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2 Macpherson Street Warriewood

NSW, 2102

Civil Engineering Consultancy

Civil Report for Development Application

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Report no: 2021791 Rev A For DA **Date:** 22nd Aug 2017

Report Amendment Register

Rev. No.	Section & Page No.	Issue/Amendment	Author/Initials	Reviewer/Initials	Date
A		For DA	JH		22/08/17

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1 Introduction

Bonacci has been engaged by Meriton to prepare a Stormwater Management Report for the Development Application for 2 Macpherson Street Warriewood.

This Civil Report assesses stormwater drainage requirements (including water quantity and quality) relating to the interim road works only, site earthworks and creek works.

2 Site Description

The site is located on Macpherson Street. It is situated within the Northern Beaches Council Local Government Area (LGA). The site is bounded by Narrabeen Creek to the north and east, Macpherson Street to the south and an undeveloped lot to the west. The site is generally flat with a high point near the centre of site. The site falls from towards Narrabeen Creek which flows from west to east. The locality map for the proposed site is shown in Figure 2-1 below.



Figure 2-1: Site Locality Map (Source: Google Maps, 2017)

2.1 Objectives

The objective of this report is to demonstrate compliance with the requirements of the Northern Beaches Council documents "*Development Control Plan Pittwater 21*", "*Warriewood Valley Urban Land release Water Management Specification*" and "*Soil and Construction Volume 1, March 2004 by Landcom (the Blue Book)*".

- To provide a stormwater management strategy for the site to support the proposed Development Application
- To provide a "Stormwater Concept Plan" for the proposed site showing stormwater drainage systems including site storage requirements and water quality treatment measures.
- To provide an on-site detention system that meets "*Warriewood Valley Urban Land release Water Management Specification*".
- To provide a water quality strategy to control the water quality of stormwater leaving the site (in accordance with Councils requirements)
- To provide creek rehabilitation works matching with Council's creek works as part of Council's Macpherson St Road Upgrade and Council approved creek works at adjacent properties.
- To provide a Soil and Water management Plan for the site which needs to be maintained during construction

3 Water Quantity

Northern Beaches Council has a specific document that details the on-site detention requirements for proposed developments

“The need for on-site detention (OSD) results from the requirement to maintain existing peak flows so that following development flooding will not be worse than pre-existing condition.” (Section A1 Northern Beaches Council, Warriewood Valley Water Management Specification).

3.1 Catchment

This report details the water quantity requirements for the interim road works only. Proposed lot sub-division is subject to future Development Application and is assumed to meet its own water quantity and quality requirements.

The catchment for the site can be broken down into the following areas:

- Road Area: 2805m²
- Lot Area: 7606m²
- Total Site Area: 21000m²

3.2 On-Site Detention

On site storage requirement is implemented through the use of wetlands on site. Since Council accept wetland as the only measure of water quality treatment where located in overland flow path below 20% AEP (Northern Beaches Prelodgement Report) and the recommendation by Council to construct wetland as part of the water management strategy (Prelodgement Report), the use of wetlands have been proposed to incorporate both water quantity and quality considerations. The wetlands have been sized to provide adequate onsite detention storage as per Warriewood Valley Water Management Specification.

Site storage requirements (SSR) (m³/ha) based on 1% AEP and 50% impervious area is 368m³/ha in accordance with Table A.1 Warriewood Valley Water Management Specification. SSR volume based on 2.1ha total site area is 773m³.

Nominal total site impervious area is assumed to be the road Area + 60% Lot Area (assumed 60% impervious area for lots)

Total site impervious area is nominally 7366m² which is 30% of total site area. This impervious area equate to a 1.47ha site (based on 50% impervious area in accordance with Table A.1 Warriewood Valley Water Management Specification. This would require approximately 540m³ of storage. As the road is contributing 38% of the total site impervious area,

38% of SSR is to be provided for the road works. This equals approximately 200m³ of detention.

Four onsite wetland are proposed, each with an area of 100m² and 0.5m extended detention depth (refer to Water Quality section). Each wetland contributes 50m³ of site storage, providing in total 200m³ of storage.

This meets on site detention requirements as per council specifications.

4 Water Quality

The water quality requirements for the site are nominated in Pittwater Council 2001, *Warriewood Valley Urban Land Release Water Management Specification*. The water quality objectives are provided below:

“Specific standards have been developed for in-sector monitoring applicable to wet or dry weather stormwater discharge concentrations. However, as a minimum, a ‘no worsening’ of existing runoff quality is required”.

The goal is to ensure that developed conditions do not worsen existing conditions and that this opportunity is taken to improve/reduce constituent loads. The proposed water quality strategy for the site, meets the above requirement set by Northern Beaches Council. The water quality strategy is described in detail below.

4.1 Water Quality Strategy

The water quality measures for the proposed site are provided to reduce pollutant loads due to the proposed development in accordance with Council requirements.

For interim road works, the total road area is 2805m². Stormwater runoff from pavement will be captured via a pit and pipe system. Pits are located at localised sag points as shown in the stormwater management plan. Four (4) wetlands will be provided for water quality treatment purposes in addition to meet water quantity requirements. The wetland treatment nodes each have a surface area of 100m² with an extended detention depth of 0.5m (this creates a detention volume of 50m³ each which is adequate for site storage requirements for the site as discussed in the water quantity section of the report).

The water quality model for the site was established using *MUSIC* (Version 6.2). The wetland and source node characteristics which were used in *MUSIC* are provided in **Appendix B** along with the “*MUSIC* Report” created.

4.2 Water Quality Model

4.2.1 Post Developed Model

The proposed interim road is divided into 4 sub-catchments.

The catchments are summarised in **Table 4.1** below:

Table 4-1: Impervious Area for Catchments with Area

Sub-Catchments	Description	Treatment Node	Area (ha)	Impervious Fraction (%)
01	Internal Road (1/4)	Wetland	0.054	90
02	Internal Road (1/3)	Wetland	0.071	90
03	Internal Road (1/2)	Wetland	0.074	90
04	Internal Road (1/1)	Wetland	0.082	90
Total			0.281	

The water quality model adopted for the proposed site is shown below.

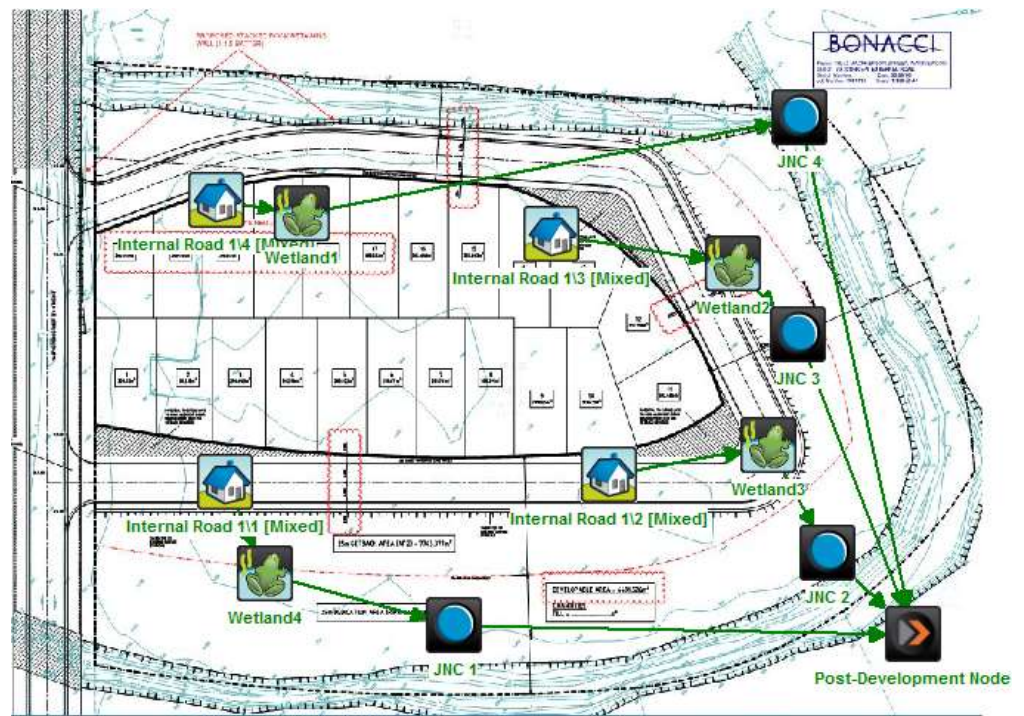


Figure 4-1: The MUSIC Model for the Proposed Site

4.2.2 Pre Developed Model

The pre-developed case is modelled as shown in the table below.

Sub-Catchments	Description	Treatment Node	Area (ha)	Impervious Fraction (%)
01	Existing	N/A	0.281	10
Total			0.281	

4.3 Results

The *MUSIC* model results show that the pollutant removal rate achieves the reduction targets provided in Section 4. The post developed case with treatment train have reduced pollutant to loads below pre developed case. The results from the *MUSIC* model are tabulated below.

Table 4-2: MUSIC Model Results Post Developed Case

Items	Mean Annual Pollutant loads (kg/yr)		
	Pre-developed	Post-developed	Post-developed with Treatment Train
Total Suspended Solids	114	873	79.2
Total phosphorous	0.511	1.48	0.217
Total Nitrogen	2.59	6.08	2.3
Gross Pollutants	12.6	12.6	0

The treatment train result at the outlet as well as the percentage reduction of pollutant loads via the use of wetlands is shown in **Appendix B**.

5 Soil and Water Management

An overview of soil and water management plan is shown in drawing C005 attached.

Given site disturbed area exceeds 2500m², Soil and Water Management Plan for interim road works has been implemented in accordance with Landcom *Managing Urban Stormwater: Soils and Construction Volume 1* "Blue Book".

2 months soil loss has been determined in accordance with Blue Book Revised Universal Soil Loss Equation (RUSLE).

$$\text{Soil Loss (m}^3\text{)} = 0.17 * A * R * k * LS * P * C / 1.3$$

Where:

A = Interim road and batter works disturbed area only (ha). This excludes lot development areas and includes batter to existing surface within lot area = 0.55ha

R = Rainfall erosivity factor = 3960 (Appendix B Blue Book)

k = Soil erodibility factor = 0.007 (Appendix C, Table C20, Narrabeen, Blue Book)

LS = Slope Length = 0.19 (Table A1 Blue Book)

P = Erosion Practice Control Factor = 1.3 (Table A2 Blue Book)

C = Cover Factor = 1

Soil loss (2 months) determined to be nominally less than 10m³. This is mainly due to a relatively flat pre-developed and post-developed surface causing low soil loss and a low soil erodibility factor in the Narrabeen region in Table C20 Blue Book. Sediment basins are typically not required for sites where there are less than 150m³ of 2 month soil loss as per section 6.3.2(d) Blue Book. Despite this, the excavation for the wetlands are to act as sediment basins for the road construction stage of works. The sediment basins can then be converted to wetlands to meet site water quality requirements.

As part of the soil and water management plan, provision of sediment fence is required in accordance with the Blue Book.

Shaker ramp is provided for vehicles entering and exiting the site from Macpherson Street.

Temporary stockpile location (shown in dwg C200) is located at the high point of the site to minimise washing away of sediments during high intensity rainfall events.

A catch drain is located on the perimeter of the road boundary to divert local drainage. The catch drain can be directed to “wetland sediment basins” with outlets leading into standard rock armouring towards Narrabeen creek.

The interim road works is to batter to existing surface on both sides. Where on the western boundary a batter profile would encroach into Narrabeen creek, a retaining wall along western boundary is proposed as shown in the stormwater management plan. The retaining wall ends at the North Western corner of the site. Road upgrade works by council on Macpherson Street include raising of the road. An interim retaining wall on the southern boundary of the site is proposed for the proposed road works.

The road is graded with low sag points. A pit and pipe system drains water from road pavement into the proposed wetland. The wetland acts as both a water quantity and water quality treatment device where sufficient storage has been provided for site storage requirements (refer to water quantity and water quality section of the report).

6 Creek Rehabilitation Works

An overview of soil and water management plan is shown in drawing series C200 attached.

Creek rehabilitation works are to be provided to councils requirements in accordance with Council's Prelodgement Report. Creek design is sympathetic to the approved creek designs for 29-31 Warriewood Road with creek level designed to match designed levels for 29-31 Warriewood Road. The creek work design matches into Council's creek works as part of Macpherson Street Road Upgrade works at the south east corner of the site (located at the road bridge).

The control line for subject site creek works is based on the alignment of the property boundary. The creek works design connects the design at 29-31 Warriewood Rd and the design at Council's creek works as part of Macpherson St upgrade.

Low flow channel is provided by others at the northern boundary (29-31 Warriewood Rd). Works within site at the north boundary consists of removal of the interim retaining wall (constructed by others) and construction of batter profile. Low flow channel is to be constructed at the eastern boundary along with the batter profile (as shown on drawing C200 series) within site. Battering on the western boundary is to be done by others (29-31 Warriewood Rd).

7 Conclusion

The Civil design for the proposed site located at 2 Macpherson St, Warriewood incorporates a stormwater quantity and quality strategy compliant with all the requirements of Northern Beaches Council.

The soil and water management plan required for the site is provided in **Section 5** and the Civil Drawings, which meets the requirements of *Managing Urban Stormwater: Soils and Construction Volume 1* (the “Blue Book”) by Landcom.

Appendix A – Civil and Stormwater Drawings

Appendix B – Music Model Parameters and Results

Music Model Parameters

Soil Properties for Music Source Nodes:

Parameter	Recommended Values
Rainfall Threshold (mm/d)	1
Soil Capacity (mm)	120
Initial Storage (%)	25
Field Capacity (mm)	80
Infiltration Capacity Coefficient a	200
Infiltration Capacity Coefficient b	1
Initial Depth (mm)	10
Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	5
Deep Seepage (%)	0

Stormwater Pollutant Generation Parameters for Music Source Nodes (Post Dev):

Land-use category		Log10 TSS (mm/L)		Log10 TP (mm/L)		Log10 TN (mm/L)	
		Storm flow	Base flow	Storm flow	Base flow	Storm flow	Base flow
Mixed Urban	Mean	2.43	1.2	-0.3	-0.85	0.34	0.11
	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12

Stormwater Pollutant Generation Parameters for Music Source Nodes (Pre Dev):

Land-use category		Log10 TSS (mm/L)		Log10 TP (mm/L)		Log10 TN (mm/L)	
		Storm flow	Base flow	Storm flow	Base flow	Storm flow	Base flow
Mixed Urban	Mean	2.15	1.3	-0.22	-1.05	0.48	0.04
	Std Dev	0.31	0.13	0.30	0.13	0.26	0.13

Wetland Node Characteristics:

Properties of Wetland2

Location:

Inlet Properties

Low Flow By-pass (cubic metres per sec)	<input type="text" value="0.00000"/>
High Flow By-pass (cubic metres per sec)	<input type="text" value="100.0000"/>
Inlet Pond Volume (cubic metres)	<input type="text" value="0.0"/>

Storage Properties

Surface Area (square metres)	<input type="text" value="100.0"/>
Extended Detention Depth (metres)	<input type="text" value="0.50"/>
Permanent Pool Volume (cubic metres)	<input type="text" value="100.0"/>
Initial Volume (cubic metres)	<input type="text" value="0.00"/>
Vegetation Cover (% of surface area)	<input type="text" value="50.0"/>
Exfiltration Rate (mm/hr)	<input type="text" value="0.00"/>
Evaporative Loss as % of PET	<input type="text" value="125.00"/>

Outlet Properties

Equivalent Pipe Diameter (mm)	<input type="text" value="10"/>
Overflow Weir Width (metres)	<input type="text" value="2.0"/>
Notional Detention Time (hrs)	<input type="text" value="84.3"/>

Use Custom Outflow and Storage Relationship

Not Defined

MUSIC Results at Outlet:

	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	1.05	2.54	1.05	1.91	0	24.8
Total Suspended Solids (kg/yr)	114	873	114	79.2	0	90.9
Total Phosphorus (kg/yr)	0.511	1.48	0.511	0.217	0	85.3
Total Nitrogen (kg/yr)	2.59	6.08	2.59	2.3	0	62.2
Gross Pollutants (kg/yr)	12.6	64.9	12.6	0	0	100

Include Post-Development