C&M CONSULTING ENGINEERS

STORMWATER MANAGEMENT PLAN

FOR

11-17 COLUMBIA LANE, HOMEBUSH

MIXED-USE DEVELOPMENT

REPORT NO. R01866-SWMP
REVISION B

AUGUST 2019

C&M Consulting Engineers Pty Ltd
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PROJECT DETAILS

Property Address: 11-17 COLUMBIA LANE, HOMEBUSH

Development Proposal: MIXED-USE DEVELOPMENT

REPORT CERTIFICATION

Report prepared by:

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DOCUMENT CONTROL

REVISION	ISSUE DATE	ISSUED TO	ISSUED FOR
A	JULY 2019	CLIENT	COORDINATION
B	AUGUST 2019	CLIENT	INFORMATION
		COUNCIL	APPROVAL

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1. INTRODUCTION

1.1 Background

This Stormwater Management Plan has been prepared in accordance with the Strathfield Council DCP to support the Development Application (DA) for the proposed development at 11-17 Columbia Lane, Homebush.

The scope of this report includes a comprehensive assessment of the stormwater management requirements for the proposed development. Accordingly, this report includes findings of the assessment and proposes a best practice stormwater management strategy.

The report describes the principles and operation of the proposed stormwater systems as well as the primary components of the drainage system. As the assessment is required under the conditions of consent, the final stormwater system layout may need to be revised in the future during the application for a Construction Certificate.

The following information and documents were utilised in this investigation:

- Concept Civil Engineering Drawings for the Development Application submission prepared by C&M Consulting Engineers;
- Email from Sydney Water (OSD Parameters);
- Strathfield Council DCP;
- Strathfield Council Stormwater Management;
- Strathfield Council WSUD Reference Guidelines;
- “Australian Runoff Quality – A Guide to Water Sensitive Urban Design”, Engineers Australia (2006);
- “Australian Rainfall and Runoff – A Guide to Flood Estimation”, Institute of Engineers, Australia (2016).

The increase in impervious areas and alteration of the natural topography due to land development has the potential to increase and concentrate peak storm flows. This has the potential to impact on flow regimes and cause erosion of the downstream drainage network and associated waterways.

To avoid any adverse impact on the downstream drainage systems, the site’s stormwater management system must be designed to ensure the safe conveyance of flows throughout the site and within the capacity of the downstream trunk drainage systems in a healthy environmental state for Ecological Sustainable Development.

1.2 The Site

The site is located at 11-17 Columbia Lane, Homebush. The site is bound by Gramophone Lane to the North, Columbia Lane to the East and an existing drainage channel to the South West (refer Figure 1).

Figure 1 - Aerial Photo of Existing Site (source maps.six.com)

The proposed development includes the development of the land for residential including associated roads and utilities.

1.3 Key Issues

The key issues to be addressed in this report include:

- **Water Quantity** – Increases in impervious areas as a result of development (such as roofs, driveways, etc) has the potential to increase stormwater flows from the site during storm events. To avoid impacting on the site and downstream properties, the site stormwater system must be designed to safely convey flows through the site and within the capacity of the downstream drainage system.

- **Water Quality** – Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in storm water runoff. To limit the impact on the downstream water quality, pollution control measures will be provided within the sites stormwater management system prior to discharging into the drainage network.

2. RELEVANT GUIDELINES

2.1 Design Guidelines

The site based stormwater management and planning elements are to be designed and constructed in accordance with the following:

Water Quantity

- Guidelines: Sydney Water OSD Policy (for discharge to channel)

The proposed development increases the total impervious area of the existing site and therefore may increase the discharge rate to the downstream drainage network and waterways. The main objective is to achieve a natural water balance which seeks to approximate the pre-development site conditions to maintain existing conditions as well as controlling erosion and sediment removal.

Water Quality

- Guidelines: Strathfield Council WSUD Reference Guidelines;

The main objective for stormwater quality is to minimise the impacts on downstream water bodies. Strathfield Council has adopted a stormwater management policy that incorporates “best practice” principles of Water Sensitive Urban Design. The site-specific water quality targets are outlined in Table 1.

Table 1 - Water Quality Reduction Targets

PARAMETERS	CRITERIA
Gross Pollutants	90% reduction of the average annual load
Suspended Solids	85% reduction of the average annual load
Total Phosphorus	60% reduction of the average annual load
Total Nitrogen	45% reduction of the average annual load

2.2 Objectives and Targets

The objective is to provide stormwater controls that ensure that the proposed development does not adversely impact on the quantity or quality of stormwater flows within, adjacent and downstream of the site. Compatible with the legislation, policy and requirements, the objectives and targets for stormwater management are as provided in Table 2.

Table 2 - Stormwater Management Objectives

STORMWATER MANAGEMENT	OBJECTIVES	TARGET
Quantity	▪ The existing runoff flow regimes for the full storm events should be maintained, and provide safe conveyance system for the major storm events. ▪ The existing runoff from the external catchment be safely mitigated through the site.	▪ Maintain existing runoff from development: – Provide safe flood mitigation measures to minimise any impact on the site, and – No adverse impact on downstream properties.
Quality	▪ The full range of typical urban stormwater pollutants shall meet Council requirements.	▪ Runoff from site is to achieve natural dry and wet weather concentrations for the catchment.

2.3 Overall Strategies

The proposed stormwater management strategies to manage runoff and ensure no detriment to the receiving environments have been divided into both short and long term strategies are summarised in Table 3.

Table 3 - Stormwater Management Strategies

STRATEGY	DESCRIPTION
Short Term Strategies	Short term strategies generally refer to control of soil and water erosion during the construction phase. The primary risk occurs while soils are exposed during construction works when suspended sediment and associated pollutants can be washed into downstream waterways. The strategies to prevent this potential degradation include adequate provision of sediment and erosion control measures that should be documented prior to commencement of the works in a Soil and Water Management Plan (SWMP). The controls will limit movement of sediment in disturbed areas, and will be designed to remove sediment from runoff prior to discharge from site.
Long Term Strategies	Long term strategies to maintain stormwater quality discharged from the site include utilisation of a number of permanent treatment measures to remove litter, suspended solids, and nutrients effectively. The main measures to be implemented are gross pollutant traps and stormfilter cartridges within the OSD tank.

This report addresses the long term impacts of the development. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with the Construction Certificate Application.

3. STORMWATER QUANTITY CONTROL

3.1 Introduction

The main criterion for the stormwater quantity control is to ensure that the post-developed peak flows do not cause detriment to the downstream waterways and Council's existing drainage network.

3.2 Proposed Drainage System

The drainage system for the proposed development will be designed to collect the majority of concentrated flows from impermeable surfaces such as access ways, parking areas and buildings. Where possible (and practical), runoff from pervious areas will also be collected.

The proposed stormwater management system for the development includes:

- A pit and pipe network to collect minor storm runoff from areas;
- Overland flow paths to carry major storms through the site;
- A below ground OSD tank with orifice control;

3.2.1 On-Site Stormwater Detention Requirements

The OSD was calculated using the below parameters given by Sydney Water (for connection to the existing stormwater channel) and the orifice plate calculation.

Permissible Site Discharge = 223L/s
On Site Detention = 82m3

The email containing the parameters from Sydney Water is attached as appendix A of this report.

See below orifice plate calculation:

Bypass flowrate = 130L/s (Kinematic Wave Calculation)

Therefore orifice flow = 223 – 130 = 93L/s

Maximum water depth is 1.15m

Orifice equation, Q = CA (2gh)^0.5 (C =0.6)

Diameter d = (0.48 Q / h^0.5)^0.5
= (0.48 x 0.093 / 1.15^0.5)^0.5
= 0.204m (204mm)

4. WATER QUALITY CONTROL

4.1 Introduction

The quality of runoff from a catchment depends upon many factors such as land use, degree of urbanisation, population density, sanitation, waste disposal practices, landform, soil types, and climate. Pollutants typically transported by runoff include litter, sediment, nutrients, oil, grease, and heavy metals. Whilst these pollutants have a deterious impact on the receiving water quality, suspended solids and nutrients cause the highest detrimental impact to the environment. Litter, oils, and other surfactants have an aesthetic impact.

Activity within a catchment during urbanisation includes the disturbance of vegetation, removal of topsoil, land shaping, road construction, installation of services, and building works. It is during this phase that the sediment movement is greatest and is estimated that the sediment production levels may be up to 6 times higher than under the existing conditions. However, once development is completed, the sediment loading may return to the existing level or remain at a higher level depending on land management practices.

As with all development projects, soil erosion during the construction phase presents a potential risk to water quality. The primary risk occurs while soils are exposed during earthworks when suspended sediment and associated pollutants can be washed into downstream watercourses.

This section of the report addresses the long term impacts of the development on water quality. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with future Construction Certificate submissions.

4.2 Water Quality Control Measures

There are a number of measures that can reduce pollutant loadings, varying in effectiveness depending on land use type, topography and the control target.

The adopted Treatment Train is temporary in nature (until Council constructs the regional water quality infrastructure) and will provide the most efficient and manageable measures suited to the subject development setting.

The measures proposed for the redevelopment are summarised in Table 4.

Table 4 - Water Quality Control Measures

MEASURES	DESCRIPTIONS
Gross Pollutant Traps	▪ An *EnviroPod* is a catch basin insert installed inside inlet pits. It is effective in removing trash, debris and other pollutants from runoff. ▪ *EnviroPods* proposed for the project utilise a 200 micron filter system. These filter baskets will be installed in indicated pits for the proposed development.
Filter Cartridges	▪ StormFilter is a proprietary device containing multiple cartridge units in a single system thereby suitable for larger catchments. ▪ One of the advantages of using StormFilter is that the cartridges come with various filtration media available to target site-specific pollutants. ▪ Each cartridge consists of Phosphorus media. ▪ There will be total of 23 x 690mm PSORB cartridges within a chamber as detailed in the engineering drawings.

In addition to the above measures for pollutant control, natural vegetated buffers will be maintained along the edges of roads, accesses, and areas of activity, which will further reduce pollutants to meet reduction targets. This added benefit has not been included in the modelling hence contributing to the conservative nature of the modelling and assessment.

4.3 Strategy Effectiveness

The effectiveness of the proposed water quality measures have been assessed using numerical modelling. The results were assessed against the established Council requirements to determine the effectiveness of the proposed strategy.

4.4 Water Quality Modelling

4.4.1 *MUSIC Program*

The water quality model adopted for this project is the MUSIC (Model for Urban Stormwater Improvement Conceptualisation version 6) water quality

numerical model developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH). MUSIC is an event basis model, and will simulate the performance of a group of stormwater management measures, configured in series or in parallel to form a “treatment train”.

The MUSIC User Manual suggests that the time-step should not be greater than the time of concentration of the smallest sub-catchment, but consideration should also be given to the smallest detention time of treatment nodes in the system. To accurately model the performance of the treatment nodes, a 6-minute time step was chosen.

The MUSIC model was generated using the historical 6-minute rainfall and monthly evapotranspiration data for Sydney (BOM Station No. 66037) for a period of 10 years from 1979 to 1988.

Catchment characteristics were defined using a combination of roof areas and non-roof catchments with varying imperviousness ratios to replicate the catchment for the development condition. The respective catchment areas are shown in Table 6.

The MUSIC model layout and results are shown in Appendix B of this report.

4.4.2 *Event Mean Concentration*

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ). Table 5 summarises the parameters used for the development site.

Table 5 - EMC Parameters

LAND USE	MEAN BASE FLOW CONCENTRATION PARAMETERS Log_{10} (mg/L)			MEAN STORM FLOW CONCENTRATION PARAMETERS Log_{10} (mg/L)		
	TSS	TP	TN	TSS	TP	TN
Roof Areas	Not Applicable*Note 1			1.300	-0.890	0.300
Ground Areas	1.200	-0.850	0.110	2.150	-0.600	0.300

*Note 1 – Roof areas consists of 100% impervious area so there is no base flow generated from this area.

4.4.3 *Configuration*

Table 6 and Table 7 provide the treatment configurations used in the MUSIC model:

Table 6 - Catchment Areas

LAND USE	DEVELOPED CONDITIONS		LAND USE CATCHMENTS (%)
	AREA (m^2)	IMPERVIOUSNESS (%)	
Roof	2507	100	38
Ground	2115	55	32
Bypass Ground	2043	78	30
Totals	6665	79	100

Table 7 - Stormwater Quality Improvement Devices (SQID)

STORMWATER QUALITY IMPROVEMENT DEVICE (SQID)	QUANTITY OF SQID
Enviropods	3 x 200micron
PSORB Stormfilter Cartridges	23 x 690mm

4.4.4 *Results*

The results of the MUSIC modelling are summarised in Table 8. The total pollutant loads from the development are expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the pollution from the post developed site to that of the existing developed state of the site.

Table 8 - Summary of Music Model Results

PARA-METER	EXISTING SITE LOADS (KG/YR)	POST DEVELOPMENT WITH TREATMENT (KG/YR)	REDUCTION %	TARGET ACHIEVED
GP	**136**	**0**	**100**	**Yes**
TSS	**548**	**74.6**	**86**	**Yes**
TP	**1.17**	**0.44**	**63**	**Yes**
TN	**11.2**	**6.17**	**45**	**Yes**

GP = Gross Pollutants
TSS = Total Suspended Solids
TP = Total Phosphorus
TN = Total Nitrogen

In all instances, the proposed water quality control measures enabled the reduction targets to be achieved for all key stormwater pollutants. Therefore, by implementing the proposed treatment train measures within the proposed development there will be no detrimental effect on the quality of stormwater running off from the site.

5. RECOMMENDATIONS

The proposed development of the site could potentially lead to significant changes in water quantity and quality if a water sensitive urban design approach is not adopted as part of the development strategy. The traditional stormwater management and investigation that only considers impacts of flooding and flood mitigation is a thing of the past. Stormwater management practices must now also consider water quality, aquatic habitats, riparian vegetation, recreation, aesthetic and economic issues.

The key strategies to be adopted for this development include the following:

1. A pit and pipe network to collect minor storm runoff from surface areas which will minimise nuisance flooding;

2. Overland flow paths to carry major storms through and around the site without causing damage to property from flooding;

3. A below ground OSD tank with orifice control with a minimum storage capacity of 82m^3 to maintain peak flows.

4. 23 x PSORB stormfilter cartridges within the OSD tank to remove pollutants and nutrients prior to leaving the site.

5. 3 x STW360 EnviroPods in nominated inlet pits will form part of the water quality treatment train, removing pollutants and nutrients that are detrimental to downstream waterways.

The results from the investigations and modelling for this project that have been summarised in this report indicate that the development with the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

6. REFERENCES

- Concept Civil Engineering Drawings for the Development Application submission prepared by C&M Consulting Engineers;
- Strathfield Council DCP;
- Sydney Water OSD Policy (for discharge to channel);
- Strathfield Council Stormwater Management;
- Strathfield Council WSUD Reference Guidelines;
- Watercom – *DRAINS Software Version 2019.03;*
- eWater – *MUSIC Version 6.2 (Build 1.1592)*

APPENDIX A

EMAIL FROM SYDNEY WATER (OSD PARAMETERS)

Patrick O'brien

From: Stormwater <Stormwater@sydneywater.com.au>
Sent: Friday, 9 August 2019 7:28 AM
To: Patrick O'brien
Cc: Edward Shin; Warren Martin
Subject: RE: 01866 - 11-17 columbia lane, homebush development

Follow Up Flag: Follow up
Flag Status: Flagged

Patrick,

Building adjacent to stormwater assets

Our available records indicate that there is a Sydney Water's stormwater channel located adjacent to your development. Any development adjacent to Sydney Water's stormwater channel is required to comply with the following conditions:

No building or permanent structure is to be proposed over the stormwater channel or within **1m** from the outside wall of the stormwater asset or within Sydney Water land/ easement whichever is larger. Permanent structures include (but are not limited to) basement car park, hanging balcony, roof eves, hanging stairs, stormwater pits, stormwater pipes, elevated driveway, basement access or similar structures. This clearance requirement would apply for unlimited depth and height.

The applicant is required to submit the elevation drawings with the stormwater channel/ pipe, to ensure that the proposed buildings and permanent structures are 1m away from the outside face of the stormwater channel and away from the Sydney Water land/ easement.

On Site Detention

The following on site detention requirements would only apply, only if you make direct stormwater connection to Sydney Water's stormwater system.

The On Site Detention requirements for the 6,665 square meters site at 11-17 columbia lane, Homebush, are as follows:

- On Site Detention 82 cubic meter
- Permissible Site Discharge 223 L/s

The approval for the On Site Detention would only be given as part of the stormwater connection application which is part of Section 73 application for this development. The On Site Detention is to be designed according to the above values and submitted to Sydney Water for approval with stormwater connection details. The following details are to be included in your submission for On Site Detention approval:

- Location of the On Site Detention in relation to the development
- Location of the On Site Detention in relation to overall stormwater network of the property
- Plan and Elevation of the On Site Detention tank with all dimensions
- Orifice plate calculation

Best Regards

Jeya Jeyadevan | **Senior Capability Assessor**
Liveable City Solutions | Sydney Water
Level 7, 1 Smith St Parramatta NSW 2150
PO Box 399 Parramatta NSW 2124
T 8849 6118 | **Mobile** 0409 318 827 | **Email**
jeya.jeyadevan@sydneywater.com.au
sydneywater.com.au

From: Patrick O'brien <Patrick@cmce.com.au>
Sent: Friday, 9 August 2019 5:14 AM
To: Stormwater <Stormwater@sydneywater.com.au>
Cc: Edward Shin <Edward@cmce.com.au>; Warren Martin <Warren@cmce.com.au>
Subject: RE: 01866 - 11-17 columbia lane, homebush development

Hi Jeya,

Thanks for getting back to me.
The areas are as follows:

- Total Site Area (draining to Powells Creek) = 6665m2
- Pre Development Impervious Area = 6665m2
- Post Development Impervious Area = 5269m2

Let me know if you require any further information.

Regards,

Patrick O'Brien
Civil Engineer
C & M Consulting Engineers Pty Ltd

A: Suite 26, 11-13 Brookhollow Avenue, Norwest, NSW, 2153
P: PO Box 7849, Baulkham Hills BC, 2153
T: 9680 3100
F: 9634 6989
E: Patrick@cmce.com.au

From: Stormwater <Stormwater@sydneywater.com.au>
Sent: Thursday, 8 August 2019 11:56 AM
To: Patrick O'brien <Patrick@cmce.com.au>
Subject: RE: 01866 - 11-17 columbia lane, homebush development

Patrick,

Please ensure all enquiries in relation to Sydney Water's stormwater system, including any On Site Detention enquiries are to be sent to the following email address:
stormwater@sydneywater.com.au

In order to calculate the required On Site Detention and Permissible Site Discharge, you need to provide us the following information:

- Total Site Area (Which will drain to Powells Creek)
- Pre development impervious area
- Post development impervious area

Best Regards

Jeya Jeyadevan | **Senior Capability Assessor**
Liveable City Solutions | Sydney Water
Level 7, 1 Smith St Parramatta NSW 2150
PO Box 399 Parramatta NSW 2124
T 8849 6118 | **Mobile** 0409 318 827 | **Email**
jeya.jeyadevan@sydneywater.com.au
sydneywater.com.au

From: JEYADEVAN, JEYA <JEYA.JEYADEVAN@sydneywater.com.au>
Sent: Thursday, 8 August 2019 11:50 AM
To: Stormwater <Stormwater@sydneywater.com.au>
Subject: FW: 01866 - 11-17 columbia lane, homebush development

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From: Patrick O'brien <Patrick@cmce.com.au>
Sent: Wednesday, 24 July 2019 2:23 PM
To: JEYADEVAN, JEYA <JEYA.JEYADEVAN@sydneywater.com.au>
Cc: Edward Shin <Edward@cmce.com.au>
Subject: 01866 - 11-17 columbia lane, homebush development

Hi Jeya,

We are doing the stormwater design including OSD and water quality for the above mentioned project.
I have attached the preDA minutes and architectural ground floor for your information. The stormwater will discharge into powels creek
Will you provide the minimum OSD volume required for the development?
Let me know if you have any queries.

Regards,

Patrick O'Brien
Civil Engineer
C & M Consulting Engineers Pty Ltd

A: Suite 26, 11-13 Brookhollow Avenue, Norwest, NSW, 2153
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T: 9680 3100
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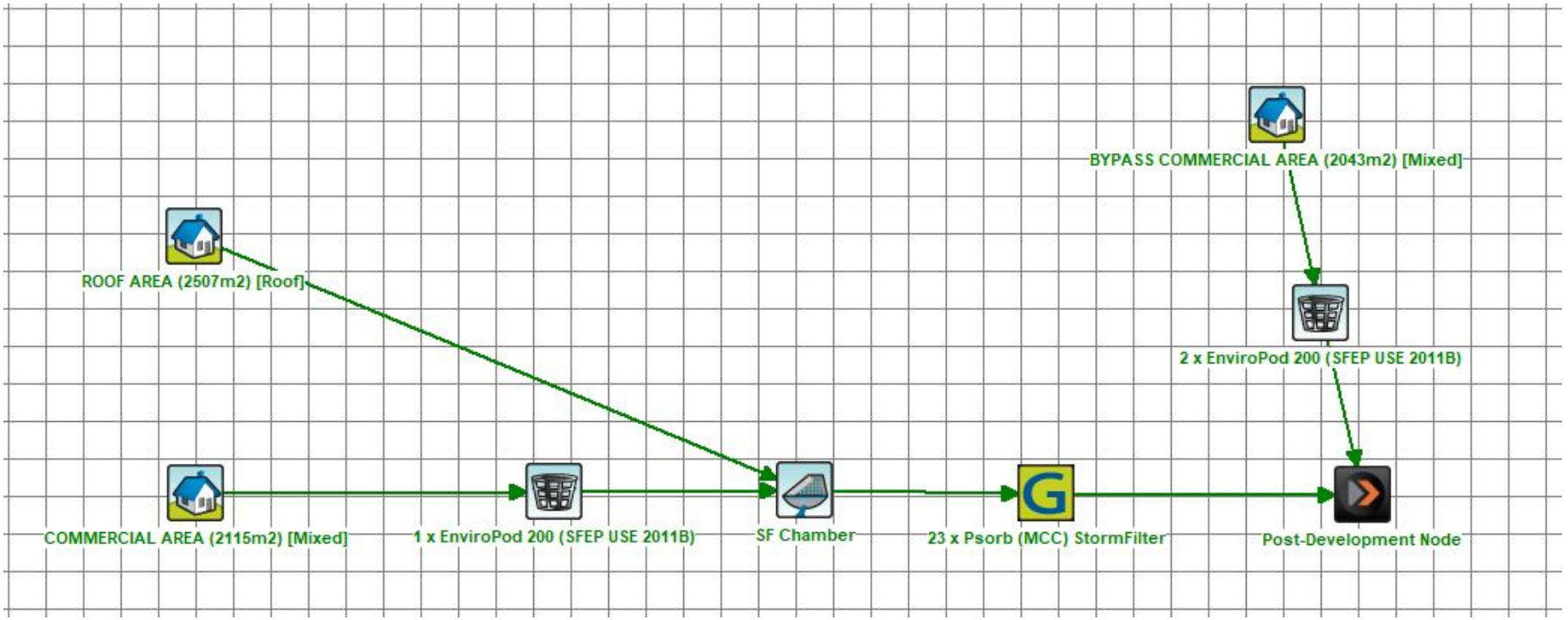
E: Patrick@cmce.com.au

APPENDIX B

MUSIC MODEL LAYOUT AND RESULTS

MUSIC MODEL LAYOUT



MUSIC MODEL RESULTS