IGS INTEGRATED GROUP SERVICES

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Stormwater Management Plan

11 – 17 Dorcas Street,
South Melbourne
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Document Control

Version	Date	Author		Reviewer	
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TABLE OF CONTENTS

1 Executive Summary

Integrated Group Services (IGS) has been commissioned to prepare a Conceptual Stormwater Management Plan (CSMP) for the proposed precinct development located at 11 – 17 Dorcas Street, South Melbourne Vic.

The stormwater quality modelling was undertaken using the MUSIC version 6.2 software. The modelling results (see **Table 1.1**) indicate the 70%, 80%, 45% and 45% reduction targets for Gross Pollutants (GP), Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) respectively can be achieved.

Table 1.1: Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Reduction Target (%)
Flow (ML/yr)	4.45	1.65	**62.9**	0
Total Suspended Solids	187	36.6	**80.4**	80
Total Phosphorus	0.727	0.24	**67**	45
Total Nitrogen	9.97	2.75	**72.4**	45
Gross Pollutants	162	0	**100**	70

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

- One (1) x 10 kL Rainwater Tank
- One (1) x 12m^2 Rain 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 11 – 17 Dorcas Street, South Melbourne Vic. The site is located within the catchment of City of Melbourne and City of Port Philip Councils.

The development a mixed used high-rise development consists of 19 story building with total of (58 residential) apartment, one by commercial tenancy possibly (food and beverage) on ground level with 2 levels of basement carpark and services plant and some storage facilities.

2.2 Site Locality

The subject site is bounded by Dorcas street from the north, Middleton Lane from the east and south and attach to neighbours property on the west. Site is within City of Port Philip city council.
(see **Figure 3.1**).

Figure 2.1 Site Location

2.3 Site Layout

The proposed development is presented on **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). These are:

- 80% reduction in Total Suspended Solids (TSS) from typical urban loads.
- 45% reduction in Total Nitrogen (TN) from typical urban loads.
- 45% reduction in Total Phosphorus (TP) from typical urban loads; and
- 70% reduction in Gross Pollutants (GP) from typical urban loads.

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 4.1** shows a schematic representation of the proposed treatment train elements.

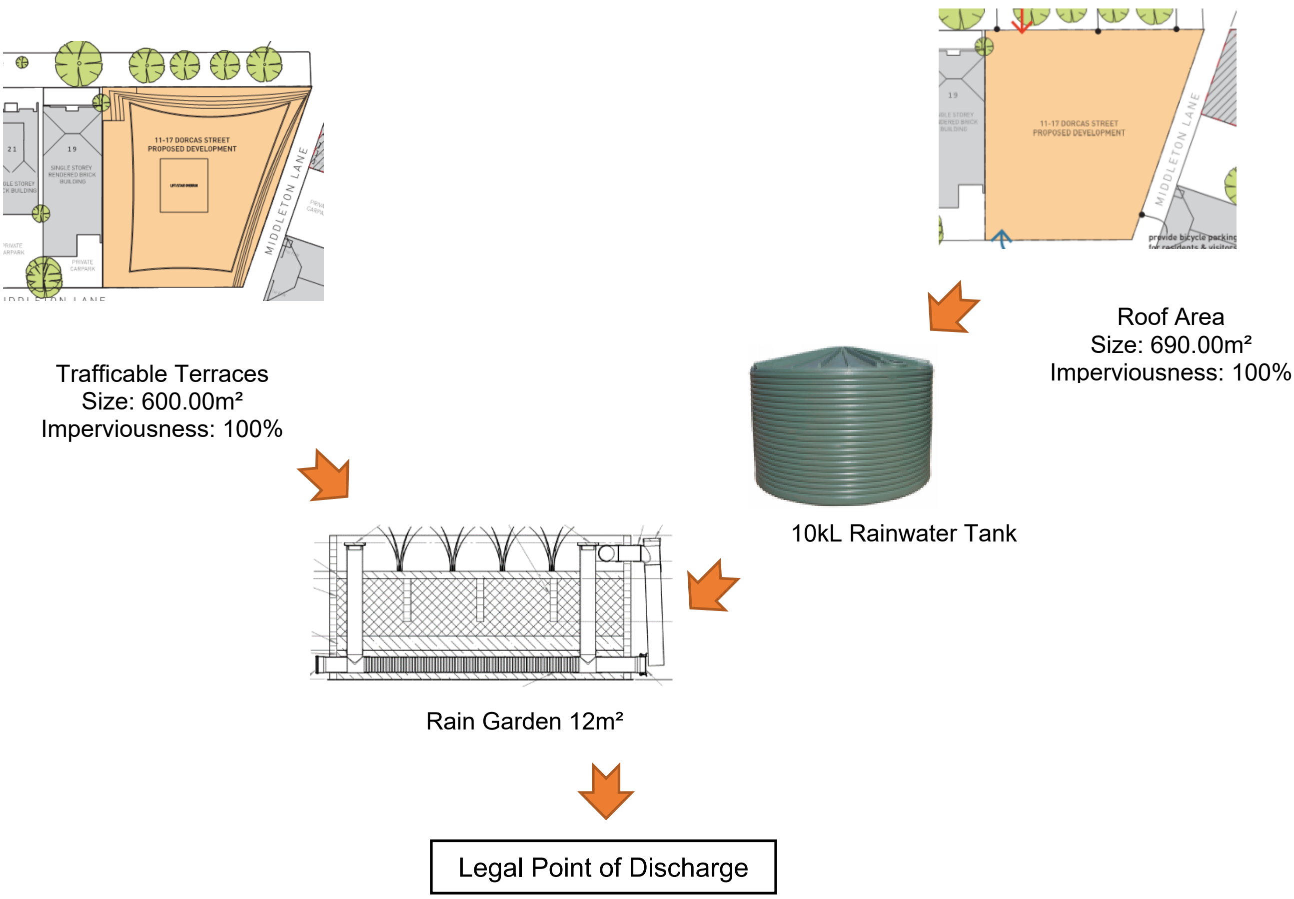

Figure 3.1 Treatment Train Schematic

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.
- The soil and plant roots work together to naturally filter the water and remove pollutants.

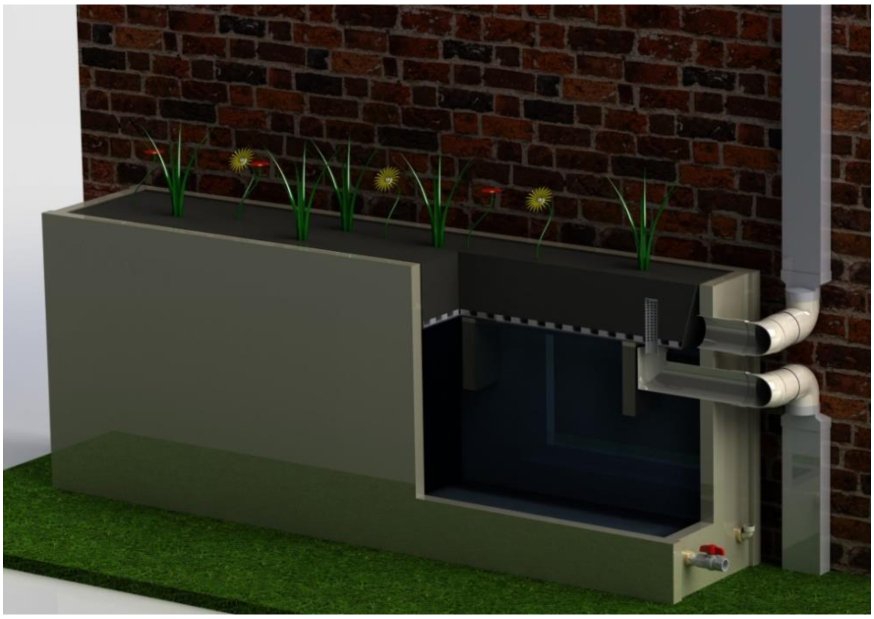

Figure 3.2 Typical Raingarden in ground illustration

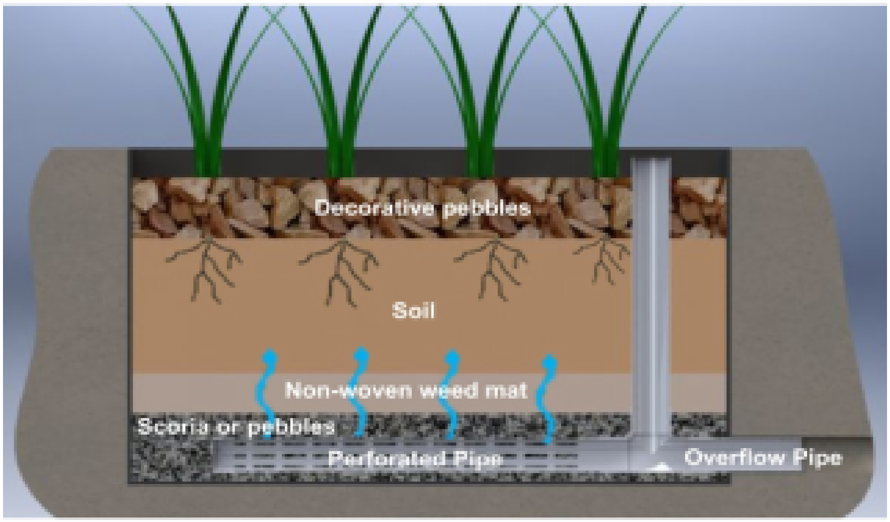

Figure 3.1 Typical Raingarden in ground for illustration purpose

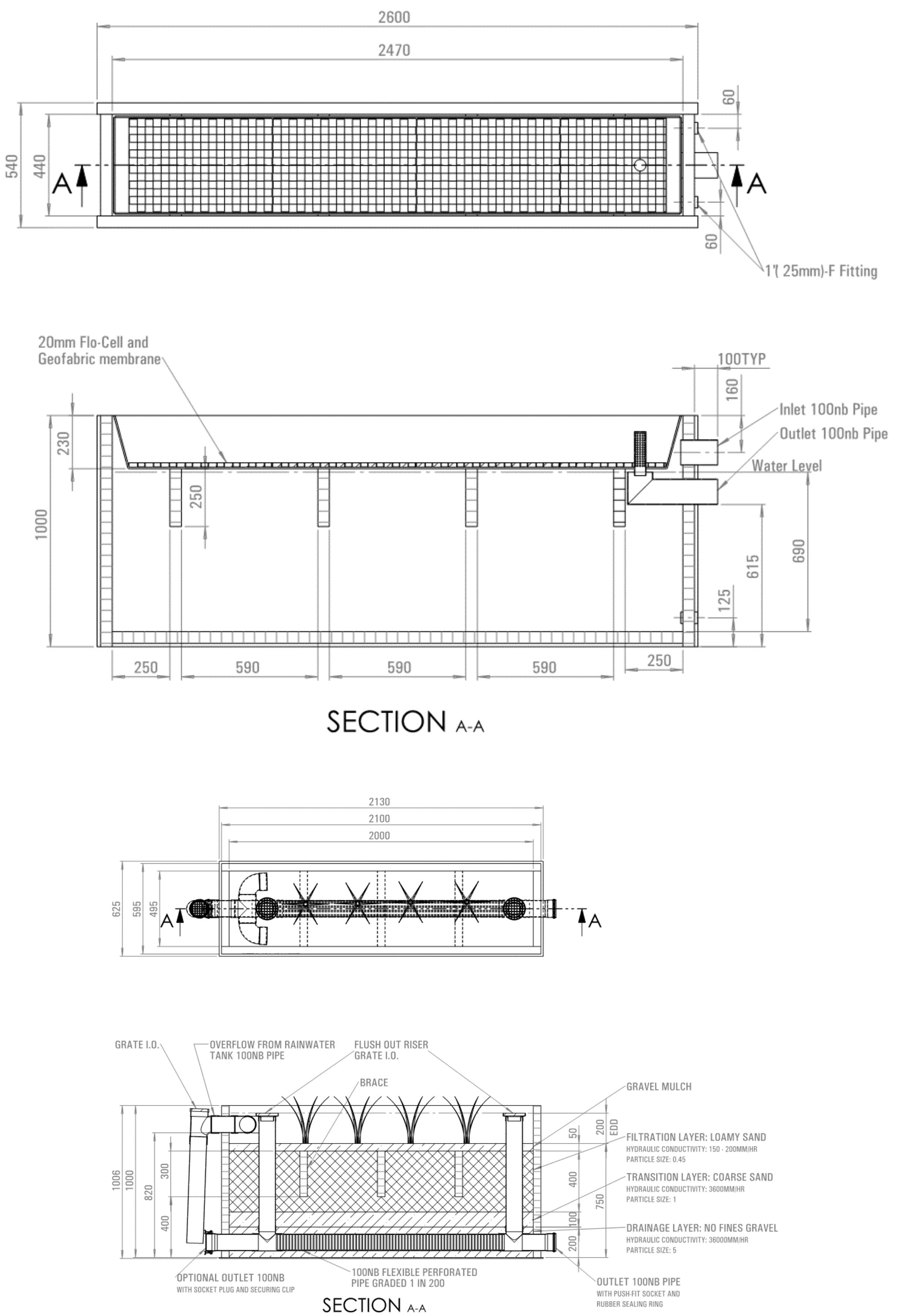

Figure 3.2 Typical Raingarden in ground diagram for illustration purpose

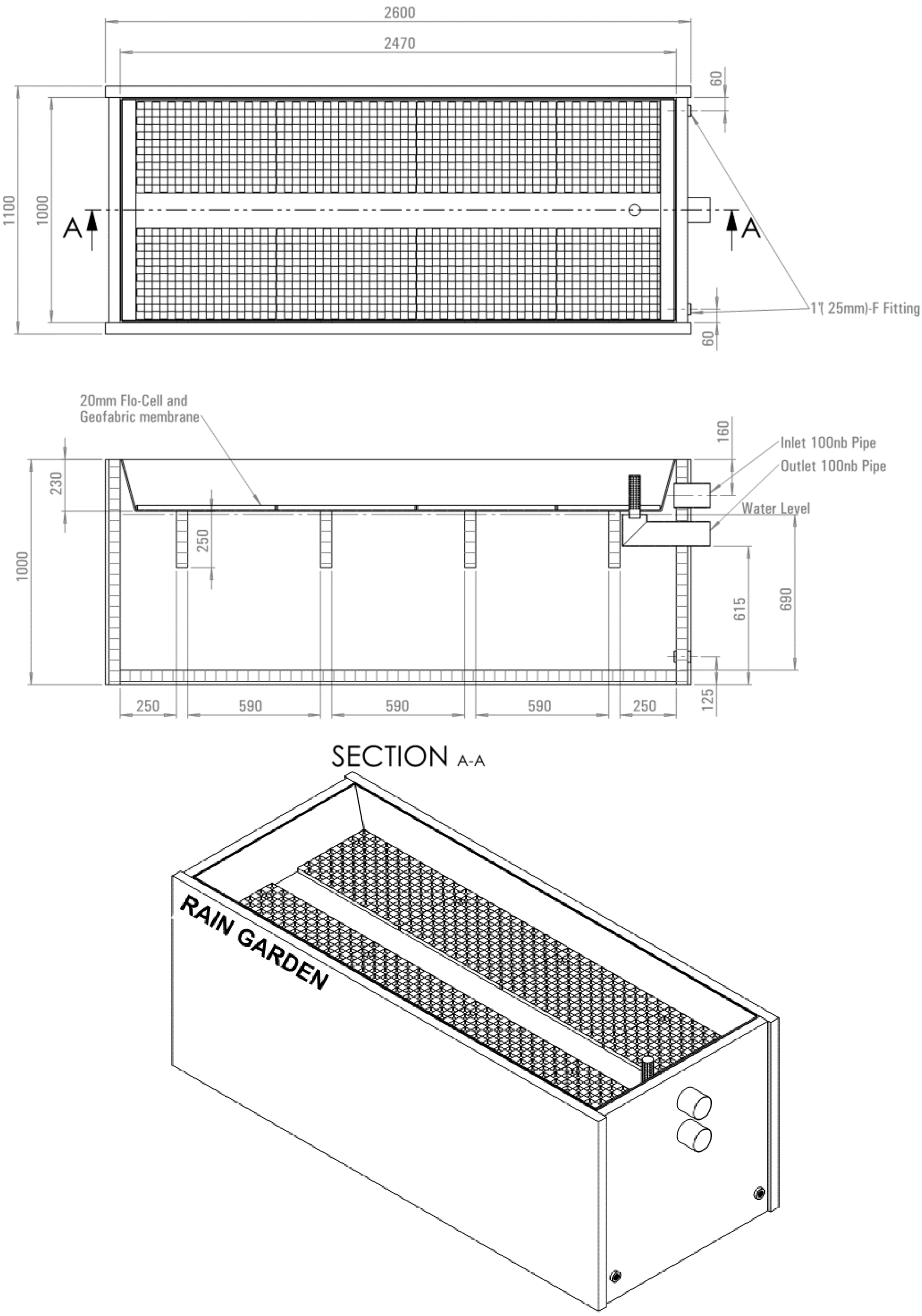

Figure 3.3 Typical Raingarden above ground diagram for illustration purpose

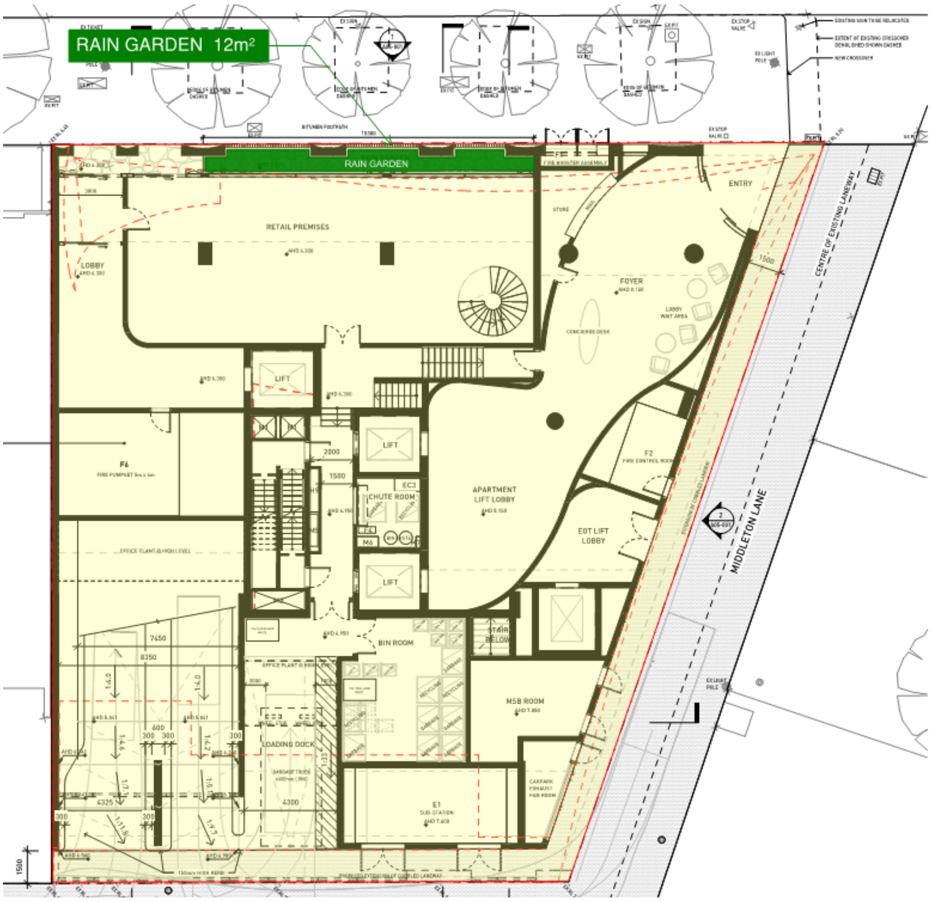

Figure 3.3 Proposed Raingarden location on Ground level

Node Water Balance - Raingarden

	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Flow In	4.4448	137.9043	0.6660	8.6529	15.8607
ET Loss	0.0240	0.0000	0.0000	0.0000	0.0000
Infiltration Loss	2.7675	31.6403	0.3820	3.3348	0.0000
Low Flow Bypass Out	0.0000	0.0000	0.0000	0.0000	0.0000
High Flow Bypass Out	0.0000	0.0000	0.0000	0.0000	0.0000
Pipe Out	0.4711	0.9536	0.0661	0.2894	0.0000
Weir Out	1.1806	35.6396	0.1740	2.4594	0.0000
Transfer Function Out	0.0000	0.0000	0.0000	0.0000	0.0000
Reuse Supplied	0.0000	0.0000	0.0000	0.0000	0.0000
Reuse Requested	0.0000	0.0000	0.0000	0.0000	0.0000
% Reuse Demand Met	0.0000	0.0000	0.0000	0.0000	0.0000
% Load Reduction	62.8399	73.4648	63.9445	68.2325	100.0000

Decimal Places 4

Figure 3.4 Raingarden Water Balance Parameters

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 reducing 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. And to maximise the use of rainwater allow for irrigation dripper line to a suitable garden area to ensure tank water suitably distributed.

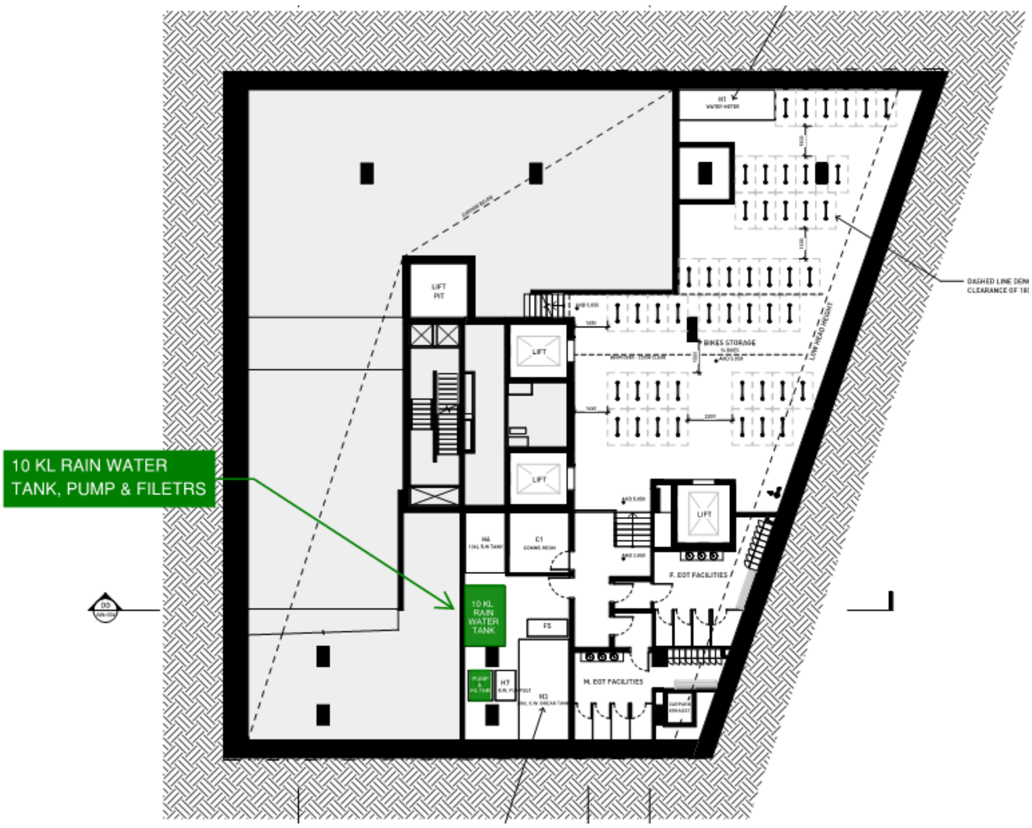

Figure 3.5 Proposed rainwater tank location within basement 2

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

Table 4.1 summarized 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 1966 – December 1966
Mean annual rainfall (mm)	678 mm
Evapotranspiration	994 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%, 45%, 45% and 70% 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 4.7 Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Reduction Target (%)
Flow (ML/yr)	4.45	1.65	**62.9**	0
Total Suspended Solids	187	36.6	**80.4**	80
Total Phosphorus	0.727	0.24	**67**	45
Total Nitrogen	9.97	2.75	**72.4**	45
Gross Pollutants	162	0	**100**	70

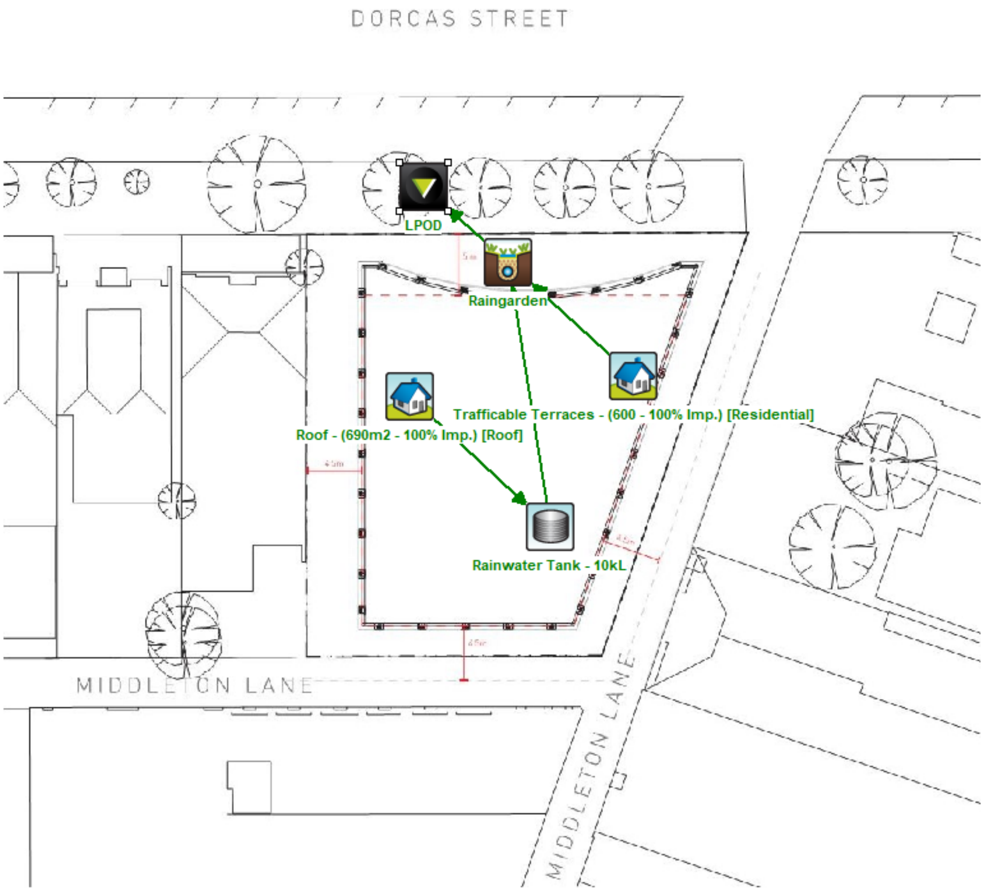

Figure 4.2: Treatment Train Effectiveness & Layout

Treatment Train Effectiveness - LPOD

	Sources	Residual Load	% Reduction
Flow (ML/yr)	4.45	1.65	62.9
Total Suspended Solids (kg/yr)	187	36.6	80.4
Total Phosphorus (kg/yr)	0.727	0.24	67
Total Nitrogen (kg/yr)	9.97	2.75	72.4
Gross Pollutants (kg/yr)	162	0	100

Figure 4.2: Treatment Train Music Model screen capture

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 Gardens (12m² of area)	1
Minimum RWT collection (10kl)	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 (%)	Reduction Target (%)
Flow (ML/yr)	4.45	1.65	**62.9**	0
Total Suspended Solids	187	36.6	**80.4**	80
Total Phosphorus	0.727	0.24	**67**	45
Total Nitrogen	9.97	2.75	**72.4**	45
Gross Pollutants	162	0	**100**	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.