: Insulation R 2.5	**R 2.5**
	Lightweight internal bathroom walls (apartments 10.03): Insulation R 2.5	**R 2.5**
Roof Insulation	Concrete roof (Level 11) & apartments 10.03, 10.23: 70mm Kingspan Kooltherm	**R 3.2**
	All apartment concrete ceilings shared with terraces above: 60mm Kingspan Kooltherm	**R 2.75**
Window Frames	Aluminium frames to all windows and glazed doors Aluminium **thermally broken** frames to apartment 10.01	
Spandrel panels	Aluminium frames, double glazing plus R2.5 insulation	**R 2.5**
Sky Lights	None	
Ceiling Fans	1200mm Diameter: Apartment 10.06	
External Blinds	Nil	

NOTES

1. The added insulation R value must be equal to or higher than that specified above to meet the energy rating results.
2. All insulation specified for construction must meet Fire Engineer requirements

Glazing

Glazing Type	Whole of Window Value		Location
Capral – 200 Series Hinged Door	**U**	**SHGC**	
CAP-048-06 Double glazed 6mm Energy Advantage/12mm Argon gap/6mm Clear	3.60	0.44	GL01
Capral – 419 Flushline Series Fixed	**U**	**SHGC**	
CAP-055-52 Double glazed 6mm Clear/12mm Argon gap/6mm Energy Advantage	2.71	0.58	GL01
Capral – 35 Series Awning	**U**	**SHGC**	
CAP-051-06 Double glazed 6mm Energy Advantage/12mm Argon gap/6mm Clear	4.42	0.41	GL01
Capral – 900 Series Sliding	**U**	**SHGC**	
CAP-057-13 Double glazed 6mm Energy Advantage/12mm Argon gap/6mm Clear	3.19	0.48	GL01
Capral – 950 Series Sliding window	**U**	**SHGC**	
CAP-065-16 Double glazed 6mm Energy Advantage/12mm Argon gap/6mm Clear	3.91	0.45	GL01

Glazing Type	Whole of Window Value		Location
Capral – 200 Series Hinged Door	**U**	**SHGC**	
CAP-048-14 Double glazed 6mm Grey/12mm Argon gap/6mm Clear Energy Tech	3.60	0.29	GL02, except listed below
Capral – 419 Flushline Series Fixed	**U**	**SHGC**	
CAP-055-54 Double glazed 6mm Grey/12mm Argon gap/6mm Clear Energy Advantage	2.71	0.34	GL02, except listed below
Capral – 35 Series Awning	**U**	**SHGC**	
CAP-051-14 Double glazed 6mm Grey/12mm Argon gap/6mm Clear Energy Tech	4.42	0.28	GL02, except listed below
Capral – 900 Series Sliding	**U**	**SHGC**	
CAP-057-26 Double glazed 6mm Grey/12mm Argon gap/6mm Clear Energy Tech	3.12	0.32	GL02, except listed below

Thermally Broken Frames

Glazing Type		Whole of Window Value		Location
Capral – Thermally Broken Futureline 419TB Series Fixed		**U**	**SHGC**	
CAP-157-04 Double glazed 6mm EnerygyTech Grey/12mm Air/6mm Clear		2.38	0.33	Apartment 10.01
Capral – Thermally Broken Futureline 54W Series Awning		**U**	**SHGC**	
Specified Glazing	CAP-116-13 Double glazed 6mm EVantage Grey/12mm Air/6mm Clear	3.10	0.22	Apartment 10.01
Energy Rating Software Equivalent	AWS-035-53 TH Awning DG 6mm Evan Grey/12mm Air gap/6mm Clear	3.10	0.23	
Capral – Thermally Broken Futureline Lift & Slide Door		**U**	**SHGC**	
Specified Glazing	CAP-133-?? Double glazed ** 6mm EnergyTech Grey/12mm Air/6mm Clear	2.70 **	0.30 **	Apartment 10.01
Energy Rating Software Equivalent	AWS-037-04 731 TH Sliding door DG 4mm Az/12mm Air gap/4mm EnergyTech	2.74	0.30	

Low SHGC Grey Glass

Glazing Type	Whole of Window Value		Location
Capral – 419 Flushline Series Fixed	**U**	**SHGC**	
CAP-055-111 Double glazed Insulglass AGG MAX GY	2.65	0.21	Apt 10.03: West facing bedroom Apt 10.07: 2 x East facing bedrooms Apt 10.06 Apt 11.05: West facing living & bedroom Apt 11.06: 2 x East facing bedrooms Apt 11.12
Capral – 582 Series Awning	**U**	**SHGC**	
CAP-034-35 Double glazed Insulglass AGG MAX GY	3.32	0.22	Apt 10.03: West facing bedroom Apt 10.07: 2 x East facing bedrooms Apt 10.06 Apt 11.05: West facing living & bedroom Apts 10.17, 11.06: 2 x East facing bedrooms Apt 11.12
Capral – 585 Series Sliding	**U**	**SHGC**	
CAP-037-28 Double glazed Insulglass AGG MAX GY	3.18	0.22	Apt 11.12

Low SHGC Clear Glass

Glazing Type	Whole of Window Value		Location
Capral – 419 Flushline Series Fixed	**U**	**SHGC**	
CAP-051-07 Clear Double glazed Insulglass AGG MAX Clear	4.42	0.20	Apts 1.20, 4.20: East facing bedroom & ensuite

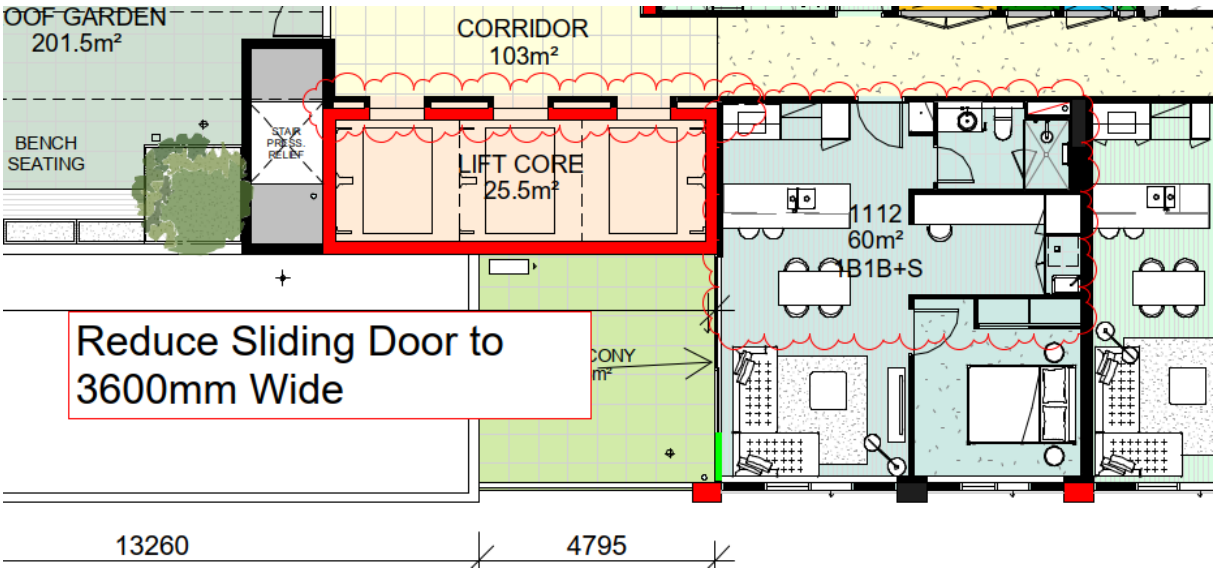
NOTE

The energy rating software accredited by the Australian Building Codes Board contains a relatively limited library of window systems. When the glazing systems specified are not available in the software, the protocol requires that the glazing type which most closely matches the specified glazing is selected for the purpose of calculating the energy rating.

The table above sets out the glazing specified on the architectural drawings together with the glazing input for the purposes of calculating the energy rating.

The whole of window U – Value must be equal or lower than the energy rating software value and the whole of window SHGC – Value must be within +/-5% of the energy rating software value.

GLAZING REDUCTION – APARTMENT 1112



General Rating Assumptions

Item	Details
Floor Coverings	• Tiles to bathrooms & entry, laundries • Carpet to bedrooms, • Timber boards to kitchen, living and all other areas
Window Coverings	• Holland blinds to all windows. (Regulation Mode)[2]
Draught Proofing	• Weather strips to all entry & external doors and windows. • Seal / self-closing to all exhaust fans.
Down lights	• Recessed down lights in ceiling /roof space to be sealed type / IC 4 rated to provide air tightness and contact with insulation
General	• All party walls are classed as neighbour walls.
Shading	• Overshadowing from adjoining buildings has been incorporated into the energy ratings

NOTES

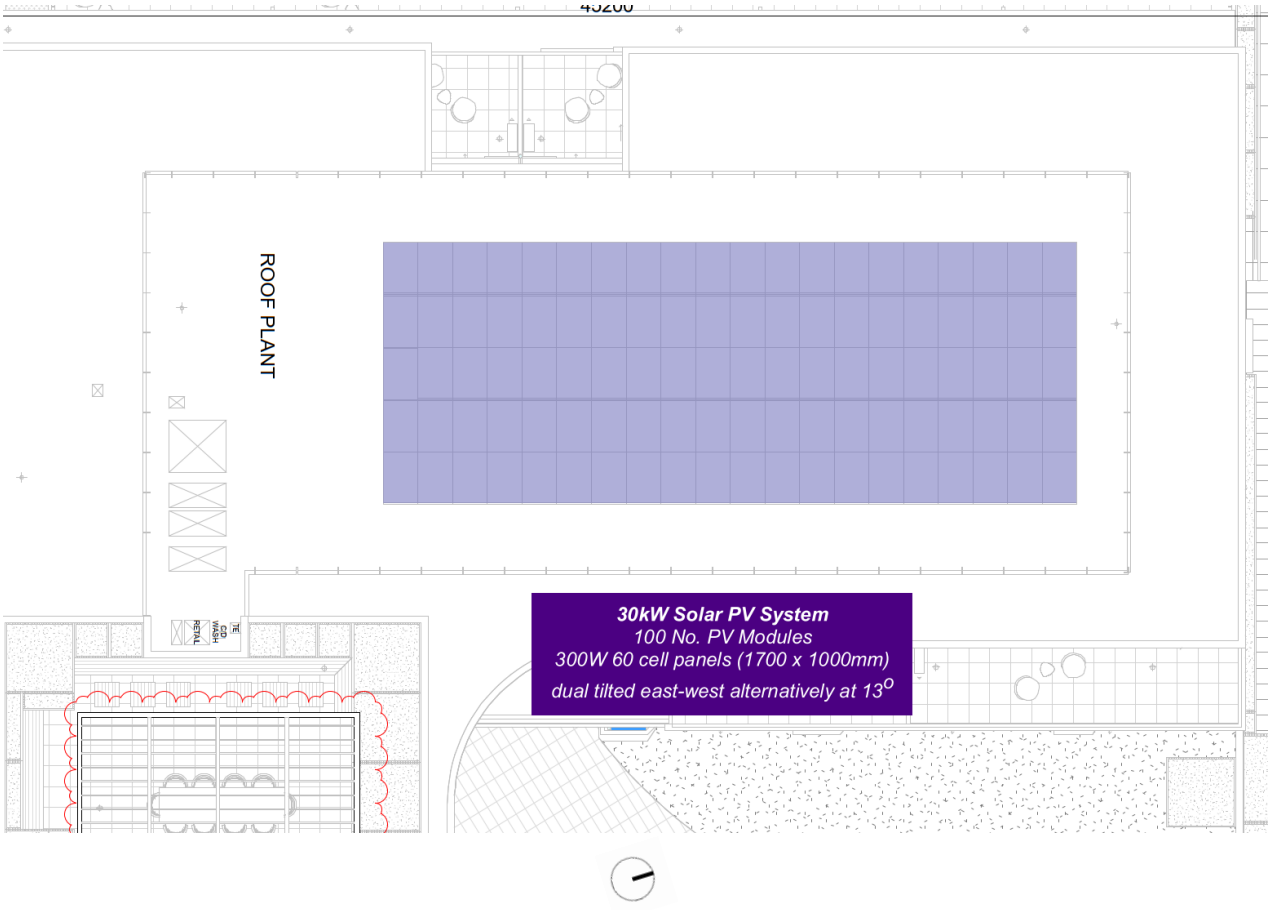
1. Changes to any of the above stated specifications may affect energy performance and invalidate the energy ratings detailed in this report.
2. Sealing of gaps and cracks: inadequate sealing of gaps and cracks can negatively affect the energy performance of a dwelling. Provide sealing in accordance with NCC 2016 Part J3.

[2] Holland blinds are assumed as required by VBA Practice Note 55 (Clause 5.2). This assumption is for regulatory purposes only.

Appendix B. Solar Photovoltaic System

High-efficiency solar PV modules with a total capacity of 30 kWp will be installed at roof level as per the preliminary layout indicated below.

Each PV module will be oriented northwards at 10-15° tilt and have at least 300Wp capacity (i.e. over 20% more efficient than traditional 250Wp 60-cell modules). High-efficiency modules deliver more compact arrays with inherently lower embodied ecological impact per unit of generation than standard efficiency modules.



Indicative Solar Photovoltaic array layout

Total yield of this array will be approximately 42 MWh per annum equating to an estimated annual carbon emissions offset of 47 tonnes $CO_{2\text{-}e}$ per annum.

139-149 Boundary Road, North Melbourne

Photovoltaic System

PV Melbourne energy delivery	MWh/y per kWe	1.40	13° tilt, East/West
PV capacity required	kWe	30.0	
Proposed PV module rating	Wp	300	
Efficiency improvement over traditional 250W module		20.0%	
Typical dimensions for 60-cell module	Width (m) x length (m)	1.0 x 1.7	
Number of panels required	rounded up	100	
Expected electricity produced	kWh/day	115.1	
Annual expected electricity produce	MWh/yr	42.0	

Electricity gas emissions factor, NG	kg_CO2-e/kWh	1.12	Scope 2 and 3
Greenhouse gas emissions reductio	tonnes_CO_2-e/yr	47.04	

[2] National Greenhouse Accounts (NGA) Factors, August 2019, table 44 "Latest", "Victoria"

Appendix C. Green Star Wat-1 Calculator

Note that these legacy calculators are from withdrawn Green Star rating tools and therefore do not form part of the Green Star pathway for this project. They are included to demonstrate compliance with the performance measures stated within Clause 22.19 Energy, Water and Waste Efficiency of the Melbourne Planning Scheme.

Green Star - Multi Unit Residential v1

Potable Water Calculator

Go to Water Category

Points Achieved (efficient fixtures and fittings)	1
Points Achieved (non-potable water use)	0
TOTAL Points Achieved	**1**

Refer to the **Green Star Potable Water Calculator Guide** for instructions on how to use the calculator and details on how the points are calculated. The **Green Star Potable Water Calculator Guide** is available from the GBCA website.

Building Information

Dwelling type	Number of dwellings	Assumed occupancy (persons)
Studio/1 bedroom	102	204
2 bedroom	169	507
3 bedroom	5	20
4 bedroom		0
5+ bedroom		0
Total	**276**	**731**

Part 1 : Efficient Fixtures and Fittings

	Water Efficiency (Enter manually OR nominate WELS star rating)		Resulting water efficiency used in calculator (l/min, except for toilets, L/flush)	Percentage of Each Type	Calculated Water Consumption (L/day)
	Manual entry from Manufacturer's data sheet (l/min, except for toilets, L/flush)	WELS Star rating selection			
Toilets					
<enter description>		4 Star	3.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
			Total	100%	10234.0
Bathroom Taps					
<enter description>		4 Star	7.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
			Total	100%	5756.6
Kitchen Taps					
<enter description>		5 Star	6	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
			Total	100%	8772.0
Showerheads					
<enter description>	7.5		7.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
			Total	100%	43860.0

Total Project Water Consumption (L/day)	**68622.6**
Benchmark for total water consumption (L/day) to achieve 1 point	**77705.3**
Benchmark for total water consumption (L/day) to achieve 2 points	**64127.0**

Points achieved	**1**

NB: Zero points will be displayed until above table is complete (100% of each fixture/fitting)

Appendix D. Green Star Greenhouse Gas Emissions Calculator

Green Star Design & As Built

Greenhouse Gas Emissions Calculator

greenstar Developed by the Green Building Council of Australia

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	**5 Star**	Stars

Project input

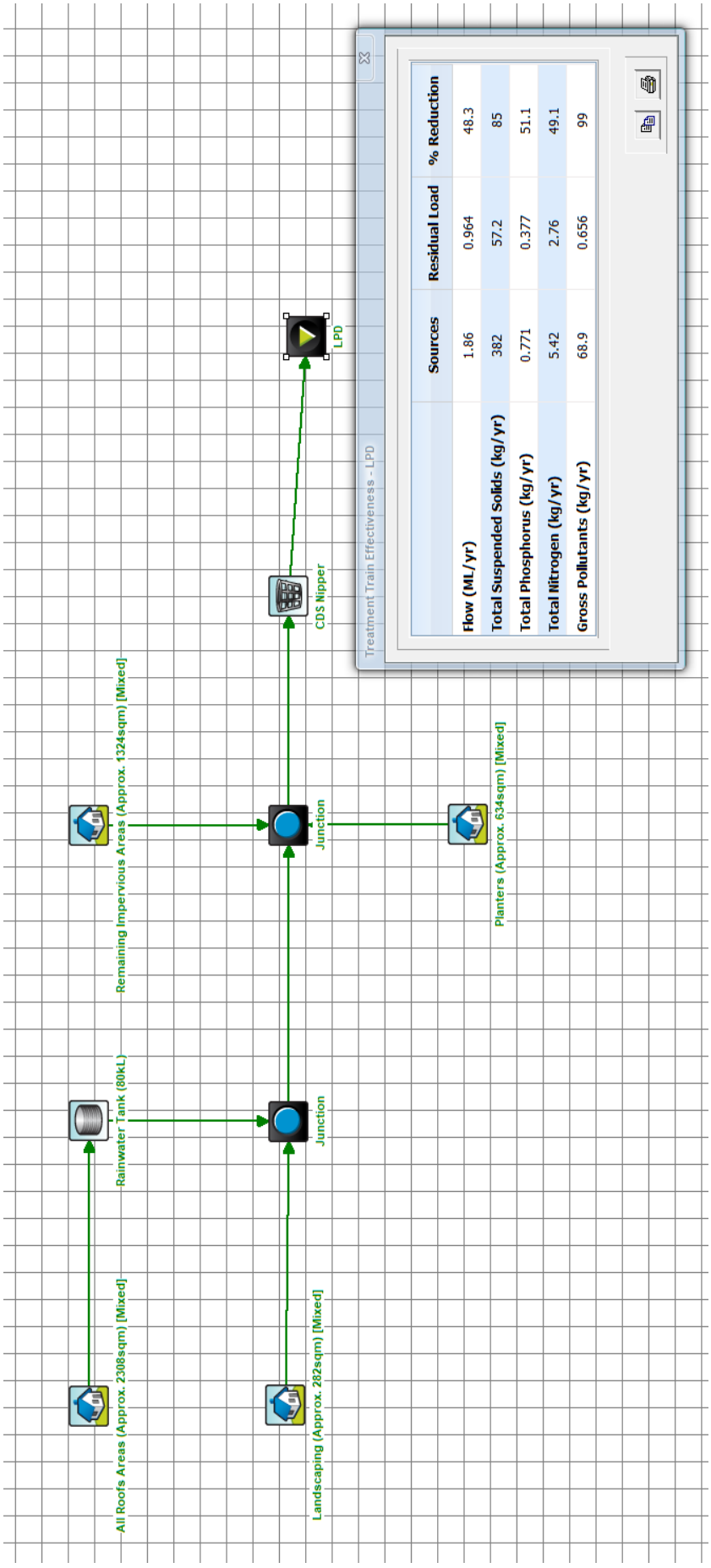
Legislated Minimum Development Average Rating	6	star
Legislated Minimum Worst-Case Apartment Rating	5	star
Project Average Energy Intensity	95.9	MJ/m²
Project Worst-Case Energy Intensity	130.4	MJ/m²
NatHERS Climate Zone	21	
Ventilation and Comfort strategy	Mechanical Heating/Cooling	
Which is provided? Heating, cooling or both?	Both	
If Mixed, proportion of apartments with nat vent	0%	
Building total nominal occupancy	731	

Benchmark Building Information		
Minimum Average Benchmark	**6.5**	**star**
Minimum Worst-Case Benchmark	**5.5**	**star**
Benchmark Energy Intensity	**98.0**	**MJ/m²**
Worst Case Energy Intensity Benchmark	**131.0**	**MJ/m²**
Energy Intensity at NatHERS 10-star	**2.0**	**MJ/m²**
Energy Intensity Conditional Requirement met?	**PASS**	
Worst Case Unit Conditional Requirement met?	**PASS**	
Performance Improvement	**2%**	

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	Yes	
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)	0	
Appliances and Equipment		
Refrigerators achieve a minimum Energy Rating of 1 star below the maximum available rating	Yes	
Washing machines achieve a minimum Energy Rating of 1 star below the maximum available rating	Yes	
Clothes dryers achieve a minimum Energy Rating of 1 star below the maximum available rating	Yes	
Dishwashers achieve a minimum Energy Rating of 1 star below the maximum available rating	Yes	
Accredited GreenPower®		
Percentage GreenPower®	50%	
Length of GreenPower contract period (in years)	10	

CREDIT SCORE	
Energy Intensity Reduction	0.2
HVAC	2.0
Lighting	1.3
Domestic Hot Water	0.5
Appliances and Equipment	1.0
Accredited GreenPower®	0.0
TOTAL POINTS ACHIEVED	**5.0**
TOTAL POINTS AVAILABLE	**16.0**

Appendix E. MUSIC Modelling Results



	Sources	Residual Load	% Reduction
Flow (ML/yr)	1.86	0.964	48.3
Total Suspended Solids (kg/yr)	382	57.2	85
Total Phosphorus (kg/yr)	0.771	0.377	51.1
Total Nitrogen (kg/yr)	5.42	2.76	49.1
Gross Pollutants (kg/yr)	68.9	0.656	99

MUSIC INPUT PARAMETERS

Assumptions		
Area Name		**Area [m^2]**
Total Roof Areas to RWT		2,308
Roof		1,090
Level 11 Roof		795
Level 6 Roofs		278
Level 1 Roofs		145
Pervious Landscape Areas		282
Part Pervious Landscape Areas		634
All planters & landscaping over basement		634
Other impervious areas		1,324
Total Site Area		**4,548**

MUSIC Model 30/09/2021		
Treatment Devices Features		
RWT		1 x 80 kL
Total RWT Capacity		80 kL
Est. daily water demand for TF (All residential toilets up to & incl. Lvl 5)		4.7 kL/day
Est. annual demand for irrigation (GF deep landscaping)		109 kL/yr
**Primary Treatment System 1 (GPT)		Rocla CDS Nipper (or equivalent)
Results		
Reduction in Total Suspended Solids (TSS)		85.0%
Reduction in Total Phosphorus (TP)		51.1%
Reduction in Total Nitrogen (TN)		49.1%
Reduction in Total Gross Pollutants		99.0%
Compliance with Melbourne Water targets		✓

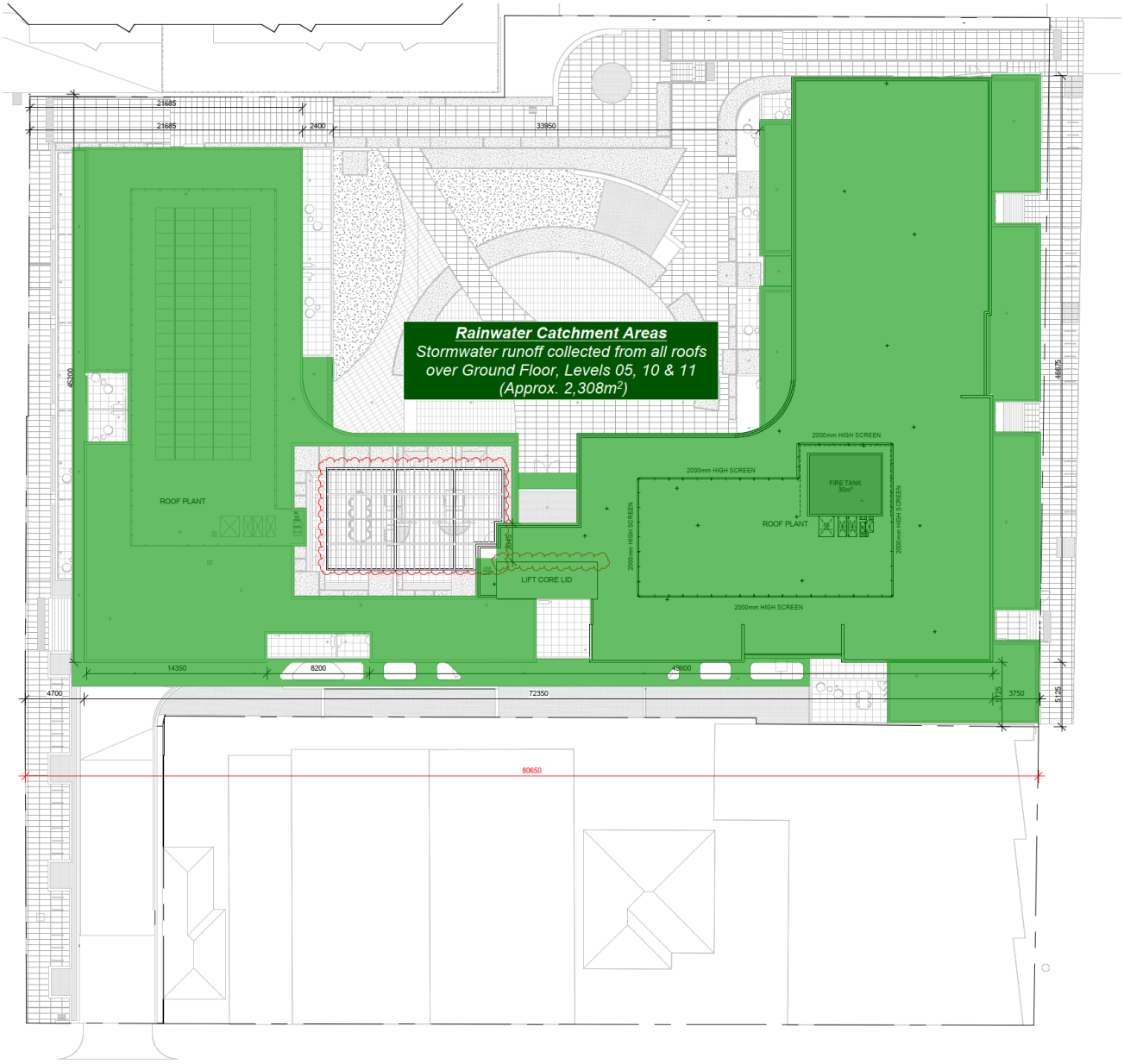
Pollutant	MUSIC Model Results	Melbourne Water Targets
Reduction in Total Suspended Solids (TSS)	85.0%	80.0%
Reduction in Total Phosphorus (TP)	51.1%	45.0%
Reduction in Total Nitrogen (TN)	49.1%	45.0%
Reduction in Total Gross Pollutants	99.0%	70.0%
Compliance with Melbourne Water targets		✓

NOTES:
**Nutrient reduction (Phosphorous and Nitrogen) not attributed to GPT as per Melbourne Water MUSIC guidelines.

Acronyms
RWT: Rain Water Tank
TF: Toilet Flushing
GPT: Gross Pollutant Trap

MUSIC v6.3.0 Input Parameters	
Rainfall data	
Rainfall Range & Station Name	B - Melbourne Airport (500-650mm)
10 Year Period	B - 1971-1980
Mean annual rainfall	B - 575mm
Evapotranspiration	B - 1041
Time step	6 minutes
Estimation method	Stochastically generated
Soil properties - Melbourne	
Soil store capacity	120mm
Field capacity	50mm
GPT Pollutant Removal Rates	
Total Suspended Solids	70%
Total Nitrogen	0%
Total Phosphorous	0%
Gross Pollutants	98%
Validation report	CRC for Catchment Hydrology

RAINWATER CATCHMENT AREAS



Appendix F. Rainwater Harvesting

Property 139-149 Boundary Rd, North Melbourne
Version

box 1

Inputs:

Commercial	Floor Area - NLA (m2)	0	
	PPL [M / F]	0	0
	Flush/Person/Day [M - Urinal]	2	
	Flush/Person/Day [M / F - WC]	0.3	2.3
	Litres/Flush [Urinal / WC]	1	3.3
	Total Daily usage (litres)	0	
Residential	PPL	235	
	Flush/Person/Day	5	
	Litres/Flush	4.0	
	Total Daily usage (litres)	4700	
Development	Total Daily usage (litres)	4700	
	Roof area (m2)	2,308	
	Collection Evaporation	5%	
	Tank Capacity (litres)	80,000	
	Irrigation Area (m2)	282	
	T'off if Total Rain (mm)	10	
	in the last	5	days

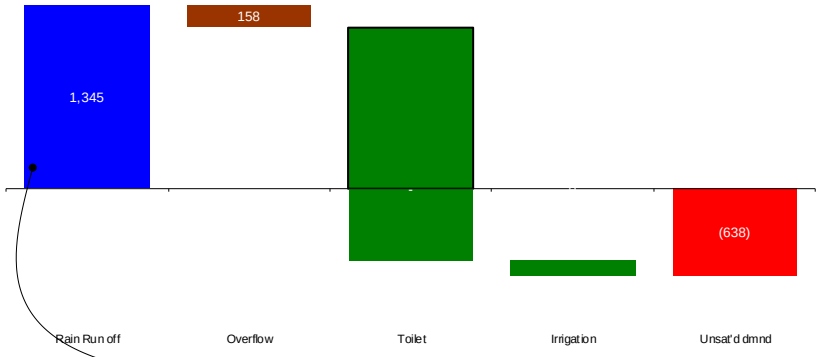
Recalc, update pivots, table and graphs

Irrigation Schedule

	l /m2	S	M	T	W	Th	Fr	S
Jan	10		y			y		
Feb	10		y			y		
Mar	10		y			y		
Apr	5		y					
May	5			y				
Jun	5			y				
Jul	5				y			
Aug	5				y			
Sep	5					y		
Oct	5					y		
Nov	10						y	
Dec	10		y				y	

box 2

System components (kls per year)



box 3

System components (kls per year) based on 12 years of actual historical daily rainfall

12 years of Averages (k l)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rain Run off	91	94	82	140	114	117	104	117	112	105	145	125	1,345
Overflow	(9)	(14)	(13)	(23)	(5)	(12)	(1)	(3)	(5)	(14)	(28)	(31)	(158)
Rain Water saved	82	79	70	117	109	105	102	114	107	90	117	94	1,187
Toilet	(146)	(133)	(146)	(141)	(146)	(141)	(146)	(146)	(141)	(146)	(141)	(145)	(1716)
(Shortfall)/Surplus before Irrigation	(64)	(53)	(76)	(24)	(37)	(36)	(43)	(31)	(34)	(55)	(24)	(51)	(528)
Irrigation	(19)	(18)	(20)	(4)	(4)	(4)	(5)	(4)	(4)	(4)	(7)	(16)	(109)
Unsatisfied Demand	(83)	(71)	(96)	(28)	(41)	(40)	(48)	(36)	(38)	(59)	(31)	(67)	(637)

Actual Years (k l)

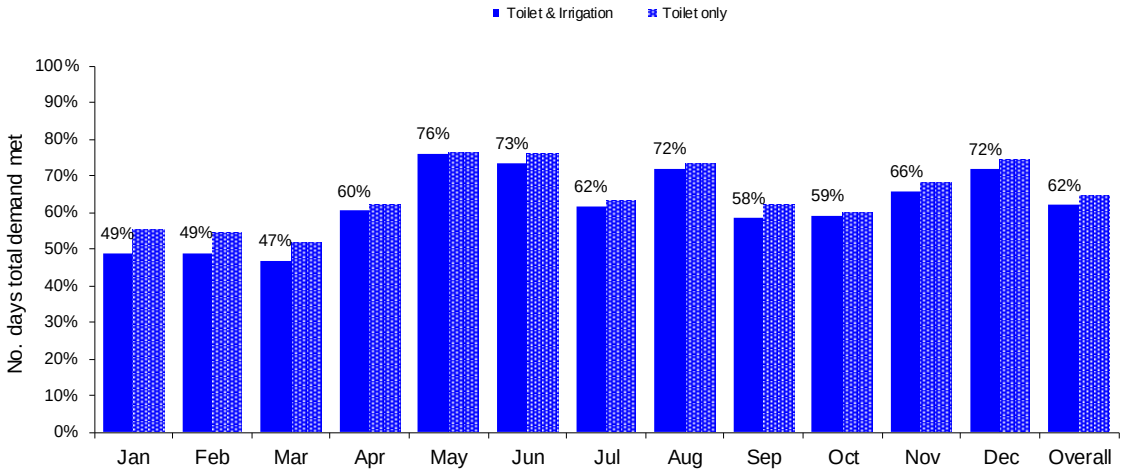
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Rain Run off	1,098	1,711	1,698	1,380	1,487	1,040	1,069	1,479	1,369	1,226	916	1,671	16,142
Overflow	(136)	(367)	(368)	(105)	(149)	(9)	-	(61)	(206)	(169)	-	(323)	(1893)
Rain Water saved	962	1,344	1,330	1,275	1,337	1,030	1,069	1,418	1,163	1,057	916	1,348	14,249
Toilet	(1716)	(1716)	(1716)	(1720)	(1716)	(1716)	(1716)	(1720)	(1716)	(1716)	(1716)	(1711)	(20,591)
(Shortfall)/Surplus before Irrigation	(753)	(371)	(386)	(445)	(378)	(685)	(647)	(303)	(553)	(658)	(799)	(362)	(6,341)
Irrigation	(120)	(99)	(102)	(107)	(106)	(114)	(110)	(104)	(106)	(117)	(133)	(92)	(1,308)
Unsatisfied Demand	(873)	(470)	(487)	(552)	(484)	(800)	(757)	(407)	(658)	(775)	(932)	(454)	(7,650)

box 4

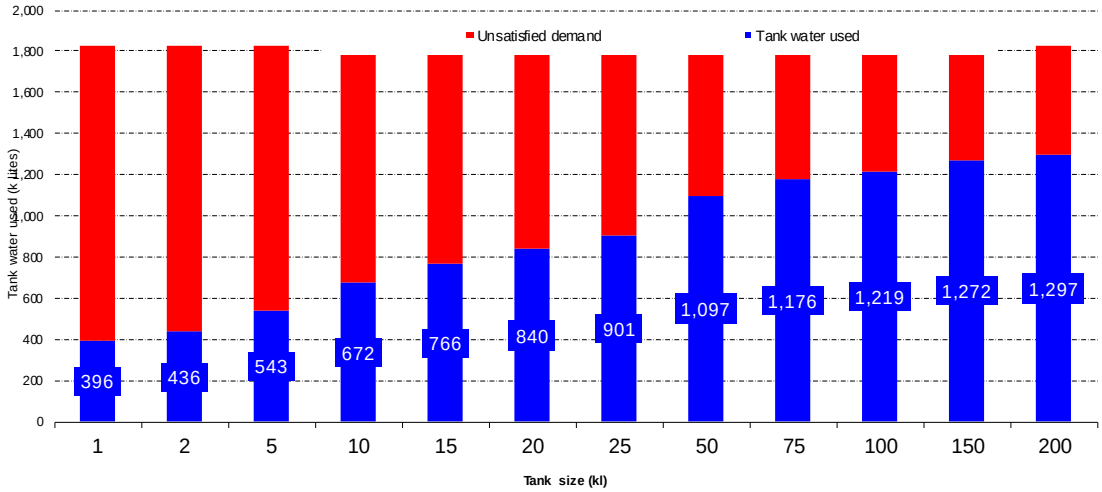
Reliability of supply (daily demand met)- Tank size what ifs

Tank	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
1k	12%	10%	10%	16%	21%	20%	19%	21%	17%	16%	15%	12%	16%
2k	12%	10%	10%	16%	21%	20%	20%	22%	18%	16%	15%	12%	16%
5k	18%	16%	17%	25%	31%	30%	29%	33%	27%	24%	25%	21%	25%
10k	22%	20%	21%	32%	41%	39%	38%	41%	34%	32%	32%	28%	32%
20k	28%	28%	28%	41%	52%	49%	48%	52%	42%	42%	41%	41%	41%
50k	41%	44%	40%	58%	72%	65%	59%	68%	54%	54%	61%	64%	57%
100k	54%	50%	50%	61%	77%	76%	63%	72%	61%	60%	68%	73%	64%
200k	65%	60%	57%	64%	78%	81%	72%	73%	66%	60%	69%	76%	69%

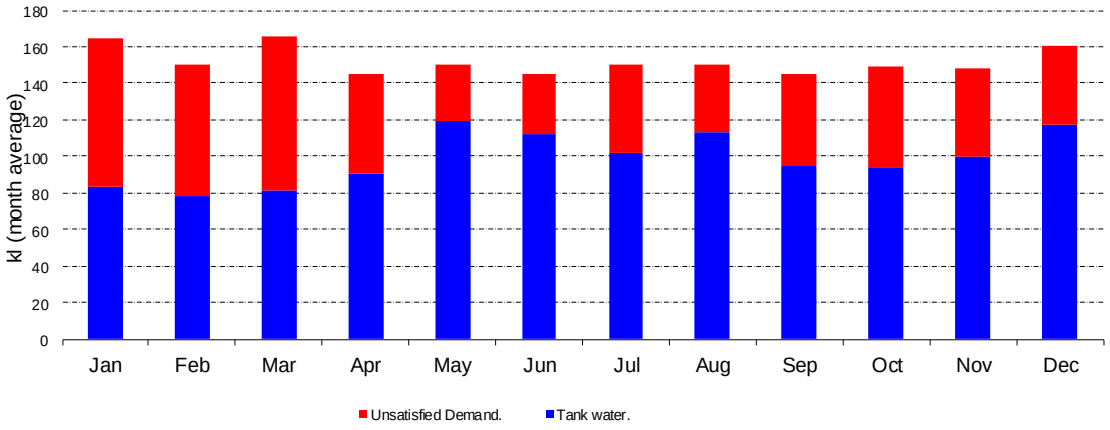
Graph 2 - Reliability of supply from tank (average across 12 years)



Graph 3 -Tank water used (per year) V Tank size Kls per year



Graph 4 - Tank water used v unsatisfied demand by month (kls per month)



Appendix G. WSUD Maintenance Manual

Rainwater Harvesting System Maintenance Program

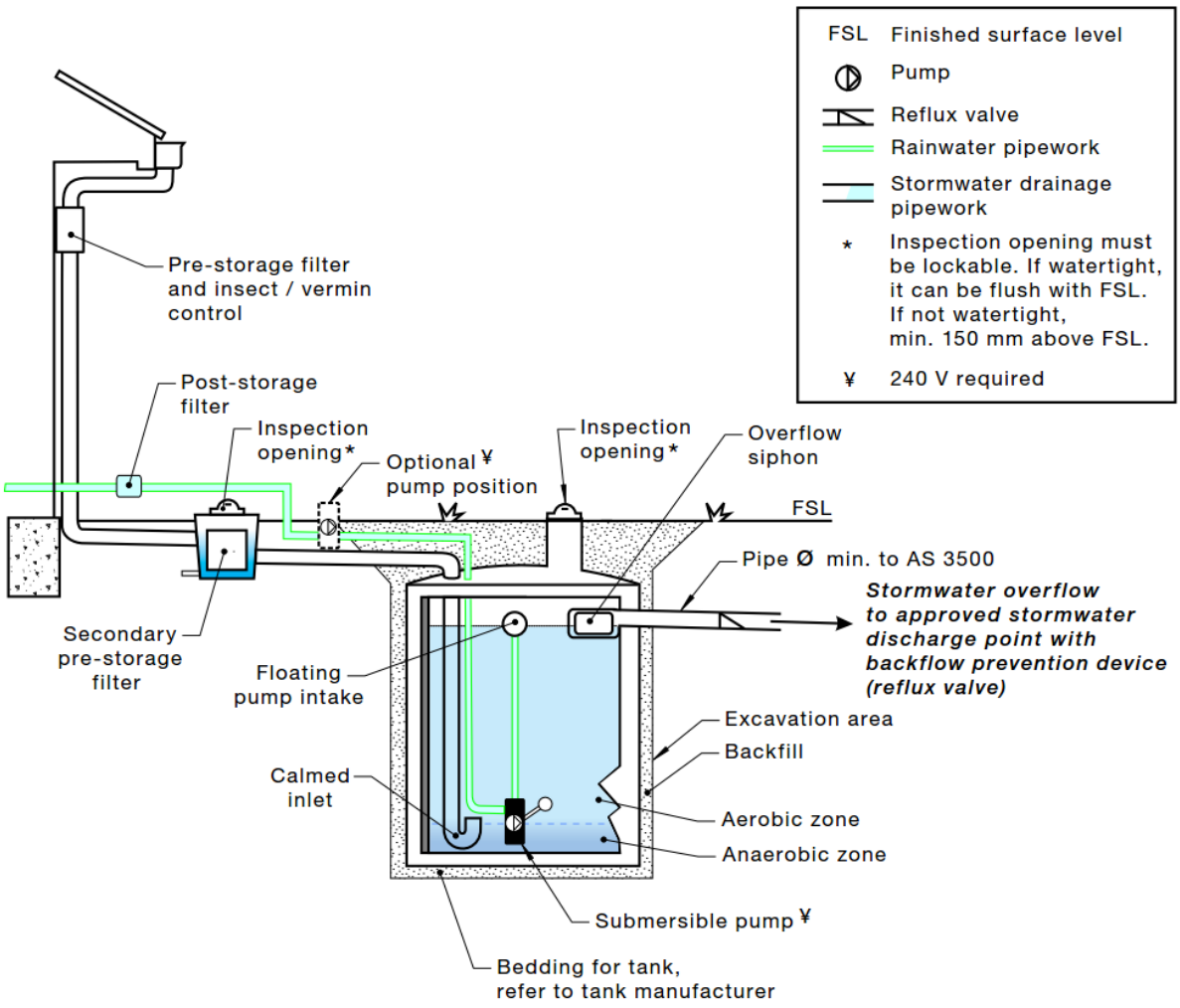
Once installed, a systematic maintenance program will be implemented by the owner's corporation maintenance contractor to ensure the rainwater harvesting system operates as designed and water quality is maintained.

The scope of the maintenance program will include inspection and rectification of issues associated with:

- Roof gutters and downpipes
- First flush screens and filtration devices
- Pumps
- Distribution pipework and reticulation systems
- Overflow systems

Inspections of the system and any maintenance works required will be undertaken on a quarterly basis or as per manufacturers guidelines.

The rainwater harvesting system will be installed in accordance with the guidelines set out in the Rainwater Design & Installation Handbook published by the National Water Commission[3]. A schematic diagram of the rainwater tank installation is provided below.



[3] Rainwater Design & Installation Handbook, National Water Commission, 2008

Maintenance Checklist

Rainwater Tank Element	Inspection Item	Y/N	Likely Maintenance Task
Roof gutters and downpipes	Is there leaf litter or debris in the gutters?		Remove by hand and dispose responsibly
First flush diverter	Is there anything blocking the first flush diverter (Leaves etc.)?		Remove by hand and dispose responsibly
Potable mains back up device	Is the potable mains back up switch operating correctly?		Repair or replace devise. Consider a manual switching device.
Mesh cover	Has the mesh cover deteriorated or have any holes in is?		Replace mesh cover.
Tank volume	Is there large amounts of sediment or debris sitting in the bottom of the tank, reducing the volume available in the tank to store water?		Remove sediment and dispose responsibly.
Pump	Is the pump working effectively? Have you heard it on a regular basis?		Check the potable mains back up is not permanently on. Repair or replace pump.
Pipes and taps	Are pipes and taps leaking?		Repair as needed.
Overflow	Is the overflow clear and connected to the storm water network?		Remove blockages and/or restore connections to stormwater network.

Maintenance Frequency												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All tasks	**x**			**x**			**x**			**x**		

Appendix H. Site Management Plan

During the construction phase, the key pollutants at risk of entering the stormwater system include:

- Sediments (soil, sand, gravel and concrete washings); and
- Litter, debris etc.

These pollutants arise from factors such as dirt from construction vehicles, stockpiles located close to surface runoff flow paths, and surface runoff from disturbed areas during earthmoving and construction works. It is therefore important to have measures that either prevent or minimise the pollutant loads entering stormwater system during construction.

In order to mitigate the impacts of the above pollutants on the stormwater system, the following stormwater management strategies will be implemented during the construction phase as appropriate:

- Installation of onsite erosion and sediment control measures. All installed control measures shall be regularly inspected & maintained to ensure their effectiveness. Such measures may include (but not limited to):
    - Silt fences
    - sediment traps
    - hay bales
    - geotextile fabrics
- Where possible, litter bins with a lid will be used to prevent litter from getting blown away and potentially entering stormwater drains.

Additionally, the following work practices shall be adopted to reduce stormwater pollution:

- Site induction by the head contractor/ builder to make personnel aware of stormwater management measures in place
- Employ suitable measures to reduce mud being carried off-site into the roadways such as installing a rumble grid/ gravel/ crushed-rock driveway (or equivalent measure) to provide clean access for delivery vehicles, removing mud from vehicle tyres with a shovel etc.
- Safe handling and storage of chemicals, paints, oils and other elements that could wash off site to prevent them from entering stormwater drains.
- Where practicable, stockpiles will be covered, located within the site's fence and away from the lowest point of the site where surface runoff will drain to. This initiative will minimise erosion.

Accordingly, the measures presented above are considered appropriate for the proposed development at this stage of the project. The measures will reduce the pollutants entering stormwater system from the site during construction works thereby protecting waterways.

Furthermore, the initiatives are consistent with the Application Requirements set out in Clause 53.18-6 of the City of Melbourne Planning Scheme.