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MAJ Consulting Pty Ltd

Stormwater Management Report

At

134 -140 Old Bathurst Road

Emu Plains, NSW 2750

For

ACO Polycrete

PO BOX 470

Emu Plains NSW 2750

Attention: Mr Sean Duff

Date: 09 September 2019

Job Ref: 20190047

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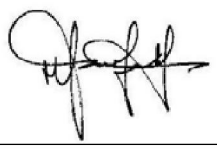
Author Signature		Approver Signature	
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Job Ref: 20190047

06 September 2019

ACO Polycrete
PO BOX 470
EMU PLAINS NSW 2750

Attention: Mr Sean Duff

Dear Sean,

Re: 133 -140 Old Bathurst Road, Emu Plains / Stormwater Management Report

1. Introduction

This report has been prepared to provide an overview of the On-Site Detention (OSD) System and Water Urban Sensitive Design (WSUD) strategy to improve water quality for the development at 134 – 140 Old Bathurst Road, Emu Plains. This report forms part of the DA submission to address the existing (bitumen and concrete) hardstand areas. In addition, a new carpark extension and additional hardstand area is being proposed as part of this DA application.

The design of OSD and WSUD has been carried in accordance with Penrith City Council design specifications which include:

- Penrith City Council's Development Control Plan 2014 Volume 1;
- ES 002 Penrith City Council's Stormwater Drainage Guidelines for Building Development;
- EH003 Penrith City Council's Water Sensitive Urban Design (WSUD);
- Penrith City Council WSUD Technical Guidelines.

In determining the size and location of the OSD and requirements for water quality improvement, the following points have been considered:

- Existing site conditions, topography and constraints;
- Consideration of overland flow path and possible discharge locations.

This report will highlight any variances of the design to Council's design specification and shall be read in conjunction with MAJCON's Stormwater Design Drawings.

2. Site Location and Flood Level

The site is located at 134 – 140 Old Bathurst Road, Emu Plains and within an industrial area. The topography of the site is flat with approximately 1% slope from West to East. There is an existing concrete open channel which runs along the eastern side of the property and eventually leads to the Nepean River. The site is affected by the mainstream flooding from the Nepean River. The flood water level for a 1% Annual Exceedance Probability (AEP) is RL 23.9m, this has been provided in the letter from Council Ref: EMC 8800129 dated 7th August, 2019.

The existing concrete and bitumen hardstand areas are located at the back of the factory building (Southwest corner of the site) and has two existing trench drains to drain surface runoff which eventually discharge into the open channel. There is an existing green area to the east of the hardstand area which could be form as a detention basin. The new carpark extension is located at the front of the factory (Northwest corner of the site).

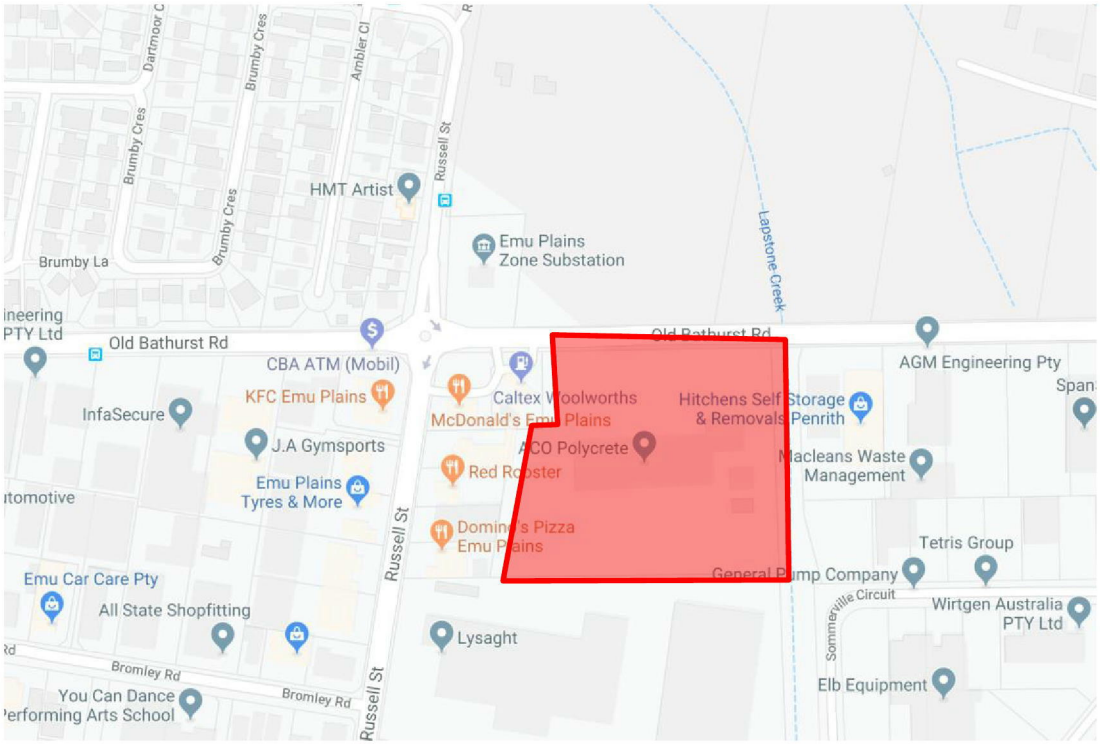

Figure 1, Locality Plan, Extract from Google Map

3. Findings

3.1. External Hardstand Areas

ACO Polycrete uses the external hardstand areas to store their stormwater products. There are three areas that are being address in the DA Application.

- Existing Concrete Hardstand Area – 5345m^2;
- Existing Bitumen Area - 287m^2;
- Proposed Concrete Hardstand Area: 1008m^2.

The total area of the external hardstand area is 6640m^2. The carpark extension will be discussed in a separation section of this report.

3.1.1. Minimum SSR and Maximum PSD

In accordance with Council's Stormwater Drainage Policy Table 7:

Table 7 PSD and SSR

Land Use	PSD (L/s/ha)	SSR (m3/ha)
Multi-Unit Housing	120	240
Residential Flat Building / Apartment / Industrial / Commercial and Others	120	280

The maximum Permissible Site Discharge (PSD) for the total hardstand area is 79L/s. The minimum Site Storage Retention (SSR) volume is 186m^3.

MAJCON acknowledge that this is a simplified method which applies for development less than 5000m^2 and will only use the minimum SSR for base comparison. DRAINS modelling adopting Australia Rainfall and Runoff (ARR) 2016 procedures has been carried out to determine the size of the OSD volume.

3.1.2. Tail Water Level and OSD Volume

In accordance with Council Stormwater Drainage Policy Section 3.1.3, "the adopted tail water for the drainage system shall be designed to be 1% AEP downstream level at the point of discharge or the top of stormwater channel, whichever greater"

The flood water level for a 1% AEP is RL 23.9m. This was provided in Council's letter Ref: EMC 8800129 dated 7th August, 2019.

MAJCON undertook DRAINS modelling with the 1%AEP Flood Level as the tail water level and determined that a 424m^3 of OSD volume which is more than two times of Council's minimum storage volume as discussed in section 3.2. An additional 15% of volume is required for above ground storage, which equals to 488m^3. The elevation difference between the water surface of the OSD (RL 24.35m) and the 1%AEP Flood Level (RL 23.9m) is very limited which restricts the outlet flow rate to maximum 46L/s. Therefore, a larger OSD volume is required. Based on MAJCON's volume analysis of the existing topography, the volume is not feasible and cannot be achieved in the retention basin (existing green area).

In MAJCON's opinion, the 1% AEP flood level (RL23.9m) will only happens towards the end of the storm or after the storm finishes when all or majority of the catchment has contributed their surface runoff. Adopting the 1% AEP Flood Level as the tail water level will overdesign the required OSD volume.

Based on measurement in Google Earth Pro, the stormwater channel is servicing approximately 118 hectares which has a time of concentration of approximately 45 minutes. Using DRAINS, the estimated maximum water level is 22.2m. This shows that the 1% AEP flood level is hugely influence by the flood level of the Nepean River. The Nepean River serves a much larger catchment and has a much longer time of concentration. Therefore, the 1%AEP flood level RL 23.9m should not be adopted as a constant tail water level in the design because this will restrict the outlet flow rate for the whole duration of a storm and is impossible.

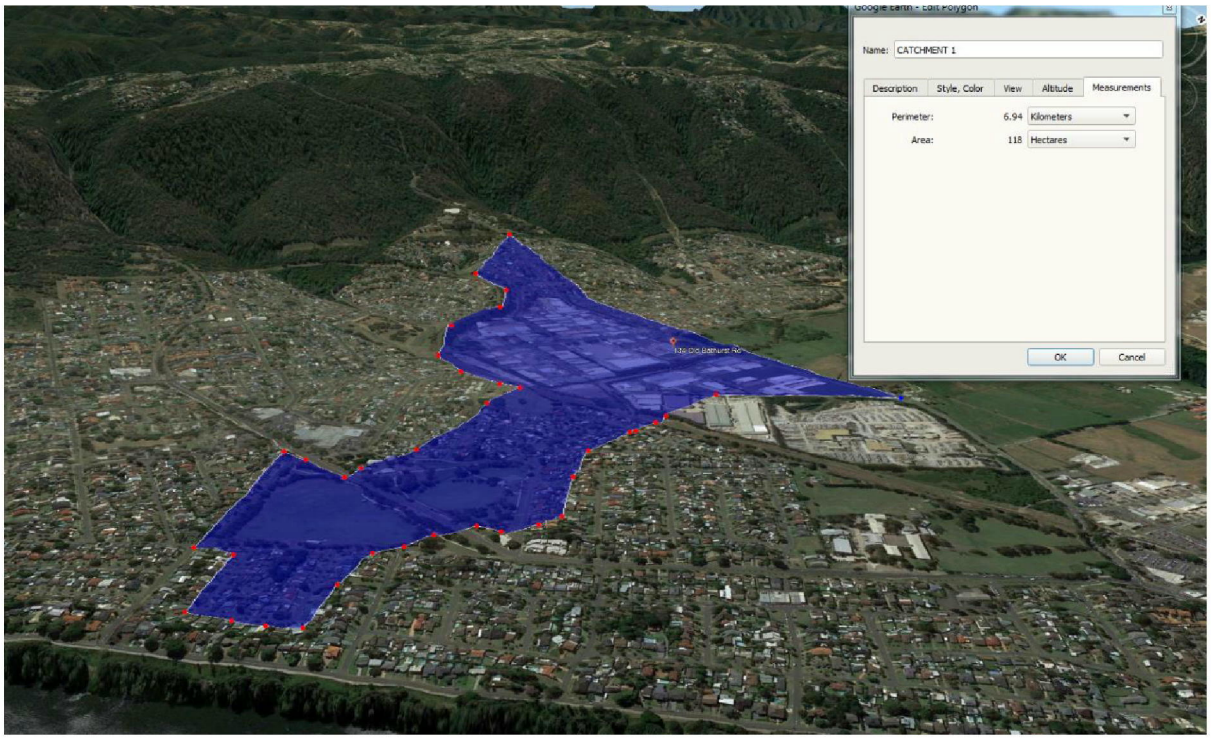

Figure 2, Perspective View of Stormwater Channel Catchment

It is important to note the MAJCON have requested the downstream stormwater channel's hydrograph or DRAINS model through the Council to model the change in downstream water level more accurately. Unfortunately, the Council has informed that the information is not available.

As an alternative approach, MAJCON conducted DRAINS model with different tail water levels. The result is presented in the following table.

Table 1- OSD Volume at different tail water level

Tail Water Level	Required OSD Volume (m^3)	+15% (For Above Ground) (m^3)	Max. Discharge Rate (L/s)
Creek Invert Level - 20.95m	313.83	361	75
Top of Bank Level – 23.31m	328.91	378	69
1%AEP Flood Level – 23.9m	424.33	488	46
Creek level change – Varies	313.83	361	75

It is recommended to adopt the top of bank level (RL 23.31m) as the tail water level, in which the OSD will require a volume of 378m^3.

3.1.3. Detention Basin

In order to achieve the required volume, it has been proposed to increase the spill level of the detention basing to RL 24.35m by constructing wall and earth mount to level RL 24.5m to allow a freeboard of 150mm, and earthwork within the basin to increase the volume. The detention basin provides a storage volume of 380m^3.

The internal building floor level is RL 25.62m, the available freeboard to water ponding surface level is 1.27m which meets the Council's freeboard requirement of 300mm. The depth of ponded water is 550mm and is within the Council's limit of 1200mm for large industrial open basins. At the concrete road access road (Southeast of the Retention Basin), there will be an approximate 350mm of ponding water during large storm events. This issue has been discussed to ACO Polycrete's Operation Manager and is deemed acceptable.

In accordance with Council stormwater drainage policy section 4.3.5 (a) *The first 10% or 2m3 of the storage volume, whichever is the greater, shall be provided underground or in an area where access is not required or the frequent ponding in minor storms will not create a nuisance.* The base of the detention basin is at RL 23.8m, it is not recommended to provide 10% of underground storage volume because the base level is below 1% AEP flood level (RL 23.9m) which means that this storage volume could be ineffective during large storm events.

At the discharge control pit, a 185mm diameter orifice is required to limit the outlet flowrate to 79L/s. A trash screen is fitted over the orifice outlet to prevent blockage of the orifice. Council's tras screen requirement in section 4.3.10 of the Stormwater Drainage Policy is 50 times the orifice area and this will be equivalent to a surface area of 9.25m^2. This surface area is not feasible in a typical junction pit. A typical trash screen size is recommended.

3.1.4. WSUD Strategy

In accordance with Council's Water Sensitive Urban Design, MAJCON undertook MUSIC modelling to determine the WSUD strategy in meeting Council Water Quality Target. The result is presented in the following table.

It is been determined that a 105m^2 of bioretention basin is required for the external hardstand areas. A report of the receiving node has been generated through Council's MUSIC Link. Please refer to Appendices.

Table 2, Bioretention Water Quality Achievement

Load Reduction	Minimum Target	Achievement
GP	90%	99.9%
TN	45%	47.4%
TP	60%	64.8%
TSS	85%	86.1%

3.2. Carpark Extension Area

ACO Polycrete is proposing a carpark extension for the existing staffs and visitors. The carpark extension is located west to the existing carpark and fronting the main entrance of the building. The area of the carpark extension is estimated to be 710m^2.

3.2.1. Minimum SSR and Maximum PSD

Due to site constraint, approximate 32m^2 of new the carpark extension will bypass the OSD system. In accordance with Council's Stormwater Drainage Policy Table 8:

Table 8 Permissible OSD discharge and Required OSD storage

Area bypassing (% of the total site)	Permissible OSD Discharge (L/s/ha)	Required OSD Storage (m3/ha)	
		Multi-Unit Housing (1)	*RFB Apartment / Industrial / Commercial and Others* (2)
0%	120	240	280
1%	113.9	249	289
2%	107.8	258	299
3%	101.7	268	310
4%	95.6	279	320
5%	89.5	290	331
6%	83.4	301	343
7%	77.3	313	358
8%	71.2	329	373
9%	65.1	344	389
10%	59.0	360	406
11%	52.9	379	429
12%	46.8	403	452
13%	40.7	427	484
14%	34.6	466	526
15%	28.6	512	572

The maximum Permissible Site Discharge (PSD) and the minimum Site Storage Retention (SSR) volume are calculated as follow:

- Total new carpark extension area = 710m^2
- Area bypassing proposed OSD system = 32m^2
- % of bypassing area = 32/710 = 4.51% (round up to 4.6%)
- For site with 4.6% of bypass area, the permissible OSD discharge rate is calculated to be 91.94 L/s/ha
- Hence permissible discharge rate = ((710-32)/10000) x 91.94 = 6.23 L/s
- For site with 4.6% of bypass area, the required OSD storage is calculated to be 326.6 m^3/ha
- Hence OSD storage required = ((710-32)/10000) x 326.6 = 22.14 m^3

3.2.2. OSD System

ACO Stormbrixx heavy duty stormwater management system is proposed to provide the required underground OSD volume. Each stormbrixx unit is 610mm deep and requires a minimum 400mm cover in grassed area.

The top water level of the detention system is 24.821m. The internal building floor level is RL 25.62m, the available freeboard is hence 0.799m which meets the Council's freeboard requirement of 300mm.

The diameter of the orifice proposed at the discharge pit is calculated using the following equation:

- $Q = CA(2gh)^{0.5}$

Where

- C = 0.61
- A = (pi x 0.061^2)/ 4 = 0.0029225 m^2
- g = 9.81 m/s^2
- h = 0.592 m
- Q = 6.08 L/s < permissible discharge = 6.23L/s

A trash screen is fitted over the orifice outlet to prevent blockage of the orifice. Council's requirement in section 4.3.10 of the Stormwater Drainage Policy is 50 times the orifice area and this will be equivalent to a surface area of 3.05m^2. This surface area is not feasible in a typical junction pit with 1m depth to invert. It is important to note that the pit depth is to be kept to the minimum to connect with downstream drainage system.

3.2.3. WSUD Strategy

In accordance with Council's Water Sensitive Urban Design, MAJCON undertook MUSIC modelling to determine the WSUD strategy in meeting Council Water Quality Target. The result is presented in the following table.

It has been determined that two SPEL Filters and one SPEL StormSack is required. A report of the receiving node has been generated through Council's MUSIC Link. Please refer to Appendices.

Table 3, Carpark extension Water Quality Achievement

Load Reduction	Minimum Target	Achievement
GP	90%	100%
TN	45%	46.7%
TP	60%	76.8%
TSS	85%	93.6%

MAJCON considered using adjacent proposed landscape areas as bioretention system. Due to limited level between surface and downstream drainage invert level. This was not a feasible solution.

SPEL's treatment system has been nominated because of their compacted size to fit in shallow junction pit. Other equivalent products may be used subject to MUSIC Modelling.

4. Operation and Maintenance Plan

4.1.1. Site Description

The site is located at 134-140 Old Bathurst Road, Emu Plains and within an industrial district of Emu Plain. The site has a typical factory arrangement which consists of factory, office, parking area, site shed and storage hardstand areas. About 50% of the site area is green or gravel area which allows surface water to penetrate the ground. The topography of the site is flat with approximately 1% slope from West to East. There is an existing concrete open channel which runs along the eastern side of the property and eventually leads to the Nepean River.

4.1.2. Site Pollutants

Since the site is located within an urbanised area and the treatment devices are mainly servicing hardstand areas, the main pollutant sources are anticipated to be gross pollutants and suspended solid from surround soil. There will also be nutrients including nitrogen and phosphorus within soil from surrounding areas.

4.1.3. Rainfall

In referencing to Bureau of Meteorology (BOM) information, the mean annual rainfall for Emu Plain is 717mm. The rainfall is relatively high between November to March and relatively low during the winter months.

4.1.4. Site Access

The main access gate is located on the northeast corner of the site. The access corridor is enough to accommodate large vehicle such as a B-Double vehicle. Therefore, accessing the site is generally not an issue for service vehicles to maintain stormwater reduction and treatment devices. There are ample parking spots available on site and access road to the bioretention basin.

4.1.5. Operation and Maintenance

The table presents the operation and maintenance information of each stormwater flow and pollutant reduction devices.

Table 4 Operation and Maintenance Table

Treatment Devices	Reponsibility	Inspection Methods (1)	Maintenance Frequency (1)	Maintenance Methods (1)	Landscape Requirement	Maintenance Cost (2)	Disposal (3)
StormBrixx - OSD	Owner / Occupant	Confirm space entry for visual inspection	Every 6 months	Confirm space entry. Tripod device setup at MH access. Water Hose to flush the system. Capture and collect at downstream MH using vacuum truck.	Not Applicable	Min. cost of Vacuum Truck + Labour ~$1000 to $1500 schedule with other tasks to save cost	Dispose waste in accordance with waste management plan (by others)
SPEL Filter	Owner / Occupant	Confirm space entry for visual inspection	Inspection and clean every 4 months Cartridge replacement every 6-8 year	Confirm space entry. Tripod device setup at MH access. Review using manufacturer checklist. Perform cleaning using vacuum truck.	Not Applicable	Min. cost of Vacuum Truck + Labour ~$1000 to $1500 schedule with other tasks to save cost	Dispose waste in accordance with waste management plan (by others)
SPEL StormSack	Owner / Occupant	Visual Inspection from ground surface into Pit	Every 3 to 4 months	Confirm Space Entry. Tripod device setup at MH access. Manual handling to remove the StormSack Filter bag	Not Applicable	Min. cost of Vacuum Truck + Labour ~$1000 to $1200 schedule with other tasks to save cost	Dispose waste in accordance with waste management plan (by others)
Bioretention / Detention Basin / Swale	Owner / Occupant	Visual Inspection	3 to 12 months	Remove litter and plant debris every 1 to 3 months. Remove and replace dead and diseased plans every 6 to 12 months Repair erosion damages as required	Remove weed and vegetation debris every 1 to 3 months	Plant Species replacement cost + Labour ~ $500 per day Varies Cost	Dispose waste in accordance with waste management plan (by others)
Orifice – Trash screen	Owner / Occupant	Visual Inspection from ground surface into pit	Every 3 to 4 months	Confirm space entry. Tripod device setup at MH access. Perform cleaning using vacuum truck.	Not Applicable	Min. cost of Vacuum Truck + Labour ~$1000 to $1200 schedule with other tasks to save cost	Dispose waste in accordance with waste management plan (by others)

4.1.5.1. Notes

(1) During periods of increased rainfall, it may be necessary to increase the period between inspections of the stormwater system. Treatment devices including Stormbrixx, SPEL Storm Filters and StormSack shall be inspected and maintained in accordance to manufacturer specification. This Operation and Maintenance plan is provided for a high-level guide only.

(2) Maintenance Cost shown is indicative only, it is subject to market demand and CPI increase. It is recommended to obtain quotation from various contractors through Client's procurement procedure and secure on-going maintenance contract to save maintenance cost and ensure contractor availability.

(3) It is recommended that a waste management plan to be prepared by a qualified person to address the classification and disposal of waste.

5. Conclusions

This report has been prepared to provide an overview of the On-Site Detention (OSD) System and Water Urban Sensitive Design (WSUD) strategy to improve water quality for the development at 134 – 140 Old Bathurst Road, Emu Plains. This report forms part of the DA submission to address the existing (bitumen and concrete) hardstand areas. In addition, a new carpark extension and additional hardstand area is being proposed as part of this DA application.

The total area of the external hardstand area is 6640m^2, whilst carpark extension area is 706m^2. The OSD volumes provided for the development are 380m^3 with outlet discharge rate at maximum 79 L/s and 23.38m^3 with outlet discharge rate at maximum 6.08 L/s respectively.

In order to meet Council's water quality target, a 105m^2 bioretention basin is needed for the external hardstand areas. Two SPEL Filters and one Storm Sack is required for the carpark extension area.

Yours sincerely,

MAJ Consulting Pty Ltd

Insert Signature here.

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Civil Engineer

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Director