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PREPARED FOR:

JCP CONSTRUCTION

WATER SENSITIVE DESIGN STRATEGY

4-12 Breese Parade, Forster

Proposed Industrial Development

Report Reference: 20230059_DA_WSDS_R01

Date: 21 June 2024

Revision: R01

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Contents

1 INTRODUCTION

JCO Consultants have been engaged by JCP Construction (client) to prepare a Water Sensitive Design Strategy Report in accordance with Midcoast Council's requirements to support the Development Application (DA) of proposed industrial units at 4-12 Breese Parade, Forster. This report aims to provide and assess water sensitive design strategies including stormwater detention and water quality treatment, to meet Council's development requirements.

The subject site is located at Lot 2, DP 1133390, No.4-12 Breese Parade, Forster. It is within Midcoast Council Local Government Area. The area of the site is 1.41ha. It is currently zoned as E2 – Environmental Conservation.

The proposed development consists of four (4) industrial units, external car parking & travelling spaces, landscaping areas and associated infrastructures including stormwater and utility services. Existing carparking areas in front of existing Midcoast Library to be adjusted slightly in terms of carparking layout while maintaining all the existing drainage system within the areas. Refer architectural drawings prepared by SBA Architects for details of the development.

A full set of engineering drawings was prepared by JCO consultants to accompany this Development Application, shown in Appendix A.

2 REFERENCE DOCUMENTS

The following documents have been referenced in developing the stormwater drainage and water sensitive urban design strategy for the proposed development:

1. *Midcoast Council Stormwater Management Policy, Version 2*
2. *Midcoast Council Stormwater Assessment Procedure, Version 2*
3. *Midcoast Council Site Stormwater Drainage Guidelines, Version 1*
4. *Midcoast Council Guidelines for Water Sensitive Design Strategy, October 2019*
5. *Draft NSW MUSIC Modelling Guidelines, 2015*

3 EXISTING SITE CONDITIONS

3.1 Existing Site Catchment

The existing site consists of multiple commercial & local government buildings and structures, bitumen carparking areas at the site entry and landscape areas at the rear. Runoff generated from the existing building and carparking areas are captured and conveyed by existing stormwater pit and pipe system and discharged to Breese Parade Council's stormwater drainage system.

3.2 External Catchments

Based on Lidar Data available, the existing development site is sitting on the crest of the local catchment. Therefore, there will be no external catchment runoff draining down to the development site.

Figure 1 – Existing Topography

3.3 Flood Planning Levels

Based on the flood level certificate issued by Council, dated 07/07/2023, the subject site is flood affected taking into account NSW Sea Level Rise Planning Benchmarks. The flood planning levels are shown in below figure extracted from Council's flood level certificate.

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FLOOD LEVEL DETAILS

Information currently available to Council, taking into account NSW Sea Level Rise (SLR) Planning Benchmarks, indicates that the property described in this certificate is flood affected as follows:-

Probable maximum flood level	4.4 m AHD	The highest flood level that could conceivably occur at this location
1% AEP flood level in Year 2010	2.0 m AHD	This level is useful for insurance purpose, refer to your insurance policy and the Insurance Contracts Regulation 1985 (Cwealth)
1% AEP Flood Level in Year 2060	2.4 m AHD	This level is useful for development in infill development area
1% AEP Flood Level in Year 2100	2.7 m AHD	Adopted 1% flood level
Flood Planning Level	3.2 m AHD	Adopted 1% flood level plus 0.5m freeboard
5% AEP Flood Level	1.6 m AHD	On Site Sewerage Management System must be above this level

The flow velocity of the 1% AEP Flood Level in Year 2100 is 0.1 m/s.

Figure 2 – Flood Planning Levels

4 STORMWATER QUALITY MANAGEMENT

4.1 Objective

In accordance with Council's Pre-Lodgement Meeting Notes (dated 14/03/23) – Water Quality Session and Council's Stormwater Assessment Procedure Version 2.0 – Table 1, water quality measures need to be provided to achieve stormwater quality targets extracted in table below.

Table 1 – Stormwater Quality Targets

	Gross Pollutants	Total Suspended Solids	Total Phosphorous	Total Nitrogen
Target Reduction Loads	**90**	**80**	**60**	**45**

4.2 Methodology

A MUSIC model was prepared to design the water quality measures for the proposed development. Key analysis utilising the software includes:

- Sizing of the proposed bio-retention filter areas and;

Rainfall Data

The rainfall and Evapo-Transpiration data used in the MUSIC model was adopted from rainfall station 1969-1978_6_min_rainfall_Zones_1_and_2, using 6 minutes time step from year 1969 to year 1978.

Parameters

The MUSIC model adopted rainfall-runoff parameters for soil hydrologic group D specified in Council's Guidelines for Water Sensitive Design Strategies, refer figure extracted below.

MUSIC parameter	Soil hydrologic group			
	A	B	C	D
Impervious rainfall threshold				
Combined impervious surfaces (mm)	1.5	1.5	1.5	1.5
Roof surfaces (mm)	0.5	0.5	0.5	0.5
Paved and road surfaces (mm)				
Pervious area parameters				
Soil Storage Capacity (mm)	155	105	100	90
Initial Storage (% of capacity)	25	25	25	25
Field Capacity (mm)	75	75	70	65
Infiltration Capacity Coefficient a (mm/day)	360	250	180	135
Infiltration Capacity Exponent b (scalar)	0.5	1.3	3	4
Groundwater Properties				
Initial Depth (mm)	10	10	10	10
Daily Recharge Rate (%)	100	60	25	10
Daily Baseflow Rate (%)	50	45	25	10
Daily Deep Seepage Rate (%)	0	0	0	0

Figure 3 – Rainfall-Runoff Parameters

The MUSIC model adopted runoff concentration parameters from the 2015 NSW MUSIC Modelling Guidelines, refer figure extracted below.

Table 5-6 Base Flow Concentration Parameters (mg/L-log10) for NSW (adapted from Fletcher et al, 2004)

	TSS		TP		TN	
	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev
Large Areas of Interest						
Residential	1.20	0.17	-0.85	0.19	0.11	0.12
Business	1.20	0.17	-0.85	0.19	0.11	0.12
Industrial	1.20	0.17	-0.85	0.19	0.11	0.12
Rural	1.15	0.17	-1.22	0.19	-0.05	0.12
Agricultural	1.30	0.13	-1.05	0.13	0.04	0.13
Eroding gullies	1.20	0.17	-0.85	0.19	0.11	0.12
Quarries	1.20	0.17	-0.85	0.19	0.11	0.12
Re-vegetated land	1.15	0.17	-1.22	0.19	-0.05	0.12
Forest	0.78	0.13	-1.22	0.13	-0.52	0.13
Small Areas of Interest						
Roofs	n/a	n/a	n/a	n/a	n/a	n/a
Sealed road pavement	1.20	0.17	-0.85	0.19	0.11	0.12
Unsealed road pavement	1.20	0.17	-0.85	0.19	0.11	0.12
Landscaped areas	1.20	0.17	-0.85	0.19	0.11	0.12

Table 5-7 Storm Flow Concentration Parameters for NSW (mg/L-log10) for NSW (adapted from Fletcher et al, 2004)

	TSS		TP		TN	
	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev
Large Areas of Interest						
Residential	2.15	0.32	-0.60	0.25	0.30	0.19
Business	2.15	0.32	-0.60	0.25	0.30	0.19
Industrial	2.15	0.32	-0.60	0.25	0.30	0.19
Rural	1.95	0.32	-0.66	0.25	0.30	0.19
Agricultural	2.15	0.31	-0.22	0.30	0.48	0.26
Eroding gullies	3.00	0.32	-0.30	0.25	0.34	0.19
Quarries	3.00	0.32	-0.30	0.25	0.34	0.19
Re-vegetated land	1.95	0.32	-0.66	0.25	0.30	0.19
Forest	1.60	0.20	-1.10	0.22	-0.05	0.24
Small Areas of Interest						
Roofs	1.30	0.32	-0.89	0.25	0.30	0.19
Sealed road pavement	2.43	0.32	-0.30	0.25	0.34	0.19
Unsealed road pavement	3.00	0.32	-0.30	0.25	0.34	0.19
Landscaped areas	2.15	0.32	-0.60	0.25	0.30	0.19

Figure 4 – Runoff Concentration Parameters

Treatment Train

The proposed stormwater treatment train includes one (1) bio-retention basin.

The bio-retention basins will require a total of approximately 85m2 of filtration area with extended detention depth of 100mm. The filter media layer has a depth of 400mm, with a 100mm sandy

transition layer and a gravel drainage layer of 150mm. Details of the proposed bio-retention profile are shown on the Civil Engineering Development Application drawings.

Modelling Layout

The MUSIC model layouts can be seen in figure below.

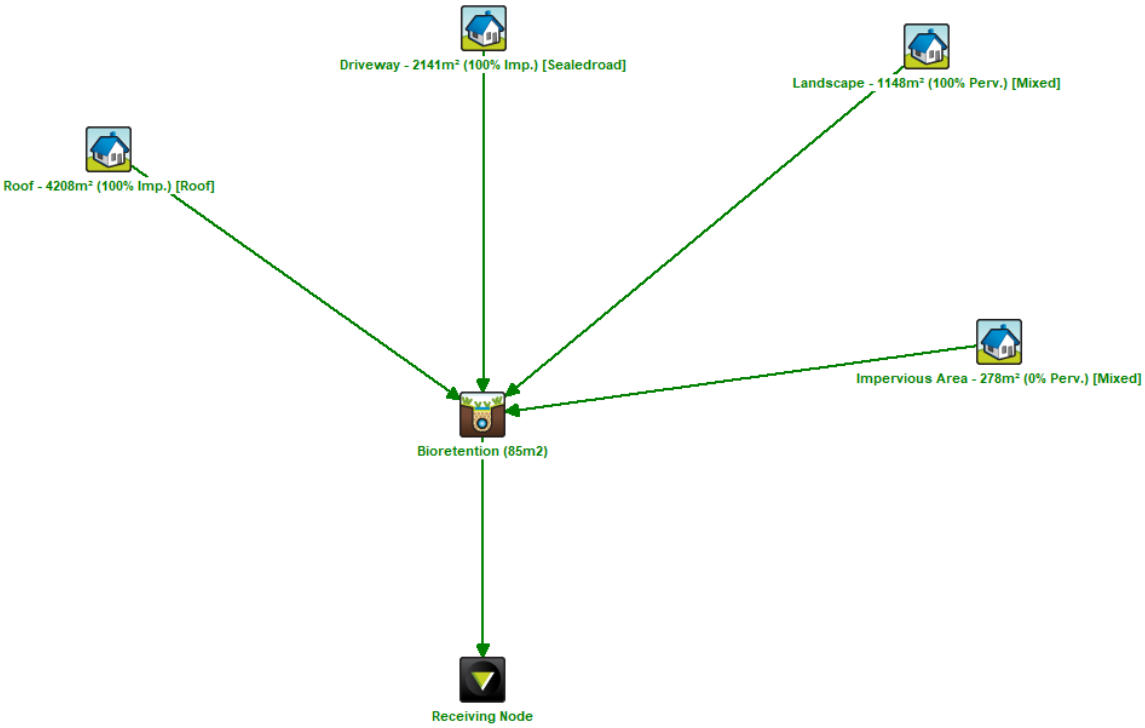

Figure 5 – MUSIC Modelling Layout

4.3 Modelling Results

A MUSIC model is developed using the above methodology to assess overall stormwater treatment effectiveness. The modelling results are shown in the table below. A copy of the model is included in the DA submission package for council's assessment.

Table 2 – MUSIC Modelling Results

	Sources	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	**1120**	**213**	**81**
Total Phosphorus (kg/yr)	**2.36**	**0.92**	**61**
Total Nitrogen (kg/yr)	**18**	**9.82**	**45.3**
Gross Pollutants (kg/yr)	**183**	**0**	**100**

The results indicate that the proposed treatment train consisting of bio-retention have achieved Council's Stormwater Quality Targets outlined in Table 1.

5 STORMWATER QUANTITY MANAGEMENT

5.1 Objective

In accordance with Council's Site Stormwater Drainage Guidelines Section 4 – On Site Detention, the objective for stormwater quantity management is to limit the discharge to an acceptable rate and hold excess discharge until capacity becomes available in the downstream drainage system by incorporating on-site stormwater detention system (OSD). The stormwater quantity management target is specified as per below:

"Computations are to be performed for the existing site conditions for a low recurrence interval (20% AEP), a medium recurrence interval (10% AEP or 5% AEP or 2% AEP), and the upper value, which will be the 1% AEP storm. The rate of stormwater runoff (both piped and overland) from the post-development site is not to exceed the rate of runoff from the pre-developed site for the above stormwater events."

5.2 Methodology

An ILSAX model in DRAINS was used to design the drainage network and the stormwater detention tank (OSD tank) for the proposed development. Key analysis utilising the software includes:

- Sizing of the proposed pit and pipe network to adequately convey stormwater flows during the 1% AEP storm event;
- Assessing safety of overland flows within the car parking areas during major storms up to 1% AEP; and
- Determining a suitably sized OSD tank to ensure objectives listed above are achieved.

Parameters

The parameters used in the ILSAX model are shown below:

- Paved (impervious) area depression storage (mm) = 1
- Supplementary area depression storage (mm) = 1
- Grassed (pervious) area depression storage (mm) = 5
- Soil Type = 3
- Overland flow equation: Kinematic Wave

Rainfall Data

The rainfall data input into the DRAINS model was obtained from the Bureau of Meteorology Intensity-Frequency-Duration AR&R1987 tool adopting the latitude and longitude of the site.

Catchment Imperviousness

The assumptions of catchment impervious percentages for pre-development and post-development scenarios are summarised in the table below.

Table 3 – Impervious Percentages

	Pre-development Impervious %	Post-development OSD Catchment Impervious %
Subject Site	**50%**	**90%**

Storm Event Analysis

The DRAINS model assessed all storm events from 20% AEP up to 1% AEP ranging from 5 minutes duration to 2 hours duration to ensure the proposed OSD satisfies Council's design criteria during all storms.

Time of Concentration

The time of concentration adopted for the pre-development scenario is calculated using Kinematic Wave equation using the existing site slope from site survey data and the measured length of flowpath.

The time of concentration adopted for the post-development scenario is generally 5 minutes (minimum time accepted by Council policy) across the site, considering the 100% imperviousness of the proposed site conditions.

5.3 Discharge Location

Stormwater runoff from the proposed development buildings associated with carparking * travelling areas will be conveyed through proposed pits & pipes system and discharge to existing Council's stormwater drainage system at Breese Parade.

5.4 Modelling Results

The DRAINS results have shown post-development flows from a portion of total areas (7775m2) where the proposed industrial units are, including OSD pipe flows and bypass flows are maintained at or below pre-development conditions incorporating OSD systems. The following table summarise the performance of the OSD tank compared to pre-development flows for a range of storm events up to and including the 1% AEP. A copy of the model is included in the DA submission package for council's assessment.

Table 4 – Site Discharge Comparison Pre VS Post

AEP Events (%)	Pre-development Flow (m^3/s)	Post-development Attenuated Flow (m^3/s)
20	0.253	0.249
10	0.290	0.258
5	0.340	0.270
2	0.367	0.280
1	0.412	0.292

The results demonstrate that the attenuated post-developed peak flows are less than the pre-developed peak flow rates.

6 OPERATION AND MAINTENANCE PLAN

Regular maintenance is required to ensure water quality and quantity management measures continue to operate in an efficient and satisfactory manner. Maintenance shall be carried out by the property owner/licensed contractor of the proposed development.

Actions and frequencies required to perform the maintenance activities are listed in the table below.

Bioretention Basin Maintenance Schedule

Filter Media Tasks

Maintenance action	Frequency	Responsibility	Procedure
Sediment deposition	Quarterly & after major storm	Maintenance Contractor	Remove sediment build up in raingardens from the surface of bioretention plants.
Holes or scour	Quarterly & after major storm	Maintenance Contractor	Infill any holes in the filter media. Check for erosion or scour and repair, provide energy dissipation (e.g. rocks and pebbles at inlet) if necessary.
Filter media surface porosity	Quarterly & after major storm	Maintenance Contractor	Inspect for the accumulation of an impermeable layer (such as oily or clayey sediment) that may have formed on the surface of the filter media. A symptom may be that water remains ponded in the raingarden for more than a few hours after a rain event. Repair minor accumulations by raking away any mulch on the surface and scarifying the surface of the filter media between plants.
Litter Control	Quarterly or as desired for aesthetics	Maintenance Contractor	Check for litter (including organic litter) in and around treatment areas. Remove both organic and anthropogenic litter to ensure flow paths and infiltration through the filter media are not hindered.

Horticultural Tasks

Maintenance action	Frequency	Responsibility	Procedure
Pests and Diseases	Quarterly or as desired for aesthetics	Maintenance Contractor	Assess plants for disease, pest infection, stunted growth or senescent plants. Treat or replace as necessary. Reduced plant density reduces pollutant removal and infiltration performance.
Maintain original plant densities	Quarterly or as desired for aesthetics	Maintenance Contractor	Infill planting: Between 6 and 10 plants per square metre should (depending on species) be adequate to maintain a density where the plant's roots touch each other. Planting should be evenly spaced to help prevent scouring due to a concentration of flow.

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Drainage Tasks

Maintenance action	Frequency	Responsibility	Procedure
Perforated pipe	6-Monthly & after major storm	Maintenance Contractor	Ensure that perforated pipes are not blocked to prevent filter media and plants from becoming waterlogged. A small steady clear flow of water may be observed discharging from the perforated pipe at its connection into the downstream pit some hours after rainfall. Note that smaller rainfall events after dry weather may be completely absorbed by the filter media and not result in flow. Remote camera (e.g. CCTV) inspection of pipelines for blockage and structural integrity could be useful.
High flow inlet pits, overflow pits and other stormwater junction pits	Monthly & after major storm	Maintenance Contractor	Ensure inflow areas and grates over pits are clear of litter and debris and in good and safe condition. A blocked grate would cause nuisance flooding of streets. Inspect for dislodged or damaged pit covers and ensure general structural integrity. Remove sediment from pits and entry sites etc. (likely to be an irregular occurrence in mature catchment).

Other Routine Tasks

Maintenance action	Frequency	Responsibility	Procedure
Inspection after rainfall	6-Monthly & after major storm	Maintenance Contractor	Occasionally observe raingarden or bioretention tree pit after a rainfall event to check infiltration. Identify signs of poor drainage (extended ponding on the filter media surface). If poor drainage is identified, check land use and assess whether is has altered from design capacity.

7 Conclusion

In conclusion, the stormwater management measures nominated for the proposed development including pit & pipe network, OSD tank and bioretention basins have met the stormwater quality and quantity objectives set by Midcoast Council.

The overall modelling results have demonstrated that stormwater is managed to avoid any adverse impacts to upstream & downstream properties and receiving natural water bodies.