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Civil

Stormwater Management Report

Prepared for:

Bloompark Consulting Pty Ltd

Prepared by:

Timothy Fitzhardinge
Project No. 33964
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Date:
16th March 2018

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Revision

Site Address:	1-5 Jeffreys St, Kirribilli
Real Property Description:	Lot 101 in DP1108496
Proposed Development:	Educational Development
Client:	Bloompark Consulting Pty Ltd
Local Authority	North Sydney Council
Authority Reference #:	N/A
Wood & Grieve Reference:	33964(B)-SYD-C-R-SMP

Tim Fitzhardinge
For and on behalf of
Wood & Grieve Engineers

REVISION	DATE	COMMENT	APPROVED BY
A	06.02.18	SSDA Issue	**TIF**
B	16.03.18	SSDA Issue	**TIF**

Contents

1. Introduction

Wood & Grieve Engineers have been commissioned by Bloompark Consulting PTY LTD to prepare this Stormwater Management Plan (SMP) in support of the Site Significant Development Application for the proposed development at 1-5 Jeffreys St, Kirribilli. The sites real address is Lot 101 in DP1108496.

This SMP outlines the conceptual DA level stormwater design for the proposed development of the future development lots on the site.

This SMP illustrates that the proposed development complies with the North Sydney Council's Engineering Guide for Development, Australian Rainfall and Runoff, Australian Standards and best engineering practise.

The purpose of this SMP is to evaluate the quantity and quality of stormwater associated with the proposed development plan so as to demonstrate to Council that an appropriate stormwater management strategy has been adopted.

The SMP specifically addresses the following items for both the construction and operational phases of the development:

- Stormwater runoff volumes and detention (Stormwater Quantity);
- Stormwater quality treatment measures (Stormwater Quality),
- Erosion and Sedimentation Control.

The following will be achieved with the correct application of this SMP report:

- Appropriate standards to be maintained on all aspects of stormwater within the site,
- Establishment of a unified, clear and concise stormwater management strategy.

2. Existing Site Characteristics

2.1 Property Detail

Address:	1-5 Jeffreys St, Kirribilli
Real Property Description:	Lot 101 in DP1108496
Total Site Area:	3427m² (0.3427Ha)

The proposed development can be seen on the concept design drawings in Appendix A of this report.

The proposed development is situated within North Sydney Council. The proposed redevelopment will consist of refurbishment of the existing educational facility.

The site is bounded by:

- Residential properties and Fitzroy to the north
- Robertson Lane to the east
- Upper Pitt Street to the south
- Jeffreys Street to the west

Refer to locality plan in figure 1.

Figure 1: Site Location Plan (Source: Nearmaps 2016)

2.2 Topography

The site falls to the south-west corner of the site towards the intersection of Jeffreys Street and Upper Pitt Street. The high point of the site is located along the Western boundary of the site at a level of RL31.92m AHD with the low point located in the South-west corner of RL28.42m AHD.

2.3 Stormwater Catchments

The surrounding area has been investigated to determine the likely impact of existing external stormwater catchments on the proposed site.

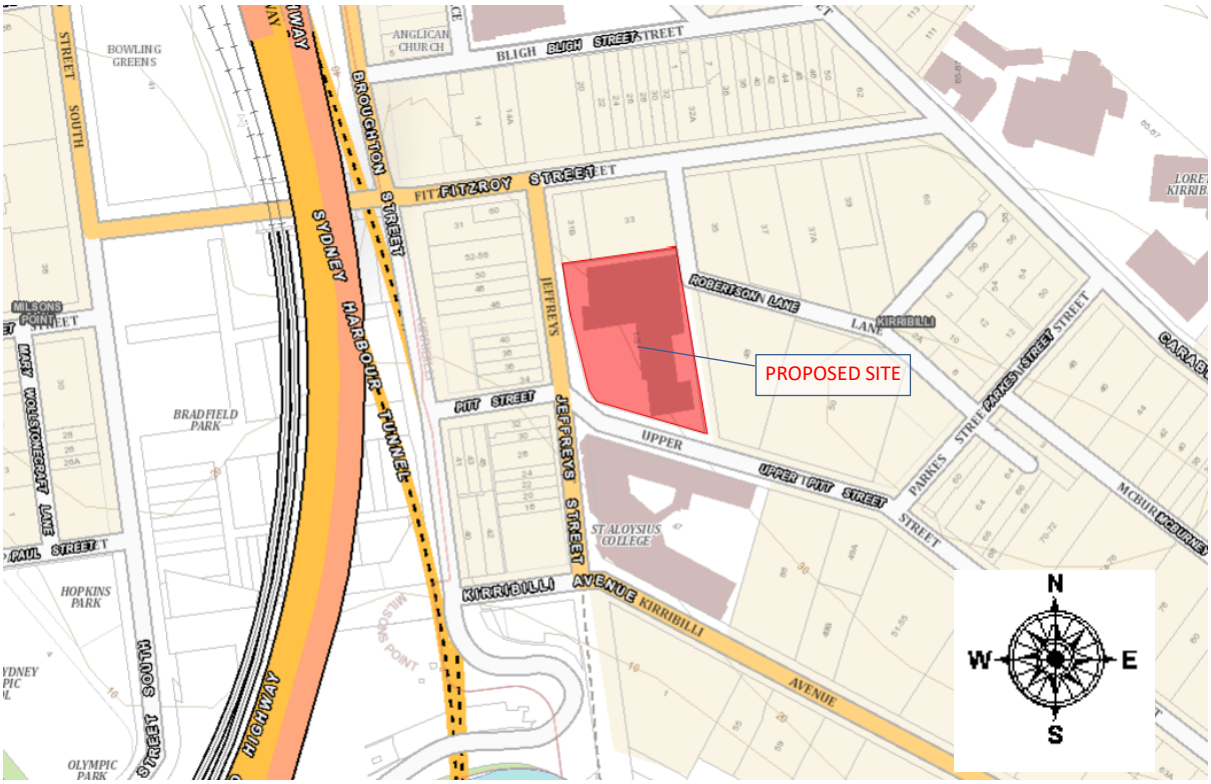


Figure 2: Upstream Catchment Plan
(Source: SIX VIEWER 2017 – Department of Land and Property Information NSW)

The site is situated around the middle of the catchment. Overland flows from the upstream catchment will be conveyed through the existing road networks.

2.4 Existing Stormwater Discharge

The site contains existing stormwater pit and pipe networks. The existing drainage network discharges via council's drainage infrastructure; through existing kerb inlet pits with a concrete lintel along Upper Pit Street.

3. Local Authority Requirements

North Sydney Council set the design requirements for any new stormwater management system associated with new development in their Engineering Guide for Development. A summary of the key requirements for the development of the Stormwater management system for this development are summarized below.

3.1 Stormwater Conveyance Requirements

Council's Engineering Guide for Development states that the following design storm Average Recurrence Intervals ARI's should be allowed for when designing the Stormwater runoff conveyance systems for the development.

Table 1: Stormwater Drainage Serviceability

Design Parameter	Design Storm ARI (Years)	Conveyance Method
Minor Drainage System	20	In Ground (Piped)
Major Drainage System	100	Overland

3.2 On Site Detention Requirements

Section 18.1.1 of North Sydney Council's DCP states "To mimic pre-development or natural drainage system as much as possible". This condition implies that On-site detention requirements are to limit post development runoff to the pre-development runoff. Both pre-development and post development areas will remain unchanged, thus no on-site detention is required. In addition, the proposed development has an existing OSD within the site catching existing storm water drainage.

3.3 Stormwater Quality Treatment

Council's DCP States that " All developments with a gross floor area greater than 2000m² are to undertake a stormwater quality assessment to demonstrate that the development will achieve the post-development pollutant load standards indicated below: "

a) Litter and vegetation larger than 5mm: 90% reduction on the Baseline Annual Pollutant Load;
b) Total Suspended Solids: 85% reduction on the Baseline Annual Pollutant Load;
c) Total Phosphorous: 65% reduction on the Baseline Annual Pollutant Load;
d) Total Nitrogen: 45% reduction on the Baseline Annual Pollutant Load.

4. Flood Impact Assessment

When considering a new development, it is necessary to assess the impact of existing flooding on the proposed development and the potential flooding impact of the proposed development upon existing developments located upstream and downstream of the site.

4.1 Existing Flooding

4.1.1 Flood Related Development Controls

Wood and Grieve have reviewed Council's LEP documentation and Council's Flood Studies North Sydney LGA Flood Study (February 2017) and the site is located within Council's 1% AEP Flood extent. From Figure 3 below, the southern and western boundary of the proposed development are impacted by minor flooding during the 1% AEP. The flood depth inundation for the 1% AEP storm event generally ranges from 0.00m to 0.15m along both Upper Pit Street and Jeffreys Street.

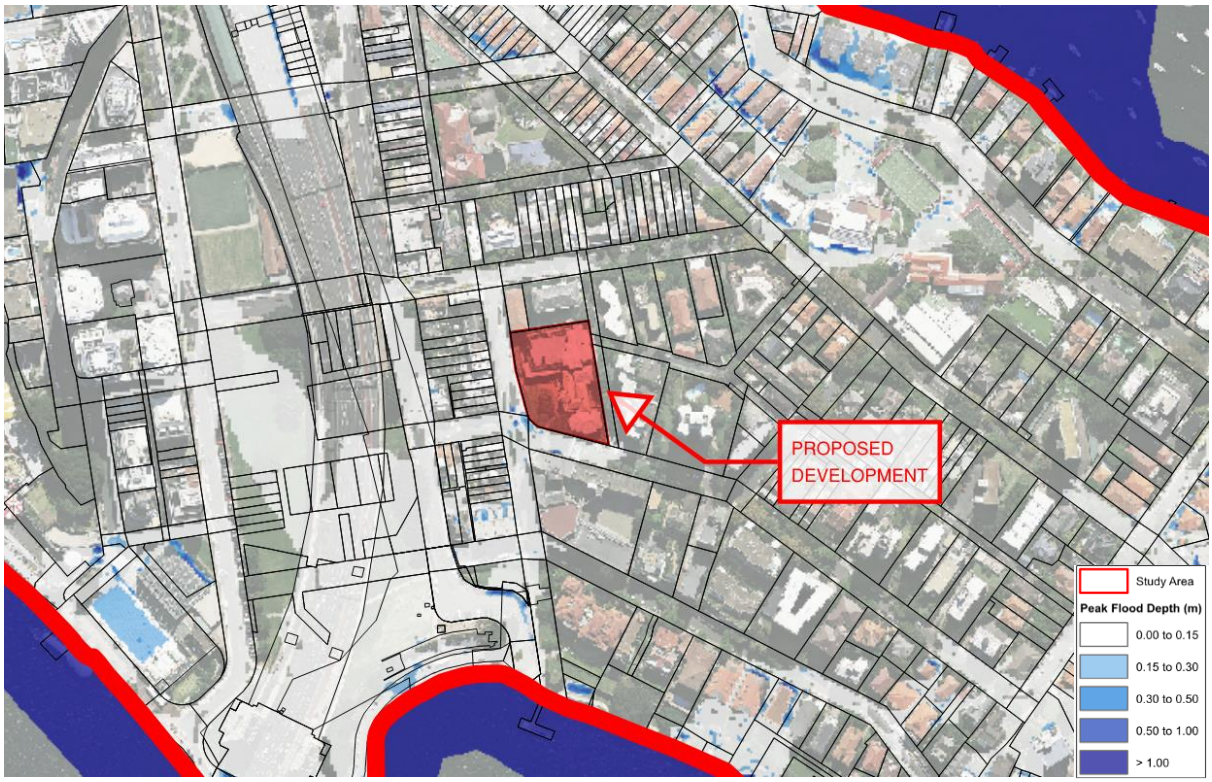


Figure 3: Peak Flood Depth and Flood Level Contours 1% AEP
(Source: North Sydney LGA Flood Study WMA water – February 2017)

Reference to North Sydney Flood mapping indicates that the site has a low risk classification for flooding. If flood barriers are required, they will be designed to meet council's 500mm freeboard, flood flooding solutions or approved equivalent.

4.1.2 Local Flooding

Local or Nuisance flooding describes flooding occurring due to site specific constraints. Local flooding is often caused by local topographical constraints and stormwater drainage system capacity restrictions.

Wood & Grieve have assessed the local constraints surrounding and through the site to ascertain any areas where local flooding may be an issue.

All proposed site drainage has been documented to fall towards to the proposed and existing stormwater pit and pipe system which ultimately drains to Upper Pitt Street.

5. Stormwater Conveyance

This section of the report discusses the systems proposed to allow for stormwater to be conveyed across the site to the legal point of discharge.

As discussed in Section 3.1 of this report Council have set minimum design parameters for the flows they require to be conveyed through the in ground drainage system and what they will allow to be conveyed in a controlled manner overland across the site.

5.1 Surface Drainage

The surface areas will be drained through a variety of methods, discussed below, in accordance with AS3500.3:2015 and Council's stormwater drainage guidelines.

5.1.1 In-Ground Drainage

The in-ground drainage has been designed to meet the following criteria:

- In the minor design storm event (20 year) there will be no surcharging of the in ground drainage system and;
- In the major design storm event (100 year) there will be no uncontrolled discharge from the site onto the residential properties to the east of the site.

Surface runoff from the development sites will be directed to stormwater inlet structures using the design topography of these elements. The inlet structures have been designed to adequately convey the surface runoff into the in ground drainage network.

The runoff will then be conveyed underground across the site through a pit and pipe system and then to the legal point of discharge using gravity and the geometric falls of the pipe system.

5.2 Legal Point of Discharge

The legal point of discharge will be into Council's kerb inlet pit and street drainage network in Upper Pitt Street.

6. Stormwater Quality

This section of the report demonstrates the Stormwater Quality Improvement Devices (SQID's) to be implemented and the Pollutant Export Modelling undertaken to demonstrate the effectiveness of the treatment system in achieving the reduction targets set by Council.

6.1 Potential Pollutants

There are a wide range of potential stormwater pollutant sources which occur from urbanised catchments, many which can be managed through appropriate stormwater quality treatment. Typical urban pollutants may include:

- Atmospheric deposition
- Erosion (including that from subdivision and building activities)
- Litter and debris
- Traffic emissions and vehicle wear
- Animal droppings
- Pesticides and fertilisers
- Application, storage and wash-off of car oil, detergents and other household and commercial solvents and chemicals
- Solids accumulation and growth in stormwater systems
- Weathering of buildings

These pollutants in urban stormwater can be placed into various categories as follows. The pollutants underlined below are able to be readily modelled:

- Suspended Solids
- Litter
- Nutrients such as Nitrogen and Phosphorous
- Biological oxygen demand (BOD) and chemical oxygen demand (COD) materials
- Micro-organisms
- Toxic organics
- Trace metals
- Oils and surfactants

While only the key pollutants underlined above will be examined within the modelling, the stormwater Quality Improvement Devices implemented are expected to assist in reducing a wide range of pollutants. For example, heavy metals are commonly associated with, and bound to fine sediments. Thus reducing the discharge of fine sediment during the construction and operational phases will reduce the discharge of heavy metals to existing stormwater systems.

6.2 Pollutant Reduction System

In order to achieve the pollutant reduction targets specified in section 3.3 of this report a series of treatment devices are proposed, which together, form a treatment train. The diagram below shows the proposed treatment train for this development.

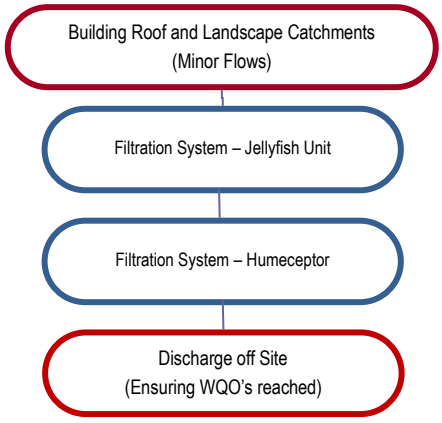


Figure 4: Proposed Water Quality Treatment Train

Further discussion on each element of this treatment train is provided below.

6.2.1 Stormwater360 Jellyfish

The Stormwater360 Jellyfish filter unit used filtration cartridges to remove high levels of stormwater pollutants including:

- Total Suspended Solids (TSS), median removal efficiency of 89%, including particles down to two microns
- Total Nitrogen (TN), median removal efficiency of 55%
- Total Phosphorous (TP), median removal efficiency of 65%
- Total Copper (Cu), median removal efficiency of 61%
- Total Zinc (Zn), median removal efficiency of 91%.
- Total Oil and Grease, median removal efficiency of 62%

Two Jellyfish JF-1200-1-1 units have been proposed for the development.
The MUSIC modelling parameters for this device are set by the manufacturer, Stormwater360.

Figure 5: Jellyfish infiltration Unit
(Source: Stormwater360)

6.2.2 Oil and Sediment Removal – HumeCeptor

The HumeCeptor unit slows incoming water to create a non-turbulent treatment environment, allow free oils and debris to rise and sediment to settle. The pollutants the unit can remove include:

- Total Suspended Solids (TSS), median removal efficiency of 80%,
- Total Nitrogen (TN), median removal efficiency of 37%
- Total Phosphorous (TP), median removal efficiency of 53%
- Total Chromium (Cr), median removal efficiency of 44%.
- Total Copper (Cu), median removal efficiency of 29%
- Total Petroleum Hydrocarbon (TPH), median removal efficiency is;
  - 65% <10 ppm (parts per million)
  - 95% 10-50 ppm (typical stormwater)
  - 99% >500ppm (emergency spills)

The MUSIC modelling parameters for this device are set by the manufacturer, Humes.

Figure 6: HumesCeptor Unit
(Source: Humes)

6.3 Pollutant Reduction Modelling

In order to demonstrate that the proposed treatment train meets the required reduction targets, pollutant reduction modelling is proposed using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Software program Version 6.1 by eWater CRC. Pollutant export rates are currently only available for Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorous (TP) and Gross Pollutants (GP). Therefore only quantitative modelling for TSS, TN, TP & GP has been undertaken using MUSIC.

Modelling has only been undertaken on the post-development proposal with SQID's installed so as to demonstrate the percentage reduction for each pollutant type.

6.3.1 MUSIC Program Setup

This section explains the setup of the MUSIC model with the detailed pollutant reduction calculations being included in the MUSIC results in Appendix C.

For MUSIC Modelling (using MUSIC 6.2.0) the following parameters have been used in accordance with North Sydney Council WSUD Reference Guideline:

Table 2: MUSIC modelling parameters

Model Parameters	
Meteorological Data:	Sydney 1959
Evaporation Data:	Sydney 1959
Time Step:	6 minute

Table 3: Recommended MUSIC Runoff Generation Parameters

Parameter	**Urban Residential**
Rainfall Threshold (mm)	1.4
Soil Capacity (mm)	120
Initial Storage (%)	25
Field Capacity	80
Infiltration Capacity Coefficient a	200
Infiltration Capacity Coefficient b	1.00
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Drainage Rate (%)	5
Daily Deep Seepage Rate (%)	0

MUSIC Concentration Parameters

Table 4: MUSIC Concentration Parameters for Sydney Catchment Authority

Land-use Type	**Parameters**	**TSS Log10 mg/L**		**TP Log10 mg/L**		**TN Log10 mg/L**	
		Base Flow	**Storm Flow**	**Base Flow**	**Storm Flow**	**Base Flow**	**Storm Flow**
Roof Area	Mean	N/A	1.3	N/A	-0.89	N/A	0.3
	STD Dev	N/A	0.32	N/A	0.25	N/A	0.19
Residential	Mean	1.2	2.15	-0.85	-0.6	0.11	0.3
	STD Dev	0.17	0.32	0.19	0.25	0.12	0.19

Table 5: Catchment modelling parameters

Node Description	**Area (Ha)**	**Percentage Impervious (%) / Area Impervious (Ha)**		**Land Use Rainfall and Pollutant Parameters**
Site - Roof	0.211	100	0.211	Urban Roof
Mixed	0.131	46	0.069	Urban Residential
	Total: 0.342Ha			

6.3.2 MUSIC Results & Parameters

MUSIC Model

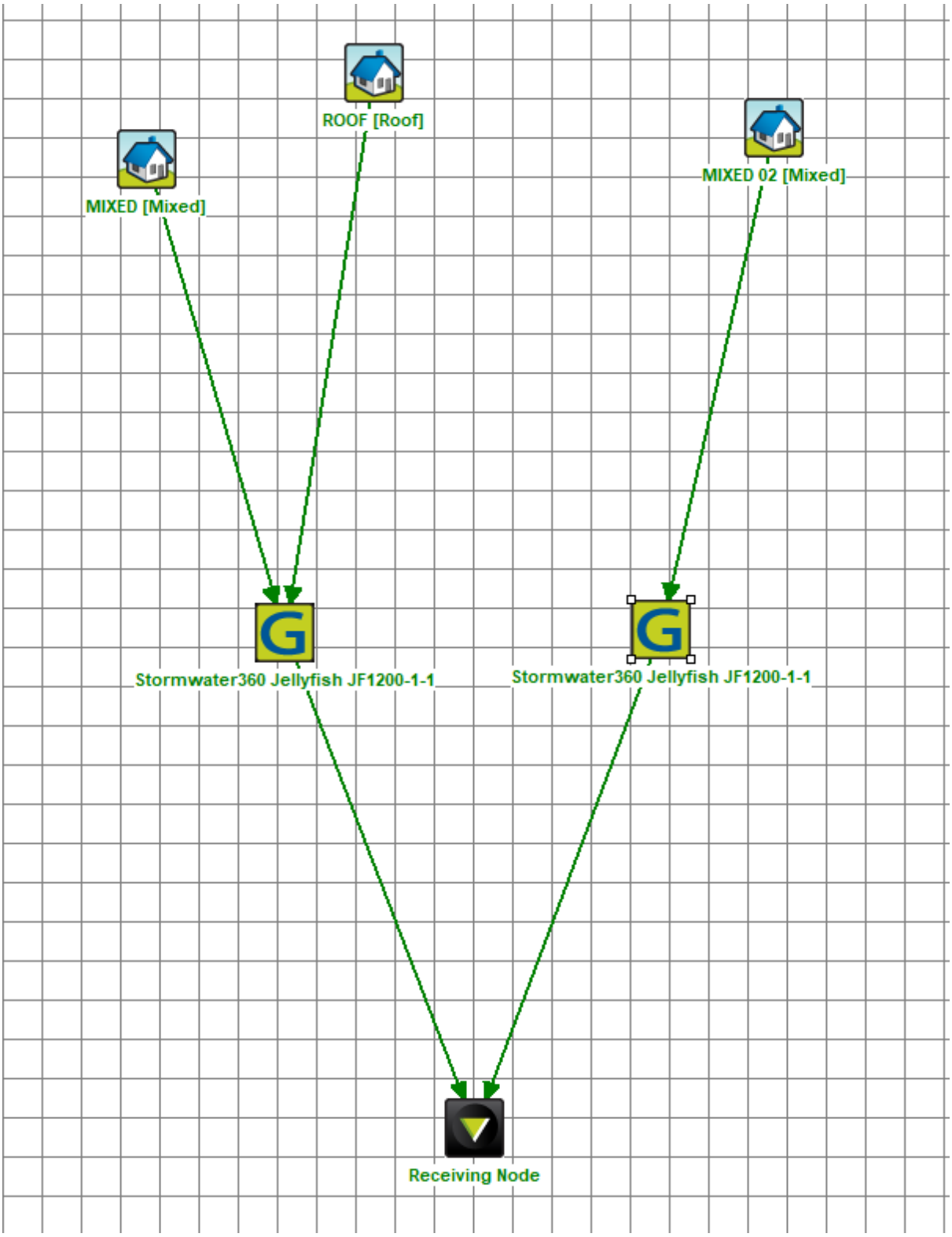
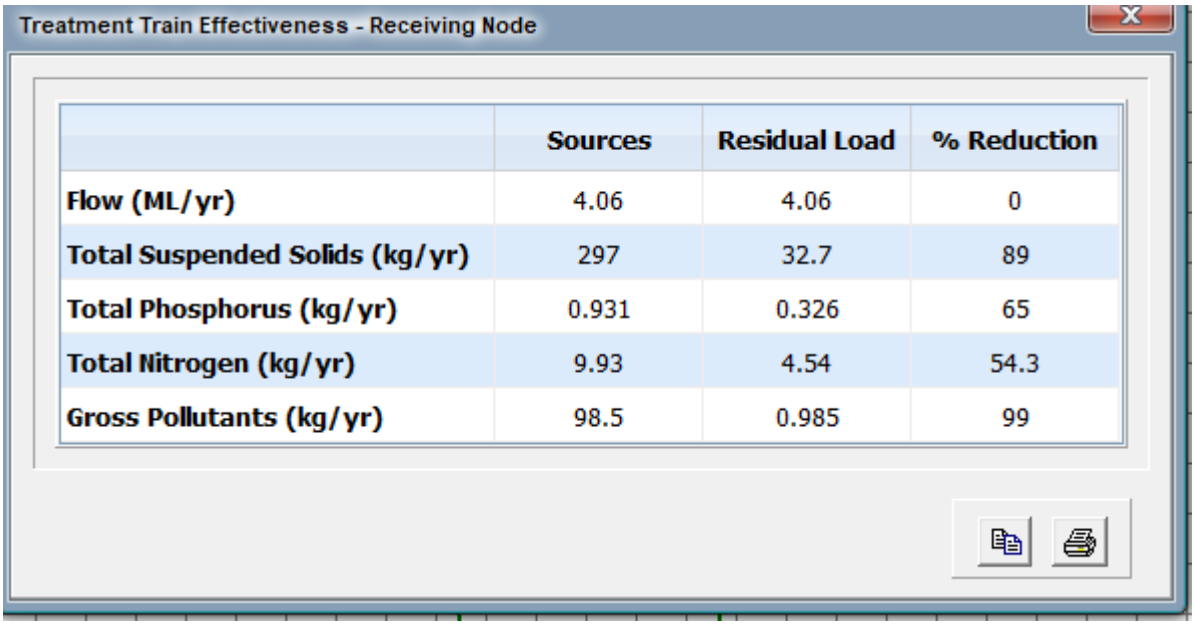


Figure 7 MUSIC Model

MUSIC Output



	Sources	Residual Load	% Reduction
Flow (ML/yr)	4.06	4.06	0
Total Suspended Solids (kg/yr)	297	32.7	89
Total Phosphorus (kg/yr)	0.931	0.326	65
Total Nitrogen (kg/yr)	9.93	4.54	54.3
Gross Pollutants (kg/yr)	98.5	0.985	99

Figure 8 MUSIC Results

6.3.3 Pollutant Reduction Results

A number of management measures have been considered with a focus on reducing polluted runoff volumes from the site. The WSUD principals proposed for stormwater treatment includes the following SQID's:

- Two Jellyfish Unit JF-1200-1-1

The effectiveness of the treatment devices proposed in the above section has been modelled using MUSIC with the overall treatment train efficiency results shown in Table 10 below.

Table 6: Treatment Train Efficiencies

Indicator	Total Site Reduction	Site Targets	Target Achieved
Gross Pollutants	99.0%	90%	Yes
Total Suspended Solids (TSS)	89.0%	85%	Yes
Total Phosphorus (TP)	65.0%	65%	Yes
Total Nitrogen (TN)	54.3%	45%	Yes

From the results presented above it can be seen that the proposed SQID's mean that the stormwater quality treatment meets with the reduction targets set for the development.

7. Erosion & Sedimentation Control

Landcom have published a design guide entitled "Managing Urban Stormwater - Soils and Construction" which is regarded as the standard to which erosion and sedimentation control should be designed to within NSW. North Sydney Council specifies compliance with the Landcom design guide in there Stormwater and Floodplain Management Technical Manual.

The control of erosion and sedimentation describes the measures incorporated during and following construction of a new development to prevent the pollution and degradation of the downstream watercourse.

A Soil and Water Management Plan has prepared as part of the development application documentation and is included in Appendix A of this report.

Common control measures adopted are:

- Sedimentation fences;
- Sedimentation basins;
- Stormwater drainage inlet protection;
- Overland flow diversion swales;
- Shaker Grids and wash downs for vehicles leaving the construction site;
- Dust control measures.

The maintenance of these control measures throughout their intended lifespan will ensure that the risk of erosion and sedimentation pollution of the downstream watercourse will be minimized.

8. Conclusion

The civil design in this report complies with North Sydney Council's DCP, Australian Standards and best practice principals. The proposed development addresses (and incorporates as required) stormwater quantity, stormwater conveyance and stormwater quality treatment in accordance with Council's Stormwater Management DCP.

APPENDIX A Civil Drawings

APPENDIX B Music Model Results

Source nodes
Location,MIXED 02,ROOF,MIXED
ID,1,4,5
Node Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode
Zoning Surface Type,Mixed,Roof,Mixed
Total Area (ha),0.083,0.211,0.048
Area Impervious (ha),0.0338906343283582,0.211,0.0346137313432836
Area Pervious (ha),0.0491093656716418,0,0.0133862686567164
Field Capacity (mm),80,80,80
Pervious Area Infiltration Capacity coefficient - a,200,200,200
Pervious Area Infiltration Capacity exponent - b,1,1,1
Impervious Area Rainfall Threshold (mm/day),1,1,1
Pervious Area Soil Storage Capacity (mm),120,120,120
Pervious Area Soil Initial Storage (% of Capacity),25,25,25
Groundwater Initial Depth (mm),10,10,10
Groundwater Daily Recharge Rate (%),25,25,25
Groundwater Daily Baseflow Rate (%),5,5,5
Groundwater Daily Deep Seepage Rate (%),0,0,0
Stormflow Total Suspended Solids Mean (log mg/L),2.2,1.3,2.2
Stormflow Total Suspended Solids Standard Deviation (log mg/L),0.32,0.32,0.32
Stormflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0
Stormflow Total Phosphorus Mean (log mg/L),-0.45,-0.89,-0.45
Stormflow Total Phosphorus Standard Deviation (log mg/L),0.25,0.25,0.25
Stormflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.42,0.3,0.42
Stormflow Total Nitrogen Standard Deviation (log mg/L),0.19,0.19,0.19
Stormflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1.1,1.1,1.1
Baseflow Total Suspended Solids Standard Deviation (log mg/L),0.17,0.17,0.17
Baseflow Total Suspended Solids Estimation Method,Stochastic,Stochastic,Stochastic
Baseflow Total Suspended Solids Serial Correlation,0,0,0
Baseflow Total Phosphorus Mean (log mg/L),-0.82,-0.82,-0.82
Baseflow Total Phosphorus Standard Deviation (log mg/L),0.19,0.19,0.19
Baseflow Total Phosphorus Estimation Method,Stochastic,Stochastic,Stochastic
Baseflow Total Phosphorus Serial Correlation,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),0.32,0.32,0.32
Baseflow Total Nitrogen Standard Deviation (log mg/L),0.12,0.12,0.12
Baseflow Total Nitrogen Estimation Method,Stochastic,Stochastic,Stochastic
Baseflow Total Nitrogen Serial Correlation,0,0,0
Flow based constituent generation - enabled,Off,Off,Off
Flow based constituent generation - flow file, , ,
Flow based constituent generation - base flow column, , ,
Flow based constituent generation - pervious flow column, , ,

Flow based constituent generation - impervious flow column, , ,
Flow based constituent generation - unit, , ,
OUT - Mean Annual Flow (ML/yr),0.685,2.85,0.528
OUT - TSS Mean Annual Load (kg/yr),121,68.8,107
OUT - TP Mean Annual Load (kg/yr),0.258,0.453,0.219
OUT - TN Mean Annual Load (kg/yr),1.98,6.36,1.59
OUT - Gross Pollutant Mean Annual Load (kg/yr),16.4,68.9,13.2
Rain In (ML/yr),1.23664,3.14375,0.715167
ET Loss (ML/yr),0.552135,0.298012,0.187156
Deep Seepage Loss (ML/yr),0,0,0
Baseflow Out (ML/yr),0.119327,0,0.03275
Imp. Stormflow Out (ML/yr),0.458961,2.84574,0.466109
Perv. Stormflow Out (ML/yr),0.10622,0,0.029153
Total Stormflow Out (ML/yr),0.565181,2.84574,0.495262
Total Outflow (ML/yr),0.684508,2.84574,0.528012
Change in Soil Storage (ML/yr),1E-6,0,0
TSS Baseflow Out (kg/yr),1.63003,0,0.447367
TSS Total Stormflow Out (kg/yr),119.769,68.7934,106.349
TSS Total Outflow (kg/yr),121.399,68.7934,106.797
TP Baseflow Out (kg/yr),0.019702,0,0.005407
TP Total Stormflow Out (kg/yr),0.238734,0.453309,0.213923
TP Total Outflow (kg/yr),0.258436,0.453309,0.21933
TN Baseflow Out (kg/yr),0.259491,0,0.071218
TN Total Stormflow Out (kg/yr),1.72084,6.36124,1.51803
TN Total Outflow (kg/yr),1.98033,6.36124,1.58925
GP Total Outflow (kg/yr),17.0219,68.859,13.4283

No Imported Data Source nodes

No USTM treatment nodes

Generic treatment nodes
Location,Stormwater360 Jellyfish JF1200-1-1,Stormwater360 Jellyfish JF1200-1-1
ID,3,6
Node Type,GenericNode,GenericNode
Lo-flow bypass rate (cum/sec),0,0
Hi-flow bypass rate (cum/sec),0.0075,0.0075
Flow Transfer Function
Input (cum/sec),0,0
Output (cum/sec),0,0
Input (cum/sec),10,10
Output (cum/sec),10,10
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Output (cum/sec), ,
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Gross Pollutant Transfer Function
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Input (kg/ML), ,
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Output (kg/ML), ,
Input (kg/ML), ,
Output (kg/ML), ,
Total Nitrogen Transfer Function
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Total Phosphorus Transfer Function
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Total Suspended Solids Transfer Function
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Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
Input (mg/L), ,
Output (mg/L), ,
TSS Flow based Efficiency Enabled,Off,Off

TSS Flow based Efficiency, ,
TP Flow based Efficiency Enabled,Off,Off
TP Flow based Efficiency, ,
TN Flow based Efficiency Enabled,Off,Off
TN Flow based Efficiency, ,
GP Flow based Efficiency Enabled,Off,Off
GP Flow based Efficiency, ,
IN - Mean Annual Flow (ML/yr),3.37,0.685
IN - TSS Mean Annual Load (kg/yr),176,121
IN - TP Mean Annual Load (kg/yr),0.673,0.258
IN - TN Mean Annual Load (kg/yr),7.95,1.98
IN - Gross Pollutant Mean Annual Load (kg/yr),82.1,16.4
OUT - Mean Annual Flow (ML/yr),3.37,0.685
OUT - TSS Mean Annual Load (kg/yr),19.3,13.4
OUT - TP Mean Annual Load (kg/yr),0.235,90.5E-3
OUT - TN Mean Annual Load (kg/yr),3.63,0.905
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.821,0.164
Flow In (ML/yr),3.37375,0.684508
ET Loss (ML/yr),0,0
Infiltration Loss (ML/yr),0,0
Low Flow Bypass Out (ML/yr),0,0
High Flow Bypass Out (ML/yr),0,0
Orifice / Filter Out (ML/yr),0,0
Weir Out (ML/yr),0,0
Transfer Function Out (ML/yr),3.37375,0.684508
Reuse Supplied (ML/yr),0,0
Reuse Requested (ML/yr),0,0
% Reuse Demand Met,0,0
% Load Reduction,0,0
TSS Flow In (kg/yr),175.59,121.399
TSS ET Loss (kg/yr),0,0
TSS Infiltration Loss (kg/yr),0,0
TSS Low Flow Bypass Out (kg/yr),0,0
TSS High Flow Bypass Out (kg/yr),0,0
TSS Orifice / Filter Out (kg/yr),0,0
TSS Weir Out (kg/yr),0,0
TSS Transfer Function Out (kg/yr),19.3149,13.3539
TSS Reuse Supplied (kg/yr),0,0
TSS Reuse Requested (kg/yr),0,0
TSS % Reuse Demand Met,0,0
TSS % Load Reduction,89,89
TP Flow In (kg/yr),0.672641,0.258436
TP ET Loss (kg/yr),0,0
TP Infiltration Loss (kg/yr),0,0
TP Low Flow Bypass Out (kg/yr),0,0
TP High Flow Bypass Out (kg/yr),0,0
TP Orifice / Filter Out (kg/yr),0,0
TP Weir Out (kg/yr),0,0
TP Transfer Function Out (kg/yr),0.235424,0.090453

TP Reuse Supplied (kg/yr),0,0
TP Reuse Requested (kg/yr),0,0
TP % Reuse Demand Met,0,0
TP % Load Reduction,65.0001,64.9998
TN Flow In (kg/yr),7.9505,1.98033
TN ET Loss (kg/yr),0,0
TN Infiltration Loss (kg/yr),0,0
TN Low Flow Bypass Out (kg/yr),0,0
TN High Flow Bypass Out (kg/yr),0,0
TN Orifice / Filter Out (kg/yr),0,0
TN Weir Out (kg/yr),0,0
TN Transfer Function Out (kg/yr),3.63451,0.905294
TN Reuse Supplied (kg/yr),0,0
TN Reuse Requested (kg/yr),0,0
TN % Reuse Demand Met,0,0
TN % Load Reduction,54.2858,54.2857
GP Flow In (kg/yr),82.1042,16.3983
GP ET Loss (kg/yr),0,0
GP Infiltration Loss (kg/yr),0,0
GP Low Flow Bypass Out (kg/yr),0,0
GP High Flow Bypass Out (kg/yr),0,0
GP Orifice / Filter Out (kg/yr),0,0
GP Weir Out (kg/yr),0,0
GP Transfer Function Out (kg/yr),0.821042,0.163983
GP Reuse Supplied (kg/yr),0,0
GP Reuse Requested (kg/yr),0,0
GP % Reuse Demand Met,0,0
GP % Load Reduction,100,100

Other nodes
Location,Receiving Node
ID,2
Node Type,ReceivingNode
IN - Mean Annual Flow (ML/yr),4.06
IN - TSS Mean Annual Load (kg/yr),32.7
IN - TP Mean Annual Load (kg/yr),0.326
IN - TN Mean Annual Load (kg/yr),4.54
IN - Gross Pollutant Mean Annual Load (kg/yr),0.985
OUT - Mean Annual Flow (ML/yr),4.06
OUT - TSS Mean Annual Load (kg/yr),32.7
OUT - TP Mean Annual Load (kg/yr),0.326
OUT - TN Mean Annual Load (kg/yr),4.54
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.985
% Load Reduction,270E-9
TSS % Load Reduction,89.0
TN % Load Reduction,54.3
TP % Load Reduction,65.0
GP % Load Reduction,99.0

Links
Location,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link
Source node ID,3,4,5,1,6
Target node ID,2,3,3,6,2
Muskingum-Cunge Routing,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed
Muskingum K, , , , ,
Muskingum theta, , , , ,
IN - Mean Annual Flow (ML/yr),3.37,2.85,0.528,0.685,0.685
IN - TSS Mean Annual Load (kg/yr),19.3,68.8,107,121,13.4
IN - TP Mean Annual Load (kg/yr),0.235,0.453,0.219,0.258,90.5E-3
IN - TN Mean Annual Load (kg/yr),3.63,6.36,1.59,1.98,0.905
IN - Gross Pollutant Mean Annual Load (kg/yr),0.821,68.9,13.2,16.4,0.164
OUT - Mean Annual Flow (ML/yr),3.37,2.85,0.528,0.685,0.685
OUT - TSS Mean Annual Load (kg/yr),19.3,68.8,107,121,13.4
OUT - TP Mean Annual Load (kg/yr),0.235,0.453,0.219,0.258,90.5E-3
OUT - TN Mean Annual Load (kg/yr),3.63,6.36,1.59,1.98,0.905
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.821,68.9,13.2,16.4,0.164

Catchment Details
Catchment Name,33964 - SENIOR
Timestep,6 Hours
Start Date,1/01/1959
End Date,31/12/1959 6:00:00 PM
Rainfall Station, 66062 SYDNEY
ET Station,Monthly User Defined
Mean Annual Rainfall (mm), 1490
Mean Annual ET (mm), 1260