SMART STRUCTURES AUSTRALIA
Consulting Engineers
ABN 91 621 842 466

Stormwater Quality Report for 170 Derby St, Penrith NSW

For :Montessori Academy

Reference: 200325.R1

13/05/2021

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DOCUMENT HISTORY

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DISCLAIMER

1. Content of this report have been based on available information as noted in the report and its appendices, thus this report should be read in conjunction with the referenced reports.
2. The limitations present in any of the referenced reports will be inherent in this report.
3. This report and associated documents have been prepared for the proposed child care development at 170 Derby St, Penrith NSW. No responsibility will be accepted for the use of any part of this report in any other context or for any other purposes.
4. This report shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.
5. Even though every effort has been made to accurately model the item(s) in question, Smart Structures Australia cannot guarantee that model is fully accurate due to lack of data.
6. The results are subject to the scope, assumptions and limitations as set out in this report and the information that has been disclosed by the client.
7. The authors best professional opinion is represented in the conclusions drawn and is based on his experience and on previous results from other investigations on similar materials. The conclusions and any recommendations made are based on the condition of the item(s) in question as portrayed in the data provided by the client.

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1. Introduction

1.1 Purpose of Document

Smart Structures Australia has been engaged by Montessori Academy to provide civil engineering consultancy services for the proposed child care development at 170 Derby St, Penrith NSW. This report has been prepared to incorporate the requirements of Council's WSUD Policy which relates to water quality and water conservation measures for the proposed development.

This report contains referenced information and standards to address stormwater quality treatment proposed for the development.

1.2 References and Input

The following reports, guidelines and information were used in the stormwater quality analysis and in the compilation of the report.

- Penrith DCP 2014 C3 Water Management
- Penrith Council Stormwater Drainage Policy
- Penrith WSUD Technical Guidelines Version 3
- Architectural Drawing Package by Cullen Feng Architects –Job No. 2023
- Managing Urban Stormwater: Soils and Construction, 4th Edition, Landcom

1.3 Proposed Development

The proposed development is a child care facility consisting of one basement car parking level, two levels of child care facility and a roof. The site occupies 1300.89m^2. The locality plan of the development is shown below in figure 1.

Figure 1: Project site: 10-12 Hargrave Street Kingswood NSW

2. Site Characteristics

2.1 Existing and proposed site's Point of Discharges

The site's pre-development usage was for a commercial purpose. In its existing state, the site comprises of a one-storey office building. The sites are covered by existing building , associated driveway and landscaping areas. The subject site falls generally towards Derby Street with the lowest point at the north-west corner of the lot. The existing building discharges stormwater drainage run-offs to the Street's drainage network's and to back of the kerb.

In post development scenario is it proposed to discharge site's treated stormwater drainage the Street's drainage network's and to back of the kerb identical to pre-development scenario.

3. Stormwater Quality Assessment

3.1 Erosion and Sediment Control (during construction)

To maintain the water quality during the construction stage, erosion and sediment control measure are to be put into place. These control measures are in accordance with Landcom's guidelines – Managing Urban Stormwater Runoff: Soils and Construction and the City of Penrith's Guidelines.

The proposed measures include:

- Sediment fences around stockpiles and construction zones where soil is exposed
- Sediment protection devices on existing and proposed inlet pits (sand bags)
- Pump and stilling pond to remove stormwater and ground water during excavation

3.2 Water Sensitive Urban Design (WSUD)

A stormwater quality assessment is to be undertaken for the development using the MUSIC software. The assessment is to determine the quality of stormwater discharging from the site in the post-development scenario. These discharges are to meet the objectives outlined in Section 3.2.1 via a treatment train approach as described in section 3.2.2.

3.2.1 Water Quality Reduction Targets

All stormwater runoff generated from the development is to pass through a Stormwater Quality Improvement Device (SQID). The SQID's are to meet the water quality reduction targets as outlined in the Penrith WSUD Technical Guidelines and summarised in the table below:

Pollutant	Target (% Reduction)
Gross Pollutants	90
Total Suspended Solids (TSS)	85
Total Phosphorous (TP)	60
Total Nitrogen (TN)	45

3.2.2 Treatment Train

The stormwater quality reduction targets are to be achieved via a treatment train approach. A water quality model for the site was created using MUSIC software (version 6.3). This treatment train will incorporate the followings:

- 20KL rainwater tank to collect roof stormwater drainage to meet percentage of non-potable demand including toilets (on ground floor level only) and landscaping areas.

- Pit's inlet filter baskets: In-pit proprietary devices such as Ocean Protect's Ocean Guards are an easily maintained inlet pit insert which is effective at removing litter, debris and other pollutants generated from runoffs generated from driveway areas.

- Proprietary Device: A proprietary SQID is to be utilised to treat the catchment discharge. A system such as the Ocean Protect's Stormfilter Cartridges are to be installed which are

effective removing TSS, TP, and TN to achieve reduction targets in accordance with Council's requirements. Based on the MUSIC modelling result, 6 numbers of the 460 Psorb stormfilter Cartridges are required to treat stormwater runoffs.

3.2.3 Water Quality Treatment Train Performance

The MUSIC model was used to evaluate the performance of the water quality treatment devices for a range of rainfall conditions. The results for the proposed treatment arrangement are summarised in figure 2.

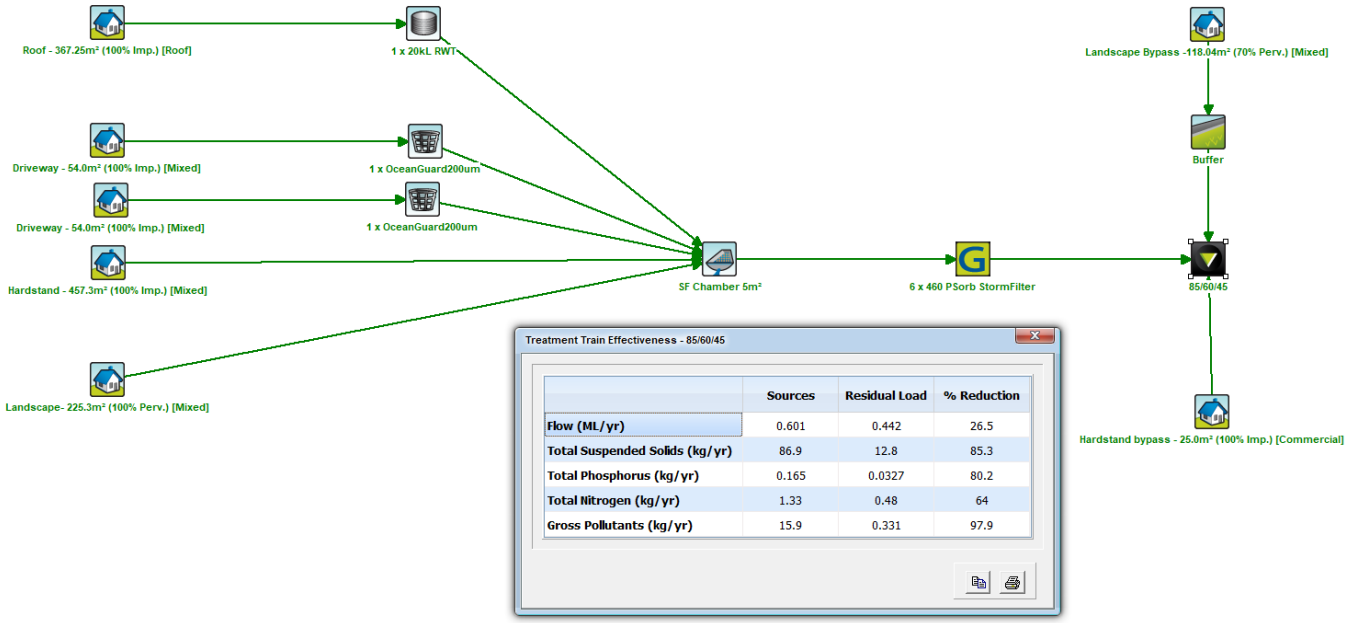

Figure 2: MUSIC model water quality treatment train performance.

As can be seen from figure 2 and the MUSIC link report (Appendix 5.1), all targets have been met by the proposed stormwater quality measures.

3.2.4 Water conservation requirements

Based on section 3.1 of the Penrith Council's WSUD Policy, water conservation seeks to reduce the demand for potable water. In this regard, all buildings not covered by the State Environmental Planning Policy, BASIX (the proposed Serviced Apartment development) are to install rainwater tanks to meet 80% of non-potable demand including outdoor use, toilets and laundry.

A feasibility study was undertaken using MUSIC software to demonstrate the percentage of reuse demand met with implementation of rainwater tank versus various sizes of rainwater tank.

Figure 3 below shows that with increase of RWT sizes, "percentage of reuse demand met" increases inconsiderably. This is due to the fact that roof areas, as the source of the rainwater is not large enough to meet the none potable water demands to a reasonable percentage (i.e. 80%).

In order to fulfill water conversation's strategy to some extent, it was decided to supply none potable water demands to 5 toilets plus all landscaping areas (367m^2) on Ground Floor level through implementation of a 20KL rainwater tank.

An efficiency curve was produced based a MUSIC model's results to demonstrate the percentage of reuse demand met with implementation of rainwater tank versus various sizes of rainwater tank for abovementioned demands and results are shown in figure 4 below.

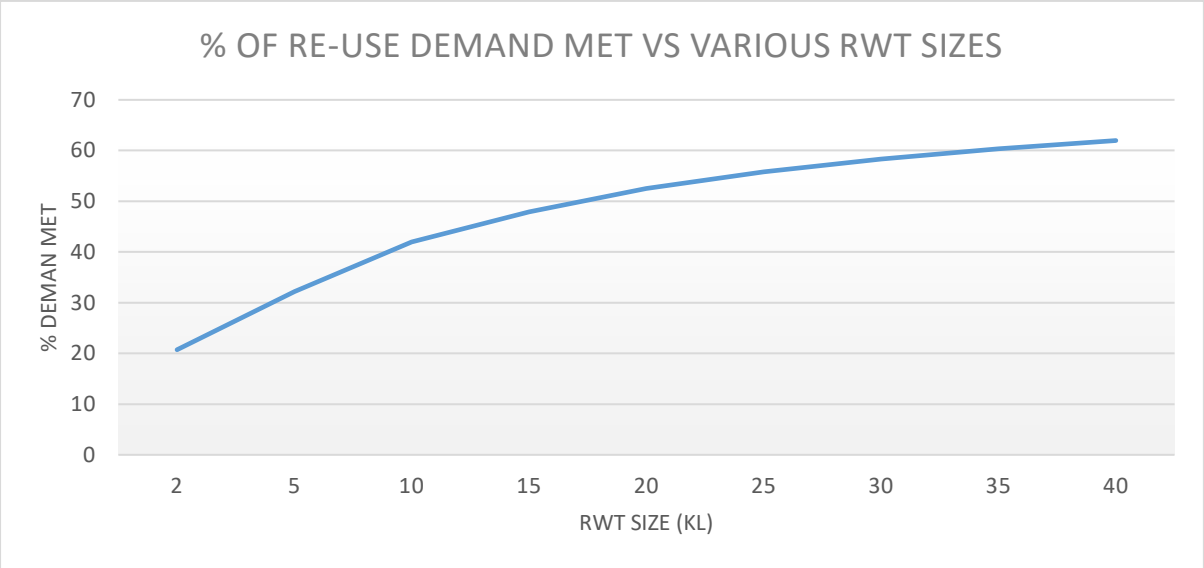

Figure 3: Efficiency Curve based on none potable demand use for 5 toilets and 367m^2 of landscaping area on Ground Floor level

It has been shown that with implementation of a 20KL rainwater tank 52% of none potable water demand can be met for proposed demand. 20KL rainwater tank is considered an optimal size where the efficiency curve plateaus before reaching 80%.

4. Conclusion

Based on MUSIC modelling results documented in this report it was demonstrated that the requirements of Water Sensitive Urban Design (WSUD) as set out in PCCDCP 2014 can be reasonably incorporated into the design and operation of the proposed Child Care Development at 170 Derby Street Penrith NSW.

The proposed methods in the stormwater quality management of the development will continue to operate effectively and efficiently through the implementation and use of a monitoring and maintenance schedule provided by the manufactures ensuring the integrity of the system is maintained.

5. Appendix

5.1 MUSIC model Report

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MUSIC-*link* Report

Project Details		Company Details	
Project:	Proposed Child Care - 170 Derby St, Penrith	**Company:**	Smart Structures Australia
Report Export Date:	13/05/2021	**Contact:**	Kamyar Eivazzadeh
Catchment Name:	170 Derby St	**Address:**	Suite 2.04, Building 3, 35-41 Waterloo Rd, Macquarie Park NSW 2113
Catchment Area:	0.131ha	[redacted]	
Impervious Area*:	73.28%		
Rainfall Station:	67113 PENRITH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	691mm		
Evapotranspiration:	1158mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.33		
Study Area:	Penrith		
Scenario:	Penrith Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: 85/60/45	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	26.5%	Rain Water Tank Node	1	Urban Source Node	7
TSS	85.3%	Sedimentation Basin Node	1		
TP	80.2%	Buffer Node	1		
TN	64%	GPT Node	2		
GP	97.9%	Generic Node	1		

Comments

The 'SF Chamber' node has been modified to represent the below ground filtration chamber. Default 'K' values have been manuallyadjusted to 1 in order to eliminate any performance from the actual tank, which would alreadybe accounted for in the Filter Generic Node Target Elements/Transfer Functions. This must be adjusted for anyproprietary filter using this method of modelling. Not doing this would represent a duplication of the chamber attenuation effect. (For anyquestions, please Contact Ocean Protect on 1300 354 722)

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x OceanGuard200um	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	1 x OceanGuard200um	Hi-flow bypass rate (cum/sec)	None	99	0.02
Receiving	85/60/45	% Load Reduction	None	None	26.5
Receiving	85/60/45	GP % Load Reduction	90	None	97.9
Receiving	85/60/45	TN % Load Reduction	45	None	64
Receiving	85/60/45	TP % Load Reduction	60	None	80.2
Receiving	85/60/45	TSS % Load Reduction	85	None	85.3
Sedimentation	SF Chamber 5m^2	High Flow Bypass Out (ML/yr)	None	None	0
Urban	Driveway - 54.0m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.007
Urban	Driveway - 54.0m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.004
Urban	Driveway - 54.0m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Driveway - 54.0m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Driveway - 54.0m^2 (100% Imp.)	Total Area (ha)	None	None	0.007
Urban	Driveway - 54.0m^2 (100% Imp.)	Total Area (ha)	None	None	0.004
Urban	Hardstand - 457.3m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.046
Urban	Hardstand - 457.3m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Hardstand - 457.3m^2 (100% Imp.)	Total Area (ha)	None	None	0.046
Urban	Hardstand bypass - 25.0m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.002
Urban	Hardstand bypass - 25.0m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Hardstand bypass - 25.0m^2 (100% Imp.)	Total Area (ha)	None	None	0.002
Urban	Landscape- 225.3m^2 (100% Perv.)	Area Impervious (ha)	None	None	0
Urban	Landscape- 225.3m^2 (100% Perv.)	Area Pervious (ha)	None	None	0.023
Urban	Landscape- 225.3m^2 (100% Perv.)	Total Area (ha)	None	None	0.023
Urban	Landscape Bypass -118.04m^2 (70% Perv.)	Area Impervious (ha)	None	None	0
Urban	Landscape Bypass -118.04m^2 (70% Perv.)	Area Pervious (ha)	None	None	0.012
Urban	Landscape Bypass -118.04m^2 (70% Perv.)	Total Area (ha)	None	None	0.012
Urban	Roof - 367.25m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.037
Urban	Roof - 367.25m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Roof - 367.25m^2 (100% Imp.)	Total Area (ha)	None	None	0.037

Only certain parameters are reported when they pass validation

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	1 x 20kL RWT	% Reuse Demand Met	80	None	53.24
Sedimentation	SF Chamber 5m^3	Notional Detention Time (hrs)	8	12	0.169
Sedimentation	SF Chamber 5m^3	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber 5m^3	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber 5m^3	Total Suspended Solids - k (m/yr)	8000	8000	1

Only certain parameters are reported when they pass validation