

ADVERTISED COPY

PROPOSED MIXED-USE DEVELOPMENT

409 Clayton Road, Clayton

SUSTAINABLE MANAGEMENT PLAN

&

WATER SENSITIVE URBAN DESIGN RESPONSE

FOR

409 CLAYTON GROUP TRUST

27 November 2020

File 1493A



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Any enquiries regarding the use of this report should be directed to:

ARK RESOURCES PTY LTD
ABN 29 086 461 369
Suite 8, 10 Northumberland Street
South Melbourne VIC 3205
Australia

P: +61 3 9636 0280

W: arkresources.com.au

E: info@arkresources.com.au

1. Executive Summary

The proposed mixed-use development at 409 Clayton Road, Clayton has been designed to meet the objectives of the Monash City Council's Sustainability Policy Clauses 19-03-3S and 22.13 (Environmentally Sustainable Development Policy) of the Monash Planning Scheme. This report demonstrates how the development meets policy objectives of Clause 22.13-2 of the Planning Scheme.

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.

The development also meets the *Best Practice* standard for Urban Stormwater Quality and is therefore also consistent with the City of Monash's Stormwater Management objectives.

Accordingly, the performance outcomes achieved by the proposed development considered to be appropriate for a mixed-use development of this scale.

2. Introduction

Ark Resources has been engaged by 409 Clayton Group Trust to provide advice in relation to environmentally sustainable development outcomes from the proposed mixed-use development at 409 Clayton Road.

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:

- Town planning Rev. A Architectural plans prepared by Ewert Leaf dated 16th November 2020 as set out below:

DRAWING LIST		TP-150	PROPOSED PLAN - BASEMENT 1
TP-000	COVER PAGE	TP-400	ELEVATIONS - EAST
TP-010	EXISTING CONDITIONS	TP-401	ELEVATIONS - SOUTH
TP-011	EXISTING CONDITIONS PHOTOS	TP-402	ELEVATIONS - WEST
TP-012	DEMOLITION PLAN	TP-403	ELEVATIONS - NORTH
TP-020	DESIGN RESPONSE - NEIGHBORHOOD CONTEXT	TP-500	SECTIONS
TP-021	DESIGN RESPONSE - KEY VIEWS	TP-501	SECTIONS
TP-022	DESIGN RESPONSE - FUTURE DEVELOPMENT	TP-900	SHADOW DIAGRAM - 9AM & 10AM
TP-023	DESIGN RESPONSE - DIAGRAMS (BUILDING FORM)	TP-901	SHADOW DIAGRAM - 11AM & 12PM
TP-024	DESIGN RESPONSE - DIAGRAMS (BUILDING USE)	TP-902	SHADOW DIAGRAM - 1PM & 2PM
TP-026	DESIGN RESPONSE - SITE PLAN	TP-903	SHADOW DIAGRAM - 3PM
TP-027	DESIGN RESPONSE - GROUND FLOOR PLAN		
TP-100	PROPOSED PLAN - GROUND FLOOR		
TP-101	PROPOSED PLAN - FIRST FLOOR		
TP-102	PROPOSED PLAN - 1A MEZZANINE FLOOR		
TP-103	PROPOSED PLAN - SECOND FLOOR		
TP-104	PROPOSED PLAN - THIRD FLOOR		
TP-105	PROPOSED PLAN - FOURTH FLOOR		
TP-106	PROPOSED PLAN - FIFTH FLOOR		
TP-107	PROPOSED PLAN - SIXTH FLOOR		
TP-108	PROPOSED PLAN - SEVENTH FLOOR		
TP-109	PROPOSED PLAN - EIGHTH FLOOR		
TP-110	PROPOSED PLAN - NINTH FLOOR		
TP-111	PROPOSED PLAN - TENTH FLOOR		
TP-112	PROPOSED PLAN - ELEVENTH FLOOR		
TP-113	PROPOSED PLAN - TWELFTH FLOOR		
TP-114	PROPOSED PLAN - THIRTEENTH FLOOR		
TP-115	PROPOSED PLAN - FOURTEENTH FLOOR		
TP-116	PROPOSED PLAN - FIFTEENTH		
TP-117	PROPOSED PLAN - SIXTEENTH		
TP-118	PROPOSED PLAN - ROOF		

3. Relevant Policy Requirements

Clause 22.13 Environmentally Sustainable Development Policy of the Monash Planning Scheme is applicable to new residential and non-residential developments.

The overarching objective of the policy is that development should achieve best practice in environmentally sustainable development from the design stage through to construction and operation.

Clause 22.13-2 cites the following relevant policy objectives in relation to specific elements of sustainable design:

Energy performance

- *To improve the efficient use of energy, by ensuring development demonstrates design potential for ESD initiatives at the planning stage.*
- *To reduce total operating greenhouse gas emissions.*
- *To reduce energy peak demand through particular design measures (e.g. Appropriate building orientation, shading to glazed surfaces, optimise glazing to exposed surfaces, space allocation for solar panels and external heating and cooling systems).*

Water resources

- *To improve water efficiency.*
- *To reduce total operating potable water use.*
- *To encourage the collection and reuse of stormwater.*
- *To encourage the appropriate use of alternative water sources (e.g. greywater).*

Indoor Environment Quality

- *To achieve a healthy indoor environment quality for the wellbeing of building occupants, including the provision of fresh air intake, cross ventilation, and natural daylight.*
- *To achieve thermal comfort levels with minimised need for mechanical heating, ventilation and cooling.*
- *To reduce indoor air pollutants by encouraging use of materials with low toxic chemicals.*
- *To reduce reliance on mechanical heating, ventilation, cooling and lighting systems.*
- *To minimise noise levels and noise transfer within and between buildings and associated external areas.*

Stormwater Management

- *To reduce the impact of stormwater run-off.*
- *To improve the water quality of stormwater run-off.*
- *To achieve best practice stormwater quality outcomes.*
- *To incorporate the use of water sensitive urban design, including stormwater re-use.*

Transport

- *To ensure that the built environment is designed to promote the use of walking, cycling and public transport, in that order.*
- *To minimise car dependency.*
- *To promote the use of low emissions vehicle technologies and supporting infrastructure.*

Waste management

- *To promote waste avoidance, reuse and recycling during the design, construction and operation stages of development.*
- *To ensure durability and long-term reusability of building materials.*
- *To ensure sufficient space is allocated for future change in waste management needs, including (where possible) composting and green waste facilities.*

Urban Ecology

- *To protect and enhance biodiversity within the municipality.*
- *To provide environmentally sustainable landscapes and natural habitats, and minimise the urban heat island effect*
- *To encourage the retention of significant trees.*
- *To encourage the planting of indigenous vegetation.*
- *To encourage the provision of space for productive gardens, particularly in larger residential developments*

4. Site Description

The proposed development comprises:

- 152 residential apartments with 200 bedrooms;
- Retail tenancies with a total NLA of approximately 1,520m²; and
- Office tenancies with a total NLA of approximately 1,710m²

The site is located within the Monash City Council.

The development site has an area of approximately 2,100m² and currently contains a single-storey brick building. The surrounding buildings are a mix of residential and commercial use.

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

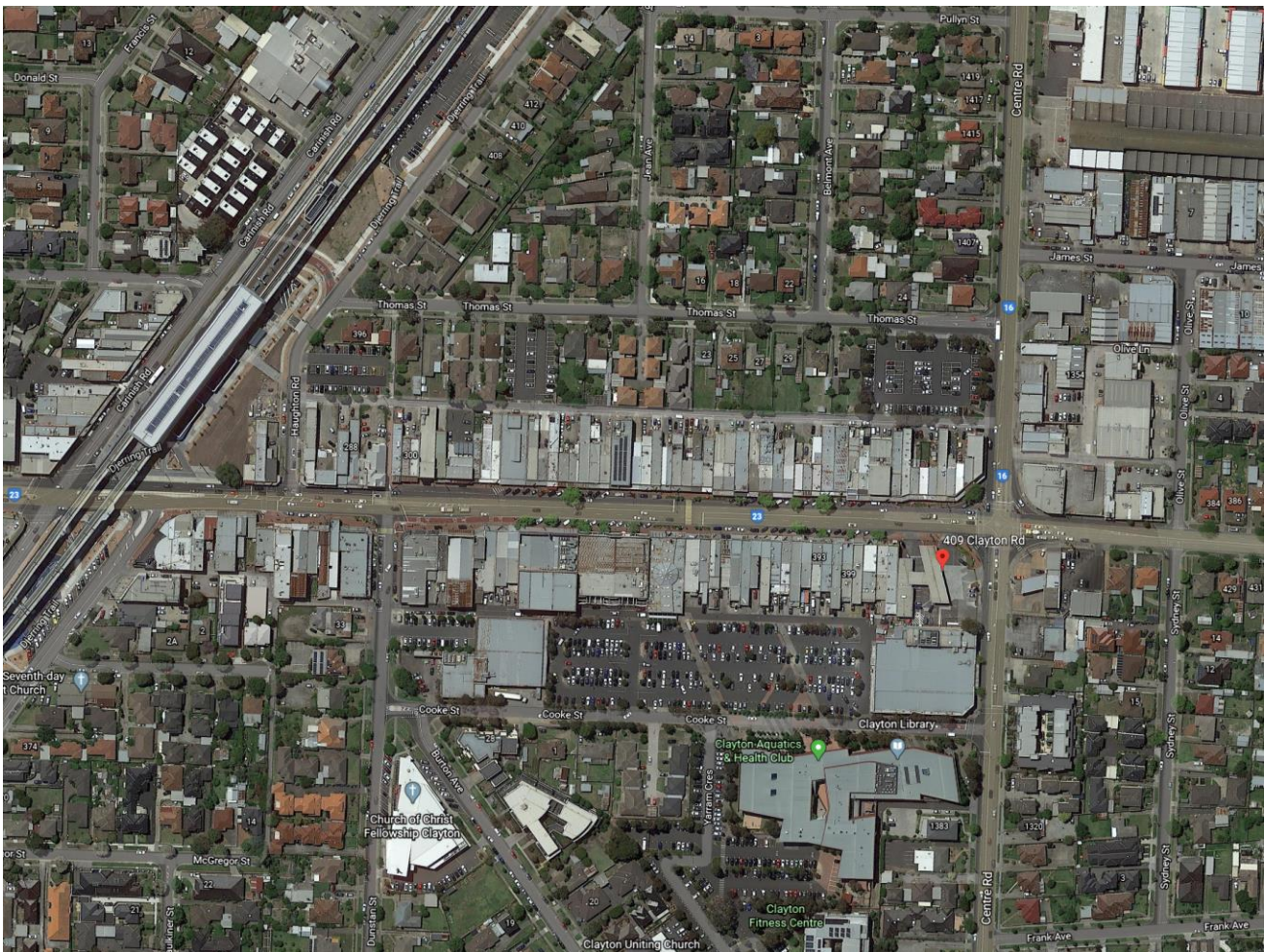


Image ©Google Earth™ (accessed April 2020)

5. Summary of Key ESD Initiatives

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

- Average NatHERS rating for apartments of 7 stars
- 28 kWp rooftop solar photovoltaic system;
- Rainwater harvesting system for toilet flushing and irrigation;
- 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* and *STORM* benchmarking tools based on the proposed architectural design and the building services and materials initiatives considered feasible at this stage of the design process.

The information presented in this report demonstrates that:

- The development will achieve a 5 star Green Star Design & As Built rating;
- The development will achieve an overall energy performance of the non-residential portion of the building 10% better than the minimum permitted by NCC 2019;
- The development meets the *Best Practice* standard for stormwater quality.

6. Green Star

The Green Star Design & As Built (Version 1.3) 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 standard¹.

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 4 star Green Star rating are detailed in Section 5.1 below.

6.1. 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 v1.3 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	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Green Star Accredited Professional involved from outset to completion • Services and Maintainability Review undertaken during design stage • Design Intent Report prepared • Commissioning plan in accordance with CIBSE Commissioning Code M • Climate Adaptation Plan prepared • Detailed Operations and Maintenance Manual prepared • Detailed guide to building systems provided to occupants • Measurement and reporting of building performance metrics 	

¹ Note that a minimum of 60 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.

Green Star Element	Design Attribute	Reference
	<ul style="list-style-type: none"> • End of life fitout waste reduced • Monitoring systems in accordance with CIBSE TM39 including metering schedule with load estimates • Head contractor to have current ISO 14001 certification • Operational Waste Management Plan prepared including targets and monitoring 	
Indoor Environmental Quality	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Ventilation systems to comply with ASHRAE 62.1, and pre-cleaned prior to handover • Exhaust systems to directly exhaust pollutants to exterior • Reverberation times in nominated areas must be below maximum stated in Table 1 of AS/NZ 2107:2016 • Commercial lighting systems designed to meet best practice illuminance levels • General fixed lighting to apartments provides illumination for the entire room and fittings (excluding decorative fittings) have a rated colour variation not exceeding 3 MacAdam Ellipses • Apartments to have wall mount or wall wash fittings to one wall in each living and bedroom space • Average ceiling illuminance of at least 30% of working plane and 90% of ceiling to have reflectance of at least 0.75 to commercial tenancies • Lighting systems designed for task lighting and brightness control • 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	<ul style="list-style-type: none"> • 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. • Commercial tenancies to achieve minimum 10% improvement over NCC Section J DTS provisions 	Conditional Requirement

Green Star Element	Design Attribute	Reference
	<ul style="list-style-type: none"> • Development NatHERS energy rating average 7 stars • Lighting power density reduced by 10% in apartments • Apartment room lighting controlled by independent switches • Common area lighting to be controlled by motion detectors and daylight sensors (as appropriate) • Reverse cycle heat pumps to apartments, with minimum energy rating of 3* heating & 3* cooling and rated capacities within 10%/20% of design capacities • 28kWp rooftop mounted photovoltaic system serving common area power. <ul style="list-style-type: none"> ○ Embodied ecological impacts of PV array and support racking will be reduced by over 25% through use of 350Wp 120-cell modules with efficiency over 25% greater than standard PV modules. ○ Embodied impacts of PV modules will be further reduced by procurement from a manufacturer with an <i>above average</i> rating on the current version Silicon Valley Toxics Coalition Solar Scorecard. • Modelling undertaken to non-residential spaces to ensure energy and greenhouse gas emissions reduction target for 4 points • 95% gross thermal efficiency gas condensing boiler • Energy efficient appliances within 1 star of best available at time of tender. • Lift energy efficiency is Class A • 95% of dwellings contain internal or external clotheslines • Air tightness testing of 10% of apartments before handover, 	<p>Appendix A</p> <p>Appendix B</p> <p>Appendix C</p>
Transport	<ul style="list-style-type: none"> • Accessible public transport options • Reduced car parking - 164 spaces provided • Electric vehicle charging infrastructure for 5% of car-parking spaces (chargers for 10 spaces). Chargers will be 3-phase 22kW IEC 62196 Type 2 Mode 3 with energy metering and remote comms capability (WiFi /Ethernet/4G). • 44 staff and residents bicycle racks, plus 18 visitor spaces 20% horizontal racks, installed at grade (10 spaces = 5 hoops) • Local amenities within walking distance 	
Water	<ul style="list-style-type: none"> • Water efficient fixtures (WELS 5 star taps, 4 star toilets, 3 star showers) • Water efficient dishwashers • STORM modelling has been undertaken to confirm the development attains the Best Practice standard for urban stormwater quality • A rainwater harvesting system will be installed comprising: <ul style="list-style-type: none"> ○ Rainwater harvesting from all roof areas and terraces on levels 10 and 11 (catchment area of approx. 1,887m²); 	<p>Appendix D</p> <p>Appendix E</p> <p>Appendix F</p>

Green Star Element	Design Attribute	Reference
	<ul style="list-style-type: none"> ○ Filtration and UV treatment prior to discharge into the rainwater tank; ○ A total storage volume of 60,000 litres; ○ Re-use of water for toilet flushing in levels 5 to level 9 toilets; ○ Re-use of water for sub-soil drip irrigation system with automatic control via moisture sensors and timers ● Cooling towers not used ● Fire test system water storage and re-use 	
Materials	<ul style="list-style-type: none"> ● Steel to be sourced from Responsible Steel Maker ● Waste contractor and processing facility comply with Green Star reporting criteria 	
	<ul style="list-style-type: none"> ● Specification of common use PVC products that meet Best Practice Guidelines for PVC in the Built Environment ● Documentation provided on product sustainability credentials for 3% of materials used on the project ● Concrete mixes to incorporate at least 30% reduction in Portland cement ● Concrete mixes to incorporate at least 50% reclaimed water ● Concrete mixes to incorporate at least 25% replacement of fine aggregate with manufactured sand ● 5% reduction in mass of steel reinforcement ● Steel fabricator to be member of the ASI Environmental Sustainability Charter Group ● Divert 90% of demolition and construction waste from landfill. Waste contractors to have compliance measures audited 	
Land Use & Ecology	<ul style="list-style-type: none"> ● 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
	<ul style="list-style-type: none"> ● Site has been previously developed ● All non-trafficable roofs to have initial solar reflectance index of 82. 	
Emissions	<ul style="list-style-type: none"> ● All outdoor lighting to comply with AS4282:1997 for light spill to inhabited boundaries. 	Conditional Requirement
	<ul style="list-style-type: none"> ● STORM 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% 	

Green Star Element	Design Attribute	Reference
	<ul style="list-style-type: none"> Strategies to minimise Legionella impacts from cooling systems implemented 	
Innovation	<p>Particularly subject to design development but may include:</p> <ul style="list-style-type: none"> Stimulate transformation of PV market through incentivising best-practice manufacturing practices, marketing and CSR reporting and promoting procurement of higher-efficiency modules. Embodied ecological impacts of PV array and support racking will be reduced by 250% through use of 350Wp 120-cell modules with efficiency 25% or greater than conventional PV modules. Electrolysed water system producing cleaning/sanitising water streams serving cleaners sinks, office/common area tea-stations etc. Electrical ‘shutdown’ master switches installed in apartments to facilitate turning off lights and air-conditioning upon departure. The objective is to minimise energy use in unoccupied spaces, in accordance with Ene-7 Credit of Green Star Multi-Residential legacy tool Stimulate transformation of EV charger market through incentivising charging via 3-phase 32A (22kW). EV charging stations with RFID badge authentication and automated load balancing between socket outlets and charging control. Remote metering and diagnostics checking functions to be provided via ethernet, WiFi or GPRS communication module using OCCP 1.6 protocol. 50% of internal paints to be ultra-low VOC type (<5g/litre). Innovation point targeted for Exceeding Green Star Benchmarks – Ultra Low VOC Paints Site-wide leak detection system installed to prevent risk of ongoing potable water wastage Provision of 4 shared pedal-assist e-bikes for residents Local Procurement - 80% of all services and skilled labour within 50km of site via site induction postcode recording 	

6.2. 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 Scorecard v1.3

Project:	409 Clayton Road Clayton	TP Application REV A	Points Available	Total Score Targeted
Targeted Rating:	5 Star - Australian Excellence	25/11/2020	100	60.3

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	Points Available	5* pathway
Management				14	
Green Star Accredited Professional	Appointment and active involvement of a Green Star AP to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional	1	1
		2.0	Environmental Performance Targets	-	Complies
		2.1	Services and Maintainability Review	1	1
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.2	Building Commissioning	1	1
		2.3	Building Systems Tuning	1	1
		2.4	Independent Commissioning Agent	1	
Adaptation and Resilience	To encourage and recognise projects resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2
Building Information	Info facilitating understanding of systems, O&M requirements and targets to optimise performance.	4.1	Building Information	1	1
Commitment to Performance	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	A. Contractual Agreements	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 Construction Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies
		7.1	Environmental Management System	1	1
		7.2	High Quality Staff Support	1	
Operational Waste (PCA requirement)	A. Performance Pathway	8A	Performance Pathway: Specialist Plan	1	1
		8B	Prescriptive Pathway: Facilities	0	
Total				14	12

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	A. Comparison to Industry Standards	2	
				B. Performance Based Approach C. Natural Ventilation		
9.3	Exhaust or Elimination of Pollutants	A. Removing the Source of Pollutants B. Exhausting the Pollutants Directly to the Outside	1	1		
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1		
		10.2	Reverberation	1	1	
		10.3	Acoustic Separation	A. Sound Reduction	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	
		11.1.1	General Illuminance and Glare Reduction	A. Non Residential Spaces B. Residential Spaces	1	1
				A. Prescriptive Method 1 B. Prescriptive Method 2 C. Performance Method		
		11.2	Surface Illuminance	A. Prescriptive Method B. Performance Method	1	1
				C. Residential Spaces (Prescriptive Method)		
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	A. Fixed Shading Devices B. Blinds or Screens C. Daylight Glare Model	-	Complies
		12.1	Daylight	A. Prescriptive Methodology B. Compliance Using Daylight Factor C. Compliance Using Daylight Autonomy	2	
				12.2		
Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Sealants and Carpets	A. Product Certification B. Laboratory Testing C. No Paints, Adhesives or Sealants	1	1
				A. Product Certification B. Laboratory Testing C. No Carpets		
		13.2	Engineered Wood Products	A. Product Certification B. Laboratory Testing	1	1
Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	A. Naturally Ventilated Spaces B. Mechanically Ventilated Spaces C. Residential Spaces	1	1
		14.2	Advanced Thermal Comfort	A. Naturally Ventilated Spaces B. Mechanically Ventilated Spaces C. Residential Spaces	1	
Total				17	10	

Energy		22		
Greenhouse Gas Emissions	B. NatHERS Rating Pathway	15B.0 Conditional Requirement: NatHERS Pathway	-	Complies
		15B.1 Thermal and Energy Performance	6	1.3
		15B.2.1 Lighting	1	1
		15B.2.2 Ventilation and Air Conditioning	2	2
		15B.2.3 Domestic Hot Water	2	1
		15B.2.4 Appliances & Equipment	1	1
		15B.2.5 Fuel Switching	1	
		15B.2.6 On-Site Storage	1	
		15B.2.7 Vertical Transportation	1	1
		15B.2.8 Passive Laundry Facilities	1	1
15B.2.9 Unoccupied Areas	1			
15B.2.10 Off-Site Renewables	5	2		
Peak Electricity Demand Reduction	A. Prescriptive Pathway	16A Prescriptive Pathway: On-Site Energy Generation	1	
		16B Modelled Performance Pathway: Reference Building	0	
Total		17	10.3	

Transport		10		
Sustainable Transport	B. Prescriptive Pathway	17A Performance Pathway	0	
		17B.1 Access by Public Transport	3	1
		17B.2 Reduced Car Parking Provision	1	1
		17B.3 Low Emission Vehicle Infrast B. Parking for Electric Vehicles	1	1
		17B.4 Active Transport Facilities	1	
		17B.5 Walkable Neighbourhoods A. Proximity to Amenities	1	1
Total		7	4	

Water		12		
Potable Water	B. Prescriptive Pathway	18A Potable Water - Performance Pathway	0	
		18B.1 Sanitary Fixture Efficiency	1	1
		18B.2 Rainwater Reuse	1	
		18B.3 Heat Rejection	2	2
		18B.4 Landscape Irrigation	1	1
		18B.5 Fire Protection System Test Water	1	1
Total		6	5	

Materials				14			
Life Cycle Impacts	B. Prescriptive Pathway - Life Cycle Impacts	19A.1	Comparative Life Cycle Assessment	0			
		19A.2	Additional Reporting	A. Additional Life Cycle Impact Reporting	0		
				B. Material Selection Improvement			
				C. Construction Process Improvement			
				D. LCA Design Review			
		19B.1	Concrete	19B.1.1	Portland Cement Reduction	2	1
				19B.1.2	Water Reduction	0.5	0.5
				19B.1.3	Aggregates Reduction	A. Course Aggregate Reduction	0.5
		19B.2	Steel	A. Reduced Mass of Steel Framing	B. Reduction in Mass	1	
		19B.3	Building Reuse	19B.3.1	Façade Reuse	2	
19B.3.2	Structure Reuse			2			
19B.4	Structural Timber	19B.4.0	Responsible Sourcing	-	Complies		
		19B.4.1	Reduced Embodied Impacts	3			
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	20.1.0	Responsible Steel Maker	-	Complies
				A. Responsible Steel Fabricator	1	1	
		20.2	Timber	A. Certified Timber	1	1	
				B. Reused Timber			
20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	A. Products That Do Not Contain PVC	1	1			
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	A. Reused Products	3	1	
				B. Recycled Content Products			
				C. Environmental Product Declarations (EPDs)			
				D. Third Party Certification			
				E. Stewardship Programs			
Construction and Demolition Waste	A. Fixed Benchmark	22.0	Reporting Accuracy	A. Compliance Verification Summary	-	Complies	
		22A	Fixed Benchmark	1	1		
		22B	Percentage Benchmark	0			
Total				12	7		

Land Use & Ecology				6		
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	A. EPBC	-	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	A. Previously Developed Land	1	1
				A. Site Contamination	1	
		24.2	Contamination and Hazardous Materials	B. Hazardous Materials		
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.1	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
		26.2	Stormwater Pollution Targets		1
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies		-
		27.1	Light Pollution to Night Sky	A. Control of Upward Light Output Ratio (ULOR)	1
Microbial Control	Minimising impacts associated with harmful microbes in building systems.	28	Legionella Impacts from Cooling Systems	B. Waterless Heat Rejection Systems	1
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerants Impacts	C. Low Impact Refrigerants	1
Total					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		1
Market Transformation	Sustainability initiatives 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	Demonstrates a substantial improvement on the benchmark required to achieve full points on existing credit.	30C	Improving on Green Star Benchmarks		2
Innovation Challenge	Addresses a sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		1
Global Sustainability	Approved credit from a Global Green Building Rating tool that addresses a sustainability issue currently outside the scope of this Green Star rating	30E	Global Sustainability		
Total					10



5* pathway	
TOTAL SCORE TARGETED	60.3
Green Star rating	5 Star

7. 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 v1.3 rating tool
- Attain an average NatHERS rating for apartments of 7 stars
- Achieves an overall energy performance of the building 10% better than the minimum permitted by NCC 2019;
- Attain the *Best Practice* standard for urban stormwater quality

Accordingly, the performance outcomes achieved by the proposed development considered to be appropriate for a mixed-use development of this scale and are consistent with the objectives set out in Clauses 19.03-3S and 22.13 (ESD Policy) of the Monash Planning Scheme.



Jan Talacko
Director

Appendix A. NatHERS Energy Rating Results

FirstRate5 Version 5.3.0 (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/m ²)		
		Total	Heating	Cooling
5.01	7.2	84.8	74.9	9.9
5.03	6.6	105.3	95.2	10.1
5.04	7.8	63.5	52.8	10.7
5.06	7.9	58.5	38.0	20.5
5.08	8.1	56.4	49.0	7.4
5.09	7.9	63.1	52.1	11.0
5.10	7.7	67.8	57.1	10.7
5.11	7.9	61.9	52.1	9.8
5.13	6.8	98.8	86.8	12.0
14.01	6.9	91.7	82.0	9.7
14.03	5.5	142.4	130.6	11.8
14.04	6.8	98.6	85.2	13.4
14.06	7.8	65.4	45.9	19.5
14.08	7.7	68.6	60.1	8.5
14.09	7.6	70.3	59.8	10.5
14.10	7.5	73.9	63.1	10.8
14.11	7.9	59.9	50.4	9.5
14.13	6.6	104.2	92.9	11.3
16.01	6.8	99.3	86.3	13.0
16.02	7.1	88.5	76.3	12.2
16.03	7.7	68.0	53.3	14.7
16.04	5.8	132.2	118.8	13.4
16.05	6.3	113.5	99.1	14.4
16.06	6.7	102.3	91.0	11.3
16.07	6.5	106.8	94.4	12.4
Estimated Development Average	7.2	85.8	73.9	11.9

The results of the modelling confirm that a cooling load average of less than 21 MJ/m² has been met [NatHERS Climate Zone 62 Moorabbin] 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 109 MJ/m² and the average cooling load of less than 26 MJ/m² for the development has been met [NatHERS Climate Zone 62 Moorabbin]. The heating load does not exceed 147 MJ/m² and the cooling load does not exceed 37 MJ/m² 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	Suspended concrete slab	
Floor Insulation	50mm Kingspan K10 G2 Kooltherm soffit board: Underside of level 5 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 1.5	R 1.5
	Lightweight clad walls: Insulation R 2.5	R 2.5
Roof Insulation	Apartment ceiling / roof sections exposed to external roof above 60mm Kingspan K10 G2 Kooltherm soffit board:	R 2.85
Window Frames	Aluminium frames to all windows and glazed doors	
Sky Lights	None	
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-048-03 Double glazed 6mm Energy Advantage/12mm Air gap/6mm Clear	3.76	0.44	All Apartments
Capral – 419 Flushline Series Fixed	U	SHGC	
CAP-055-18 Double glazed 6mm Clear/12mm Air gap/6mm Energy Advantage	2.91	0.58	All Apartments
Capral – 35 Series Awning	U	SHGC	
CAP-051-03 Double glazed 6mm Energy Advantage/12mm Air gap/6mm Clear	4.55	0.41	All Apartments
Capral – 900 Series Sliding door	U	SHGC	
CAP-057-05 Double glazed 6mm Energy Advantage/12mm Air gap/6mm Clear	3.37	0.48	All Apartments

Glazing Type	Whole of Window Value		Location
Capral – 419 Flushline Series Fixed	U	SHGC	
Specified Glazing	CAP -059-071 Double Glazed 24mm InsulglassMax 564-Air	2.7	Apt 16.05 west bedroom window
Energy rating Software equivalent	CAP-055-50 419 Flushline Double glazed 8.38mm CPGy37/12Argon gap/6mm Clear	2.70	
Capral – 35 Series Awning Window	U	SHGC	
CAP 051-07 Double Glazed 24mm InsulglassMax 564-Air	4.4	0.20	Apt 16.05 west bedroom window

NOTES

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.

General Rating Assumptions

Item	Details
Floor Coverings	<ul style="list-style-type: none"> • Tiles to bathrooms, • 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 all exhaust fans.
Down lights	Recessed down lights in ceiling /roof space to be fitted with fire proof unvented down light covers (external roof areas only) 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
Ceiling Calculation	Calculation for loss of ceiling insulation due to down lights, exhaust fans, ceiling speakers etc. have been incorporated into the energy rating where applicable

NOTES

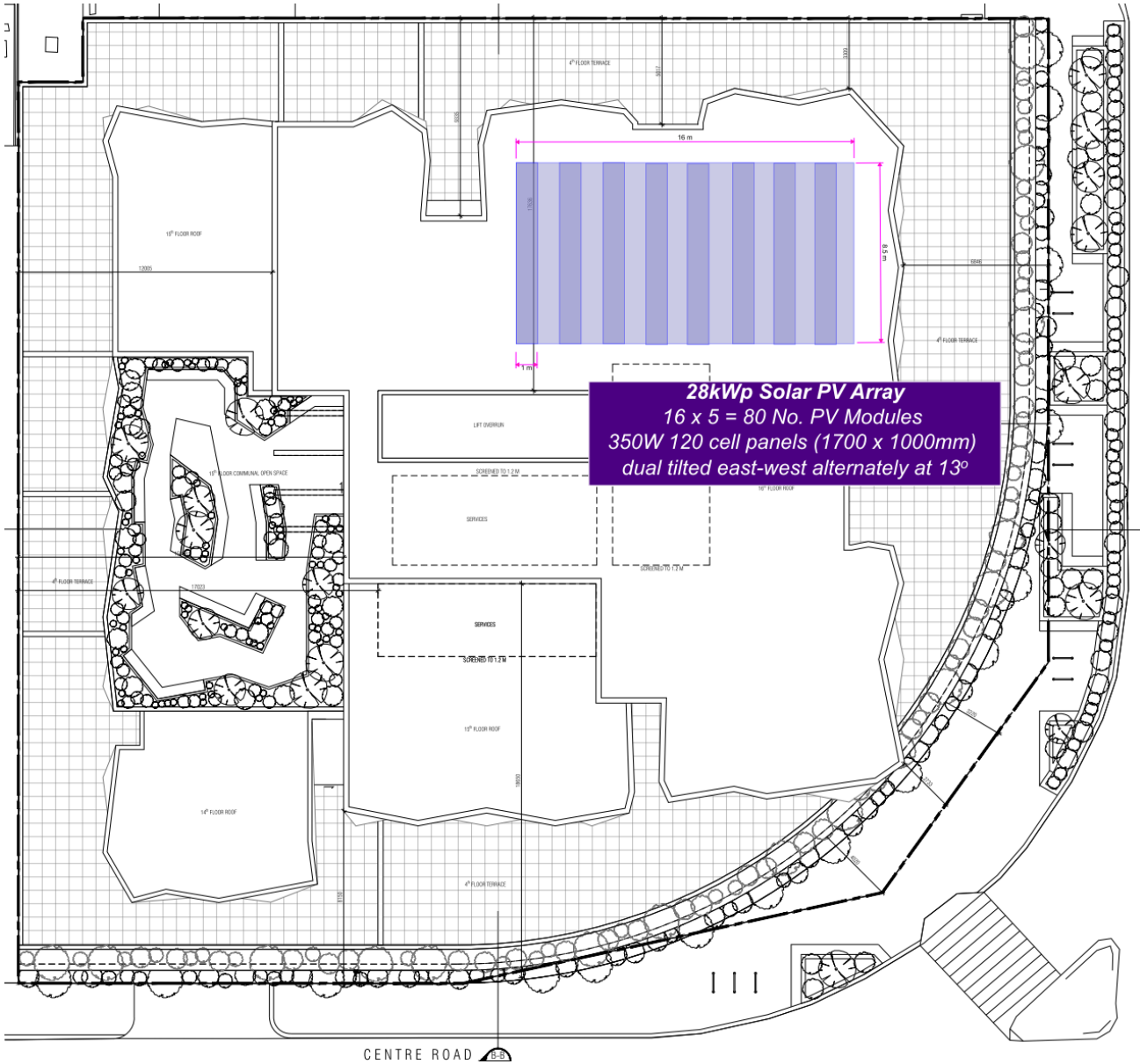
1. Changes to any of the above stated specifications may affect energy performance and invalidate the energy ratings detailed in this report.
2. Sealing of gaps and cracks: inadequate sealing of gaps and cracks can negatively affect the energy performance of a dwelling. Provide sealing in accordance 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 28kWp will be installed at roof level as per the preliminary layout indicated below.

PV modules will be oriented in pairs to the east and west at 10-15° tilt and have at least 350Wp capacity (i.e. over 25% more efficient than traditional 280Wp 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

The undulating east-west configuration prevents self-shadowing of the array and provides a low-profile installation with maximised packing factor. It also helps maximise self-consumption due to its flatter and broader power output yield profile.



Total yield of this array will be approximately 35MWh per annum equating to an estimated annual carbon emissions offset of 40 tonnes CO_{2-e} per annum.

Solar Modelling



Caution: Photovoltaic system performance predictions calculated by PVWatts[®] include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts[®] inputs. For example, PV modules with better performance are not differentiated within PVWatts[®] from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at <https://sam.nrel.gov>) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

Disclaimer: The PVWatts[®] Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department of Energy ("DOE") and may be used for any purpose whatsoever.

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any support, consulting, training or assistance of any kind with regard to the use of the Model or any updates, revisions or new versions of the Model.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a fixed (open rack) PV system at this location.

RESULTS

35,309 kWh/Year*

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)	Value (\$)
January	6.68	4,737	N/A
February	6.12	3,916	N/A
March	4.78	3,405	N/A
April	3.13	2,187	N/A
May	2.07	1,504	N/A
June	1.65	1,171	N/A
July	2.06	1,519	N/A
August	2.47	1,836	N/A
September	3.80	2,710	N/A
October	4.64	3,407	N/A
November	6.02	4,231	N/A
December	6.55	4,686	N/A
Annual	4.16	35,309	0

Location and Station Identification

Requested Location	moorabbin	
Weather Data Source	(INTL) MOORABBIN AIRPORT, AUSTRALIA	3.5 mi
Latitude	37.98° S	
Longitude	145.1° E	

PV System Specifications (Residential)

DC System Size	28 kW
Module Type	Premium
Array Type	Fixed (open rack)
Array Tilt	13°
Array Azimuth	90°
System Losses	11.08%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

Economics

Average Retail Electricity Rate	No utility data available
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Performance Metrics

Capacity Factor	14.4%
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Appendix C. NCC J1.5 Façade Calculator

Preliminary J1.5 Façade calculations have been carried out to determine window/wall ratios and thermal performance is achievable with the proposed design. NCC Section J compliance will be verified during detailed design via a dynamic thermal simulation in accordance with the NCC methodology.

NCC 2019 Wall-Glazing Calculator v3.0											
Wall and glazing energy efficiency in Class 2-9 buildings - Method 2 of Specification J1.5a, NCC 2019											
Building name and description 409 Clayton Road, Clayton					Classification Other			Climate Zone 6			
Calculated Area-Weighted U-Value 1.77					Calculated Representative Air-Conditioning Energy Value 185.4			Allowable Representative Air-Conditioning Energy Value 188.7			
Allowable Area-Weighted U-Value 2.00					Building total U-Value allowance met 89%			Building total SHGC allowance met 99%			
Check Values Visible		Wall Element Requirements Met			Display Glazing Element Requirements Met						
Use of this calculator does not guarantee compliance with the NCC. The disclaimer and a version update check are available at the bottom of the page.											
Element Description					U-Value			SHGC and Shading			
ID	Description (optional)	Element Type	Facing Sector	Area (m ²)	U-Value	U-Value Element share of allowance used	SHGC	Glazing Height (m)	Shading Height (m)	Shading Projection (m)	SHGC Element share of allowance used
1		Wall	North	384.10	0.60	5% of building total					Not counted
2		Wall	East	146.57	0.60	2% of building total					Not counted
3		Wall	South	115.10	0.60	1% of building total					Not counted
4		Wall	West	493.19	0.60	6% of building total					Not counted
1		Wall	Internal	550.01	0.60	7% of building total					Not counted
2		Display Glazing	North	0.00	5.80	Not counted	0.81				Not counted
3		Display Glazing	East	246.79	5.80	Not counted	0.81				Not counted
4		Display Glazing	South	57.70	5.80	Not counted	0.81				Not counted
5		Display Glazing	West	0.00	5.80	Not counted	0.81				Not counted
6		Glazing	East	46.33	3.90	4% of building total	0.21	2.7	0		0 9% of building total
7		Glazing	East	46.33	3.90	4% of building total	0.21	2.7	2.7		1 6% of building total
8		Glazing	East	116.89	3.90	10% of building total	0.21	3.3	3.3		1 15% of building total
9		Glazing	East	116.89	3.90	10% of building total	0.21	3.3	3.3		1 15% of building total
10		Glazing	East	79.53	3.90	7% of building total	0.21	2.95	2.95		1 11% of building total
11		Glazing	North	31.71	3.90	3% of building total	0.21	2.95	2.95		1 0% of building total
12		Glazing	North	19.97	3.90	2% of building total	0.21	2.95	2.95		1 0% of building total
13		Glazing	North	31.95	3.90	3% of building total	0.21	2.95	2.95		1 0% of building total
14		Glazing	South	66.15	3.90	6% of building total	0.21	2.7	0		0 7% of building total
15		Glazing	South	66.15	3.90	6% of building total	0.21	2.7	2.7		1 6% of building total
16		Glazing	South	80.82	3.90	7% of building total	0.21	3.3	0		0 9% of building total
17		Glazing	South	80.82	3.90	7% of building total	0.21	3.3	3.3		1 8% of building total
18		Glazing	South	67.91	3.90	6% of building total	0.21	3.3	3.3		1 6% of building total
19		Glazing	South	17.52	3.90	1% of building total	0.21	2.95	2.95		1 2% of building total
20		Glazing	South	10.35	3.90	1% of building total	0.21	2.95	2.95		1 1% of building total
21		Glazing	South	39.18	3.90	3% of building total	0.21	2.95	2.95		1 4% of building total
22		Glazing	South	12.18	3.90	1% of building total	0.21	2.95	2.95		1 1% of building total
23						Not counted					Not counted
Disclaimer:											
This calculator has been developed to assist in developing a better understanding of the glazing energy efficiency parameters of NCC 2019. While the author believes that the calculator, if used correctly, is likely to produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all. Your use of this calculator is entirely at your own risk and the author accepts no liability of any kind.											
Made by Alex Zeller											
Email alex.wallglazingcalculator@gmail.com with any suggestions for improvement										Check for version update	

Appendix D. STORM Results



STORM Rating Report

TransactionID: 1069199
 Municipality: MONASH
 Rainfall Station: MONASH
 Address: 409 Clayton Rd

Clayton
 VIC

Assessor: MR
 Development Type: Residential - Mixed Use
 Allotment Site (m2): 2,100.00
 STORM Rating %: 135

Description	Impervious Area (m2)	Treatment Type	Treatment Area/Volume (m2 or L)	Occupants / Number Of Bedrooms	Treatment %	Tank Water Supply Reliability (%)
Roofs + L10 & L11 terraces	1,887.00	Rainwater Tank	60,000.00	80	150.00	81.80
Remaining impervious	213.00	None	0.00	0	0.00	0.00

Date Generated: 25-Nov-2020

Program Version: 1.0.0

Rainwater Catchment Areas



Appendix E. Rainwater Harvesting

Property **409 Clayton Rd, Clayton**
Version

box 1

Inputs

PPL	80
Flush/Person/Day	5
Litres/Flush	3.3
Total Daily usage (litres)	1320
Roof area (m2)	1,887
Collection Evaporation	5%
Tank Capacity (litres)	60,000
Irrigation Area (m2)	115
T off if Total Rain (mm)	10
in the last	5 days

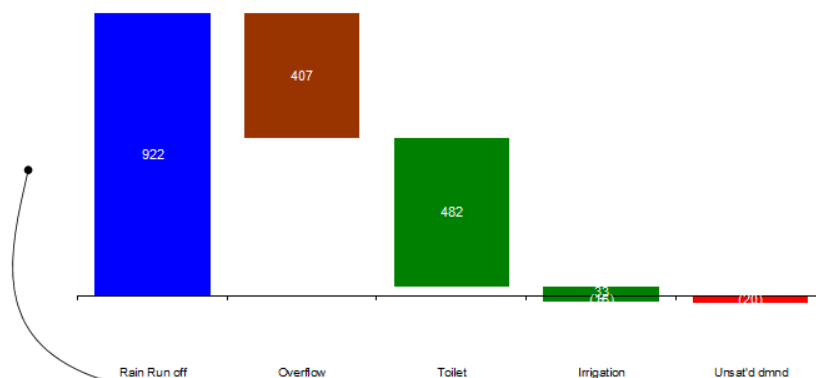
Recalc, update pivots, table and graphs

Irrigation Schedule

	I/m2	S	M	T	W	Th	Fr	S
Jan	10		y					
Feb	10		y					
Mar	10		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 (kL)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rain Run off	60	82	53	84	78	67	63	83	71	92	94	95	922
Overflow	(14)	(47)	(15)	(30)	(33)	(24)	(19)	(38)	(32)	(51)	(51)	(53)	(407)
Rain Water saved	46	35	38	54	45	43	43	44	39	41	43	42	515
Toilet	(41)	(37)	(41)	(40)	(41)	(40)	(41)	(41)	(40)	(41)	(40)	(41)	(482)
(Shortfall)/Surplus before Irrigation	6	(2)	(3)	14	4	3	2	3	(0)	0	3	1	33
Irrigation	(8)	(7)	(9)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(3)	(8)	(48.720)
Unsatisfied Demand	(3)	(9)	(11)	13	2	1	0	2	(2)	(2)	0	(7)	(16)

Actual Years (kL)

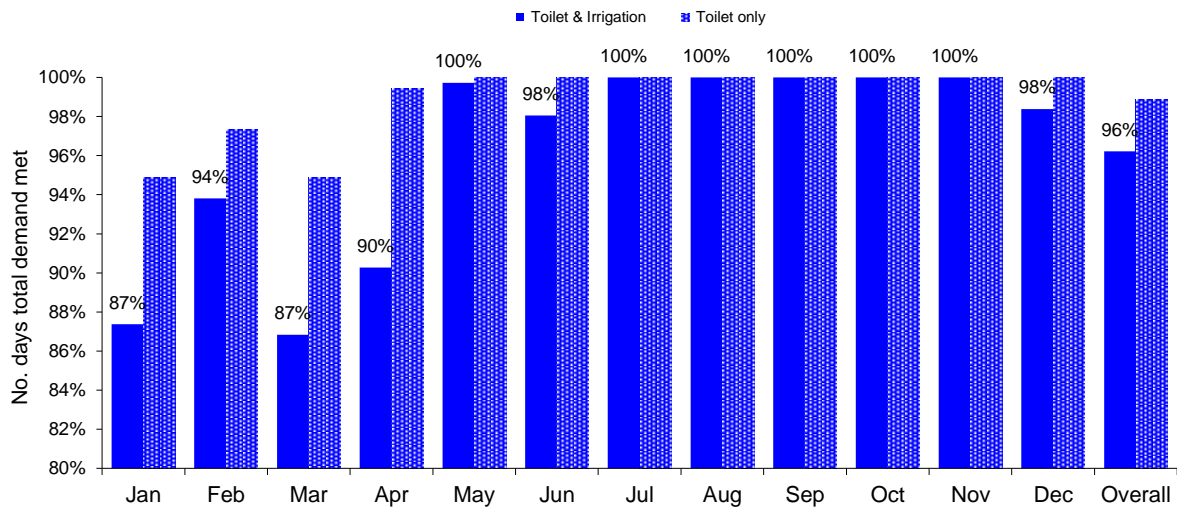
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Rain Run off	645	1,049	1,094	1,128	1,085	711	884	1,115	1,058	786	758	751	11,064
Overflow	(165)	(496)	(566)	(610)	(579)	(211)	(361)	(587)	(566)	(295)	(225)	(227)	(4,888)
Rain Water saved	480	552	528	518	506	500	523	528	492	491	533	525	6,176
Toilet	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(482)	(5,783)
(Shortfall)/Surplus before Irrigation	(2)	71	46	37	24	18	41	47	10	10	52	41	393
Irrigation	(55)	(41)	(41)	(45)	(49)	(49)	(51)	(47)	(51)	(44)	(56)	(55)	(585)
Unsatisfied Demand	(57)	29	5	(9)	(25)	(31)	(10)	(1)	(41)	(34)	(5)	(14)	(191)

box 4

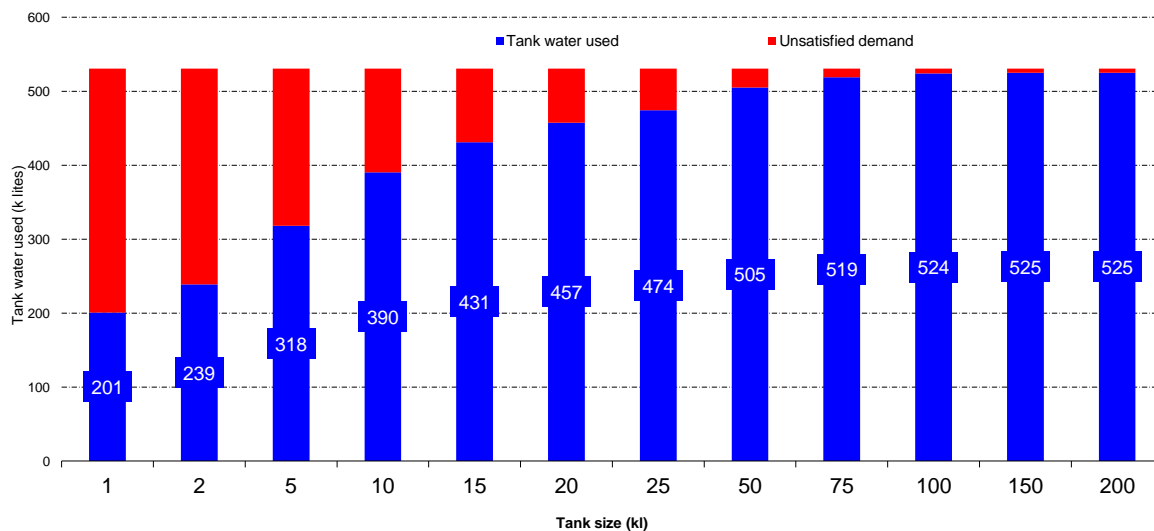
Reliability of supply (daily demand met)- Tank size what ifs

Tank	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
1k	21%	19%	17%	26%	31%	30%	36%	34%	35%	37%	29%	22%	28%
2k	27%	28%	24%	37%	42%	42%	48%	45%	48%	50%	38%	31%	38%
5k	38%	45%	36%	54%	57%	60%	67%	65%	65%	68%	55%	46%	55%
10k	50%	64%	48%	71%	74%	78%	81%	83%	79%	82%	74%	62%	71%
20k	67%	81%	60%	84%	91%	91%	94%	97%	91%	89%	95%	81%	85%
50k	84%	91%	82%	89%	100%	98%	100%	100%	100%	100%	100%	97%	95%
100k	95%	99%	94%	98%	100%	100%	100%	100%	100%	100%	100%	100%	99%
200k	95%	99%	94%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%

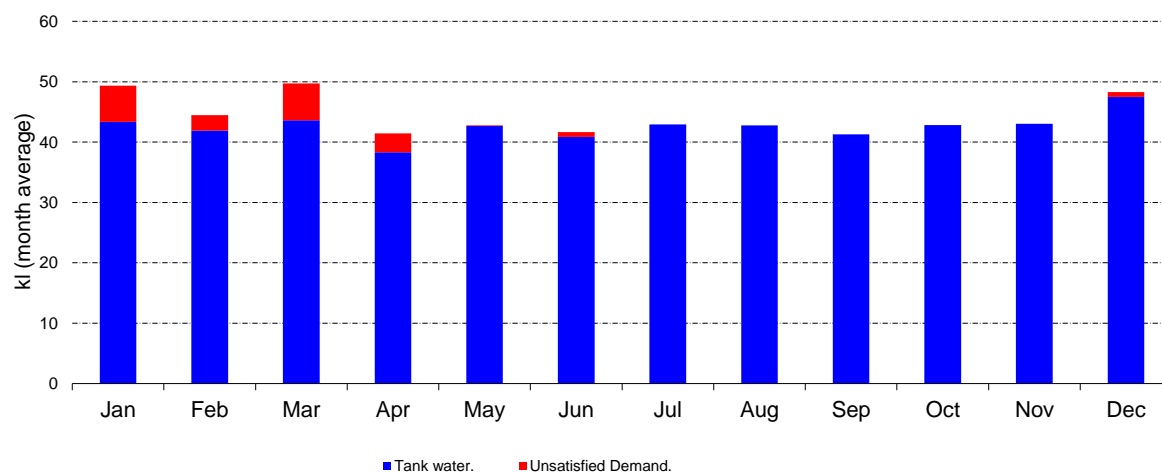
Graph 2 - Reliability of supply from tank (average across 12 years)



**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 F. WSUD Maintenance Program

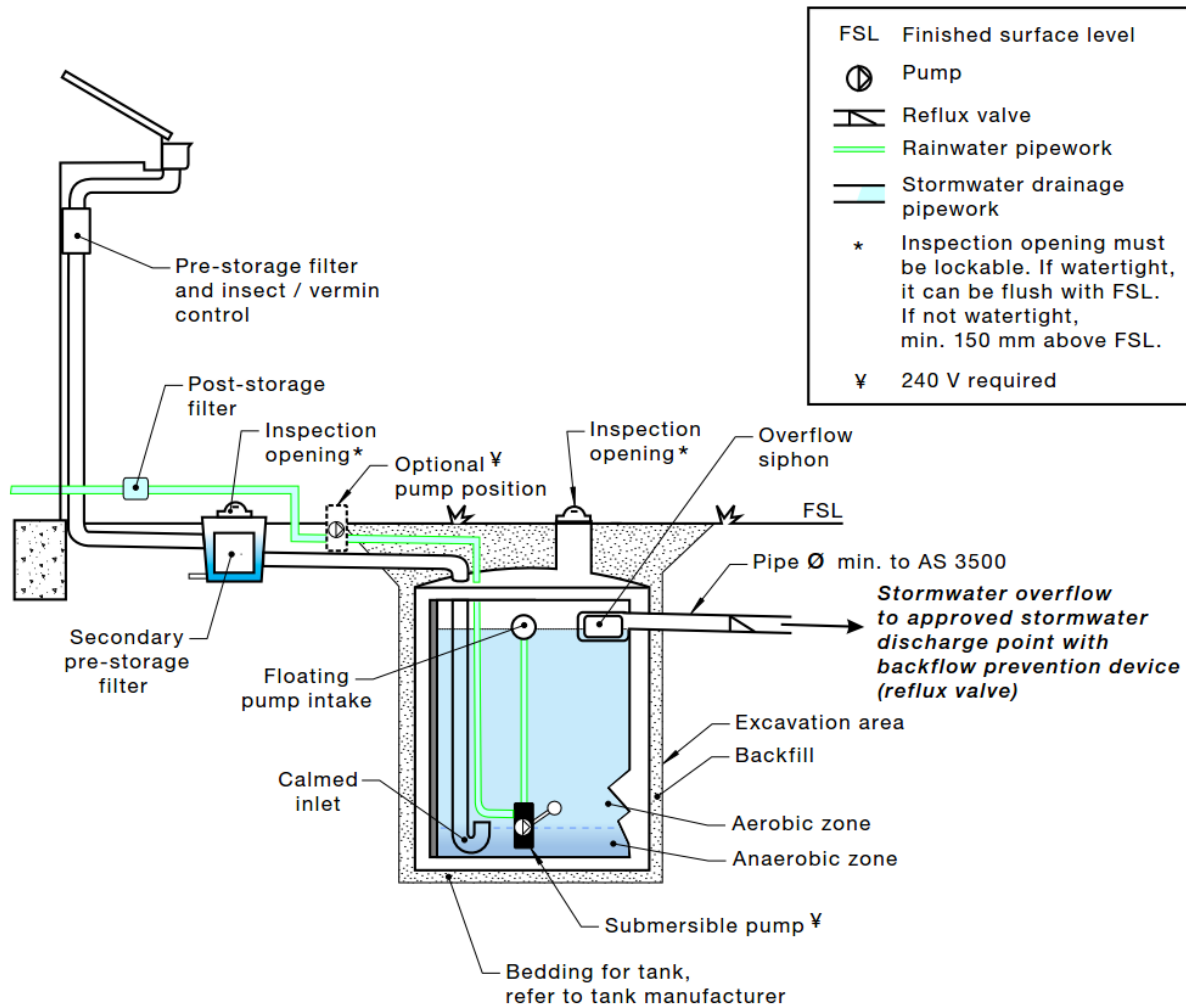
Once installed, a systematic maintenance program will be implemented by the owner’s corporation maintenance contractor to ensure the rainwater harvesting system operates as designed and water quality is maintained.

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 Commission³. A schematic diagram of the rainwater tank installation is provided below.



³ Rainwater Design & Installation Handbook, National Water Commission, 2006

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 device. Consider a manual switching device.
Mesh cover	Has the mesh cover deteriorated or have any holes in it?		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 G. 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.