van der meer

STORMWATER MANAGEMENT REPORT

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Site 2A and 2B, Australia Avenue

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1 Introduction

van der Meer Consulting has been commissioned by Ecove to prepare a Stormwater Management Report for the proposed commercial development at Site 2A and 2B, Sydney Olympic Park. This report will be lodged to Sydney Olympic Park Authrority (SOPA) for the Development Application for this development. This report contains the stormwater management procedures, modelling and result.

The development consists of 2 towers with a basement parking, ground floor retails tenancies, hotel, landscaping, and public domain works. The subject site area is approximately 7,711 m^2 and bounded by Murray Rose Avenue, Australia Avenue and Parkview Drive. Currently, there is an existing on-grade carpark grading to the north east of the subject site. The site is located in the East area of Sydney Olympic Park Precinct as shown in Figure 1.

Figure 1 Subject site aerial view (Nearmap, 2019)

2 Design Control and Guidelines

2.1 SOPA Stormwater Management and WSUD Policy (2016)

SOPA Stormwater Management and Water Sensitive Urban Design (WSUD) Policy is applies to all development design and construction within Sydney Olympic Park area. The policy was followed for the stormwater management strategy in the subject site.

2.2 SOPA Stormwater Management Technical Manual (2017)

SOPA Stormwater Management Technical Manual outlines the design and construction for new stormwater systems for new development and infrastructure within the Sydney Olympic Park Precinct.

2.3 SOPA Infrastructure Engineering and Construction Manual (2018)

SOPA Infrastructure Engineering and Construction Manual outlines the engineering specification such as stormwater drainage requirement within the Sydney Olympic Park Precinct.

2.4 Landcom's Managing Urban Stormwater – Soils and Construction (2004)

Landcom's Managing Urban Stormwater – Soils and Construction provide a mitigation guideline for the land disturbance activities on soils, landform, and receiving water by focussing on erosion and sediment control.

2.5 Australian Rainfall and Runoff (2016)

Engineers Australia (EA) published the Australian Rainfall and Runoff – A Guide to Flood Estimation which provided the information and approach for hydrology and stormwater management. It contains information to estimate the stormwater runoff, design storm event, and design method for the urban stormwater drainage systems.

3 Erosion and Sedimentation Control

3.1 Introduction

During construction, water quality control is achieved by deposition and trapping of silts and clays which often have nutrients such as phosphorus and nitrogen attached to their surfaces. Silt fences will be erected prior to construction to control sediment runoff. This will reduce and isolate sediments and particulate matter.

An Erosion and Sediment Control Plan has been provided in accordance with Landcom's "Managing Urban Stormwater – Soils and Construction (2004)". This will ensure that a significant portion of sediments and attached nutrients can be contained on site during construction.

A copy of the preliminary Soil & Water Management Plan included in Appendix A, details:

- The location and extent of proposed sediment & erosion control measures
- The location of the sediment control fence
- The locations and control measures for temporary stockpiles.
- The locations and control measures for vehicle wash down areas.

3.2 Sedimentation Basin

The subject site cleared area is assumed to be the total area or 7,711 m^2 which is greater than 2500m^2. Therefore, a Soil and Water Management Plan and sediment basin assessment are required. SOPA Stormwater Management and WSUD Policy specify the requirement for the sedimentation basin design. The sedimentation basin is to be design as follows:

- *According to the NSW Blue Book (Section 6.3.4 and Appendix E). The calculation of the sedimentation basin size must be submitter with the Development Application*
- *Type D soils (unless otherwise demonstrated by an analysis of the site soils by a qualified geotechnical consultant and which must be submitted with the development application)*
- *For all events up to the peak flow rate from the 1 in 10-year Ari event for the site for the 5-day rainfall event*
- *A gypsum flocculent is to be added to the sediment basin in accordance with Appendix E of the Blue Book (note that Alum is not the be used as a flocculent at Sydney Olympic Park)*

However, if the soil loss from the total area of land disturbance is less than 150 m^3/year, sediment basin is not required within the development. Based on calculation, the the soil loss of the subject site is 72 m^3/year. As a result, **sedimentation basin is not required** within the subject site development. The calculation of the sedimentation basin is shown in Appendix B.

4 Stormwater Quantity Management

4.1 Stormwater Drainage System Requirements

According to Sydney Olympic Park Authority (SOPA) Policy – Stormwater Management and Water Sensitive Urban Design, the drainage system requirement are as follows:

- *All internal piped drainage systems are to be designed to cater for the 1 in 20-year ARI design event and is to discharge to SOPA's drainage system*
- *All surface runoff in the 1 in 100-year ARI event, including any external discharge onto the site, must have a safe passage through the site along an internal pathway, public domain or road system*
- *Depth x velocity for all overland flow paths must be limited to be less than* $0.4m^2/s$

4.2 On-Site Detention (OSD) Tank

On Site Detention is to be provided to attenuate peak flows from the development in accordance with Sydney Olympic Park Authority Policy – Stormwater Management and Water Sensitive Urban Design, the OSD requirement are as follows:

- *1 in 1-year ARI event post development peak discharge rate is equivalent to the pre development (un-developed catchment) 1 in 1-year ARI event*
- *1 in 100-year ARI event post development peak discharge rate is equivalent to the pre development (un-developed catchment) 1 in 100-year ARI event*

Un-developed catchment is assumed to be 100% pervious surface. OSD tank will be provided for this development, details refer to Appendix A.

4.3 Water Quantity Modelling

The OSD for the proposed development has been calculated using DRAINS to limit post-development runoff to the pre-development runoff. DRAINS is a computer modelling program for hydraulic models and commonly used in Australia. DRAIN is capable to model the runoff routing process, pit and pipe hydraulic, and detention basin.

4.3.1 DRAINS Catchment Area

All catchment area in the subject site has been considered in the DRAINS analysis to meet the pre-post peak discharge requirement. Catchment breakdown are presented in Table below and also shown in Appendix C.

Table 1 DRAINS catchment areas

Condition	Paved Area (m^2)	Supplementary Area (m^2)	Grassed Area (m^2)	Total Area (m^2)
Un-developed	0	0	7,711	7,711
Post development	7,292*	0	419	7,711

**5,056m² catchment area flows to OSD Tank while 2,236m² catchment bypass OSD*

In order to calculate the Permissible Site Discharge (PSD), it is assumed that the existing site is 100% pervious (un-developed). Then, the proposed drainage system was modelled in DRAINS incorporating the total catchment area of the subject site. By keeping the area consistent, the pre and post peak discharge can be compared.

4.3.2 DRAINS Parameters

Following are the input parameters that were used in the DRAINS analysis:

<u>Hydrological model</u>

- Paved (impervious) area depression storage = 1 mm
- Supplementary area depression storage = 1 mm
- Grass (pervious) area depression storage = 5 mm

<u>Rainfall Data and Temporal Pattern</u>

Rainfall data and Temporal Pattern form AR&R Data Hub and Bureau of Meteorology (BoM) has been adopted for the DRAINS analysis.

<u>Tailwater Level</u>

The proposed drainage system will discharge into the existing drainage network in Murray Rose Avenue. Therefore, based on SOPA Stormwater Management Technical Manual, the inlet pipe obvert in the downstream pit can be adopted as the tailwater level.

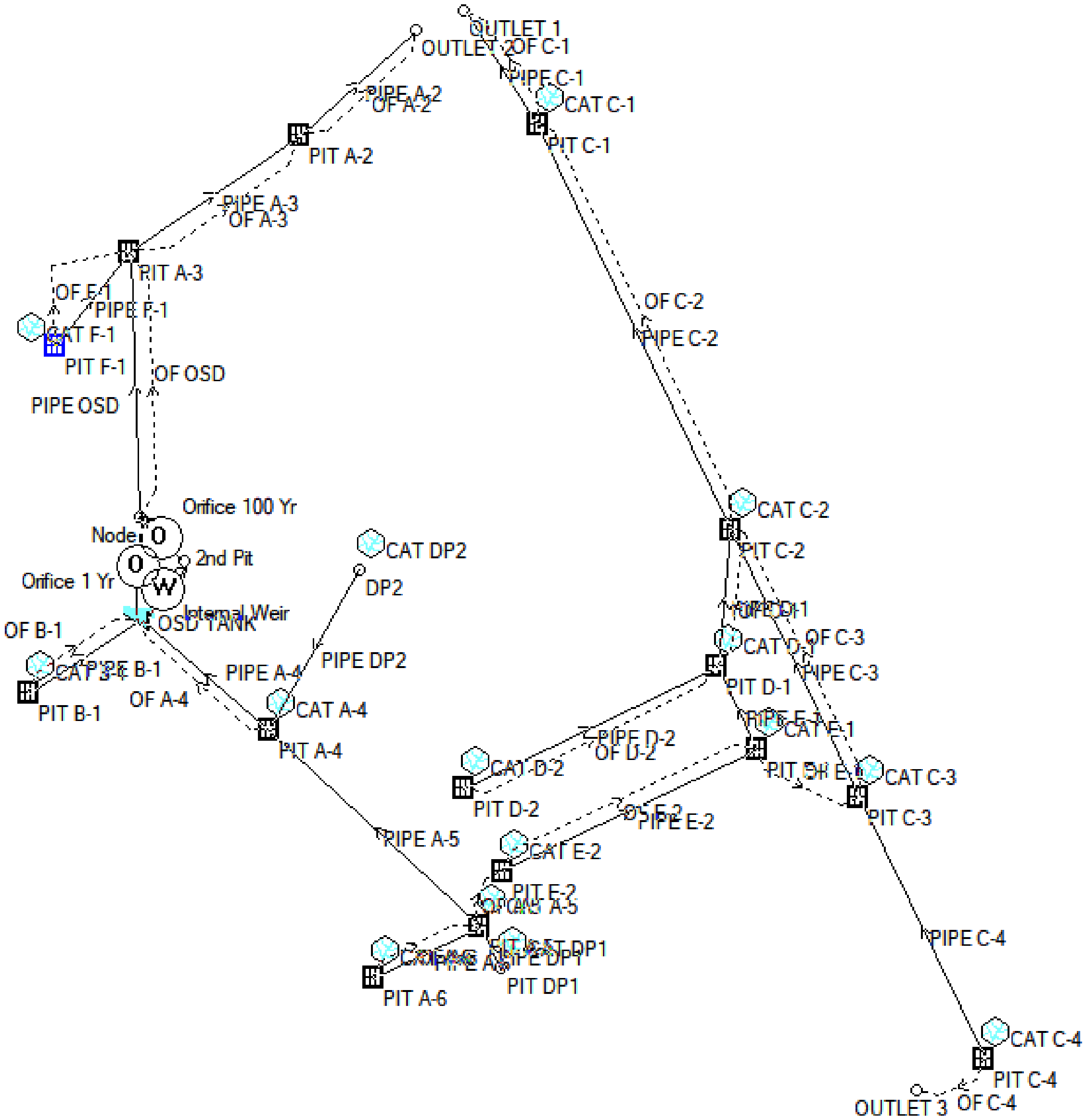

Figure 2 DRAINS model

4.3.3 DRAINS Results

80 mm of orifice plate diameter was used in the OSD tank. Following are the summary of the DRAINS analysis:

Table 2 DRAINS pre-post comparison

ARI Event	Pre Development Site Discharge (Undeveloped) (m^3/s)	Post Development Peak Discharge with OSD Tank (m^3/s)	OSD Storage Volume (Required) (m^3)	OSD Storage Volume (Provided) (m^3)
1 year	0.062	0.060	117.6	120.5
100 year	0.314	0.194	179	184.5

Results indicate that during the minor and major storm, the proposed stormwater drainage system and OSD tank satisfy with SOPA requirements. It should be noted that the tank storage volume indicates the volume of stormwater detained inside the OSD tank, not the total volume of the tank.

5 Stormwater Quality Management

5.1 Stormwater Quality Requirements

According to Sydney Olympic Park Authority (SOPA) Policy – Stormwater Management and Water Sensitive Urban Design, the stormwater quality requirements are as follows:

- *Development within a Sydney Olympic Park non-stormwater harvesting catchment (shaded red in Map 1) must strive the maximum extent practicable, to meet the following water quality targets:*
  - *90% reduction in the mean annual load of Total Suspended Solids (TSS)*
  - *85% reduction in the mean annual load of Total Phosphorus (TP)*
  - *65% reduction in the mean annual load of Total Nitrogen (TN)*
  - *95% reduction in the mean annual load of gross pollutants*

5.2 Proposed Water Quality Treatment System

5.2.1 OceanGuard™

OceanGuard™ is one of the stormwater treatment device design to capture pollutant the run into the stormwater drains. It can be installed in the new or existing pits. It is effective to remove gross pollutant, total suspended solids, and attached pollutant. 4 OceanGuard™ are to be provided in the nominated pit inlets.

5.2.2 StormFilter™

StormFilter™ is to be provided to be used as the primary stormwater treatment for the subject site. 24 stormFilter™ are to be placed inside the proposed OSD tank. StormFilter™ are effective to reduce a high level of stormwater pollutant including total suspended solids, total phosphorus, and total nitrogen.

5.3 Water Quality Modelling

MUSIC was used to analyse the performance of the stormwater quality treatment devices.

5.3.1 MUSIC Catchment Area

In the MUSIC analysis, it is assumed that catchment area that flows into road drainage is not included in the analysis. This is necessary to create a separate drainage system between private developer and SOPA. It is assumed that the excluded catchment area will be treated by SOPA's existing WSUD infrastructure.

Table 3 MUSIC catchment area

Node	Total Area (m^2)	Impervious (%)	MUSIC Source Node
Mixed Use	1,310	100	Mixed
Mixed Use to road drainage*	989	100	Mixed
Landscape (bypass)	419	0	Mixed
Road*	1,247	100	Sealed Road
Roof	3,746	100	Roof

*excluded from the MUSIC analysis

5.3.2 MUSIC Parameters

Rainfall Data

6 minutes pluviography from Sydney Observatory Station was used in the MUSIC Analysis. The period from 1975 to 1985 was selected for the modelling with the continuous 6 minutes rainfall data input.

Average Potential Evapo-Transpiration Data

The potential evapotranspiration value adopted in the MUSIC analysis are as follows:

Table 4 Average potential evapo-transpiration values (Source: Climatic Atlas of Australia)

Month	Areal Potential Evapotranspiration (mm/month)
January	180
February	135
March	128
April	85
May	58
June	43
July	43
August	58
September	88

October	127
November	152
December	163

Pollutant Concentration Parameters

The pollutant concentration parameters in the MUSIC source nodes are shown on Table 5

Table 5 MUSIC pollutant source node (Source: BMT WBM, 2015)

Land use		Log10 TSS (mg/L)		Log10 TP (mg/L)		Log10 TN (mg/L)	
		Baseflow	Stormflow	Baseflow	Stormflow	Baseflow	Stormflow
Mixed	Mean	1.20	2.15	-0.85	-0.6	0.11	0.30
	Std Dev.	0.17	0.32	0.19	0.25	0.12	0.19
Roof	Mean	N/A	1.30	N/A	-0.89	N/A	0.30
	Std Dev.	N/A	0.32	N/A	0.25	N/A	0.19

Stormwater Treatment Parameters

Various stormwater treatment devices are proposed in the subject site. Table 6 shows the stormwater pollutant removal efficiency in the proposed devices.

Table 6 Stormwater treatment nodes parameters

Parameters		Adopted Values
StormFilter™		
	Concentration based capture efficiency	
	TSS input/output value	1000/66
	TP input/output value	10/1.39
	TN input/output value	100/44.1
	GP input/output value	14.9393/0
OceanGuard™		
	Concentration based capture	

efficiency	
TSS input/output value	121/30
TP input/output value	10/7
TN input/output value	50/39.5
GP input/output value	14.7808/0

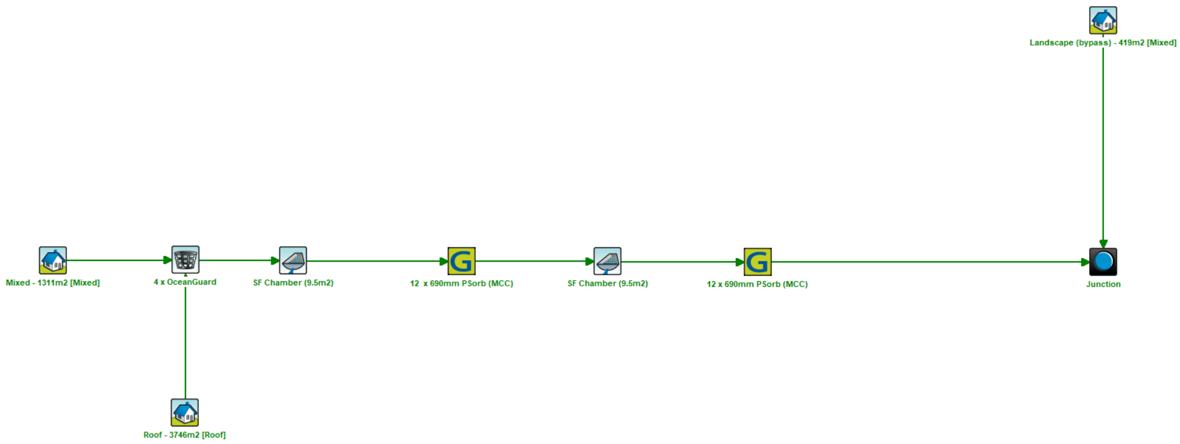

Figure 3 MUSIC model

5.3.3 MUSIC Results

The result of the MUSIC analysis is shown on Table 7. The values summarise the stormwater pollutant reduction for the entire treatment train.

Table 7 Stormwater pollutant reduction results

Pollutant	**Site 2A and 2B Proposal**			**Pollutant Reduction Target**
	Source Load (kg/yr)	Residual Load (kg/yr)	% Reduction	% Reduction
TSS	374	30.6	91.8	90%
TP	1.05	0.145	86.2	85%
TN	12	3.27	72.8	65%
Gross Pollutant	133	0	100	95%

MUSIC analysis result indicated the proposed stormwater treatment device is able to satisfy with SOPA's stormwater quality reduction objectives for TSS, TP, TN, and gross pollutant.

5.4 Monitoring and Maintenance

Monitoring and maintenance are required to make sure the stormwater treatment devices work properly on the daily basis. Table 8 shows the monitoring and maintenance requirements for subject site stormwater systems

Table 8 Stormwater devices monitoring and maintenance schedules

Stormwater Devices	Monitoring Schedule	Maintenance Schedule
OSD Tank	6 months	12 months
OceanGuard™	As per manufacturer specification	As per manufacturer specification
StormFilter™	As per manufacturer specification	As per manufacturer specification

6 Recommendations

The proposed development of the site could potentially lead to significant changes in water quantity and quality if the Water Sensitive Urban Design approach is not adopted as part of the development strategy.

The key strategies to be adopted for this development include the following:

1. A pit and pipe network to collect minor storm runoff from surface areas which will minimise nuisance flooding
2. Overland flow paths to carry major storms through and around the site without causing damage to property from flooding;
3. OceanGuard™ at nominated inlet pits will form part of the water quality treatment train, removing pollutants and nutrients that are detrimental to downstream waterways;
4. An on-site stormwater detention tank to maintain existing peak flows will be constructed. The tank will be fitted with 24 x 690 StormFilter™ to treat the water prior to it leaving the site.

The results from the investigations and modelling for this project, which have been summarised in this report, indicate that the development with the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

Appendix A – Civil Plan

Appendix B – Sedimentation Basin Calculation

Appendix C – DRAINS Catchment Plan

Appendix D – MUSIC Catchment Plan