IWM Case Study 2

Sustainability management plan for multi-tower mixed use residential development

This case study demonstrates how a multi-tower, mixed use residential development can achieve compliance with Fishermans Bend Urban Renewal Area (FBURA) integrated water management (IWM) planning requirements. It highlights the key elements required to support a planning application as part of a Sustainability Management Plan, including the use of MUSIC for modelling compliance with stormwater management requirements and the Green Star Certification System for green building performance rating. It is accompanied by a checklist for applicants.

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Applicant Checklist

A: Proposed development description:

- ❑ **A1**: Describe the proposed development e.g. describe the land use, anticipated tenancy, buildings and works, number of car parking spaces, expected number of occupants, etc.
- ❑ Assess site opportunities and constraints for Integrated Water Management (IWM).
- ❑ **A2.** Assess Fishermans Bend Planning Scheme requirements that apply to the site
- ❑ Register the proposed development with the Green Building Council of Australia.
- ❑ Hold a pre application discussion with Council to confirm proposed design response to planning requirements.

A. Development description

The development site area is 14,570 m^2. The application proposes a multi-tower, mixed use development with 6 towers located on 2 podiums as follows:

- Multi-tower apartment complex comprising 793 dwellings, encompassing 1, 2 and 3-bedroom apartments. The tallest two towers are 24 levels and the remaining towers are 20 levels high, all with a four-level podium.
- Retail and commercial premises, amenities and car parking at podium level and over 4 levels within the podium.
- Trafficable podium area for use by residents and visitors, with access to commercial and retail premises and shared recreational areas.
- Placement of solar panels on the full roof area of the largest two towers.
- New road reserve including footpaths to be developed on the northern edge of the site.
- Central laneway to be placed between the podiums.

Development summary

Element	m^2	% of site area
Apartment towers A, B and C	2500	17%
Apartment towers D, E and F	2500	17%
Eastern Podium surface area	3050	21%
Western Podium surface area	3050	21%
Road reserves including northern road reserve and footpaths, central laneway and southern footpath	3470	24%
Total	**14,570**	

There is a total combined equivalent occupancy (residential + commercial/retail) of approximately 1,560 people. Gross Floor Area (GFA) is estimated at 132,400 m^2.

The site presents the following design opportunities and constraints:

Opportunities	Constraints
• Significant proportion of podium available for greening and recreational space for residents and visitors. • Opportunity for innovative terraced podium seating design that integrates with green infrastructure. • Greening at ground and podium level can provide public realm connectivity, biodiversity benefits and permeability for cross ventilation. • Northern orientation provides natural light to Towers A, C, D and F, with shading on the lower levels of all towers reducing the impacts of summer sun. • Ground level trees to meet site tree canopy and deep soil requirements.	• No ground level open space for the placement of pervious recreational spaces • Tower height results in a more exposed roof area where greening and any proposed resident access will require wind and sun protection. • Shadow impact on podium from buildings on lot and on adjacent site(s). • Exposed podium areas may require sun protection and the management of potential wind impacts. • Area is known to be subject to flooding.

A2. Fishermans Bend Planning Scheme requirements

The Port Phillip and Melbourne Planning Schemes contain policy and planning controls that support integrated water management. Some are mandatory requirements of a planning permit and must be pursued prior to the commencement of building and works.

The requirements that apply to this development are specified in Table 1. Case study compliance is noted against each requirement.

Table 1 Fishermans Bend Planning Scheme Requirements and Development Compliance

Mandatory Provisions	IWM Element	Development Compliance
MPS Clause 37.04 Schedule 4 Sub Clause 4.3 PPPS Clause 37.04 Schedule 1 Sub Clause 4.3	- Third Pipe - Rainwater Tank - Green Star Rating	✓
MPS Clause 22.27-4.5 PPPS Clause 22.15-45	- Urban Heat Island - Sea level rise, flooding, and water recycling	✓
MPS 22.27-4.7 PPPS 22.15-4.7 Clause 58.03-5 (Better Apartment Design Standards)	- Landscaping and vegetation	✓
MPS Clause 22.23 PPPS Clause 22.12 Clause 58.03-8 (Better Apartment Design Standards) Clause 65.01	- Stormwater management - Construction management	✓
South East Water Condition of Connection	- Use of Recycled Water - Connection and inspection requirements	✓

Submission requirements

It is a requirement that the following formats and tools are utilised in the planning process to support a planning application:

- **Sustainability Management Plan (SMP):** All planning applications must submit a detailed sustainability assessment of the proposed development at the planning stage. This will include an IWM response and stormwater management assessment that demonstrates how the site will achieve the IWM requirements of the applicable policies of the Melbourne and Port Phillip Planning Schemes. An SMP will include as a minimum a description of all proposed WSUD assets, stormwater quality reports using appropriate stormwater assessment tools, site layout plans, a construction site management plan, and an asset maintenance program
- **MUSIC**: SMPs for all developments in Fishermans Bend must utilize the MUSIC tool to model best practice stormwater flow and stormwater pollutant reduction to be achieved in their development through the implementation of water sensitive urban design.
- **Green Star**: All developments must utilize the Green Star certification system (or equivalent system providing third party verification and accreditation) to provide a green buildings performance rating.

A3: IWM Response

❑ Describe the proposed IWM Response. Include a discussion of constraints to IWM where relevant. The response should address each policy requirement for:

- Water efficiency
- Dual reticulation
- Rainwater capture and reuse
- Fit for purpose use and treatment of alternative water sources
- Stormwater flow reduction
- Green infrastructure
- Stormwater pollutant reduction
- Best practice water management

A3. Integrated Water Management (IWM) response, features and benefits

The following schematic illustrates an IWM Response for the development that achieves Fishermans Bend planning requirements. The performance of the response delivers benefits to onsite potable water demand reductions, stormwater treatment to improve water quality and flow reduction, fit for purpose onsite water use, third pipe management, and urban heat island mitigation amongst other areas.

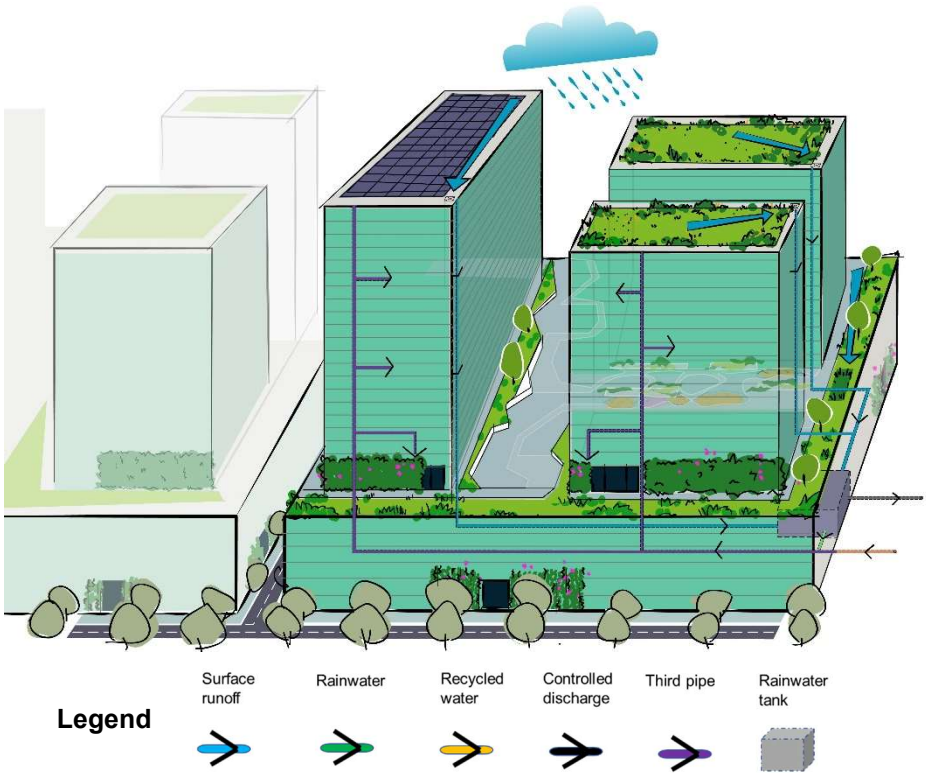


Figure 1 Proposed IWM Response

The development should achieve IWM outcomes through the implementation of:

- **Best practice water efficiency**: Application of a minimum 5-star WELS ratings to internal sanitary fixtures including taps, urinals, toilets, washing machines, and dishwashers, and 3-star rating for showers.
- **Water reuse**: Rainwater capture from 100% of roof and podium areas to supply internal non-potable demand and external landscape irrigation, with overflows directed to street drainage, with provisions for controlled release through Smart Tank technology. Water harvested from these areas will supply 14.5% of internal toilet flushing, washing machine and onsite irrigation demand for landscaped areas including green walls and green roofs.
- **Fit for purpose water use**: Treatment of rainwater prior to reuse, including first flush diversion, sediment removal and UV treatment.
- **Stormwater flow reduction**: Average annual flow reduction of 72% discharged from the site compared to predevelopment levels, through water retention and reuse on site.
- **Use of recycled water network**: Dual reticulation of non-potable water to all non-potable water outlets throughout the development for the future supply of precinct scale recycled water.
- **Green infrastructure**: Green roofs placed on 50% of tower roof areas and 2 story green walls placed on north facing walls of Towers A, C, D and F.

Water efficient landscaping with high proportion of native and low water use plants, including small and medium canopy trees at street and podium level with deep soil zones. All landscaping will be irrigated with rainwater first and supplemented by recycled water, through controlled access and sub-surface irrigation systems.

- **Green Factor Score of 0.69**: Site greening achieves optimal levels of performance, contributing to a healthy human connection to nature and connectivity with landscaping at street level**.**
- **Urban Heat Island**: The urban heat island effect will be mitigated through the use of extensive greening and shading across the site, increased water in the landscape, horizontal and vertical greening and the use of roofing and podium materials with a minimum three-year Solar Reflectance Index of 64. These measures will be placed on 86% of the site area.[1]
- **Stormwater pollutant reduction**: The development will exceed best practice stormwater pollution reduction through retention and reuse, reducing mean annual pollutant loads for Total Suspended Solids, Total Phosphorous and Total Nitrogen.
- **Best practice management**: Metering on all main end uses, recycled and rainwater outlets, and individual apartments to enable effective monitoring and identify leaks. All plumbing connections meet South East Water's conditions of connection.
- **Building services**: No water-based heat rejection methods will be used for the air conditioning system, fire protection system testing will be controlled with isolation valves for each floor, and water utilised for testing will be reserved and reused for landscape irrigation.
- **Best practice construction management**: A site management plan will be prepared to minimise the risks of stormwater pollution from the development in particular sediments, gross pollutants, and construction debris.
- **Green Star Rating**: The response maximizes the points that can be achieved through IWM following a performance pathway, providing an estimated reduction in potable water consumption of up to 30% compared to a reference building.

What are the costs and benefits of onsite IWM?

Fishermans Bend planning controls introduce a range of requirements that increase local amenity and user experience and have the potential to positively impact property value.

IWM measures are best integrated in the early stages of development planning to reduce additional construction and maintenance costs and minimise the potential impact that a design response may have on development yield.

A recent assessment of high-density development typologies undertaken in the City of Melbourne suggests that IWM and enhanced site greening can add an average of 1-3% on the cost of construction per m2. However, there is evidence from premiums applied to comparable developments that these costs can be recovered, and that developments with these features and their benefits may be able to achieve premiums of 2-8% (Arup, 2018).

Maintenance costs for green roofs have been estimated at 10% of the capital cost per annum, or 5% for roofs larger than 100 m^2. Maintenance of green facades has been estimated at between 8-10% of the capital cost per annum (Arup, 2018).

[1] These measures include photovoltaic panels which are classified as shading structures in the planning scheme.

Flood protection from rainfall and storm events

Most of the stormwater flow volume over a year and the associated pollutants occur within the more frequent 'every day' events and these are the most important for stormwater treatment. Larger, less frequent events individually have a lot of volume but do not happen often. Over a long period, they are less important but are significantly more difficult to treat so stormwater treatment focusses on treating the more frequent flows.

Less frequent events with a 1-20% chance of happening within a year are of most concern for flood mitigation protection with the events with a 5-20% chance of happening causing most flood damages (although rare events cause a lot of damage when they do occur).

It is neither technically possible or economic to capture or treat all rainfall or protect an urban development for all flood events and the level of protection provided is a balance between effort and cost required and the expected benefits of the protection. Certain standards of protection must be achieved. Typically these are for all building floors to be above the flood level for events up to a 1% chance of happening within a year with flows safely managed in pipes and overland flow paths and for all flows to be contained in pipes for events up to a 5-20% chance of happening within a year, depending on the development type.

Specifying green roofs, walls and façades

Green roofs are vegetated landscapes installed on roofs to provide building insulation, capture and retain stormwater, increase local plant diversity, and provide increased amenity and property value. Green roofs vegetation will vary based on the proposed design, desired irrigation requirements, and the weight bearing capacity of the building roof. Green walls provide similar benefits and are vertical vegetated systems that are generally attached to a wall, and incorporate vegetation, growing medium, irrigation and drainage into a single system. Green facades generally consist of climbers that grow up a façade from the building base or through container planting at different levels. Green walls differ from green facades in that they incorporate multiple modular plantings to create the vegetation cover rather than being reliant on fewer numbers of plants that climb and spread to provide cover (City of Melbourne, 2015).

Green roofs, walls and facades provide significant benefits to buildings including increased commercial returns, enhanced amenity, improved thermal building performance, and habitat for increased biodiversity, amongst others.

To produce successful green infrastructure, it is important to carefully consider the orientation of the site, and the potential exposure to excessive sun, wind and shading. As a result, the vegetation must be selected carefully, and provided with sufficient irrigation, soil and drainage to support healthy growth in such conditions. Council encourages the use of indigenous or native plants to support local biodiversity and water efficiency.

The cost of green roofs, walls and facades will vary based on a number of factors including the type of green infrastructure approach adopted, the size and location of the infrastructure on the building, structural and anchoring requirements, soil depth and vegetation selected, and access for maintenance amongst other factors.

For further information please refer to the City of Melbourne's Growing Green Guide (City of Melbourne, 2014).

Policy requirements for rainwater tanks – mandatory sizing

It is mandatory that onsite rainwater tanks are sized at a minimum 0.5 m^3/10 m^2 of suitable roof area, including podiums, and that these are fitted with a first flush device, meter, in built discharge control and water treatment supporting fit for purpose use. Discharge control can be achieved through the use of Smart Tank technology that utilises projected rainfall and tank level sensors to program the automatic discharge of rainwater from the tank prior to a rainfall event. Smart Tanks provide a means to maximise the retention of water from a rainfall event, thus reducing the impact of stormwater flows on the drainage system. Where a Smart Tank is not used, demand should be sufficient to regularly draw down the tank or alternatively a regulated detention outlet ideally to on-site green infrastructure should be provided.

For further information please contact your water retailer.

B: Include a site layout plan, catchment areas and IWM treatment systems:

- ❑ **B1:** Provide a site layout plan showing all building roofs and covered areas, sealed surface areas and unsealed surface areas with dimensions. This should be consistent with the plan lodged with the planning application.
- ❑ **B2:** Show the site boundary, dimensions, and total site area and the site layout plan.
- ❑ **B3:** Show the legal point of discharge.
- ❑ **B4:** Provide a drainage plan for the design solution. Specify the area draining to each downpipe and legal point of discharge (includes both impervious and pervious areas).
- ❑ **B5:** Show the location, type and surface area (m^2) of the proposed WSUD treatment systems on plan, including how each internal catchment area to be treated will be connected to a WSUD element. Show how piped connections will be made within the site and to the legal point of discharge.
- ❑ **B6:** Indicate the expected volume of onsite stormwater reuse and how this has been calculated.
- ❑ **B7:** If relevant to development type, identification of potential toxicants generated by the business to be located on the premise requiring structural isolation from the runoff draining to a WSUD treatment system or storm drain.
- ❑ **B8**: Consideration of the site's response contributing to cooling, improving local habitat and providing attractive/enjoyable spaces.

B. Site layout plans, catchment areas and IWM systems

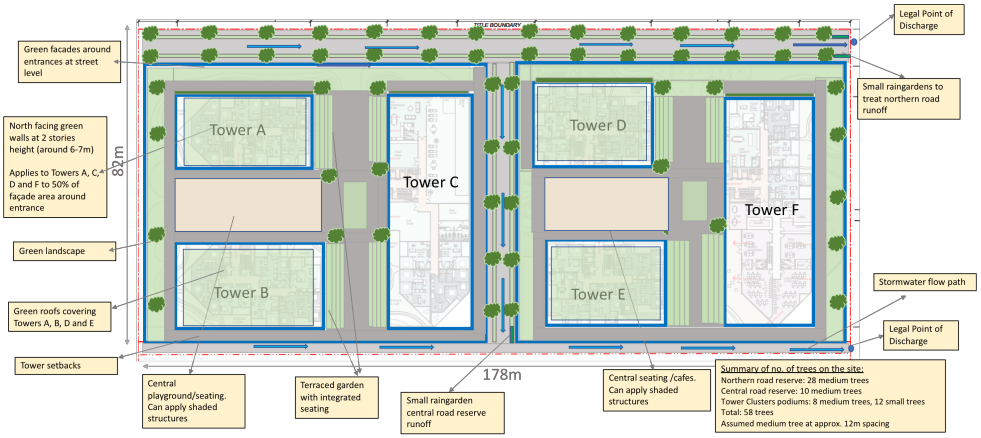


Figure 2– Site layout plan

An assessment of internal and external non-potable demand was undertaken to better understand the impact of tank sizing, while still meeting policy requirements. Outcomes include:

- Internal non-potable water demand for rainwater was estimated based on toilets and washing machine demand at 10.8 ML/year.[2]
- External non-potable water demand for landscape irrigation of common areas from rainwater was estimated at 1.28 ML/yr.[3]
- Tanks were sized at minimum 0.5 $m^3/10m^2$ for roof and podium areas, according to planning scheme requirements.
- This results in tanks of 250 kL for both of the podium clusters.
- These tanks have high reuse efficiency however they do not meet internal and external water demand.
- There is a shortfall of 20.9 ML/yr demand to be met by recycled water.

[2] Rainwater reuse consumption was estimated utilising occupancy rates per dwelling, specified WELS rated appliances, and an average number of flushes and washing machine loads per day. Commercial demand is expected to add another 10% to this total. Green Star Design & As Built Potable Water Calculator provides an alternative means to build demand across a broader number of uses.

[3] The City of Melbourne Growing Green Guide suggests an irrigation demand for hydroponic green walls of between 0.5 -2L/m^2/day. The mean value of 1.25 L/ m^2/day has been adopted, providing an irrigation demand of 1,668 L/day irrigation demand, or 0.609 ML/yr (modelled as seasonally distributed based on rain-PET).

Maintaining rainwater tanks primary flood detention function

It is important to ensure that there is sufficient internal and external demand to quickly draw down rainwater tanks and maintain their primary flood detention function. This should account for any seasonal irrigation and demand variability.

Policy requirements for third pipe connection

It is policy that a third pipe connection is provided to all non-potable water outlets across the development, for approved uses including toilet flushing, washing machine use and irrigation. This connection will supply all rainwater, stormwater and recycled water via a purple pipe. It is a requirement that rainwater and stormwater harvested on the site are the primary water source for this third pipe, supplemented by recycled water.

(cont.)

❑ **B9:** Table summarising the internal drainage catchment areas shown on the site layout plan, the size of the catchment area, the percentage of the site this represents and information about the corresponding WSUD treatment system. The table should equal 100% of total site area. The information should correspond to the information shown on the site layout plan.

Table 2- Catchment type or WSUD asset surface area

Catchment type	Area (m^2)	Treatment	Alternative Water demands	% demand met
Apartment towers A, B and C	2500	Smart Tank (250KL) to toilet flushing, washing machine and irrigation	12.1 ML/year	15
Western Podium surface area	3050			
Apartment towers D, E and F	2500	Smart Tank (250KL) to toilet flushing, washing machine and irrigation	12.5 ML/year	14
Eastern Podium surface area	3050			
Road reserves including northern road reserve and footpaths, central laneway and southern footpath	3470	38 medium street trees (passive irrigation), 2 raingardens (30m2 total area)	Not estimated	NA
Total site area	**14,570**			

Note: Additional plans and drawings should be supplied to capture all items raised in the accompanying checklist. This includes plans that show all IWM assets, their catchments and drainage connections.

C: Modelling and compliance: MUSIC should be utilised to demonstrate compliance with policy requirements.

- ❑ **C1:** Compliance summary with policy requirements.
- ❑ **C2**: MUSIC report with results that meet best practice performance for stormwater pollutant load reductions: TSS:80%; TP:45%; TN 45%; Litter 70%.
- ❑ Summary of MUSIC model input parameters for each WSUD treatment system
- ❑ Schematic of model.
- ❑ Check MUSIC file using the MUSIC auditor (https://www.musicauditor.com.au/).
- ❑ The applicant should submit a copy of the MUSIC file (.sqz) used to generate treatment performance.

C. Modelling and compliance

MUSIC software was used to model the water balance of the proposed site design as shown in the model schematic in Figure 3. The modelling climate details are summarised in the Table 2. The climate data was chosen according to the recommended pluviograph data for the Melbourne city region (10 years of data with mean annual rainfall between 650 and 750 mm/yr).

Table 3– MUSIC modelling parameters

MUSIC Model Inputs	
Site location	Melbourne regional
Rainfall data used	086071 MELBOURNE (1952-1961)
Modelling timestep	6 mins
PET data	Melbourne Average Monthly PET
Pollutant characteristics	Defined according to surface types as per Table 3 in Melbourne Water MUSIC Guidelines 2018

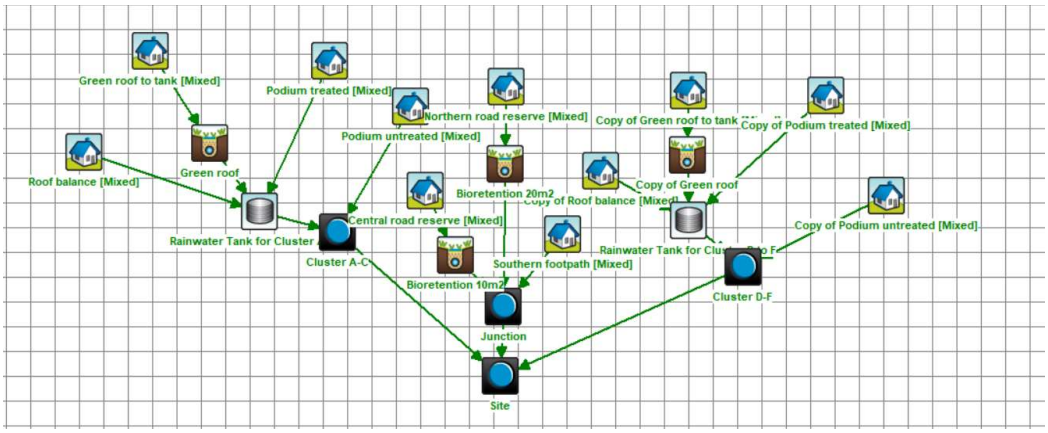


Figure 3 – MUSIC model schematic[4]

The effectiveness of the treatment systems is summarised in Table 4 demonstrating it exceeds compliance with water quality improvement requirements outlined in Best Practice Environmental Management Guidelines (minimum 80% reduction in Total Suspended Solids, 45% reduction in Total Phosphorus and 45% in Total Nitrogen). Due to the high demand / roof area ratio, the targets are easily met through water retention on site.

Note: for the purposes of MUSIC modelling, green infrastructure on podiums and roofs can be modelled as shallow bioretention systems. These areas will require additional irrigation to ensure the optimal growth and health of this infrastructure.

[4] Water is discharged from site at the legal point of discharge noted as the junction, receiving node or site discharge point in MUSIC.

C: Modelling and compliance (cont.)

- ❑ **C3:** Minimises impact of chemical pollutants and other toxicants, as relevant.
- ❑ **C4:** Contributes to cooling, improving local habitat and providing attractive/enjoyable spaces.
- ❑ **C5:** Tank installation and fit for purpose treatment of water harvested from trafficable and non-trafficable areas must be undertaken in accordance with South East Water's Conditions of Connection and Guidelines for the use of Recycled Water and Rainwater (2018).
- ❑ For combined rainwater and recycled water infrastructure, it is advised to consult with the relevant water corporation or local council for design and treatment requirements of the rainwater system.

Table 4 – MUSIC modelling compliance results

	Sources	Residual Load	% Reduction
Flow (ML/yr)	6.9	1.97	71.5
Total Suspended Solids (kg/yr)	1380	180	87
Total Phosphorus (kg/yr)	2.82	0.544	80.7
Total Nitrogen (kg/yr)	19.8	3.45	82.5
Gross Pollutants (kg/yr)	265	29.8	88.8

Tank performance

Table 5 – MUSIC modelling parameters

	Tank 1 Towers A-C	Tank 2 Towers D-F
Volume captured (ML/yr)	1.847	1.822
Demand (ML/yr)	12.1	12.5
Demand met (ML/yr)	1.81	1.78
Demand met (%)	15	14
Stormwater Volume Reduction (%)	97	97
Demand Shortfall (ML/yr)	10.2	10.7
Total volume harvested from tanks (ML/yr)	3.6	

The demand shortfall for internal non-potable demand and irrigation will be met exclusively using recycled water. Potable water can be supplied through the third pipe until such a time as recycled water becomes available for the precinct.

Cooling, habitat and enjoyable spaces

The proposed greening for the site, including vegetation at podium level, green walls and façade greening contribute to providing the combined benefits of cooling and adding enjoyable aesthetics for inhabitants and visitors to the complex.

Fit for purpose treatment

Rainwater and stormwater harvested from the site will be applied in a fit for purpose manner and treated to reduce risks associated with nutrients and pathogens in these water sources.

Rainwater treatment will be undertaken according to the Department of Health and Human Services guidelines, and will include maintenance of harvesting areas, first flush devices, back flow prevention, and some level of post storage treatment including filtration and disinfection, and UV or chlorination.

Water for reuse may require additional treatment to mitigate risk of any contaminants entering the stormwater system (for example cleaning detergents, cigarette butts, and other contaminants from trafficable surfaces). Treatment may include sediment removal to protect the UV system, and some sacrificial areas to retain flows if required. Controlled access to treated water, including sub-surface

irrigation, will be applied for risk reduction, as will the placement and monitoring of backflow prevention devices and control switches with the recycled water system.

The importance of backflow prevention, system switches, and controlled access is critical in reducing risks associated with use and ensuring that Class A recycled water is not compromised. The design and treatment associated with these systems will be undertaken in accordance with South East Water's Condition of Connection and Guidelines for Recycled Water and Rainwater in Medium to High Density Developments.

Governance of these systems will be established between the owners, body corporate and relevant authorities.

Tank sizing and green infrastructure planning

The planning scheme defines tank sizing requirements on the basis of 50% of the storm event volume for a 5-year design ARI over a 72-hour duration event. Tanks should be sized with a corresponding volume, accounting for all accessible catchment areas and any green infrastructure proposed within.

Green infrastructure must drain and connect back to the tank to meet the flood retention objectives of the tanks. In some instances, protection such as a media filter may be required to further protect tank assets. The design storm event volume should be determined to size the tank appropriately considering other objectives and the minimum tank size required for flood mitigation and reuse applied.

Further guidance

South East Water Conditions of Connection (S.145 of the Water Act 1989)

Standard Conditions of Connection – Fisherman's Bend Precinct

South East Water (2018) Guidelines for Recycled Water and Rainwater in Medium to High Density Developments

Melbourne Water MUSIC Guidelines (2018)

MUSIC Software Auditor to review the MUSIC file submitted as part of the application

Department of Health and Human Services (2013), Rainwater use in urban communities – Guidelines for non-drinking applications in multi-residential, commercial and community facilities

D. Functional design

Information relating to the functional design of the development will be included with the planning application. This will include the detailed presentation of tank design and the treatment of rainwater harvested on site including first flush, pre-treatment, secondary and tertiary treatment prior to entering the building's recycled water network. It will also include detailed specification of green roofs, green walls and green facades, as well as cross sections of any raingardens and passively irrigated street trees proposed. Additional design details may be required as a condition of permit.

Further guidance

Melbourne Water WSUD Engineering Procedures

WSUD Engineering Procedures: Stormwater Appendix A: Suggested plant species for WSUD treatment elements

Melbourne Water Water Sensitive Urban Water Design Guidelines: South East Councils

City of Melbourne Stormwater Drainage Design Guidelines

E: Green Star Response: applications should achieve a 5 Star Green Star Rating.

- ❑ **E1:** Certified 5 Star Green Star Design Rating as rated through the Green Star Design and As Built Tool v1.3.
- ❑ **E2:** Conditional rating to be documented in detailed design and achieved within 12 months of building occupation.
- ❑ **E3:** Provide evidence for all rated initiatives including plans, modelling, and strategy.
- ❑ **E4:** Maximise points achieved against the following categories:
  - ❑ 2. Commissioning and Tuning
  - ❑ 3. Adaptation and Resilience
  - ❑ 5. Commitment to Performance
  - ❑ 6. Metering and Monitoring
  - ❑ 18. Potable Water
  - ❑ 25. Heat Island Effect
  - ❑ 26. Stormwater
  - ❑ 30. Innovation
- ❑ **E5:** Third party verification of the design.

Note: Project teams must review the Green Star Potable Water Calculator Guide prior to utilising the Potable Water Calculator to ensure that the design response reflects the assumptions set out in the

E. Green Star response

The development will be planned to achieve a 5-star Design and As Built Green Star Rating and has been assessed utilising the Green Star Design and As Built Submission Guidelines (v1.3) and scorecard. The IWM response aims to maximise the points achieved across specific Green Star categories that facilitate the delivery of IWM outcomes specified in the planning scheme.[5]

Optimal performance across these category areas can contribute up to 26 points towards the required 60 points to achieve a 5 Star whole of project rating, which represents an Australian Excellence performance level. The IWM response outlined in this report will target a total of 18 points towards the required total.

Table 6 outlines the Green Star credits and points targeted by the development's IWM response. Points targeted across categories that encompass additional responses beyond IWM require additional action across all nominated building systems and services, for example Metering and Monitoring, Commissioning and Tuning, and Commitment to Performance.

Table 6 Green Star response of development

Category	Maximum Points	Requirements	Points Targeted

18.Potable Water	12[6]	• 18A: A performance pathway was adopted to determine reductions in potable water consumption. The result is up to a 30% potable water reduction compared to a reference building
		• The pathway includes the following actions:
		  ○ High WELS rated sanitary fixtures and appliances
		  ○ Heat rejection: No water used for heat rejection in air conditioning.
		  ○ Landscape irrigation: drip irrigation with moisture override sensor
		  ○ Fire system test water: reuse and sprinkler systems with isolation valves.
		  ○ Application and reuse of recycled water and rainwater on site.
		• 18B: Should the prescriptive pathway be adopted it would be possible to achieve up to 6 points based on these actions. However, it would not be possible to meet the pathway's Green Star tank sizing requirements due to the large site GFA[7]. A technical question can be lodged with the GBCA to demonstrate that onsite detention
			6

[5] Green Star points are classified into eight categories, with each category allocated a number of credits, each with an associated number of points. The total number of points equals 100, with no weightings applied to the categories.

[6] A maximum of 12 points are awarded following a performance pathway when a development achieves a 75% reduction on a reference project with standard water efficiency. A maximum of 6 points are awarded following a prescriptive pathway when the development addresses specified key water uses.

[7] Tank sizing is specified at 10L/m^2 Gross floor area

Category	Maximum Points	Requirements	Points Targeted
		and retention has been maximized for the catchment area with the proposed sizing. • **Note**: Precinct wide recycled water collection may not be available at the time of the As Built submission. As a result, the project may not be able to claim the benefits of this initiative, which would impact on the targeted % potable water reduction on a reference building. Should the availability of recycled water be guaranteed within two years of the practical completion of the building, a technical question may be lodged with the GBCA to determine whether the benefits can be included in the credit assessment.	
26. Stormwater	2	• 26.1: The development's peak event stormwater discharge does not exceed the predevelopment discharge[8], as a result of the capture of water from both the podium and roof area. • A risk assessment has been conducted providing the ability to access adaptation and resilience credits (Category 3). • 26.2: Stormwater pollutant reduction targets for total nitrogen, total phosphorous and total suspended solids have been exceeded. • It is assumed that hydrocarbons and oils will be generated on road reserves. Management approaches to these contaminants include capture through biofiltration media (raingardens) and passively irrigated street trees as proposed across the site.	2
6. Metering and Monitoring	1	• An energy and water consumption metering and smart monitoring system has been put in place. • This system is connected to Smart Tanks capturing rainwater and recycled water prior to connection to the third pipe. • Attainment of these points is dependent on the placement of meters and monitoring on all nominated building systems.	1
2. Commissioning and Tuning	4	• Environmental performance targets have been set for the development, including a consumption target of 100L/person/day. • The development is committed to a comprehensive commissioning and tuning process covering the operation, servicing, safety and	4

[8] The measure utilises a 5-year design ARI for medium to high risk climate change risks over the design and lifetime of the project

Category	Maximum Points	Requirements	Points Targeted
		maintainability of all IWM systems from the design, tender, construction, commissioning and tuning phases of the project. • An independent agent has been appointed to support the commissioning and tuning phase throughout the project lifecycle. • Attainment of these points is dependent on the commissioning and tuning of al nominated buildings services and systems.	
25. Heat Island Effect	1	• The development complies with the requirement that a minimum 75% of the site comprise of green infrastructure or shading structures with minimum SRIs and pitches, which has been applied to 78% of the site.[9]	1
30. Innovation	3 for potable water and stormwater	• The development improves on the following Green Star benchmarks: o Stormwater pollutant reduction requirements (Column B targets). • Availability of recycled water at the time of practical completion may impact the ability of the project to claim an additional innovation credit for improving on Green Star benchmarks for discharge to sewer.	1
5. Commitment to Performance	1	• An environmental building performance target for potable water use has been set (100L/person/day), with regular measurement supported by smart metering and at least quarterly reporting. • Attainment of this target relies on the measurement of other environmental building performance targets.	1
3. Adaptation and Resilience	2	• A site wide Climate Adaptation Plan has been developed for the site. This incorporates the outcomes of a precinct wide climate risk assessment and site level responses to urban heat island, sea level rise and storm events, application of IWM and green infrastructure across the site, and community preparedness to respond to climate risks. • A technical question may be lodged to confirm that the precinct level assessment covers the development site. approach	2

[9] For the purpose of the assessment of this credit, areas allocated to photovoltaic panels or solar hot water should be excluded from the total site area to be assessed, as per advice in the Submission Guidelines. Solar panels have low SIR values, are not classified as shading structures, and are therefore not complaint surfaces that contribute to the attainment of this credit.

Technical questions

Technical questions are a useful mechanism for reviewing and justifying alternative approaches to achieving Green Star credits. This is the case with Smart Tank sizing, where a larger tank based on the development's GFA will not provide additional flood mitigation or water reuse benefit to the site. It can also apply to requirements associated with Smart Tank Commissioning, where it may be possible to meet documentation requirements through approvals processes associated with South East Water's conditions of connection for rainwater tanks and third pipe. Confirmation with the GBCA for any alternative approaches to those outlined in the Submission Guidelines will be required as part of the certification process.

Green Star future focus

The Green Building Council is preparing to transition the Design & As Built tool to a new tool: Green Star for new buildings. This tool will present minimum performance requirements for the potable water category including three levels of achievement (minimum expectations, credit achievement and exceptional performance) and changes to how categories are grouped and assessed. It is expected that the transition will take place in late 2021.

Further guidance

Green Building Council Australia Green Star Design & As Built v1.3 Submission Guidelines – can be purchased at the GBCA website.

CSIRO (1999) Best Practice Environmental Management Guidelines (as amended)

F: Green Infrastructure – Green Factor Response: applications should achieve a minimum Green Factor Score of 0.55

- ❑ **F1:** Define approach to site greening including green elements and site areas contributing to the score.
- ❑ **F2:** Score Green elements in the Green Factor Scorecard and provide as part of the SMP.
- ❑ **F3:** Engage a Landscape Architect and Irrigation Consultant if appropriate to finalise the design.

F. Green Infrastructure: Green Factor response

The development presents a strong green infrastructure response across common areas that supports the attainment of IWM and urban heat island mitigation objectives, controls and standards. The assessment does not include greening of balconies and private areas of individual dwellings. Internal planting is not proposed as part of the development.

About Green Factor

Green Factor is a tool that can assist applicants to achieve compliance wth policy requirements related to green infrastructure. The tool provides applicants with a Green Factor Score that is calculated as a ration of the total vegetated area (m2) relative to the total site area. Green Factor incorporates green walls, roofs and facades and provides an opportunity to value both horizontal and vertical greening.

A minimum score of 0.55 is deemed necessary to achieve required IWM and urban heat island policy objectives at a lot scale.

The IWM response has been scored in Green Factor based on the following assumptions:

- **Green Roof:** 90% greening of Towers A, B, D and E (2450 m^2) comprising:
  - 816 m^2 of large shrubs and equivalent soil areas exceeding 500mm in depth,
  - 816 m^2 of small shrubs and equivalent soil areas between 200mm and 500mm in depth,
  - 816 m^2 in groundcover and equivalent soil areas under 200 mm in depth,
  - Limited access for maintenance only, visibility from Towers C and F.
- **Podium greening:** 40% greening at podium level (2440m^2), split equally over two podiums, comprising:
  - 8 medium canopy trees (canopy diameter of 8 m)[10] with 400 m^2 of deep soil volumes (1000- 1500mm in depth),
  - 12 small canopy trees (canopy diameter of 6m) with 144 m^2 of medium depth soil volumes (600-1000mm),
  - Terraced seating with interspersed greening comprising 696 m^2 in groundcover and equivalent soil areas under 2000mm, 928 m^2 in small shrubs and equivalent soil areas between 2000mm-5000mm, and 696 m^2 in large shrubs and equivalent soil areas over 500mm.[11]
- **Green wall**: 2 story high green wall along the north facing walls of Towers A, C, D and F at podium level (612 m^2). Equal mix of groundcover and small shrub type coverage.
- **Green façade**: Street level greening positioned around 4 ground level entrances covering 2 stories providing 30 m^2 shading at each level (120 m^2)
- **Road reserves**: placement of:
  - 38 medium canopy trees (304 m^2),
  - Extensive nature strips (1050 m^2) across the northern and central road reserves,
  - Deep soils exceeding 1500mm in depth (1900 m^2) to support trees,

[10] These trees are defined according to standards set out in the Better Apartment Design Standards to meet Clause 58.03-5 Standard D10. The design utilises 12 small Type A canopy trees and 48 medium Type B canopy tree to comply with the deep soil requirements for the site as specified in Table 1.

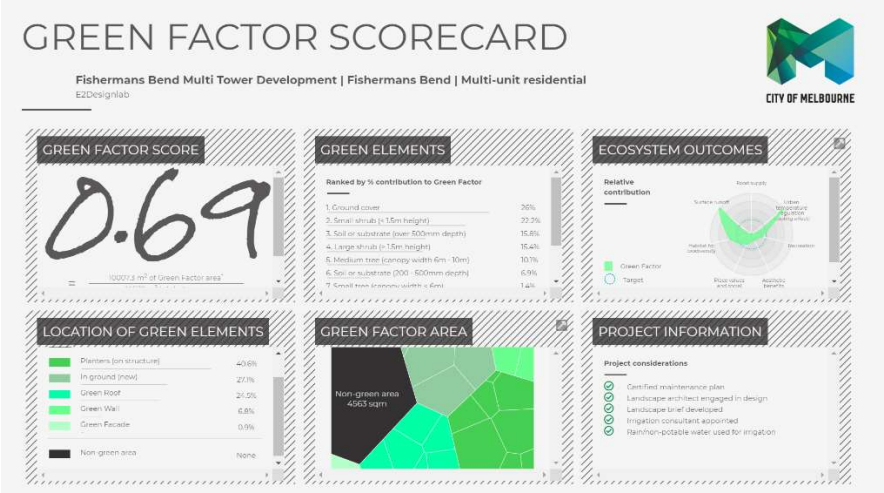
[11] Data input for deep soils in the Green Factor tool may require some adjustments to account for vegetation located under trees and colocation of trees and vegetation in the design.

- 1 x 20 m^2 raingarden and 1 x 10 m^2 raingarden to treat runoff from the northern and central road reserves.

- **Species selection:** native flowering species and climbers with a low to medium irrigation need have been selected as appropriate to green the site. Canopy trees located on the podiums have a larger irrigation requirement and are to be irrigated with stormwater and supplemented with recycled water.

The IWM response exceeds the minimum Green Factor score required as a result of the significant podium and rooftop greening as well as inground infrastructure proposed for the site, with a Green Factor Score of **0.69.** The design delivers significant ecosystem outcomes across a number of areas including urban heat island amelioration, surface runoff treatment and biodiversity. The design can be modified to deliver increased benefits through the incorporation of more accessible vegetation to non residents at street level, such as façade greening.

Figure 5 Green Factor scorecard rating for the development



Green Factor sensitivity analysis

Alternative greening configurations will provide the following Green Factor Scores:

- More extensive street level façade greening along the northern walls of the podium (460 m^2) would provide a Green Factor score of 0.71.
- Removal of the north facing green walls would provide a Green Factor score of 0.63.
- A 20% reduction of green roof to allow for trafficable pathways would provide a Green Factor score of 0.65.

The impact of measures at ground level, podium and roof level is broadly similar with the podium providing a slightly higher contribution to the overall score.

The following conditons are required to support the planting:

- Location: Consideration of building height levels providing optimal orientation, sun and wind conditions.
- Irrigation: Automatic drip irrigation systems for green walls, facades and planter boxes which can be more water intensive than ground level vegetation. These will be required to maintain plant health particularly for

vegetation that is more exposed to wind and rain. All vegetation will be controlled access irrigation with rainwater and recycled water.

- Drainage: Drainage to support the structural integrity of the building and planted areas and to respond to extreme weather events.

Support from a Landscape Architect and Irrigation consultant can greatly assist with the development of effective green infrastructure.

Meeting landscaping standards for apartments

The green infrastructure response meets some but not all landscaping standards as set out in Clause 58.03-5. The design meets the requirements for tree canopy cover including the required number and type of canopy trees, but is unable to meet the requirements for deep soil defined as 'an area of natural ground unimpeded by a structure below (and above), providing opportunities for groundwater infiltration and canopy trees' (Apartment Design Guidelines, 2017). This is as a result of expected capping of the site due to soil contamination issues and as a result of trees on podiums that are unable to satisfy this requirement as there is no ground level vegetation for groundwater infiltration.

Requirements for a minimum of 1 medium tree per 50 m^2 of deep soil have been exceeded in the response, with the provision of 46 medium trees with the corresponding deep soil volumes required to achieve optimal canopy growth and health. An additional 12 small trees have been proposed for the podium to provide additional canopy with less structural load. Site opportunities and constraints will indicate the extent to which optimal canopy provision can be attained on site.

Planter structures on podiums and green roofs are a primary mechanism for achieving landscaping and greening policy requirements in Fishermans Bend particularly on highly developed sites. Consideration should be given to the soil and irrigation requirements for these structures to support healthy green infrastructure.

Alternative green infrastructure approaches

In addition to the design response outlined, it is possible to consider a number of other solutions for application at ground level or on structures, depending on the opportunities and constraints of the site. These include:

- Rock or stone wool, an alternative to soils which offers a lightweight yet high load bearing storage and release option for irrigation of roofs, podiums and streetscape vegetation.

- Wicking beds, which provide an opportunity for ground level retention and release of harvested water to green infrastructure.

- Raingardens, which can be placed at ground level or on structures to provide amenity and treat stormwater runoff.

Further guidance

Adoption Guidelines for Green Treatment Technologies. (Cooperative Research Centre for Water Sensitive Cities, 2018).

Green walls, roofs and facades: Technical Guidelines (Inner West Council, 2020).

Growing Green Guide (City of Melbourne, 2014)

G: Construction:

- ❑ G1: Development of a Site Management Plan that outlines construction measures to protect the stormwater system during construction.
- ❑ G2: Site management measures shown on a plan.

G. Construction

All construction activities will be carried out under the guidance of a site sediment and erosion construction management plan. A site management plan will be prepared for the development, with consideration of the following:

- Protection of stormwater drains surrounding the site and downstream waterways from sediment, topsoil, construction debris and other pollutants that may leave the site during construction due to wind or rainfall or runoff
- Implementation of measures to contain sediment and litter from construction on-site. Measures include the use of designated wash-down areas, the direction of run-off to drains and bunded areas, stockpile protection using tarps and covers, and waste containment measures on site amongst others.\
- Site risk assessment and risk reduction measures

Further guidance

EPA Victoria publications at Prevent stormwater pollution on building sites

In 2020 EPA Victoria will release a new guide outlining common hazards in the construction industry in accordance with the *Environment Protection Amendment Act 2018* to come into effect in July 2021.

H. Commissioning

Building commissioning of mechanical and electrical services and irrigation systems is an important step in ensuring that systems are calibrated optimally. Smart Tank technology and other water using services form part of this process and will be assessed and tuned based on as-built drawings, operation and maintenance manuals (O&Ms), building user guides, and feedback from building managers. These guides will provide clarity on how the building can use water efficiently, its likely water consumption, and relevant building management systems that track and monitor its usage.

Smart Tanks have specific power and telecommunications requirements as follows:

- Power is required to run the smart tank controller and the discharge control equipment.
- Accessible 4G network is required for receiving purge messages, monitoring tank performance, and conveying alarms to the monitoring platform.
- Access to AC 240V 50Hz power supply and to 4G network is required in the rainwater tank control room or where the smart tank controller is installed.

Mandatory recycled water inspections are required at multiple stages during project delivery and commissioning.

Further guidance

South East Water Conditions of Connection (S.145 of the Water Act 1989)

Standard Conditions of Connection – Fisherman's Bend Precinct

I: Asset Maintenance:

- ❑ **H1:** Development of an Inspection and Maintenance Checklist for all IWM assets.
- ❑ **H2:** Clearly labelled drawings identifying items that need to be maintained.

I. Asset maintenance

Asset maintenance is recognised as a critical factor in ensuring the ongoing functionality of IWM assets, ensuring these achieve on site reuse and stormwater retention and detention objectives together with the ongoing protection of downstream environments. Considered early planning and design processes can facilitate the development of assets that are more easily maintained, ensuring adequate access is achieved for each IWM asset.

An asset maintenance program will be developed for all IWM assets, including a schedule of maintenance and clarity regarding maintenance responsibilities. Given the complex network of interconnected assets on site, the plan must clarify which aspects of asset maintenance are the responsibility of the future tenant, building owner, body corporate, or responsible authority.

Governance

For this development the management of onsite tanks will be the responsibility of the owner and Body Corporate, and the management of recycled water will be the responsibility of South East Water.

Key considerations include the establishment of inspection and cleaning schedules as well as performance standards across the following assets:

- **Smart Tank Technology**: Tank maintenance will incorporate a review of the functionality of remote sensors, monitoring equipment and the functionality of triggers and alerts as well as monitored data to ensure the tank is functioning as intended, the presence of leaf litter or debris blocking downpipes and first flush valves, the presence of sediment or debris in the tank, review of pump functionality, ongoing connection to stormwater for overflow and structural stability of the tank. All smart tanks should have telemetry with alerts to a responsible party for critical indicators and issues such as abnormal water level patterns as well as any identified pump failure, power outage, inlet or outlet blockage.
- **Rainwater Treatment**: Technical specifications, performance monitoring, random sampling.
- **Third pipe connection**: Inspection and testing of backflow devices, pump systems and changeover devices relating to rainwater use.
- **Planters on structures, green roofs, walls and facades:** Establishment and routine maintenance of vegetated structures including plant replacement, weeding and fertilizing. Review of irrigation infrastructure including pumps and sprinkler heads/drippers. It should also include inspection and works to ensure the underlying building structures are maintained, functional and safe, with inspection of any waterproofing membranes for leaks. Access must be carefully considered based on the location of the structure (Inner West Council, 2020).
- **Irrigation system and drainage system maintenance:** Inspection for blockages and removal of debris, review of automatic sensors and system functionality.
- **Raingardens and passively irrigated trees:** Removal of litter at regular intervals as part of monthly maintenance, inspection of raingarden inlets, surface level and temporary detention to ensure ongoing functionality, plant health and replacement of surface soil media if required, removal of blockages to the stormwater network connection.

Maintenance can be undertaken inhouse or with the support of specialist contractors and should be budgeted as part of ongoing operational costs. Ongoing maintenance costs have been estimated by the Royal Institution of Chartered

Surveyors at approximately 2 - 12% per year of the installation costs (City of Melbourne, 2016).

It is the owner's responsibility to maintain and irrigate green walls, roofs, and facades. If these are not maintained appropriately and die, it is the owner's responsibility to replace these as per the original sizing and dimensions.

Further guidance

Stormwater Victoria WSUD Audit Guidelines

City of Port Phillip Raingardens Maintenance Manual

J. Applicant Checklist: IWM in Fishermans Bend

The Port Phillip and Melbourne Planning Schemes contain policy and planning controls that support integrated water management. Some are mandatory requirements of a planning permit and must be pursued prior to the commencement of building and works.

This checklist outlines the key steps to follow when addressing integrated water management as part of a Sustainability Management Plan (SMP). In addition, the applicant should review all planning scheme requirements for the land and the development type, including local controls.

Applicants are encouraged to check with their local council if they are not sure which planning scheme provisions apply and complete a site layout plan before starting the SMP.

A: Proposed development description:

❑ **A1**: Describe the proposed development e.g. describe the land use, anticipated tenancy, buildings and works, number of car parking spaces, expected number of occupants, etc.

  ❑ Assess site opportunities and constraints for IWM.

❑ **A2.** Assess Fishermans Bend Planning Scheme requirements that apply to the site

  ❑ Register the proposed development with the Green Building Council of Australia.

  ❑ Hold a pre application meeting with Council to confirm proposed design response to planning requirements.

❑ **A3 IWM Response**: Describe the proposed IWM Response. Include a discussion of constraints to IWM where relevant. The response should address each policy requirement for:

- Water efficiency
- Dual reticulation
- Rainwater capture and reuse
- Fit for purpose use and treatment of alternative water sources
- Stormwater flow reduction
- Green infrastructure
- Stormwater pollutant reduction
- Best practice water management

B: Site layout plan, catchment areas and IWM treatment systems:

❑ **B1:** Provide a site layout plan showing all building roofs and covered areas, sealed surface areas and unsealed surface areas with dimensions. This should be consistent with the plan lodged with the planning application.

❑ **B2:** Show the site boundary, dimensions, total site area and the site layout plan.

❑ **B3:** Show the legal point of discharge

- ❑ **B4:** Provide a drainage plan for the design solution. Specify the area draining to each downpipe and legal point of discharge (includes both impervious and pervious areas).

- ❑ **B5:** Show the location, type and surface area (m^2) of the proposed WSUD treatment systems on plan, including how each internal catchment area to be treated will be connected to a WSUD element. Show how piped connections will be made within the site and to the legal point of discharge.

- ❑ **B6:** Indicate the expected volume of onsite stormwater reuse and how this has been calculated.

- ❑ **B7:** If relevant to development type, identification of potential toxicants generated by the business to be located on the premise requiring structural isolation from the runoff draining to a WSUD treatment system or storm drain.

- ❑ **B8**: Consideration of the site's response contributing to cooling, improving local habitat and providing attractive/enjoyable spaces.

- ❑ **B9:** Table summarising the internal drainage catchment areas shown on the site layout plan, the size of the catchment area, the percentage of the site this represents and information about the corresponding WSUD treatment system. The table should equal 100% of total site area. The information should correspond to the information shown on the site layout plan.

C: Modelling and compliance: MUSIC should be utilised to demonstrate compliance with policy requirements.

- ❑ **C1:** Compliance summary with policy requirements.

- ❑ **C2**: MUSIC report with results that meet best practice performance for stormwater pollutant load reductions: TSS:80%; TP:45%; TN 45%; Litter 70%.

  - ❑ Summary of MUSIC model input parameters for each WSUD treatment system.

  - ❑ Schematic of model.

  - ❑ Check MUSIC file using the MUSIC auditor (https://www.musicauditor.com.au/).

  - ❑ The applicant should submit a copy of the MUSIC file (.sqz) used to generate treatment performance as well as a summary report file (*.mrt) or MUSIC Auditor report.

- ❑ **C3:** Minimises impact of chemical pollutants and other toxicants, as relevant.

- ❑ **C4:** Contributes to cooling, improving local habitat and providing attractive/enjoyable spaces.

- ❑ **C5:** Tank installation and fit for purpose treatment of water harvested from trafficable and non-trafficable areas must be undertaken in accordance with South East Water's Conditions of Connection and Guidelines for the use of Recycled Water and Rainwater (2018).

- ❑ For combined rainwater and recycled water infrastructure, it is advised to consult with the relevant water corporation or local council for design and treatment requirements of the rainwater system.

D: Functional design consideration

This section may be required for inclusion with the planning application, or else the information is to be provided as a condition of permit. Check with your Council for advice on which applies.

Note: All applications must be accompanied by details of the proposed stormwater management system, including drainage works and retention, detention and discharges of stormwater to the drainage system.

- ❑ **D1:** Plan from Checklist item B (Site layout plan, catchment areas and IWM treatment systems) or amended plan required by permit.
- ❑ **D2:** Sectional view of each WSUD treatment showing indicative levels.
- ❑ **D3:** Size of treatment elements, e.g. tank volume, raingarden width and length, extended detention depth, etc.
- ❑ **D4:** Details of pipe connections between the rainwater tank, recycled water and third pipe network and end uses, e.g. toilet/s, laundry, hot/cold water and irrigation, as applicable.
- ❑ **D5:** Relative Levels (RL's) for each WSUD treatment including surface level, extended detention depth, filter layers and depth, under drain system, and connection to the legal point of discharge (LPOD).
- ❑ **D6:** Plant species and planting densities to be used in any vegetated treatment systems, in accordance with best practice requirements. I.e. Melbourne Water recommends 6 – 10 plants / sqm in a raingarden.
- ❑ **D7:** For vegetated treatment systems, management of the interface between the WSUD treatment and immediately surrounding areas, e.g. car parking spaces, walkways, lawns, so that the WSUD elements and public safety are protected.

E: Green Star Response: applications should achieve a 5 Star Green Star Rating.

- ❑ **E1:** Certified 5 Star Green Star Design Rating as rated through the Green Star Design and As Built Tool v1.3.
- ❑ **E2:** Conditional rating to be documented in detailed design and achieved within 12 months of building occupation.
- ❑ **E3:** Provide evidence for all rated initiatives including plans, modelling, and strategy.
- ❑ **E4:** Maximise points achieved against the following categories:
  - ❑ 2. Commissioning and Tuning
  - ❑ 3. Adaptation and Resilience
  - ❑ 5. Commitment to Performance

- ❑ 6. Metering and Monitoring
- ❑ 18. Potable Water
- ❑ 25. Heat Island Effect
- ❑ 26. Stormwater
- ❑ 30. Innovation

❑ **E5:** Third party verification of the design.

Note: Project teams must review the Green Star Potable Water Calculator Guide prior to utilising the Potable Water Calculator to ensure that the design response reflects the assumptions set out in the Tool's calculation methodology.

F: Green Factor Response: applications should achieve a minimum Green Factor Score of 0.55

- ❑ **F1:** Define approach to site greening including green elements and site areas contributing to the score.
- ❑ **F2:** Score Green elements in the Green Factor Scorecard and provide as part of the SMP.
- ❑ **F3:** Engage a Landscape Architect and Irrigation Consultant if appropriate to finalise the design.

G: Construction:

- ❑ **G1**: Development of a Site Management Plan that outlines construction measures to protect the stormwater system during construction.
- ❑ **G2**: Site management measures shown on a plan.

I: Asset Maintenance:

- ❑ **H1:** Development of an Inspection and Maintenance Checklist for all IWM assets.
- ❑ **H2:** Clearly labelled drawings identifying items that need to be maintained.