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ESD Services
Sustainable Management Plan

Residential Development
437 St Kilda Road
Melbourne

Project No: 23058
Date: 02/02/2024

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Document Control

Version	Date	Issue	Author		Reviewer	
00	07/07/2023	Issue for Review	Li Huan	LH	Slav Angelovski	SA
01	10/08/2023	General Updates and Issue for Comments	Li Huan	LH	Slav Angelovski	SA
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04	02/02/2024	Issue for Submission	Earnest Joseph	EJ	Slav Angelovski	SA

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1. Executive Summary

The proposed residential building development at 437 St Kilda Road has been designed to meet the City of Melbourne's Energy, Water and Waste Efficiency Policy and National Construction Code (NCC 2019) Section J energy efficiency requirements.

Starting from 2022, the City of Melbourne has had numerous ESD requirements within the planning scheme and the most relevant one is under clause 15.01-2L-01 Energy and resource efficiency dated 21/09/2022.

The objective of Clause 15.01-2L-01 is to ensure buildings achieve high environmental performance standards at the design, construction and operation phases. It requires the residential development to be designed in line with accommodation energy efficiency, water efficiency and operational waste reduction. Below is an extract from the document.

Type of Building		Performance Measure	
		Energy Efficiency	Water Efficiency
Accommodation (except for Dependant Person's Unit, Camping & Caravan Park, Corrective Institution, Host Farm)	Up to 5,000 square metres gross floor area	N/A (sufficiently covered by the Building Code of Australia)	1 point for Wat-1 credit the Green Star – Multi Unit Residential rating tool or equivalent.
	Over 5,000 square metres gross floor area	Same minimum energy and water requirements as buildings up to 5,000 square metres plus a 5 star rating under a the Green Star - Multi Unit Residential rating tool or equivalent.	

The whole residential development at 437 St Kilda Road has been designed to exceed Clause 15.01-2L-01 requirements on accommodation as summarised below:

- Energy efficiency: Exceed NCC 2019 Section J;
- Minimum 20% potable water reduction under Green Star Buildings Version 1.0;
- A Waste Management Plan (WMP) has been prepared in accordance with the current version of the City of Melbourne's Guidelines for Waste Management Plans; and
- A 5 Star Green Star design and construction under the Green Star Buildings Version 1.0 for the whole development.

This report has demonstrated how the development especially the residential apartments will be designed in line with Clause 15.01-2L-01 performance measures on accommodation energy efficiency, water efficiency and operational waste reduction, Clause 53.18 'Stormwater Management in Urban Development' and Clause 19.03-3L 'Stormwater Management (Water sensitive urban design)' of the Melbourne Planning Scheme.

2. Introduction

The Sustainable Management Plan has been prepared to summarise the environmental objectives and initiatives incorporated into the design of the proposed residential development and demonstrates how these components incorporate environmentally sustainable design initiatives in accordance with the City of Melbourne clause 15.01-2L-01 Energy and resource efficiency objectives, Clause 53.18 'Stormwater Management in Urban Development' and Clause 19.03-3L 'Stormwater Management (Water sensitive urban design)' of the Melbourne Planning Scheme.

The ESD initiatives proposed for this development are based on:

- Architectural Drawing Package date 16/01/2024 Town Planning RFI Issue by Bates Smart Architecture;
- Discussions and correspondence with the Architects and Services Engineers.

The Site

The proposed 17-storey residential development is located at 437 St Kilda Road, Melbourne with convenient access to the gardens, entertainment and recreational facilities, schools and public transport. There are tram stops located within 1000m walking distance from the development and the development has achieved a ranking of 'Very Walkwable'via Walkscore.com.

Site Location

The development is located within the City of Melbourne and consists of

- Basement Level 3: Car Park and Lifts;
- Basement Level 2: Car Park, Lifts and Services;
- Basement Level 1: Car Park, Switch Room, Lifts and Services;
- Ground: Lobby, Gym, Pool, Bike Storage and Services;
- Level 01 to Level 07: Residential Tenancy;
- Level 08: Residential Tenancy, Outdoor Amenities and Services;
- Level 09 to Level 17: Residential Tenancy;
- Level 18 Roof Plant: Services Plant and Solar PV Panels.
- Level 19 Parapet

3. Sustainable Design Assessment in the Planning Process

The City of Melbourne current requirements on sustainable building design are to conform to the Melbourne Planning Scheme clause 15.01-2L-01 Energy and resource efficiency dated 21/09/2022. Below is an extract from the document.

Type of Building		Performance Measure	
		Energy Efficiency	Water Efficiency
Accommodation (except for Dependant Person's Unit, Camping & Caravan Park, Corrective Institution, Host Farm)	Up to 5,000 square metres gross floor area	N/A (sufficiently covered by the Building Code of Australia)	1 point for Wat-1 credit the Green Star – Multi Unit Residential rating tool or equivalent.
	Over 5,000 square metres gross floor area	Same minimum energy and water requirements as buildings up to 5,000 square metres plus a 5 star rating under a the Green Star - Multi Unit Residential rating tool or equivalent.	

3.1 Energy Efficiency

Thermally enhanced building fabric and window system are proposed to all residential apartments within the development. All apartments are to achieve a minimum 5.5-Star and average above 7.5-Star NatHERS energy rating to exceed NCC 2019 Section J requirements by minimum 10%.

3.2 Water Efficiency

Water efficient fixtures are proposed in conjunction with 30kL rainwater tank for toilet flushing, landscaping irrigation and fire testing water collection and reuse. Water efficient landscaping design is proposed to minimise water usage for irrigation.

3.3 Waste Efficiency

A Waste Management Plan (WMP) has been prepared in accordance with the current version of the City of Melbourne's Guidelines and Green Star requirements for Waste Management Plans.

3.4 5-Star Green Star

A 5-Star Green Star certified rating is targeted under Green Star Buildings V1 to form the base level of sustainable performance for the proposed mixed-use residential development. Refer to Section 4 for detail description.

4. Sustainable Design Initiatives – 5 Star Green Star

This section is focusing on implementing Green Star Buildings V1 environmental categories throughout the design and construction process to a 5-Star Green Star certified design which represents "Australian Excellence'' sustainable design.

A summary of the targeted Green Star credits of the proposed development is tabulated below.

Green Star Category	Targeted Score
Responsible	11
Healthy	8
Resilient	2
Positive	14
Places	3
People	0
Nature	2
Leadership	1
Overall score	**41 (35+ for a 5-Star Green Star design)**

A minimum of 35 points will be achieved to a 5-star Green Star design. An alternative assemblage of the Green Star targeted credits is considerable on condition that the performance outcome meets the City of Melbourne sustainable building design policies. A Green Star Scorecard is enclosed as Appendix A for reference.

4.1 Responsible

4.1.1 Industry Development

The development will facilitate partnership, collaboration, and data sharing to contribute to industry transformation through the following strategies:

- A principal participant in the design team is an ESD accredited professional engaged to provide sustainability advice throughout the project. IGS have been appointed to this role on the project;
- Disclose the costs related to sustainable building practices;
- Market the sustainability achievements for the building.

4.1.2 Responsible Construction

Improved environmental and social outcomes will be achieved through responsible construction practices for the development. The following sustainable initiatives will be implemented to meet the credit requirements.

- An environmental management system (ISO14001 accredited) will be implemented to manage the development's environmental impact on site;
- An environmental management plan covering the scope of the construction activities will be incorporated;
- At least 90% of the construction and demolition waste will be diverted from landfill complying with the Green Star Construction and Demolition Waste Report Criteria;
- At least three days of adequate training will be provided on the development's sustainable targets to 95% of all contractors and subcontractor on site.

4.1.3 Verification and Handover

The building will be designed to deliver high level of performance in terms of operation by incorporating the following initiatives:

- Appropriate metering and monitoring systems will ensure optimum building management;
- The building will address set environmental performance targets being commissioned, tuned, designed and tested airtightness;
- Operations and maintenance information will be provided to the building facilities maintenance team along with a Building logbook. Building User Guide will be provided to building users on how to mostly efficiently use the building.
- An independent commissioning agent will be appointed to provide verification to the design, planning, commissioning and tuning processes and / or soft landings approach involving the future facilities management team will be used in the project.

4.1.4 Operational Waste

The building will have appropriate spaces for waste management and an appropriately sized waste and resource storage area with safe and efficient access for occupants and contractors.

4.1.5 Responsible Procurement

A risks and opportunities assessment will be undertaken to ensure the building's design and construction follows ISO 20400 Sustainable Procurement – Guidance. A responsible procurement plan will then be developed to mitigate the risks and incorporate opportunities identified in the assessment.

4.1.6 Responsible Structure

Responsibly manufactured products with a Responsible Products Value of at least 10 will be used for 50% of the building's structural components (by cost).

4.1.7 Responsible Envelope

Responsibly manufactured products with a Responsible Products Value of at least 10 will be used for 30% of the building's envelope components (by cost).

4.1.8 Responsible Systems

Responsibly manufactured products with a Responsible Products Value of at least 6 will be used for 20% of the building's active systems (by cost).

4.1.9 Responsible Finishes

Responsibly manufactured products with a Responsible Products Value of at least 7 will be used for 40% of the building's internal finishes (by cost).

4.2 Healthy

4.2.1 Clean Air

The ventilation system is to be designed to mitigate the entry of outdoor pollutants, for ease of maintenance and cleaning; and will be cleaned prior to occupation and use. Design will comply with AS1668.2-2012 with regard to minimum separation distances between pollution sources and outdoor air intakes.

It is proposed that outside air rates be improved by at least 50% over the minimum requirements detailed in AS1668.2 for each mechanically ventilated air conditioning space. This is intended to improve the indoor air quality and assist the productivity and wellbeing of the building occupants.

4.2.2 Light Quality

All lights within the project are designed to be flicker free and accurately address the perception of colour in the space and all lighting levels and quality will comply with AS/NZS 1680.

The project team will ensure Glare from light sources will be limited to meet the credit requirements. The 437 St Kilda Road development is to provide high levels of natural daylight to the occupied areas. This can be in the form of external windows. As well as implementing a combination of best practice artificial lighting and best practice access to daylight.

Daylight Modelling Report is enclosed as Appendix B for reference.

4.2.3 Acoustic Comfort

An Acoustic Comfort Strategy describing how the building and acoustic design aims to achieve acoustic comfort to building occupants will be prepared.

The project will demonstrate two out of three of the following noise level requirements. These include maximum internal noise levels, acoustic separation and impact noise transfer.

4.2.4 Exposure to Toxins

The materials used in the construction of the development will be specifically selected to minimise off-gassing of Volatile Organic Compounds (VOC) and formaldehyde, which can impact on indoor air quality. At least 95% of internally applied paints, adhesives, sealants (by volume) and carpets (by area) must meet stipulated 'Total Volatile Organic Compounds (TVOC) Limits'. Material specifications will include:

- All paints, wall covering, adhesives and sealants used in the construction will be low-VOC paints;
- Carpets and flooring will be specially selected to be low-VOC; and
- It is proposed that only low formaldehyde composite wood products will be utilised.

Low Volatile Organic Compound (VOC) paints, adhesive and sealant to be used in the development,

Product Type Category	Max TVOC Content (g/l of ready-to-use product)
General purpose adhesives	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250

Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

Low-TVOC Carpets to be selected for the development.

Compliance Option	Test Protocol	Limit
ASTM D5116	ASTM D5116 - Total VOC limit	0.5mg/m^2 per hour
	ASTM D5116 - 4-PC (4-Phenylcyclohexene)	0.05mg/m^2 per hour
ISO 16000 / EN 13419	ISO 16000 / EN 13419 - TVOC at three days	0.5 mg/m^2 per hour
ISO 10580 / ISO/TC 219 (Document N238)	ISO 10580 / ISO/TC 219 (Document N238) - TVOC at 24 hours	0.5mg/m^2 per hour

Low formaldehyde wood products to be used in the development.

Test protocol	Emission limit/ Unit of Measurement
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤1.0mg/L
AS/NZS 1859.1:2004 – Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.5mg/L
AS/NZS 1859.2:2004 – MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.0mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	≤1.0mg/L
Japanese Agricultural Standard MAFF Notification NO.701 Appendix Clause 3 (11) - LVL	≤1.0mg/L
JIS A 5908:2003 – Particle Board and Plywood, with use of testing procedure JISA 1460	≤1.0mg/L
JIS A 5905:2003 – MDF, with use of testing procedure JIS A 1460	≤1.0mg/L
JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1mg/m^{2}hr
ASTM D5116 (applicable to high pressure laminated and compact laminates)	≤0.1mg/m^{2}hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤0.1mg/m^{2}hr (at 3 days)
ASTM D6007	≤0.12mg/m^3
ASTM E1333	≤0.12mg/m^3
EN 717-1 (also known as DIN EN 717-1)	≤0.12mg/m^3
EN 717-2 (also known as DIN EN 717-2)	≤3.5mg/m^{3}hr

A comprehensive hazardous materials survey will be carried out on any existing buildings or structures on the project site, in accordance with the relevant Environmental and Work Health and Safety (WHS) legislation to ensure no banned or highly toxic materials are used in the development. Where the survey identified asbestos, lead, or PCBs in any existing buildings or structures, the materials must be stabilised or removed and disposed of in accordance with best practice guidelines.

On site verification will be undertaken to verify that the TVOC concentration is below 0.27ppm and formaldehyde levels are below 0.02ppm.

4.2.5 Amenity and Comfort

The residential building will provide internal amenities that improve occupant experience by having dedicated amenities rooms to act as a parent room, relaxation room and an exercise room. The size of the room is calculated at a ratio of 1m^2 per every 10 occupants.

4.3 Resilient

4.3.1 Climate Change Resilience

The project team will complete the climate change pre-screening checklist and advice the building owner the development's exposure to climate change risks.

A suitably qualified professional will undertake the Climate Change Risk and Adaptation Assessment and will meet the following requirements:

- Perform the assessment using the information from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report Representative Concentration Pathway 8.5 (RCP 8.5) or most recently published version;
- Perform the assessment using two timescales that are relevant to the project's anticipated lifespan: one medium-term timescale between 2040 to 2050 one long-term timescale between 2070 to 2090;
- Identify the primary and secondary climate change variables from Table 2 in AS5334:2013 Climate change adaptation for settlements and infrastructure relevant to the project and each risk;
- Define and include the consequence and likelihood tables and risk matrix used to assess climate risks;
- Assess risks in consultation with multidisciplinary representatives from within the project team and a selection of relevant external stakeholders;
- Develop a register of risks to the building and surrounding infrastructure, and provide treatment options for risks identified as 'extreme' or 'high';
- Communicate the results of the assessment to the leads of all design disciplines.

The professional will ensure the assessment aligns with AS 5334:2013 and follows the principles of risk management outlined in AS/NZ ISO 31000:2009 Risk Management.

The project team will ensure the following risks related to the development are addressed:

- All risks rated as 'Extreme' must be addressed through specific design responses;
- All risks rated as 'High' must be addressed through design or future operational responses;
- Regardless of risk rating, at least two risks identified in the assessment must be addressed by specific design responses.

4.3.2 Heat Resilience

At least 75% of the whole site will incorporate of one or a combination of strategies that reduce the heat island effect.

A Green Factor assessment has been carried out to benchmark the green infrastructure credentials of Green Factor Score of 0.55 within the development.

The Green Factor Report is enclosed as Appendix D for reference.

4.4 Positive

4.4.1 Upfront Carbon Emissions

The building's upfront carbon emissions are at least 20% less than those of the reference building.

To offset demolition works, the project team will complete the 'Existing Building' section of the Upfront Carbon Emissions calculator.

4.4.2 Energy Use

The building's energy use is at least 20% less than the reference building. Roof mounted Solar PV Panels are proposed with minimum capacity of 20kW-e with yield of approximately 22,000kWh electricity per annum. tilt angle to be minimum 10°.

For all apartments, 5.5-star minimum and 7.5-star Average NatHERS energy Rating are targeted.

NatHERS Modelling Report is enclosed as Appendix C for reference.

4.4.3 Energy Source

The project team will develop a Zero Carbon Action Plan for the development which will be signed off by the building owner or developer. The Zero Carbon Action Plan will address all the requirements outlined in the credit and will be included in the operational documents for the building.

All energy use within the building will be sourced from the onsite renewables and GreenPower purchase.

4.4.4 Other Carbon Emissions

The project will eliminate the use of High – GWP refrigerants via selection of refrigerant GWP of 10 or less or offset 100% of the carbon emissions from refrigerants.

4.4.5 Water Use

To minimise the amenity water consumption and discharge to the municipal sewerage system, water efficient fixtures are to be selected with the minimum WELS rating stated below:

- Taps - 5 Star WELS Rating
- WCs - 4 Star WELS Rating
- Urinals - 5 Star WELS Rating (≤ 1.0 L/flush)
- Showers - 3 Star WELS Rating (≤ 7.0 L/min)
- Dishwasher - 5 Star WELS Rating
- Washing Machines – 4 Star WELS Rating if provided as base building works.

Minimum 30kL rainwater tank(s) is to be installed to collect the rainwater from the trafficable terrace and non-trafficable roof and reused for all apartments toilet flushing and landscaping irrigation. Fire Temporary tank is proposed for minimum 80% fire testing water collection and re-use. Pool cover is to be installed and pool backwash water collection and reuse are to be considered.

The proposed potable water conservation initiatives will ensure the building uses 20% to 30% less potable water compared to a reference building as defined by Green Building Council of Australia.

4.5 Places

4.5.1 Movement and Place

Access to these facilities will be well lit between entryway to bike parking, all amenities and lift lobbies and main access points to the building.

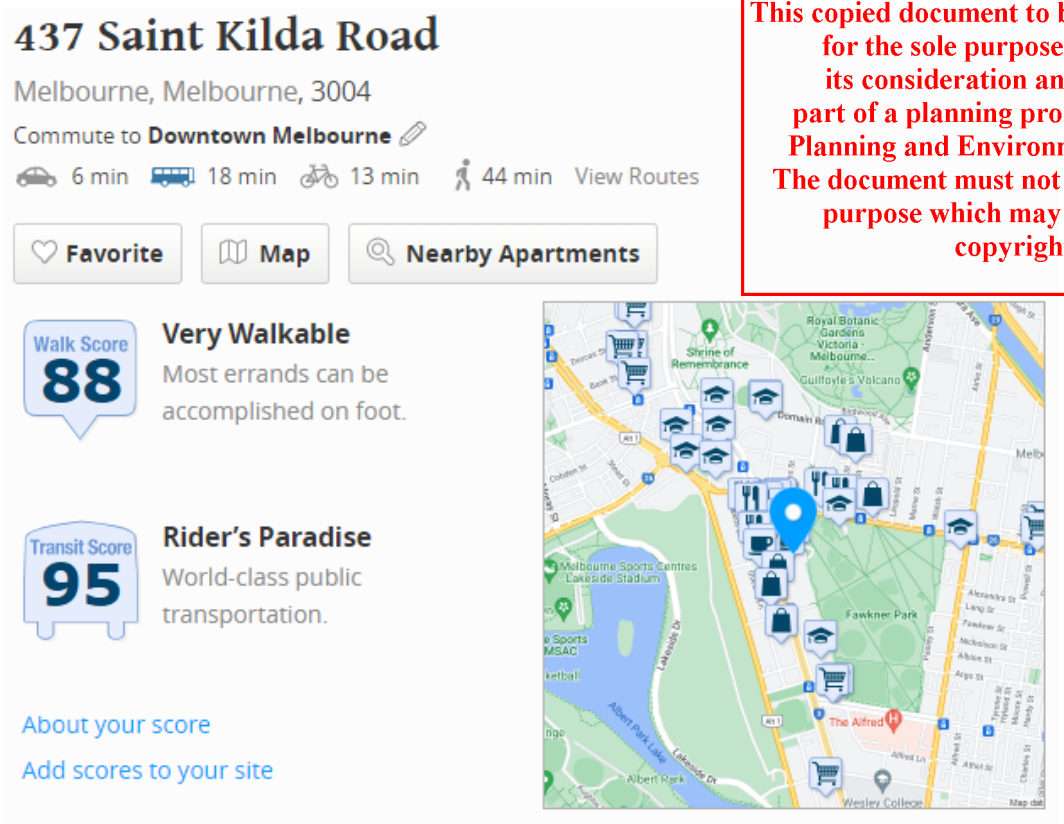
A Sustainable Transport Plan will be prepared by a qualified Transport Planner or Engineer and will reflect the design of the building's facilities and ongoing operational processes.

The building's access will prioritise walking and cycling options. The bicycle parking facilities will ensure the cycling equipment is safely secured. For 84 Apartments, minimum 80 bicycle parking spaces are to be provided for the building users within the development with 5 bicycle parking spaces for visitors. In total, minimum 85 Bike Parking Spaces are to provide. More bicycle facilities are to be considered to further improve the bicycle uses.

Minimum 5% of parking has been proposed with electric charging facilities with future allowances of total 25% of all car parking spaces (including 5% already installed).

The building's design and location will be shown to reduce emissions from transport, encourage public transport use, and reduce vehicle kilometres travelled compared to a reference building. The Movement and Place calculator will be completed to demonstrate.

437 St Kilda Road, Melbourne has a walk score of 88 and is deemed to be 'Very Walkable' and 'Rider's Paradise'. This encourages walkability by providing world class amenities and public transport at walking distances.



4.6 Nature

4.6.1 Impacts to Nature

The development will not take place at a site with a high ecological value.

All outdoor lighting within the project boundary will comply with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting. Light pollution to night sky is minimised via the selection of external luminaire with ULOR not exceeding 5%.

4.6.2 Waterway Protection

The project will demonstrate a reduction in average annual stormwater discharge (ML/yr) of 40% across the whole site by reusing rainwater and undertaking a civil pollutant reduction design. The following pollutant reduction levels are targeted and achieved. Refer to Appendix E – Stormwater Management Plan for details.

Pollutant	Reduction Target (%)
Total Suspended Solids (TSS)	85%
Gross Pollutants	90%
Total Nitrogen (TN)	45%
Total Phosphorus (TP)	65%

The Environmental Management will be Minimizing the potential ingress of chemical pollutants and other noxious substances into the stormwater system is of paramount importance. This entails, among other measures:

The implementation of containment measures, such as bunding, within areas dedicated to chemical storage, loading, refueling, or work activities. Any inadvertent chemical spills should be directed towards trade waste disposal or subjected to appropriate treatment processes. Furthermore, these designated areas should be equipped with roofing or awnings to channel rainfall runoff separately into the stormwater system.

For sites featuring more than 200 square meters of open spaces frequented by vehicles for transit and/or parking, it is imperative to incorporate hydrocarbon treatment devices. These devices should be meticulously selected to achieve a minimum removal efficiency of 98% for hydrocarbons and must be adequately sized to handle storm events with a return period of 1-in-3 months (equivalent to a 4-year ARI). It should be noted that parking facilities exclusively designated for electric vehicles are exempt from inclusion in the aforementioned calculation.

4.7 Leadership

4.7.1 Leadership Challenge – Energy Positive

This innovation will be achieved as 100% of the building's energy will be sourced from renewables.

5. Targeted Green Star Buildings Rating

With inclusion of all ESD initiatives summarised above, the proposed design will achieve and overall 35+ point to a 5-Star Green Star certified design and demonstrates 'Australian Excellence' sustainable design.

Category	Points Available	Points Targeted
Responsible	17	11
Healthy	14	8
Resilient	8	2
Positive	30	14
Places	8	3
People	9	0
Nature	14	2
Leadership	-	1
Total Core Points	**100**	**41**

6 Conclusion

This report provides a summary of sustainable design features, which are integrated into the design of the proposed development, in order to meet the objectives of the City of Melbourne Sustainable Building Design.

In terms of the building performance, the proposed development will be designed to achieve:

- Energy efficiency: Exceed NCC 2019 Section J;
- Minimum 20% potable water reduction under Green Star Buildings Version 1.0;
- A Waste Management Plan (WMP) has been prepared in accordance with the current version of the City of Melbourne's Guidelines for Waste Management Plans; and
- A 5 Star Green Star design and construction under the Green Star Buildings Version 1.0 for the whole development.

Therefore, the proposed development has been designed to meet the objectives of City of Melbourne Sustainable Building Design as addressed and the project team will ensure the performance outcomes proposed in this Sustainable Management Plan be implemented prior to occupancy at no cost to the City of Melbourne and be to the satisfaction of the Responsible Authority.

Appendix A – Green Star Scorecard

Submission planner

Summary

Registering from / certified	2023 onwards		
Climate Positive Pathway targeted	Yes	**Targeted Green Star rating**	5 Star
Minimum expectations met	Yes	**Core points targeted**	40
Credit Achievement points targeted	37	**Leadership points targeted**	1
Exceptional Performance points targeted	3	**Total points targeted**	41

	Credit	Minimum Expectation	Credit Achievement	Exceptional Performance	Total points available	Targeted performance level	Total points targeted
Responsible					**17**		
1	Industry Development		1		**1**	Credit Achievement	**1**
2	Responsible Construction	•	1		**1**	Credit Achievement	**1**
3	Verification and Handover	•	1		**1**	Credit Achievement	**1**
4	Operational Waste	•			**0**	Minimum Expectation	•
5	Responsible Procurement		1		**1**	Credit Achievement	**1**
6	Responsible Structure		3	2	**5**	Credit Achievement	**3**
7	Responsible Envelope		2	2	**4**	Credit Achievement	**2**
8	Responsible Systems		1	1	**2**	Credit Achievement	**1**
9	Responsible Finishes		1	1	**2**	Credit Achievement	**1**
						Total	**11**
Healthy					**14**		
10	Clean Air	•	2		**2**	Minimum Expectation	•
11	Light Quality	•	2	2	**4**	Credit Achievement	**2**
12	Acoustic Comfort	•	2		**2**	Credit Achievement	**2**
13	Exposure to Toxins	•	2		**2**	Credit Achievement	**2**
14	Amenity and Comfort		2		**2**	Credit Achievement	**2**
15	Connection to Nature		1	1	**2**		**0**
						Total	**8**
Resilient					**8**		
16	Climate Change Resilience	•	1		**1**	Credit Achievement	**1**
17	Operations Resilience		2		**2**		**0**
18	Community Resilience		1		**1**		**0**
19	Heat Resilience		1		**1**	Credit Achievement	**1**
20	Grid Resilience		3		**3**		**0**
						Total	**2**
Positive					**30**		
21	Upfront Carbon Emissions	•	3	3	**6**	Credit Achievement	**3**
22	Energy Use	•	3	3	**6**	Credit Achievement	**3**
23	Energy Source	•	3	3	**6**	Exceptional Performance	**6**
24	Other Carbon Emissions		2	2	**4**	Credit Achievement	**2**
25	Water Use	•	3	3	**6**	Minimum Expectation	•
26	Life Cycle Impacts		2		**2**		**0**
						Total	**14**
Places					**8**		
27	Movement and Place	•	3		**3**	Credit Achievement	**3**
28	Enjoyable Places		2		**2**		**0**
29	Contribution to Place		2		**2**		**0**

30	Culture, Heritage and Identity		1		**1**		**0**
						Total	**3**
People					**9**		
31	Inclusive Construction Practices	•	1		**1**	Minimum Expectation	•
32	Indigenous Inclusion		2		**2**		**0**
33	Procurement and Workforce Inclusion		2	1	**3**		**0**
34	Design for Inclusion		2	1	**3**		**0**
						Total	**0**
Nature					**14**		
35	Impacts to Nature	•	2		**2**	Minimum Expectation	•
36	Biodiversity Enhancement		2	2	**4**		**0**
37	Nature Connectivity		2		**2**		**0**
38	Nature Stewardship		2		**2**		**0**
39	Waterway Protection		2	2	**4**	Credit Achievement	**2**
						Total	**2**
Leadership					**2**		
40	Market Transformation				**0**		**0**
41	Leadership Challenges		2		**2**		**1**
						Total	**1**

Appendix B – Daylight Modelling Report

IGS INTEGRATED GROUP SERVICES

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GREEN STAR DAYLIGHT ACCESS MODELLING REPORT

437 St. Kilda Road,
Melbourne

Project No: 23058
Date: 02/02/2024

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1. Executive Summary

IGS was engaged to undertake a daylight simulation on the residential development at 437 St. Kilda Road, Melbourne to identify the Green Star Daylight Access – Residential daylight availability compliances.

The daylight availability simulation has been undertaken above the finished floor level for the residential apartments under the Uniform Cloudy Sky. A Uniform Cloudy Sky represents a sky with a constant value of luminance. The values are derived from a statistical analysis of outdoor illuminance levels. They represent a horizontal illuminance level that exceeds 85% of the time between the hours of 9am and 5pm throughout the year. They also represent that the building has been designed to meet the modelled daylight levels for at least 85% of the daytime annually.

Green Star Buildings – Light Quality credit requires the development to achieve high levels of daylight to each apartment as a credit achievement requirement. High daylight levels must be available to at least 20% of each bedroom and living area with each apartment combining the living room and bedroom achieving no less than 60% daylight requirement.

The daylight assessment exhibits that all apartments will achieve a daylight factor of 1.6% to at least 60% of the combined living room and bedroom area of each apartment with each area achieving no less than 20% compliance meeting the credit achievement requirements for the Light Quality – Daylight criteria.

2. Introduction

2.1 Key Assumptions

The proposed external windows visible light transmissions (VLTs) are recommended to be:

- All external windows: VLT ≥ 50%

Finishes Reflectance Values

The following reflectance values are used for the building finishes daylight availability modelling.

- Floor covering reflectance = 0.4
- Walls and Internal Partitions reflectance = 0.8
- Ceiling reflectance = 0.8
- Surrounding Buildings reflectance = 0.4

2.2 Sky Model

The Uniform Cloudy Sky of horizontal external illuminance of 10,000 Lux is used for daylight availability simulation. A Uniform Cloudy Sky represents a sky with a constant value of luminance. The values are derived from a statistical analysis of outdoor illuminance levels. They represent a horizontal illuminance level that exceeds 85% of the time between the hours of 9am and 5pm throughout the year. Thus, they also represent that the building has been designed to meet the modelled daylight levels for at least 85% of the daytime annually.

2.3 Building Shape

The building physical shape is modelled in accordance with the preliminary architectural drawings package issued on 16/01/2024 for DTP RFI

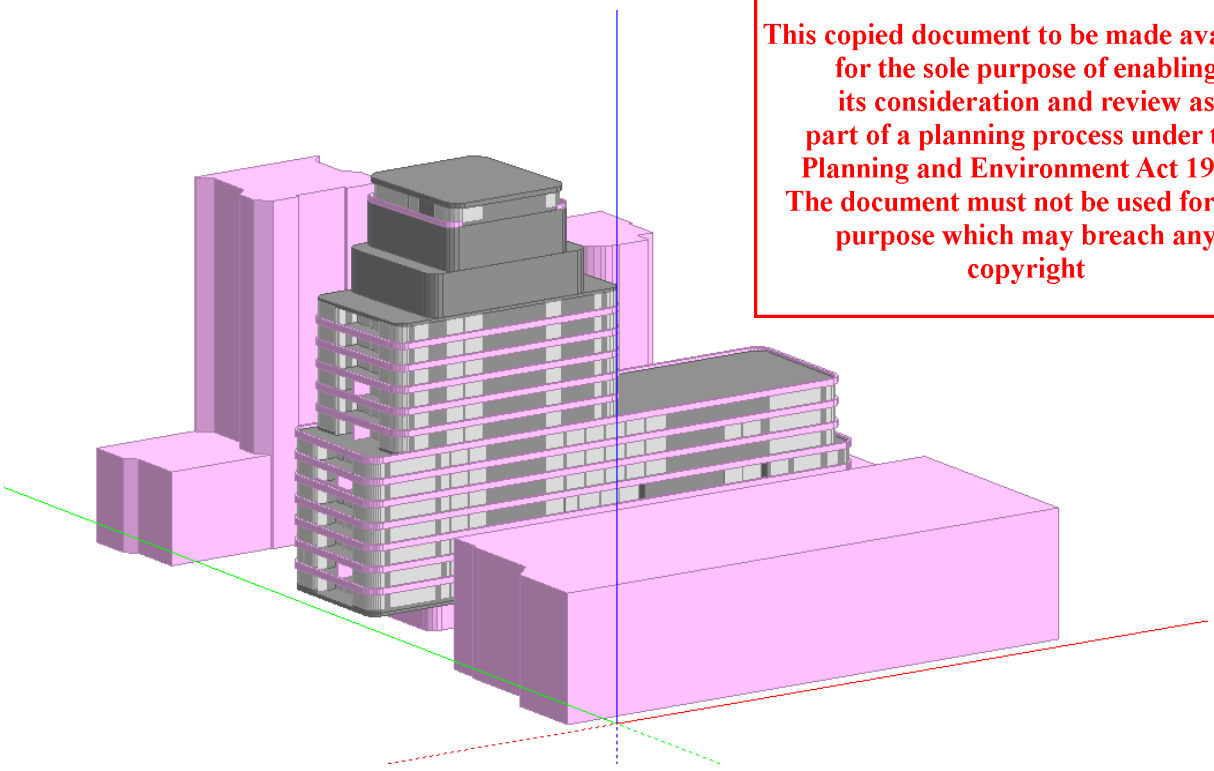

Figure 1 – Building Model

3. Introduction

3.1 Level 02 Representative Floor Daylight Result – Contour Plot

Below is the daylight contour plot extracted from Design Builder daylight modelling result showing daylight availability across Level 02 apartments. This floor is representative from Level 01 to Level 04.

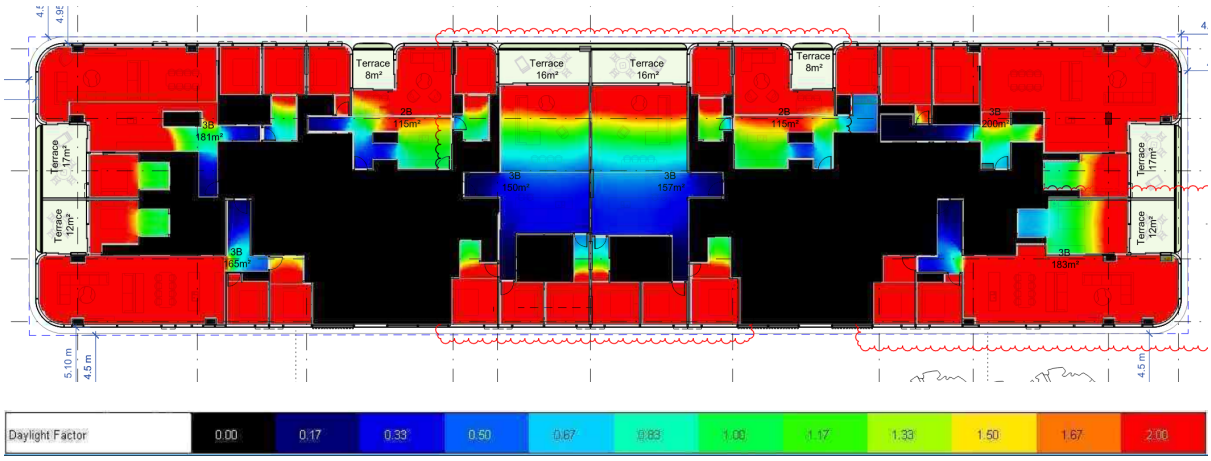

Figure 2 – Level 02 Daylight Contour Plot

3.2 Level 06 Representative Floor Daylight Result – Contour Plot

Below is the daylight contour plots extracted from Design Builder daylight modelling result showing daylight availability across Level 06 apartments. This floor is representative from Level 05 to Level 07.

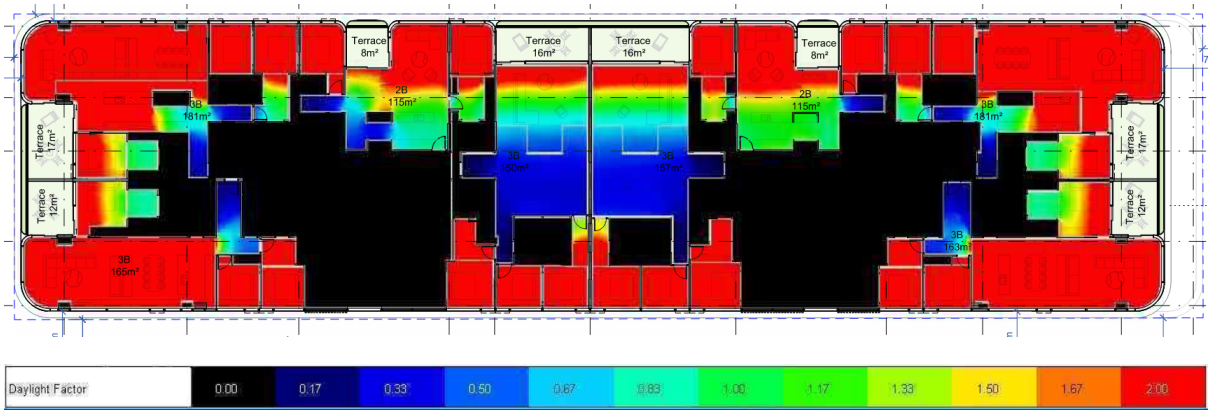

Figure 4 – Level 06 Daylight Contour Plot

3.3 Level 10 Representative Floor Daylight Result – Contour Plot

Below is the daylight contour plots extracted from Design Builder daylight modelling result showing daylight availability across Level 10 apartments. This floor is representative from Level 08 to Level 13.

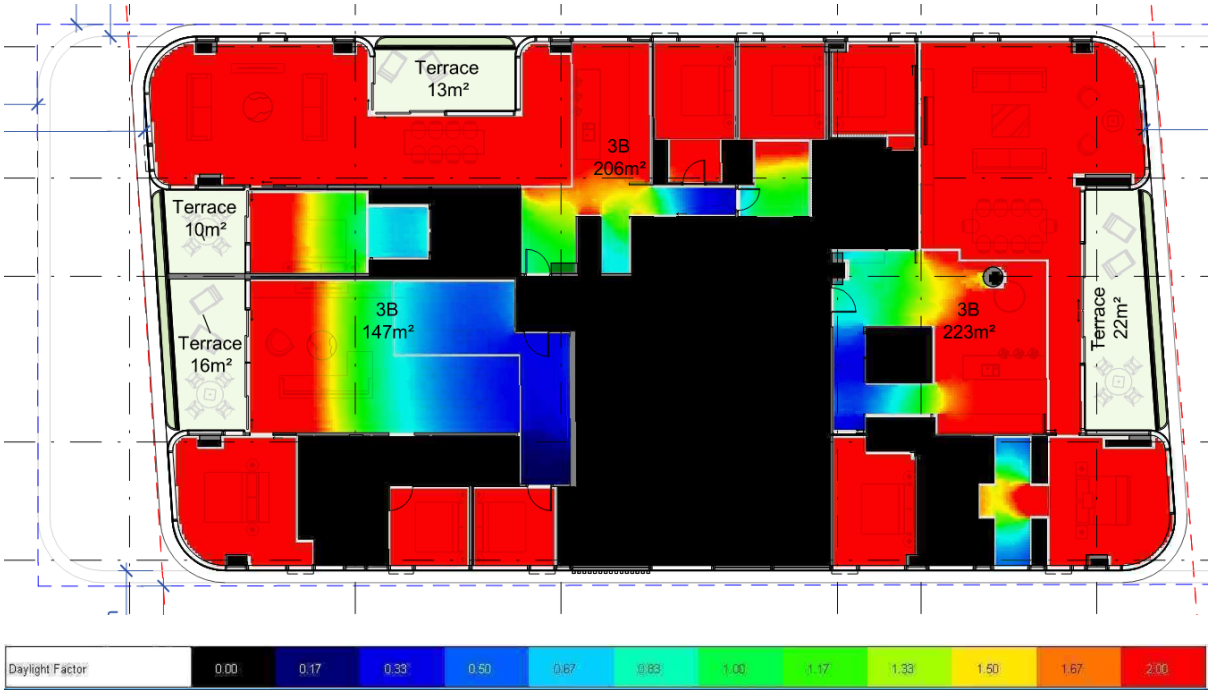

Figure 4 – Level 10 Daylight Contour Plot

3.4 Level 17 Representative Floor Daylight Result – Contour Plot

Below is the daylight contour plots extracted from Design Builder daylight modelling result showing daylight availability across Level 17 apartment. This floor is representative from Level 14 to Level 17.

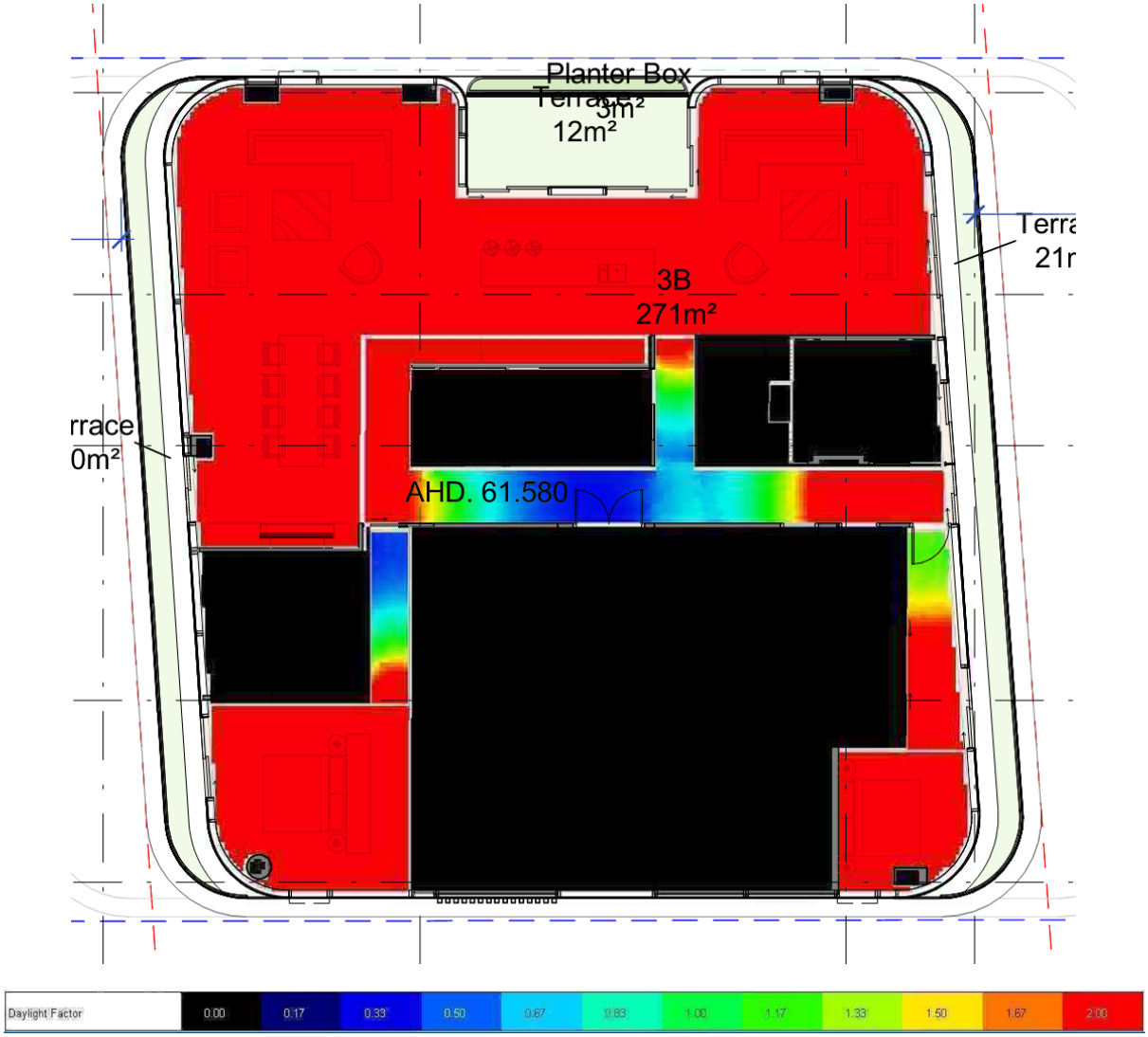

Figure 5 – Level 17 Daylight Contour Plot

3.5 Residential Development Daylight Result – Summary Table

Daylight availability output of the residential development at 437 St. Kilda Road is tabulated below:

Block	Zone	Floor area (m^2)	Floor Area above Threshold (m^2)	Floor Area above Threshold (%)	Floor Area above Threshold per Unit (%)
Level 2	201-BED1	10.6	10.6	100%	**100.0%**
Level 2	201-BED2	10.2	10.2	100%	
Level 2	201-BED3	9.9	9.9	100%	
Level 2	201-LIV	51.7	51.7	100%	
Level 2	202-BED1	9.9	9.9	100%	**97.3%**
Level 2	202-BED2	10.3	10.3	100%	
Level 2	202-LIV	24.9	23.7	95%	
Level 2	203-BED1	10.8	10.8	100%	**66.0%**
Level 2	203-BED2	9.5	9.5	100%	
Level 2	203-BED3	9.3	9.3	100%	
Level 2	203-LIV	39.2	15.8	40%	
Level 2	204-BED1	11.3	11.3	100%	**67.6%**
Level 2	204-BED2	9.7	9.7	100%	
Level 2	204-BED3	10.5	10.5	100%	
Level 2	204-LIV	42.7	18.6	44%	
Level 2	205-BED1	10.2	10.2	100%	**100.0%**
Level 2	205-BED2	10.3	10.3	100%	
Level 2	205-LIV	24.9	24.9	100%	
Level 2	206-BED1	14.9	14.9	100%	**99.6%**
Level 2	206-BED2	13.2	13.2	100%	
Level 2	206-BED3	10.7	10.1	95%	
Level 2	206-LIV	83.5	83.5	100%	
Level 2	207-BED1	23.3	10.1	43%	**88.2%**
Level 2	207-BED2	9.5	9.5	100%	
Level 2	207-BED3	8.9	8.9	100%	
Level 2	207-LIV	73.8	73.8	100%	
Level 2	208-BED1	11.6	11.6	100%	**100.0%**
Level 2	208-BED2	8.8	8.8	100%	
Level 2	208-BED3	8.5	8.5	100%	
Level 2	208-LIV	62.1	62.1	100%	
Level 06	601-BED1	10.6	8.6	81%	**97.6%**
Level 06	601-BED2	10.2	10.2	100%	
Level 06	601-BED3	9.9	9.9	100%	
Level 06	601-LIV	51.7	51.7	100%	
Level 06	602-BED1	10.7	10.7	100%	**94.8%**
Level 06	602-BED2	10.3	10.3	100%	
Level 06	602-LIV	24.9	22.6	90%	

Level 06	603-BED1	9.1	9.1	100%	**65.1%**
Level 06	603-BED2	10.5	10.5	100%	
Level 06	603-BED3	8.9	8.9	100%	
Level 06	603-LIV	31.4	10.5	33%	
Level 06	604-BED1	9.6	9.6	100%	**67.0%**
Level 06	604-BED2	9.3	9.3	100%	
Level 06	604-BED3	11.1	11.1	100%	
Level 06	604-LIV	32.5	11.9	37%	
Level 06	605-BED1	10.6	10.6	100%	**98.4%**
Level 06	605-BED2	10.1	10.1	100%	
Level 06	605-LIV	24.5	23.8	97%	
Level 06	606-BED1	10.0	10.0	100%	**97.5%**
Level 06	606-BED2	10.2	10.2	100%	
Level 06	606-BED3	10.9	8.5	78%	
Level 06	606-LIV	66.2	66.2	100%	
Level 06	607-BED1	9.5	9.5	100%	**96.1%**
Level 06	607-BED1	13.4	9.8	73%	
Level 06	607-BED2	8.5	8.5	100%	
Level 06	607-LIV	61.3	61.3	100%	
Level 06	608-BED1	11.6	7.8	68%	**95.9%**
Level 06	608-BED2	8.8	8.8	100%	
Level 06	608-BED3	8.5	8.5	100%	
Level 06	608-LIV	62.1	62.1	100%	
Level 10	1001-BED1	13.8	7.4	53%	**93.8%**
Level 10	1001-BED2	11.1	11.1	100%	
Level 10	1001-BED3	11.7	11.7	100%	
Level 10	1001-LIV	66.9	66.9	100%	
Level 10	1002-BED1	10.6	10.6	100%	**100.0%**
Level 10	1002-BED2	20.4	20.4	100%	
Level 10	1002-BED3	13.8	13.8	100%	
Level 10	1002-LIV	67.4	67.4	100%	
Level 10	1003-BED1	8.9	8.9	100%	**67.9%**
Level 10	1003-BED2	8.7	8.7	100%	
Level 10	1003-BED3	21.2	21.2	100%	
Level 10	1003-LIV	44.9	18.0	40%	
Level 17	1701-BED1	21.0	21.0	100%	**100.0%**
Level 17	1701-BED2	10.2	10.2	100%	
Level 17	1701-LIV	114.7	114.7	100%	

4. Conclusion

A daylight simulation using radiance daylight engine has been undertaken to assess the overall daylight compliance of the residential development proposed at 437 St. Kilda Road, Melbourne.

The daylight assessment exhibits that all apartments will achieve a daylight factor of 1.6% to at least 60% of the combined living room and bedroom area of each apartment with each area achieving no less than 20% compliance meeting the credit achievement requirements for the Light Quality – Daylight criteria.

Appendix C – NatHERS Modelling Report

IGS INTEGRATED GROUP SERVICES

Value | Innovation | Trust

ESD Services
NCC 2019 / 2022 NatHERS Assessment Report

437 St Kilda Rd,
Melbourne

Project No: 23058
Date: 02/02/2024

Level 4, 108 Elizabeth Street
Melbourne VIC 3000
Web: www.igs.com.au

Document Control

Version	Date	Issue	Author		Reviewer	
00	04/08/2023	Issue for Review	Li Huan	LH	Slav Angelovski	SA
01	23/01/2024	Draft Issue for Comments	Li Huan	LH	Slav Angelovski	SA
02	02/02/2024	Issue for Submission	Li Huan	LH	Slav Angelovski	SA

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1. Summary

Thermal performance assessment of the Class 2 apartments using accredited FirstRate5 Version 5.5.3.2a software has been conducted on all sample residential apartments to NCC 2019 Section J0.2 and City of Melbourne Planning Conditions.

NCC 2019 Volume 1 Section J0.2 requires all Class 2 apartment units to achieve a minimum rating of 5.0 stars individually and an average (all apartments) rating of 6.0 stars.

As part of Melbourne City Council planning permit condition, 5-Star Green Star sustainable design is benchmarked under Green Star Buildings and all residential apartments are to achieve a minimum NatHERS rating of 5.5 stars and an average NatHERS rating of above 7.5 stars.

Based on the NatHERS modelling results, all apartments will meet the Melbourne City Council planning permit condition having achieved a minimum NatHERS rating of above 5.5 stars, an average rating of above 7.5 stars and no dwellings exceed the maximum NatHERS annual cooling load of 30 MJ/m^2.

The following residential thermal performance assessor details are provided for building permit purposes.

Assessor's Name:	Li Huan
Accreditation Number:	DMN/12/1395
AAO:	FirstRate5 House Energy Rating Organization

Refer to Appendix 1 for NatHERS star rating results. The official star rating certificate can be provided by FirstRate5 House Energy Rating Organization on request and at the client's cost of $100 (+GST) per certificate which includes $30(+GST) per certificate application required by FirstRate5 House Energy Rating Organization and $70(+GST) for processing, uploading per energy model and downloading per certificate. The certificate can be generated no later than three (3) months after the report is issued.

2. Overview

Project: 437 St Kilda Road, Melbourne

Applicable NCC: 2019

Climate Zone: 6

NCC Classification and Verification method:

- Class 2 – Apartments with shared underground carpark spaces
- Class 2 building fabric and services – NCC 2019 deemed-to-satisfy provisions, Part J0.

Reference Documents: This report has been based upon review of a set of Architectural Drawings dated 16.01.2024 Issued for DTP RFI.

3. Modelling Inputs Assumptions

Building Fabric Thermal Performance

Element	Type	Description	Minimum Added Insulation	Total System R-value
Wall	All	Refer architectural drawings		
	Internal	Walls adjoining an unconditioned corridor	R1.5	≥ R1.8
	Internal	Cast concrete walls adjoining lift shaft/stairwell	R1.5	≥ R1.8
	Internal	All other internal walls	-	-
	External	Exposed External Walls	R2.5	≥ R2.8
Floor	Typical Floor	Suspended Concrete Slab to commercial space/communal space/exposed area	R2.0	≥ R2.3
		Suspended Concrete Slab to neighbour apartment – All other units	-	-
Ceiling		Suspended Concrete Slab adjoining neighbour/conditioned area – All other apartments	-	-
		Suspended Concrete ceilings to adjoining	R2.0	≥ R2.3
		Top Floor Ceiling	R5.0 Ceiling Insulation	≥ R5.3
LED Downlights		All recessed downlights to be IC-4 rated or equivalent	Nil	

Windows Thermal Performance

Element	Type	Description
Windows (Typical)	Windows (Fixed and Awning)	Aluminium Frames & Double Glazed. $U_w \leq 2.7$, SHGC = 0.3 ± 5% VLT ≥ 50%
	Sliding Doors	Aluminium Frame & Double Glazed. $U_w \leq 3.2$, SHGC = 0.3 ± 5% VLT ≥ 50%

4. NatHERS Assessment Results

Location	Building Apartment Number	Number of Apartments	NatHERS Rating	Energy (MJ/m²)			Net Conditioned Floor Area
				Total	Heating	Cooling	(m²)
Level 1	101	7	7.9	54.6	42.3	12.3	162.9
Level 1	102	7	8.2	48.2	40.5	7.7	96
Level 1	103	7	8.9	27.1	23.3	3.8	136.5
Level 1	104	7	8.9	25.7	21.7	4	118.8
Level 1	105	7	7.7	63.1	53.3	9.8	96.5
Level 1	106	7	8.4	41.6	33.9	7.7	180.4
Level 1	107	7	8	52.8	43.5	9.3	162.1
Level 1	108	7	7.1	78.8	67.2	11.6	144.2
Level 9	901	3	7.2	77.4	62.8	14.6	181.6
Level 9	902	3	8	53.8	40.8	13	204.3
Level 9	903	3	7.4	68.4	60.9	7.5	131.7
Level 17	1701	1	6.5	97.5	76	21.5	248.2
TOTALS		**66**		**53.0**	**43.6**	**9.4**	
WEIGHTED AVERAGE					**7.97**		
CALCULATED MINIMUM					**6.5**		

Appendix D – Green Factor Report

GREEN FACTOR SCORECARD

CITY OF MELBOURNE

437 St Kilda Road Melbourne Vic 3004 | Melbourne | Multi-unit residential
Planning application number:
Integrated Group Services

GREEN FACTOR SCORE

0.61

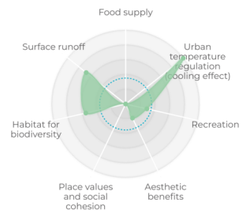
= 1853.6 m² of Green Factor area* / 3027 m² total site area

GREEN ELEMENTS

1. Small shrub (< 1.5m height)	33.9%
2. Medium tree (canopy width 6m - 10m)	22.3%
3. Soil or substrate (over 500mm depth)	15.6%
4. Small tree (canopy width < 6m)	10.7%
5. Climbers	7.8%
6. Ground cover	6.5%
7. Large shrub (≥ 1.5m height)	2.2%

ECOSYSTEM OUTCOMES

Relative contribution



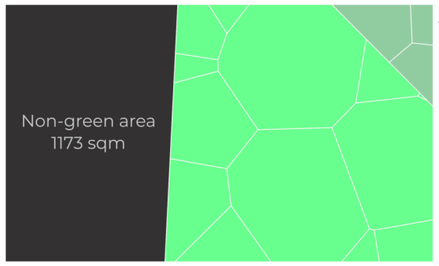
Green Factor
Target

LOCATION OF GREEN ELEMENTS

Ranked by % contribution to Green Factor

Planters (on structure)	92.2%
Green Facade	7.8%
Non-green area	None

GREEN FACTOR AREA



PROJECT INFORMATION

Project considerations

- ✗ Certified maintenance plan
- ✓ Landscape architect engaged in design
- ✓ Landscape brief developed
- ✗ Irrigation consultant appointed
- ✓ Rain/non-potable water used for irrigation
- ✗ Urban Forest Fund

Published: August 10, 2023

SPECIFIED GREEN INFRASTRUCTURE ELEMENTS

Green Facade

Climbers	Indigenous	37 sqm
Climbers	Native	125 sqm
Climbers	Exotic	78 sqm

Planters (on structure)

Small tree (canopy width < 6m)	Indigenous	12 pcs
Small shrub (< 1.5m height)	Indigenous	52 sqm
Ground cover	Indigenous	25 sqm
Large shrub (> 1.5m height)	Native	22 sqm
Small shrub (< 1.5m height)	Native	364 sqm
Ground cover	Native	22 sqm
Medium tree (canopy width 6m - 10m)	Exotic	23 pcs
Small tree (canopy width < 6m)	Exotic	8 pcs
Large shrub (> 1.5m height)	Exotic	17 sqm
Small shrub (< 1.5m height)	Exotic	166 sqm
Ground cover	Exotic	98 sqm
Soil or substrate (over 500mm depth)	Soil	724.7 sqm
Soil or substrate (200 - 500mm depth)	Soil	40.4 sqm

Appendix E – Stormwater Management Plan

IGS INTEGRATED GROUP SERVICES

Value | Innovation | Trust

Stormwater Management Plan

Residential Development
437 St Kilda Road
Melbourne

Project No: 23058
Date: 02/02/2024

Level 4, 108 Elizabeth Street,
Melbourne VIC 3000
Web: www.igs.com.au

Document Control

Version	Date	Issue	Author		Reviewer	
00	22/09/2023	Issue for Review	Li Huan	LH	Slav Angelovski	SA
01	23/01/2024	Draft Issue for Comments	Earnest Joseph	EJ	Slav Angelovski	SA
02	02/02/2024	Issue for Submission	Earnest Joseph	EJ	Slav Angelovski	SA

TABLE OF CONTENTS

1 Executive Summary

Integrated Group Services (IGS) has been commissioned to prepare a Stormwater Management Plan (SWMP) for the approved residential development located at 437 St Kilda Road, Melbourne, Vic 3004.

The stormwater quality modelling was undertaken using the MUSICX version 1.1.0 software.

The modelling results (see **Table 1.1**) indicate the Green Star Target on 90%, 85%, 65% and 45% reduction for Gross Pollutants (GP), Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) respectively can be achieved and this exceeds the Council's Best Practice Stormwater Pollutant's reduction target.

Table 1.1: Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Green Star Reduction Target (%)	Council Best Practice Reduction Target (%)
Flow (ML/yr)	1.405	0.6654	**53%**	40%	-
Total Suspended Solids	102.2	14.58	**86%**	85%	80%
Total Phosphorus	0.3133	0.05112	**84%**	65%	45%
Total Nitrogen	3.207	0.5588	**83%**	45%	45%
Gross Pollutants	50.34	4.909	**90%**	90%	70%

Stormwater management for the site is achieved using the following devices:

- **One (1) x 30kL Rainwater Tank**
- **One (1) x 10m^2 Raingarden**

2 Overview

2.1 Introduction

This report has been prepared by Integrated Group Services (IGS) to be considered part of a Development Application (DA) for a proposed development located at 437 St Kilda Road, Melbourne, VIC 3004. The site is located within the catchment of Melbourne City Council.

The development is a residential building with 19 levels with 3 levels of basement carpark, storage, and services plantrooms and 17 levels of residential apartments.

2.2 Site Locality

The proposed development is to be built at 437 St Kilda Road, Melbourne and the Responsible Authority is the City of Melbourne.

Site Location

2.3 Site Layout

The proposed development is presented within **Figure 2.2**.

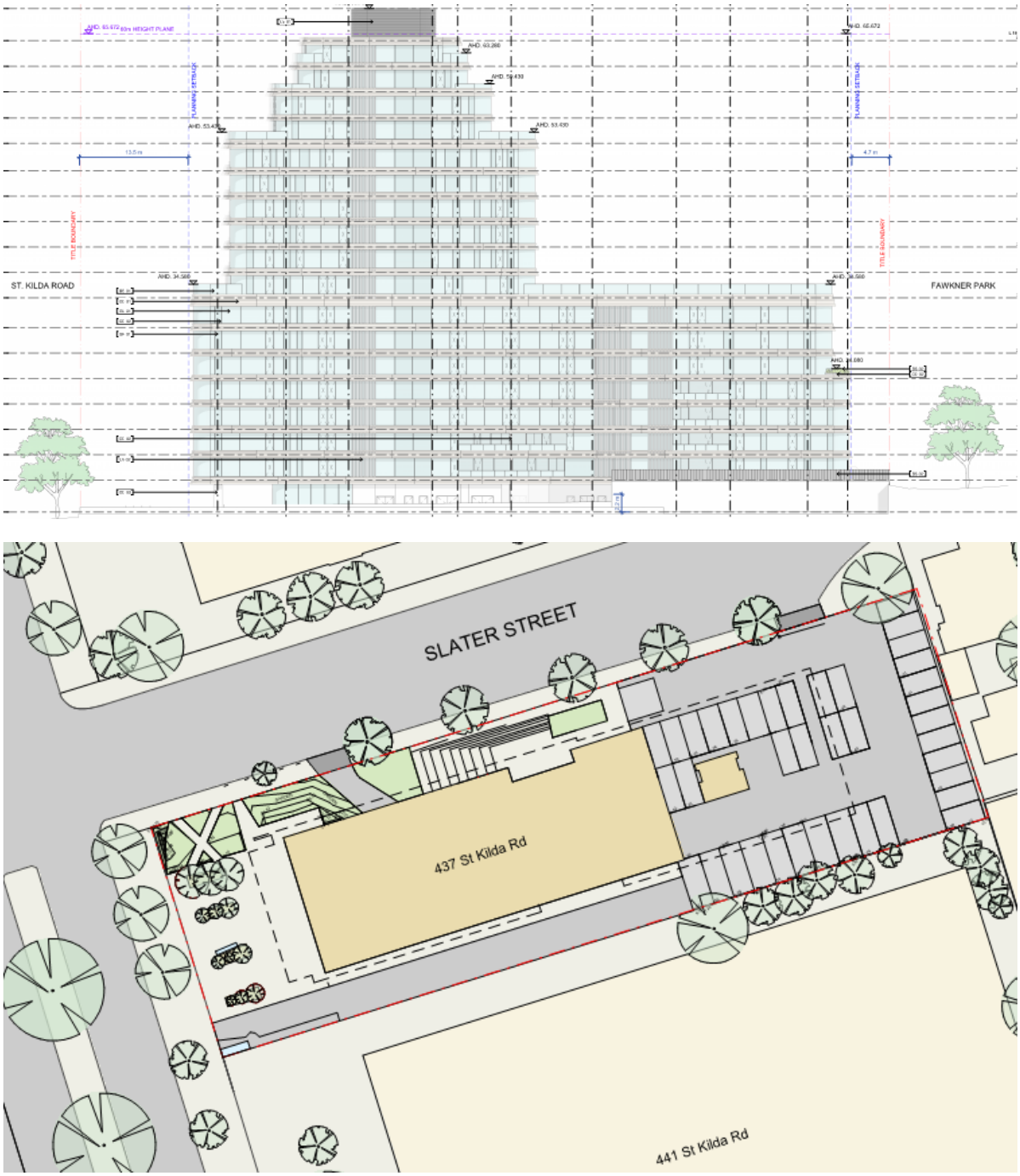


Figure 2.2 Proposed Site Layout

3 Quality Management – Operational Controls

3.1 Water Quality Objectives

Melbourne Water (2018) requires treatment of stormwater so that annual pollutant loads achieve targets set out in the Best Practice Environmental Management Guidelines (BPEMG) and Green Star (where applicable). These are the following targets:

- 85% reduction in Total Suspended Solids (TSS) from typical urban loads.
- 45% reduction in Total Nitrogen (TN) from typical urban loads.
- 65% reduction in Total Phosphorus (TP) from typical urban loads; and
- 90% reduction in Gross Pollutants (GP) from typical urban loads.

The Stormwater Management will be implemented in line with the Melbourne Planning Scheme Clause 53.18 'Stormwater Management in Urban Development' and Clause 19.03-3L 'Stormwater Management (Water sensitive urban design)'.

3.2 Treatment Train

Based on the site characteristics and the range of available Stormwater Quality Improvement Devices (SQIDs), this study has developed an overall concept that will satisfy the requirements of downstream environmental protection. **Figure 3.1** shows a schematic representation of the proposed treatment train elements.

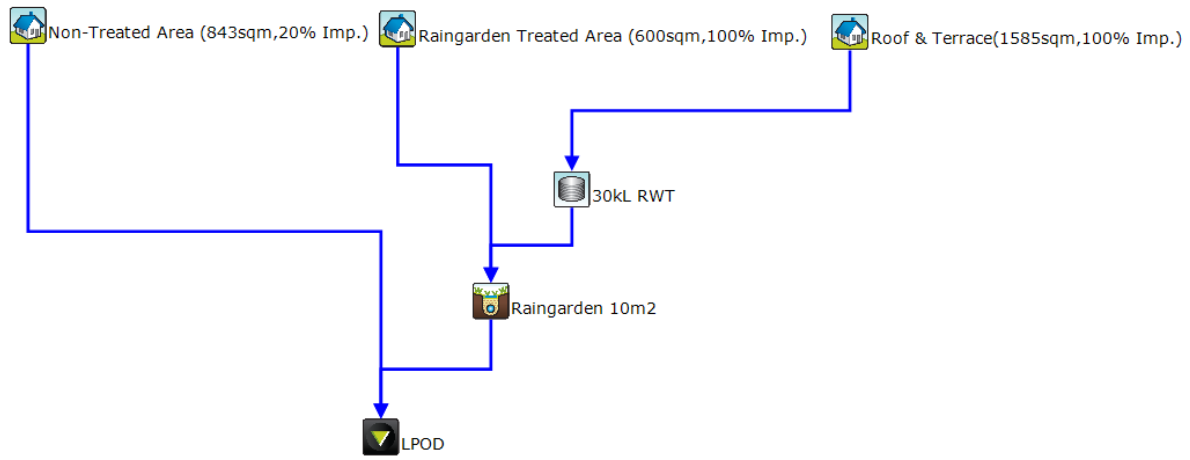


Figure 3.1 Treatment Train Schematic

3.3 Rain Garden

Raingardens are specially designed garden beds that filter stormwater runoff from surrounding areas or stormwater pipes. Raingardens are also called bioretention systems because they use soil, plants, and microbes to biologically treat stormwater.

Although they may look similar to a normal garden, raingardens are designed to stop stormwater run-off from polluting Stormwater waterways with nutrients, rubbish and other sediments, the system operates as follows.

- Water collects and settles on the garden surface.
- Water soaks through the plants and filter media, trapping rubbish and sediment on the surface.
- Plants use the nutrients in the stormwater, and toxins stick to the soil; and
- The soil and plant roots work together to naturally filter the water and remove pollutants.

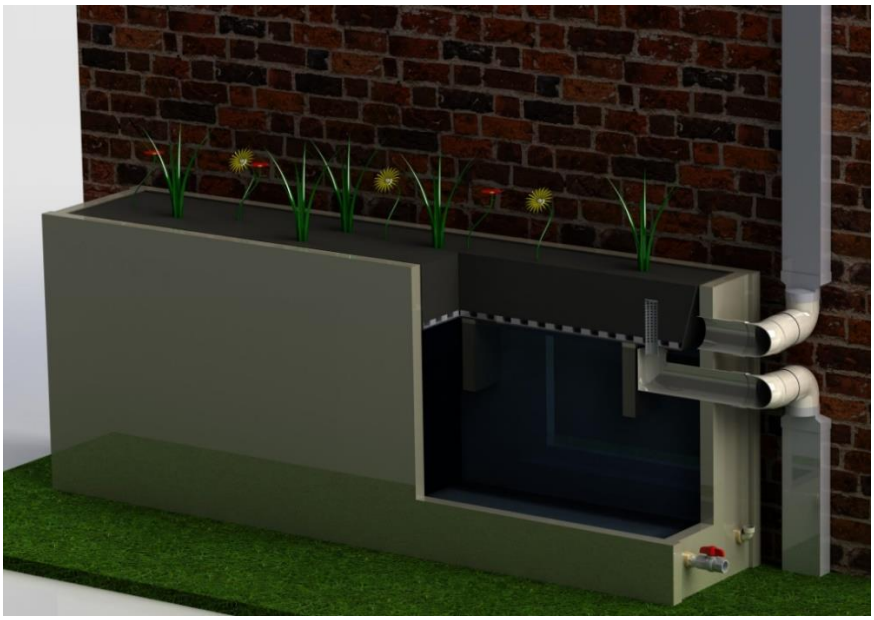


Figure 3.2 Typical Raingarden in ground illustration

3.4 Rainwater Tank

Rainwater tanks can reduce the harm to Stormwater waterways caused by too much stormwater. Tank water can be reused for toilet flushing, laundry washing, gardens and lawn irrigation and cars wash, this will significantly reduce the potable / drinking cold water consumption.

Rainwater tanks collect stormwater run-off from impervious surfaces such as roofs, the tank will be fitted with an overflow outlet that in the event of tank full capacity the excessive pour down will be redirected or fall into the stormwater drainage system.

Rainwater tanks are generally used for watering gardens are much less efficient than tanks used for flushing toilets.

Advantages of rainwater tanks are that they:

- minimise water usage when used in the toilet, laundry or garden.
- reduce strain on the stormwater drainage system.
- retain water close to source.
- reduce site run-off and flood peaks.

To maximise the use of roof rainwater runoff it will be best to increase the tank capacity and ensure the design allows for maximum catchment. To maximise the use of rainwater, allow for irrigation dripper line to a suitable garden area to ensure tank water suitably distributed.

For this development, the rainwater collected will used for toilet flushing and landscaping irrigation.

4 Quality Analysis – MUSIC

Water quality modelling has been undertaken of the post-development (mitigated) scenario using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to demonstrate the load-based reduction targets are achieved. A stormwater treatment train has been developed and modelled to determine the effectiveness of the proposed system in achieving the relevant water quality objectives.

4.1 Rainfall and Evapotranspiration Parameters

The below table summarizes the meteorological and rainfall-runoff data used in the MUSIC model.

Table 4.1 Meteorological and Rainfall Runoff Data

Parameter	Value
Rainfall station	86071 – Melbourne City
Time step	6 minutes
Modelling period	January 1952 – December 1961
Mean annual rainfall (mm)	708 mm
Evapotranspiration	995 mm

4.2 Catchment Parameters

Based on the proposed land uses within the development, the subject site has been modelled as an urban source node. The rainfall-runoff parameters and pollutant generation parameters are based on parameters recommended by Melbourne Water **(2018) (Tables 4.2 and 4.3).**

Table 4.2 Rainfall Runoff Parameters

Parameter	All Nodes
Rainfall threshold (mm)	1.0
Soil storage capacity (mm)	120
Initial storage (% capacity)	25
Field capacity (mm)	50
Infiltration capacity coefficient a	200
Infiltration capacity exponent b	1
Initial depth (mm)	10
Daily recharge rate (%)	25
Daily base flow rate (%)	5
Daily deep seepage rate (%)	0

Table 4.3: Pollutant Export Parameters for Urban Sites

Catchment ID		Total Suspended Solids [log (mm/L)]		Total Phosphorous [log (mm/L)]		Total Nitrogen [log (mm/L)]	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Landscape	Storm Flow Concentration	1.9	0.333	-0.7	0.242	0.243	0.182
	Base Flow Concentration	0.96	0.401	-0.731	0.36	-0.566	0.363
Hardstand	Storm Flow Concentration	2.431	0.333	-0.301	0.242	0.343	0.205
	Base Flow Concentration	0	0	0	0	0	0
Roof	Storm Flow Concentration	1.301	0.333	-0.886	0.242	0.301	0.205
	Base Flow Concentration	0	0	0	0	0	0

4.3 Treatment Node Parameters

The following sections describe the modelling parameters applied to MUSIC for each of the treatment nodes included as part of the water quality assessment.

4.4 MUSIC Results

Results of the MUSIC modelling for the treatment train effectiveness are summarised in **Table 4.7**. The results indicate the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and gross pollutants respectively are achieved. A screen capture of the MUSIC modelling results is included as **Figure 4.2**.

Table 4.4 Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Green Star Reduction Target (%)	Council Best Practice Reduction Target (%)
Flow (ML/yr)	1.405	0.6654	**53%**	1.36	-
Total Suspended Solids	102.2	14.58	**86%**	85%	80%
Total Phosphorus	0.3133	0.05112	**84%**	65%	45%
Total Nitrogen	3.207	0.5588	**83%**	45%	45%
Gross Pollutants	50.34	4.909	**90%**	90%	70%

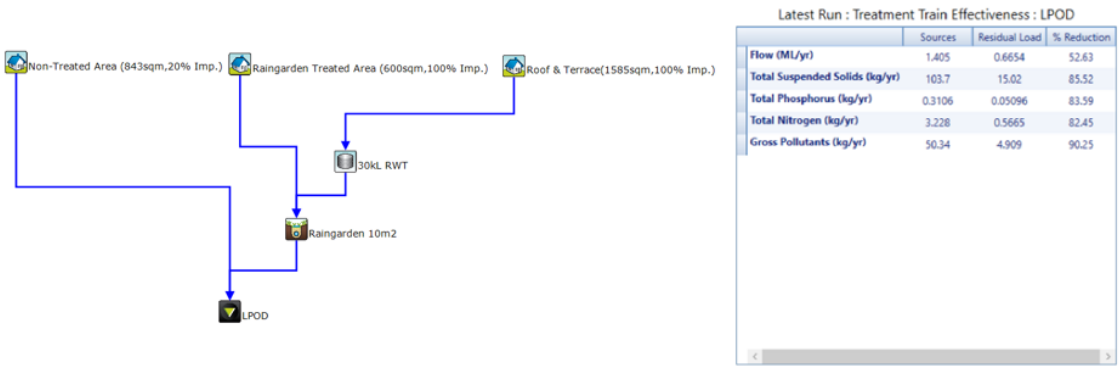


Figure 4.1: Treatment Train Effectiveness & Layout

5 Summary

Based on the water quality assessment using the MUSIC software, it is found that the pollutant reduction targets can be achieved by adopting the Rain Garden and SWAL as specified in **Table 6.1.**

Table 5.1 Recommended Stormwater Quality Improvement Devices

Stormwater Quality Improvement Device	Quantity
Rain Garden (10m² of area)	1
RWT (30kL)	1

6 Recommendation

6.1 Stormwater Quality Improvement Device

6.1.1 Rainwater Tank

Rainwater tanks can reduce the harm to stormwater waterways caused by too much stormwater. Tank water can be reused for toilet flushing, laundry washing, gardens and lawn irrigation and car wash, this will significantly reduce the potable / drinking cold water consumption.

6.1.2 Rain Garden

The recommended raingardens are designed to capture stormwater at the downstream end of the drainage network and treat the runoff prior to discharging into the local waterway. The pollutant reduction targets achieved (as modelled in MUSIC) are summarised in Table 5.1.

Table 6.1: MUSIC modelling results

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Green Star Reduction Target (%)	Council Best Practice Reduction Target (%)
Flow (ML/yr)	1.405	0.6654	**53%**	1.36	-
Total Suspended Solids	102.2	14.58	**86%**	85%	80%
Total Phosphorus	0.3133	0.05112	**84%**	65%	45%
Total Nitrogen	3.207	0.5588	**83%**	45%	45%
Gross Pollutants	50.34	4.909	**90%**	90%	70%

7 Site Managements Plan During Construction

The stormwater management strategy will adopt the following procedures during construction:

- Ground water seepage shall be managed and treated prior to discharge to council's LPD by builder / contractor during construction. To protect drainage infrastructure and receiving waters from sedimentation and contamination.

- To protect the site and surrounding area from environmental degradation prior to and during construction of subdivision works.

- An application should describe how the site will be managed prior and during the construction period and may set out requirements for managing:

    - Erosion and sediment.
    - Stormwater.
    - Litter, concrete, and other construction wastes; and
    - Chemical contamination.

8 Maintenance

The maintenance procedure shall be in conjunction with the building maintenance and specification and shall Comply with relevant / applicable authority design guidelines and codes of practice requirements. The stormwater management strategy shall adopt the following maintenance procedures.

- Quarterly routine maintenance procedure to thoroughly maintain raingarden free of debris and general clean-up process by building management as part of building maintenance programme.
- Annually / 6-month drain and flushing of rainwater tank cleaning tank internally from debris and sediment collection captured from roof surface, by building management as part of building maintenance programme.
- Quarterly inspection of gutters to ensure they are free of debris and clean as required.
- Quarterly inspection of stormwater downpipes and grates to ensure no water leakage, they are free of debris and clean as required.
- Yearly inspections of rainwater tanks and supports to ensure no leakage, inspect joints and clean as required.
- Water storage tanks should be inspected, cleaned and disinfected in accordance with AS 3500.
- Bi-annual inspection of pumps to ensure correct operation, no leakage and clean as required.
- Service items and equipment in conformance with the maintenance schedules as per the operation and maintenance manuals.

    - Carry out the manufacturers' recommended maintenance instruction.
    - Attend to reported defects and complaints.
    - Check for and repair corrosion.
    - Check for and rectify any unsafe conditions.
    - Replace faulty or damaged parts and consumable components.
    - connections, for deterioration and for freedom of movement of assembly.
    - Identification of pipes, conduits and ducts maintenance: To AS 1345.
    - Safety signs maintenance: To AS 1319.
    - Remove waste and clean all parts of the installation.
    - Remove temporary protective coatings, packaging and labels.
    - Clean screens and strainer baskets.

9 References

The report has used the following references:

- Melbourne Water (2018) MUSIC Guidelines – input Parameters and modelling approaches for MUSIC user in Melbourne Water's services area 2018.
- Urban Stormwater Best Practice Environmental Management Guidelines.