St. George Illawarra Dragons Community & High-Performance Centre

St George Illawarra Dragons - Stormwater Management Plan

Populous

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Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008
PO Box 23061
Docklands VIC 8012
Australia

T +61 3 9975 3000
F +61 3 9975 3444
E melbourne@aurecongroup.com
W aurecongroup.com

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Author signature		Approver signature	
Name	Gervaise Christie	Name	Edward Sell
Title	Associate	Title	Technical Director

Contents

1 EXECUTIVE SUMMARY

Purpose

The purpose of this report is to outline the stormwater management strategy for St George Illawarra Dragons High Performance & Community Centre and to detail how stormwater quality and quantity control will meet the obligations of the following:

- City of Wollongong Development Control Plans (DCP) 2009
- City of Wollongong Local Environment Plan (LEP) 2009

The overarching water quality and quantity objectives and outcomes of the project are shown in Table 1-1 Stormwater Quantity and Quality Results

Table 1-1 Stormwater Quantity and Quality Results

	Objective	Result
Stormwater Quantity	The development will not adversely impact the adjacent land holders including the adjacent public road. The development will not make the existing culverts condition worse.	■ Additional Storage of 1260kL has been added to not make conditions worse. ■ The stormwater quantity target has been achieved on this project.
Stormwater Quality	■ Pre-Construction and Construction phase, water runoff will be managed in accordance with 'Managing Urban Stormwater: Soils and construction', commonly referred to as the 'blue book'. ■ Post construction the development will achieve NoBE (Neutral or Beneficial Effect) for permanent stormwater quality.	■ MUSIC model shows NoBE is met using bioretention, channels and rainwater tanks.

3 INTRODUCTION

3.1 Purpose

The purpose of this report is to present the stormwater strategy for the St George Illawarra Dragons High Performance & Community Centre, detailing how best practice stormwater quantity and quality has been approached and implemented in design.

The report includes:

- An assessment of the existing site drainage
- An assessment of the proposed development unmitigated
- Assessment of Mitigation treatment to achieve Development Control Plan requirements for City of Wollongong.

3.2 Limitations

This report is based on the following information. This report is reliant on the following information:

- City of Wollongong Development Control Plans (DCP) 2009.
- City of Wollongong Local Environment Plan (LEP) 2009.
- Detailed Feature Survey
- ARR Data Hub extracted on 19th July 2023.

3.3 Definitions

Gross Pollutants (GP)	Litter and vegetation with particles size > 5mm
Sediments (course)	Particles with a size > 0.125 mm
Total Suspended Solids (TSS)	Sediment with a particle size < 1mm
AEP	Average Exceedance Probability of storm
GPT	Gross pollutant trap
WSUD	Water sensitive urban design
Primary treatment	Removal of gross pollutants, rubbish and litter
Secondary treatment	Removal of fine sediment and hydrocarbons
Tertiary Treatment	Removal of dissolved components (Nitrogen and Phosphorus)
LGA	Local Government Authority / Municipal Authority
MUSIC Conceptualisation	Model for Urban Stormwater Improvement ***MUSIC is applied across Australia by government and private entities for the conceptual design and assessment of stormwater runoff treatment designs.***

5 SITE CONDITIONS

5.1 Climate

The mean annual rainfall for is currently 1100mnm.

AR&R data hub has identified the client change factor of RCP8.8 is 16.3% to year 2090. All modelling will include this allowance.

5.2 Existing Site

The proposed site for the St George Illawarra Dragons High Performance & Community Centre with the following site characteristics in Table 5-1.

Table 5-1 Project Information

Characteristics	Description
Location	University of Wollongong (UoW) Innovation Campus
Address	7 – 9 Squires Way, Fairy Meadow
Local Government Area	Wollongong City Council
Relevant Planning Framework	Wollongong Development Control Plan 2009 Wollongong Local Environment Plan 2009
Zoning	SP1- Special Activities
Site Area	6.3 Ha
Building GFA (Gross Floor Area)	39,500 m^2

The existing site has three legal points of discharge across Squires way as shown in Figure 5-1.

Figure 5-1 Existing Connection Point

The site varies between RL 4.2 and RL 2.1 falling towards Squires Way.

5.3 Existing Contributing Catchment

The existing Contributing catchment for each legal point of discharge is shown in Figure 5-2. The measured areas of each type of contributing catchment are shown in Table 5-2.

Figure 5-2 Pre-Development Contributing Catchment

Table 5-2 Pre-Development Catchment Areas of Contributing Catchment

Catchment Name	Catchment Area					
	Total (ha)	Pervious (ha)	Roof (ha)	Road (ha)	Hardstand (ha)	Impervious percentage (%)
North (Project area)	4.23	3.74	0.1	0.19	0.2	12%
North (External)	2	1.04	0.35	0.32	0	35%
North Catchment (Total)	**6.2**	**4.48**	**0.45**	**0.51**	**0.2**	**28%**
Mid (Project Area)	1.44	1.09	0.06	0.27	0.03	25%
(Mid (External)	NIL	NIL	NIL	NIL	NIL	NIL
Mid Catchment (Total)	1.44	1.09	0.06	0.27	0.03	25%
South (Project Area)	1.26	0.93	0.25	0.05	0.03	26%
South (External)	1.5	0.45	0.525	0.525	0	70%
South Catchment (Total)	**2.94**	**1.38**	**0.775**	**0.575**	**0.03**	**53%**

5.4 Existing Stormwater Conveyance

As shown indicatively on Figure 5-3 (the blue line colour), there is both internal and council drainage to convey flows from upstream of the subject site, through to the legal point of discharges across Squares Way.

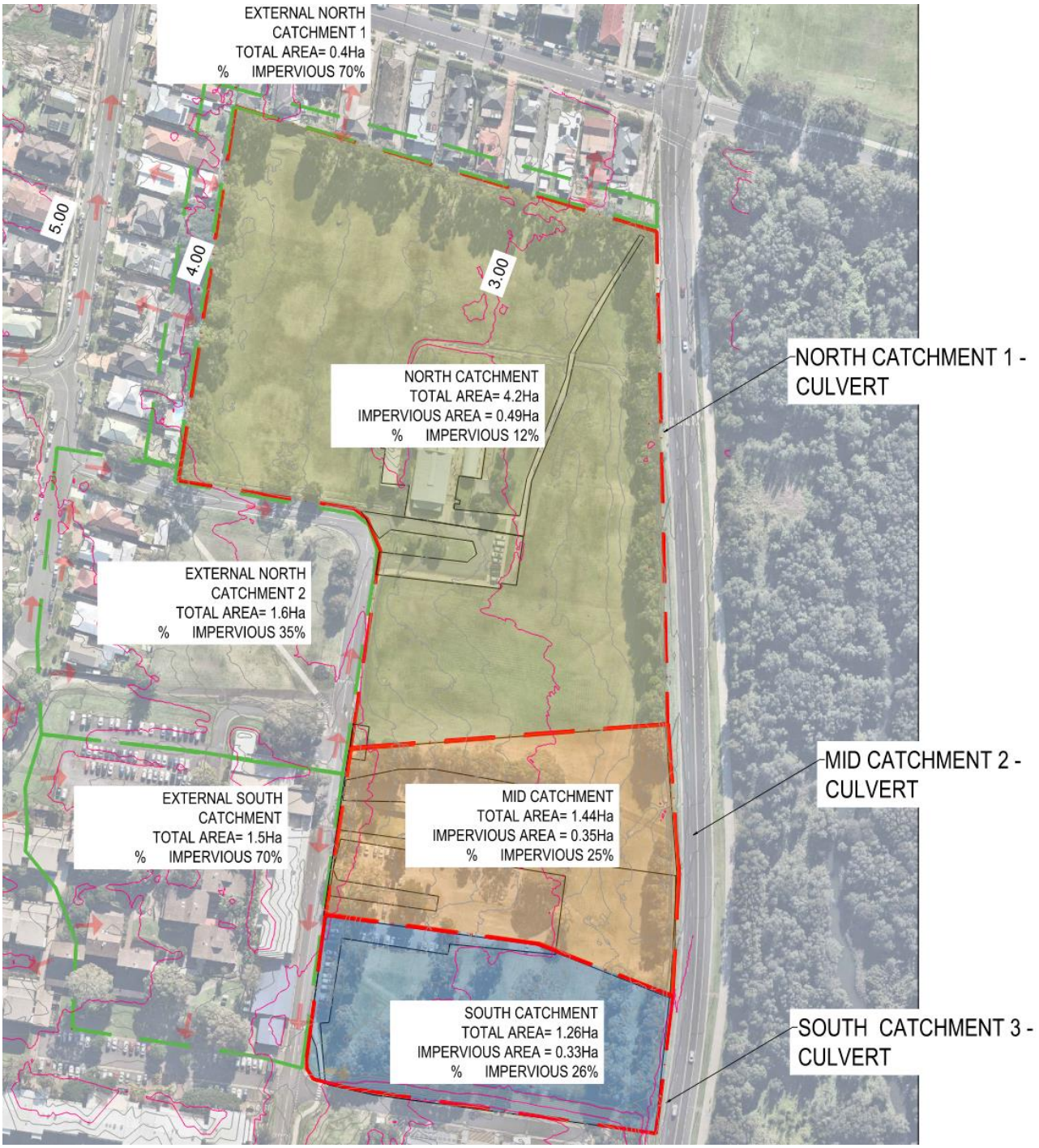

Figure 5-3 Existing Stormwater Conveyance

7 PROPOSED DEVELOPMENT

7.1 Post Development Layout

The proposed site includes two new sporting fields, a new proposed building, external carparking spaces, outdoor sprint track, concrete footpaths, public realm and new roads/walkways, comprising a circa 39,500sqm centre.

7.2 Post Development Contributing Catchment

There are three existing Legal Points of Discharge that cross Squares Way that are proposed to be used to convey the contributing catchments identified in Figure 7-1.

Figure 7-1 Post Development Contributing Catchment

Table 7-1 Post Development Contribute Catchment Areas

Catchment Name	Catchment Area					
	Total (ha)	Pervious (ha)	Roof (ha)	Road (ha)	Impervious Fields) (ha)	Impervious percentage (%)
North (Project area)	4.64	2.28	0.1	0.36	1.9	55%
North (External)	2	1.04	0.35	0.32	0	35%
North (Total)	**6.64**	**3.32**	**0.45**	**0.68**	**1.9**	**50%**
Mid (Project Area)	1.08	0.43	0.29	0.36	0	46%
(Mid (External)	NIL	NIL	NIL	NIL	NIL	NIL
Mid (Total)	1.08	0.43	0.29	0.36	0	46%
South (Project Area)	1.09	0.8	0	0.3	0	27%
South (External)	1.5	0.45	0.525	0.525	0	70%
South (Total)	**2.59**	**1.25**	**0.525**	**0.905**	**0**	**52%**

8 STORMWATER QUALITY MANAGEMENT

8.1.1 Development Control Plan – Water Quality Outcomes

To meet the DCP guidelines with respect to water quality for the DA, the following requirements are proposed:

- Pre-Construction and Construction phase, water runoff will be managed in accordance with 'Managing Urban Stormwater: Soils and construction', commonly referred to as the 'blue book'.
- Post construction the development will achieve NoBE (Neutral or Beneficial Effect) for permanent stormwater quality.

8.1.2 Pre-Construction

Prior to the commencement of any construction activities, the following measures need to be implemented to ensure minimal disturbance and adverse water quality impacts. These measures may be adopted in a staged approach.

- Provision of sediment fences to the perimeter of the construction area as required.
- Nominate specific areas for plant and construction material storage.
- Diversion of upstream stormwater runoff around disturbed areas of the development as required.
- Immediate stabilisation of disturbed areas as required.
- Designation and marking of transport routes across the site to minimise dust disturbance.
- Provision of rock pad or shaker grid on the site's construction exit.
- Provision of stormwater inlet protection devices to existing stormwater inlet structures within the site, and within the roadways immediate downstream of the site.
- Education of site personnel to the sediment and erosion control measures implemented on site.

8.1.3 Construction Phase

The siteworks will be contained within the property limits. Sediment generated during the construction phase shall be dealt with in accordance with an Erosion and Sediment Control Plan (ESCP) to be maintained and kept on site during the construction phase.

The following erosion and sediment control measures are proposed to mitigate water quality impacts during construction:

- Prior to the release of any stormwater from the site, water quality samples are to be taken and analysed.
- Monitoring of stormwater quality discharging from the development and the implementation of additional measures / modification of existing measures if the quality of stormwater discharging from the site will have a negative impact. The quality of any stormwater released from the site is to meet Council stormwater quality standards.
- Construction activities are to be limited to the designated construction area(s).
- Regular inspection and maintenance of the erosion control measures. Following rainfall events greater than 20 mm, inspection of erosion control measures and removal of collected material shall be undertaken. Replacement of any damaged equipment shall be performed immediately.
- Monitoring of water quality impacts from construction activities as appropriate. Any erosion and sediment control devices that are not performing to Council standards are to be replaced or supplemented with additional measures.

8.1.4 Post-Construction Phase

Modelling Assessment Approach

A quantitative assessment of stormwater runoff quality has been undertaken for the operational phase of the development. The predicted future (operational phase) load reductions of key pollutants have been conducted using the “Model for Urban Stormwater Improvement Conceptualisation” (MUSIC). MUSIC is a stormwater quality modelling program that provides estimates of stormwater pollution generation and the performance of stormwater management measures used in series or parallel to form a ‘treatment train’.

An assessment of the pre- and post-development stormwater quality was undertaken using MUSIC software. All source nodes to be consistent with the proposed stormwater plans and parameters should be set based on the NSW MUSIC Guidelines 2015 (BMT WBM, 2015).

Meteorological Data

Rainfall and evapo-transpiration data has been obtained from the Port Kembla Meteorological station (68131 PORT KEMBLA – BSL CENTRAL LAB) which has continuous records from 1963. 6-minute rainfall intervals and daily evapo-transpiration data was used with 6-minute modelling time steps.

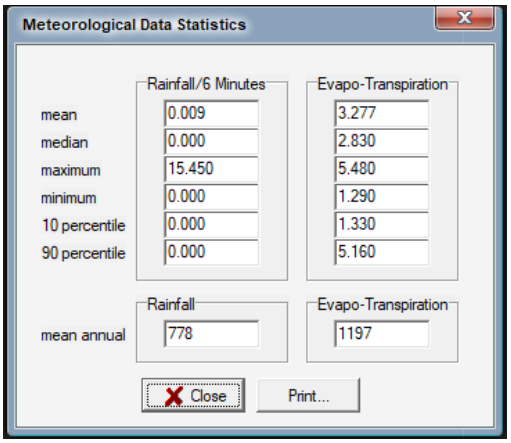

Figure 8-1: MUSIC meteorological statistics

Catchment Inputs

The proposed site into three sub catchments draining under Squires Way. Impervious percentage and land use for each catchment was measured from historical aerial photo and proposed development plans.

Due to the largely impervious existing conditions, making complying with water quality targets onerous, special dispensation was given by Wollongong Council at pre-DA meeting to consider the site as it was prior to November 2019 when the University of Wollongong had student accommodation located on the site.

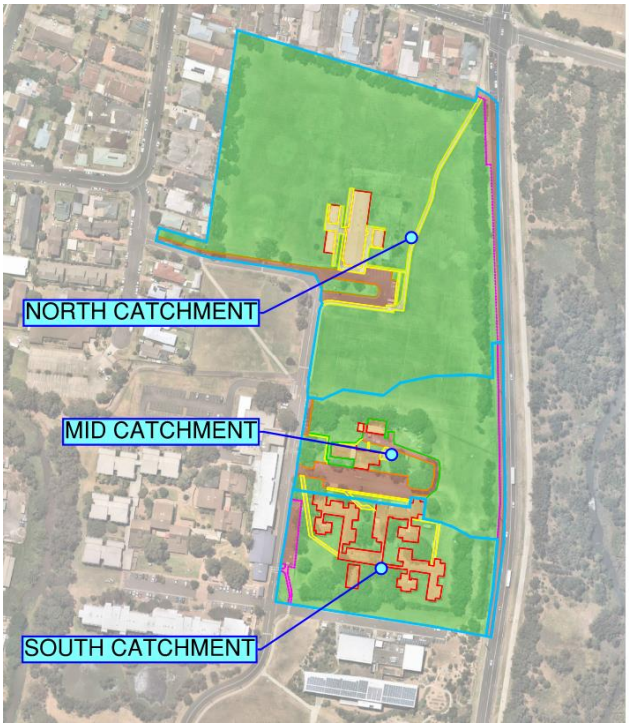

Figure 8-2 Site Only Pre-Developed Catchments

Figure 8-3 Site Only Post-Developed Catchments

Table 8-1 Post Development Project Area Catchments

Catchment Name	Catchment Area					
	Total (ha)	Pervious (ha)	Roof (ha)	Road (ha)	Impervious Fields) (ha)	Impervious percentage (%)
North (Project area)	4.64	2.12	0.255	0.36	1.9	55%
Mid (Project Area)	1.08	0.43	0.29	0.36	0	46%
South (External)	1.09	0.8	0	0.3	0	27%

The second step taken in creating the MUSIC model was to define ‘Source Nodes’ or Sub-Catchments. Source nodes for modelling the catchments were defined as per the Water by Design MUSIC Modelling Guidelines.

The subject development has been identified as a commercial site and has been modelled as such. The model consisted of four types of Commercial source nodes:

- Source nodes representing roof areas
- Source nodes representing sealed roads
- Source nodes representing hardstand and
- Source nodes representing landscaping.

Results

The modelling results are tabulated below outlining the water quality performance to achieve the NorBE requirements. The proposed Treatment Train to meet NorBE requirements are shown below. The results are shown in Table 8-2.

Proposed Treatment Train

The three proposed treatment trains are identified in Figure 8-4, Figure 8-5 and Figure 8-6.

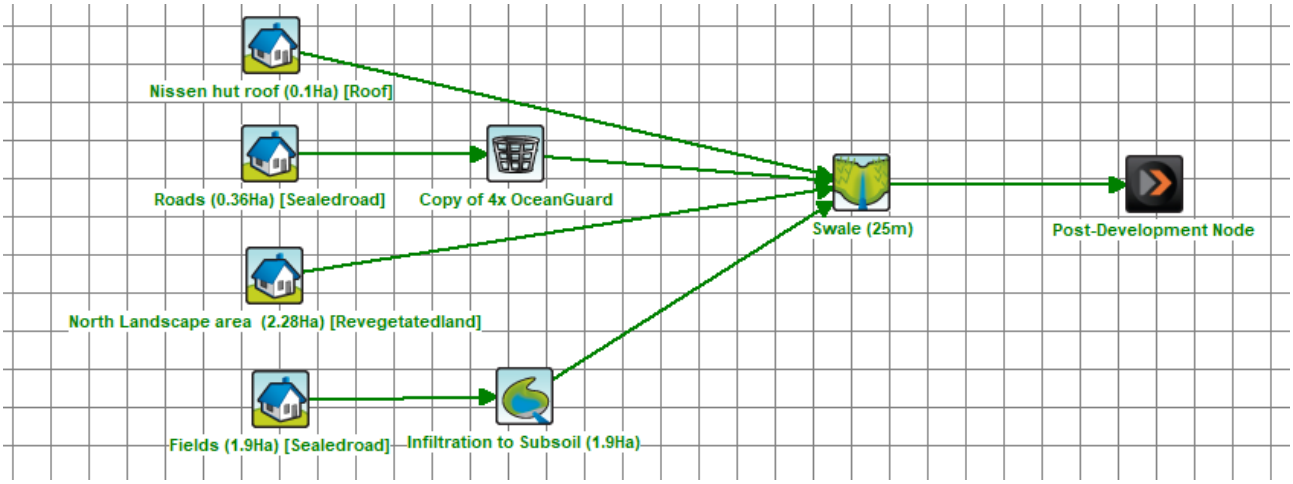

Figure 8-4 Proposed Treatment North Catchment

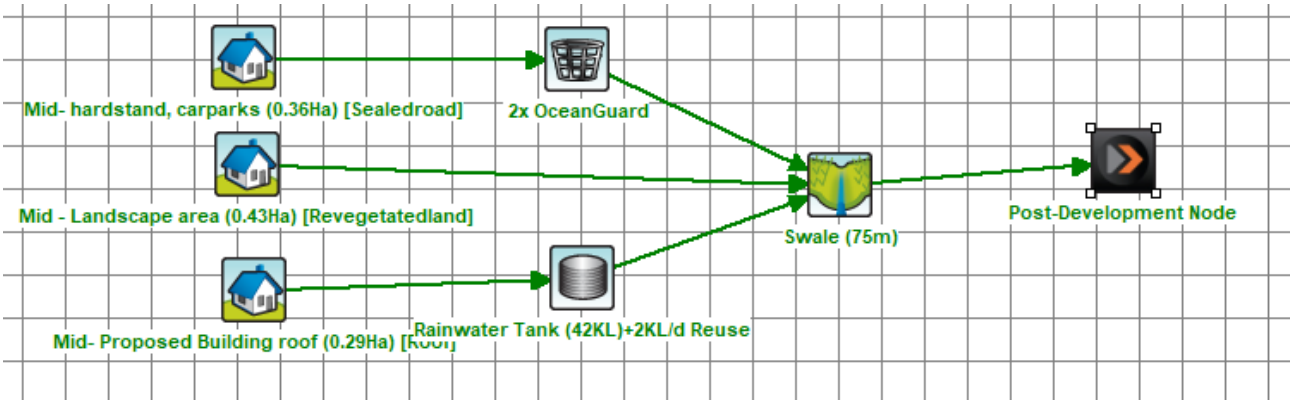

Figure 8-5 Proposed Treatment – Mid Catchment

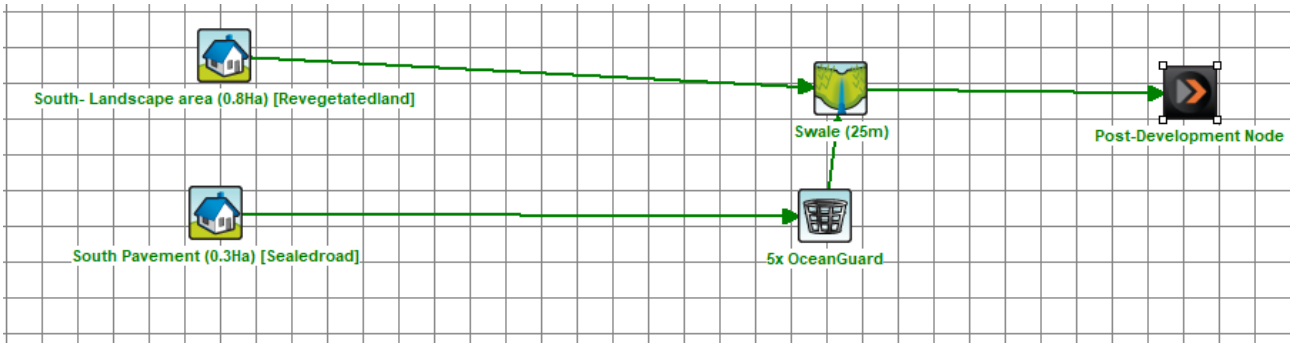

Figure 8-6 Treatment Train – Southern Catchment

Table 8-2 Treatment train effectiveness

	PRE - DEVELOPMENT RESIDUAL LOAD	POST - DEVELOPMENT RESIDUAL LOAD		UNIT	SATISFACTORY
North Catchment					
Total Suspended Solids	1010	319		kg/yr	Y
Total Phosphorus	2.3	1.5		kg/yr	Y
Total Nitrogen	19.3	15		kg/yr	Y
Gross Pollutants	87	0		kg/yr	Y
Mid Catchment					
Total Suspended Solids	683	97.3		kg/yr	Y
Total Phosphorus	1.41	0.735		kg/yr	Y
Total Nitrogen	8.96	8.8		kg/yr	Y
Gross Pollutants	63.3	0		kg/yr	Y
South Catchment					
Total Suspended Solids	270	112		kg/yr	Y
Total Phosphorus	0.753	0.7		kg/yr	Y
Total Nitrogen	7.75	6.87		kg/yr	Y
Gross Pollutants	58.4	0		kg/yr	Y

9 STORMWATER QUANTITY MANAGEMENT

9.1 Stormwater Drainage Methodology

Modelling of stormwater runoff quantity from the development site has been setup to compare the existing case and proposed development case scenarios. Modelling of the stormwater and drainage characteristics for each scenario has adopted industry standard techniques as specified in the Australian Rainfall and Runoff 2019 (AR&R). The drainage modelling software package DRAINS has been used in this assessment to give a simple representation of stormwater flows both within the drainage infrastructure and in overland flow paths. ILSAX modelling within DRAINS software was utilised to size any detentions required to ensure non worsening of events up to the 1% AEP + climate change.

AR&R data hub was used to extract rainfall data and climate change factors.

Pervious area losses for the site were modelled as 10mm/hr initial loss and 2.5mm/hr for initial and continuing losses respectively. This is in accordance with calibrated loss parameters from the Fairy and Cabbage Tree Creeks Flood study by Advisian.

Impervious area losses for the site were modelled as 1mm/hr initial loss and 0m/hr for initial and continuing losses respectively. This is in accordance with standard practise.

9.2 Pre-Development Flows

The predevelopment flows for the 10% AEP and 1% AEP with climate change are shown in Table 9-1.

Table 9-1 Predevelopment Flow to Legal Points of Discharge

Catchment Name						
	Total (ha)	Impervious percentage (%)	10% AEP (m3/s)	1% AEP (m3/s)	10% AEP Critical event	1% AEP Critical event
North Catchment (Total)	**6.2**	**28%**	**1.65**	**3.16**	**15 Minute Storm 5**	**15 Minute Storm 8**
Mid Catchment (Total)	**1.44**	**25%**	**0.402**	**0.781**	**15 Minute Storm 5**	**20 Minute Storm 5**
South Catchment (Total)	**2.94**	**53%**	**0.885**	**1.59**	**30 Minute Storm 2**	**90 Minute Storm 8**

While this above table identified the predevelopment flow towards the existing culverts, an assessment of the existing culverts identified the following peak capacities:

- Northern Legal Point of Discharge - 0.6m wide by 0.45m high – 410L/s
- Mid Legal point of Discharge – 0.9m wide by 0.45m high- 500L/s
- South Legal Point of Discharge - 0.45m diameter – 334L/s

This identifies that for all minor and major events for all three culverts, there is insufficient capacity for entirely free flowing. As such, there is existing storage adjacent the highway within the subject property. The volumes to attenuate flows to the culvert capacity for all events up to the 1% AEP + Climate change are shown in Table 9-2

An analysis of the existing surface identifies that the Northern and Mid Legal Point of discharge has a shared storage area as shown in Figure 9-1. Additional any flow in excess of the Southern Legal point of discharge bypasses to the Mid Legal Point of Discharge.

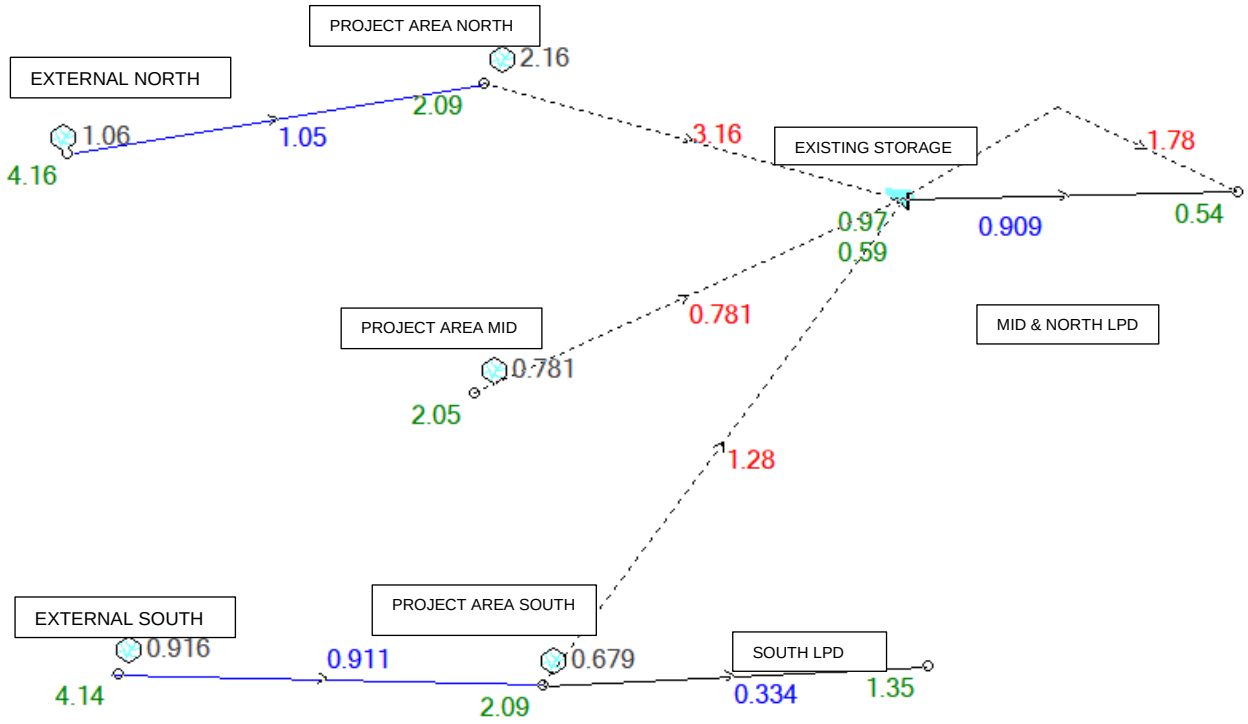

Figure 9-1 Pre Development DRAINS 1% AEP+CC

An assessment of the 10% AEP+CC is shown in Figure 9-2 for completeness.

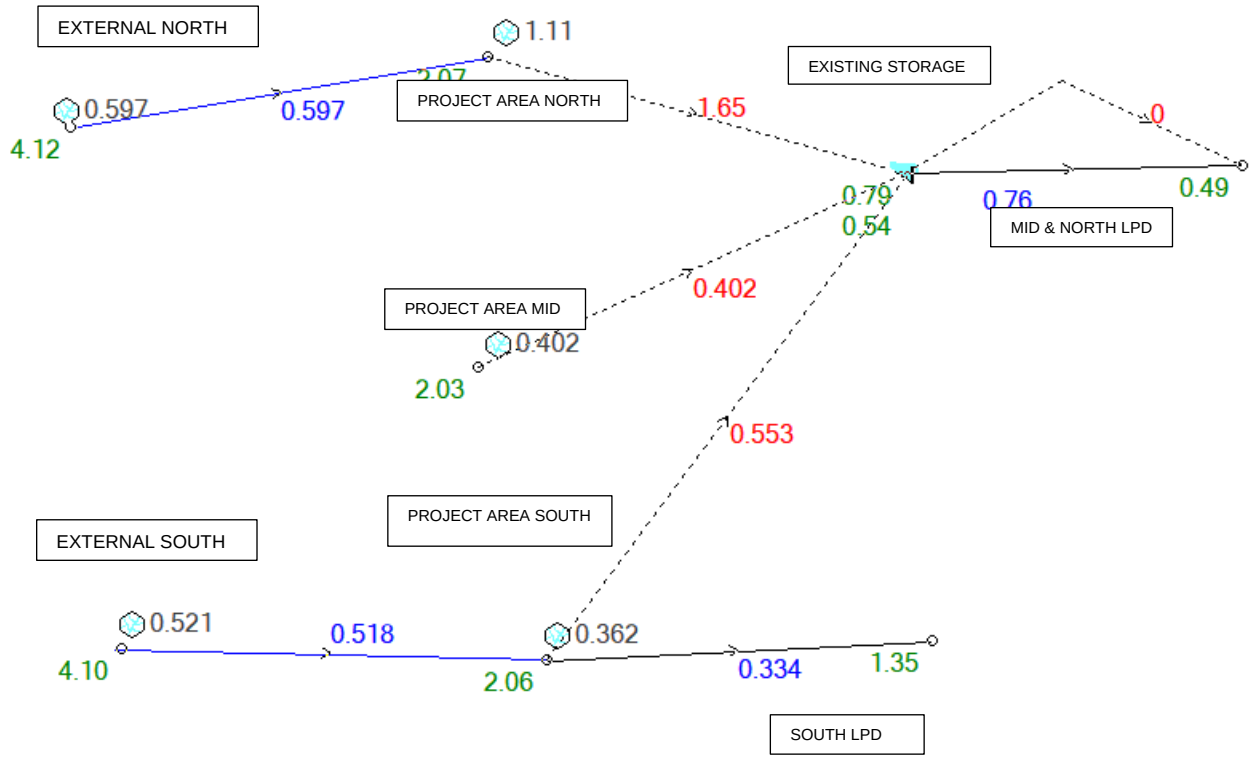

Figure 9-2 Pre-Development Drains 10% AEP+CC

Table 9-2 Existing Storage due to Existing Maximum Culvert Capacity

Catchment Name						
	Total (ha)	Impervious percentage (%)	Max Culvert Capacity	Existing Outlet Max 1% AEP (m3/s)	1% AEP Critical event	Existing Storage during 1% AEP Event
Total Catchment	**10.58**	**35%**	**1240L/s**	**3.023**	**30 Min Storm 6**	**3,508**

It is should be noted that that in the 10% AEP assessment the storage volume is 1,994kL and does not overtop the road.

9.3 Post Development Flows (Unmitigated)

The post development unmitigated flows for the 10% AEP and 1% AEP with climate change are shown in Table 9-3.

Table 9-3 Post Development Unmitigated Flows

Catchment Name						
	Total (ha)	Impervious percentage (%)	10% AEP (m3/s)	1% AEP (m3/s)	10% AEP Critical event	1% AEP Critical event
North Catchment (Total)	**6.64**	**50%**	**2.01**	**3.72**	**15 Minute Storm 6**	**10 Minute Storm 6**
Mid Catchment (Total)	**1.08**	**46%**	**0.351**	**0.665**	**10 Minute Storm 6**	**10 Minute Storm 6**
South Catchment (Total)	**2.59**	**52%**	**0.847**	**1.53**	**15 Minute Storm 6**	**90 Minute Storm 5**

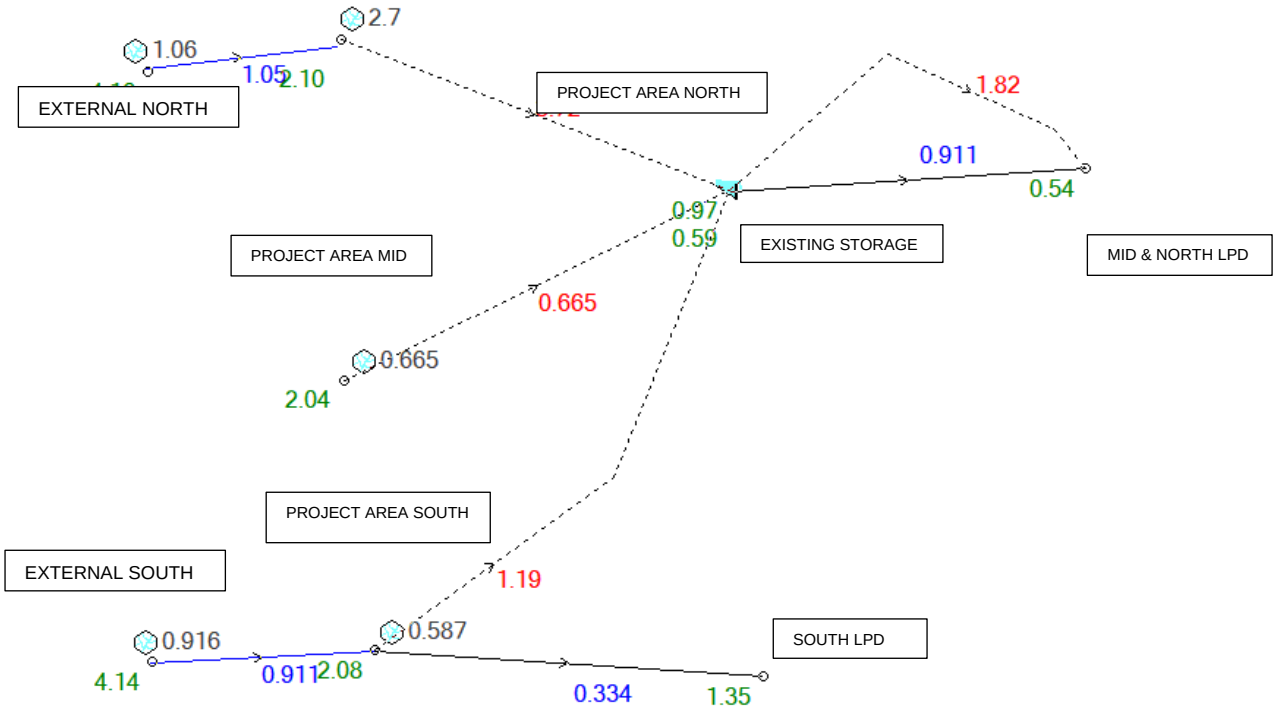

Figure 9-3 Post Development DRAINS 1% AEP+CC

For completeness the 10% AEP event is shown in Figure 9-4

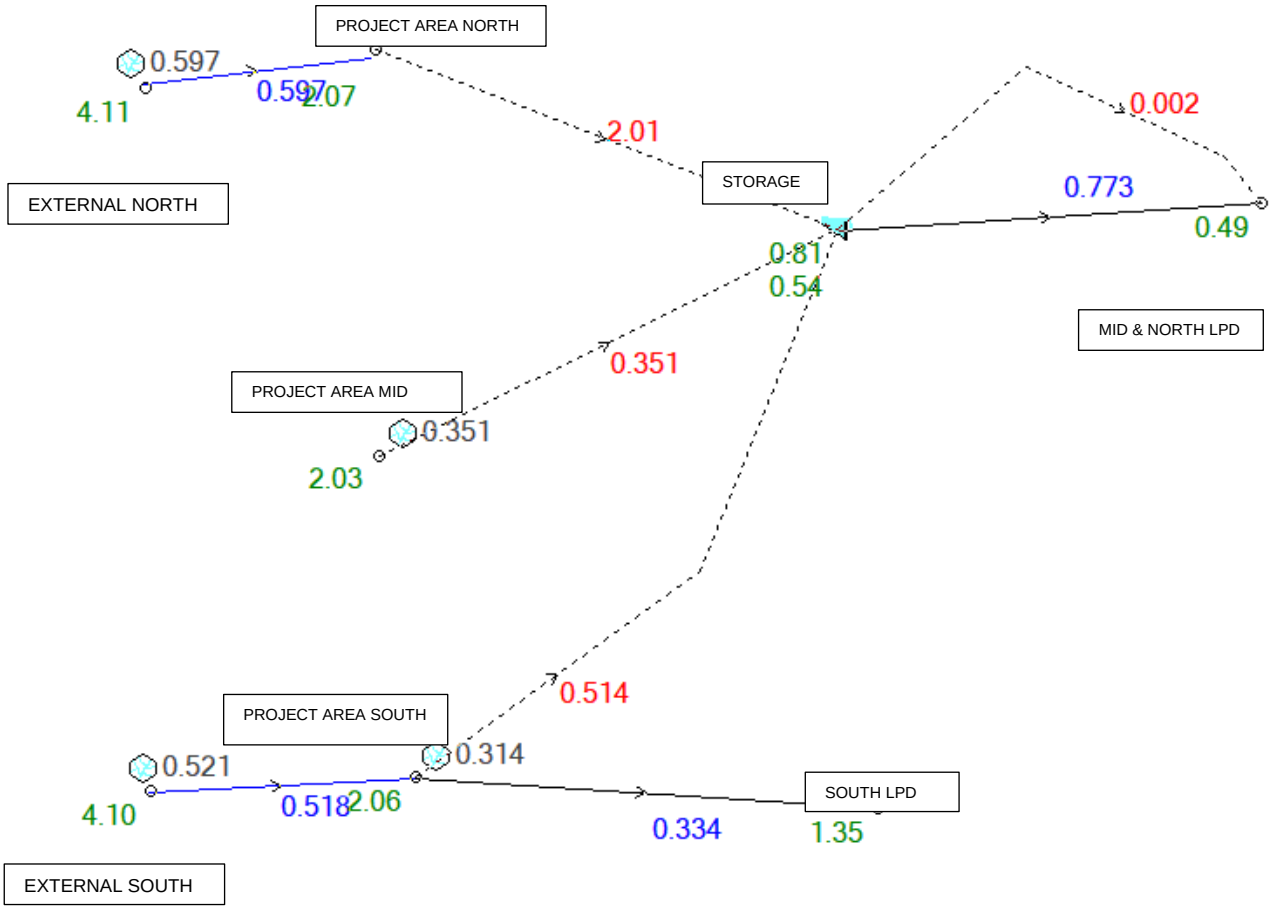

Figure 9-4 Post Development DRAINS 10% AEP+CC

The following table identifies the unmitigated storage.

Table 9-4 – Post Development Unmitigated Storage

Catchment Name						
	Total (ha)	Impervious percentage (%)	Max Culvert Capacity	Post Development Incoming Max 1% AEP (m3/s)	1% AEP Critical event	Existing Storage during 1% AEP Event
Total Catchment	**8.83**	**54%**	**1240L/s**	**3.085**	**30 Min Storm 8**	**3,530**

It should be noted that the 10% AEP assessment of storage volume is 2,104kL and does not overtop the road.

9.4 Post Development Flows (Mitigated)

The additional storage required is the difference between the existing and post development flows for Minor and Major Flow is as following:

Minor Flows – (10% AEP +CC)

Predevelopment Storage – 1,994kL

Post Development Storage – 2,104kL
Major Flow – (1% AEP + CC)

Pre development Storage – 3,508kL
Post Development Storage – 3,530kL

Therefore, to compensate for the additional storage requirements for minor and major events a compensation storage of at least 110m3 will be allowed for to not make existing conditions worse.

APPENDIX A – ENGINEERING PLANS

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873

Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008

PO Box 23061
Docklands VIC 8012
Australia

T +61 3 9975 3000
F +61 3 9975 3444
E melbourne@aurecongroup.com
W aurecongroup.com

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