

PROJECT: PROPOSED ECO-TOURIST FACILITY

PLANSET: CONCEPT STORMWATER MANAGEMENT PLAN

CLIENT: CONTRACT PROPERTIES PTY LTD

DRAWING LIST		
DWG NO.	REV	DWG TITLE
GENERAL		
PS01-A000	G	COVER SHEET
CONSTRUCTION MANAGEMENT WORKS		
PS01-B300	E	SEDIMENT & EROSION CONTROL PLAN
PS01-B310	C	SEDIMENT & EROSION CONTROL DETAILS
EARTHWORKS		
PS01-C500	B	CUT-FILL PLAN
DRAINAGE WORKS		
PS01-E100	F	DRAINAGE PLAN
PS01-E200	B	DRAINAGE DETAILS
PS01-E600	A	OSD CATCHMENT PLANS AND DETAILS
PS01-E700	C	WATER QUALITY CATCHMENT PLAN, MODEL & RESULTS

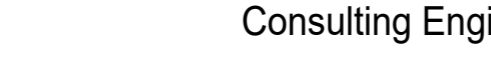


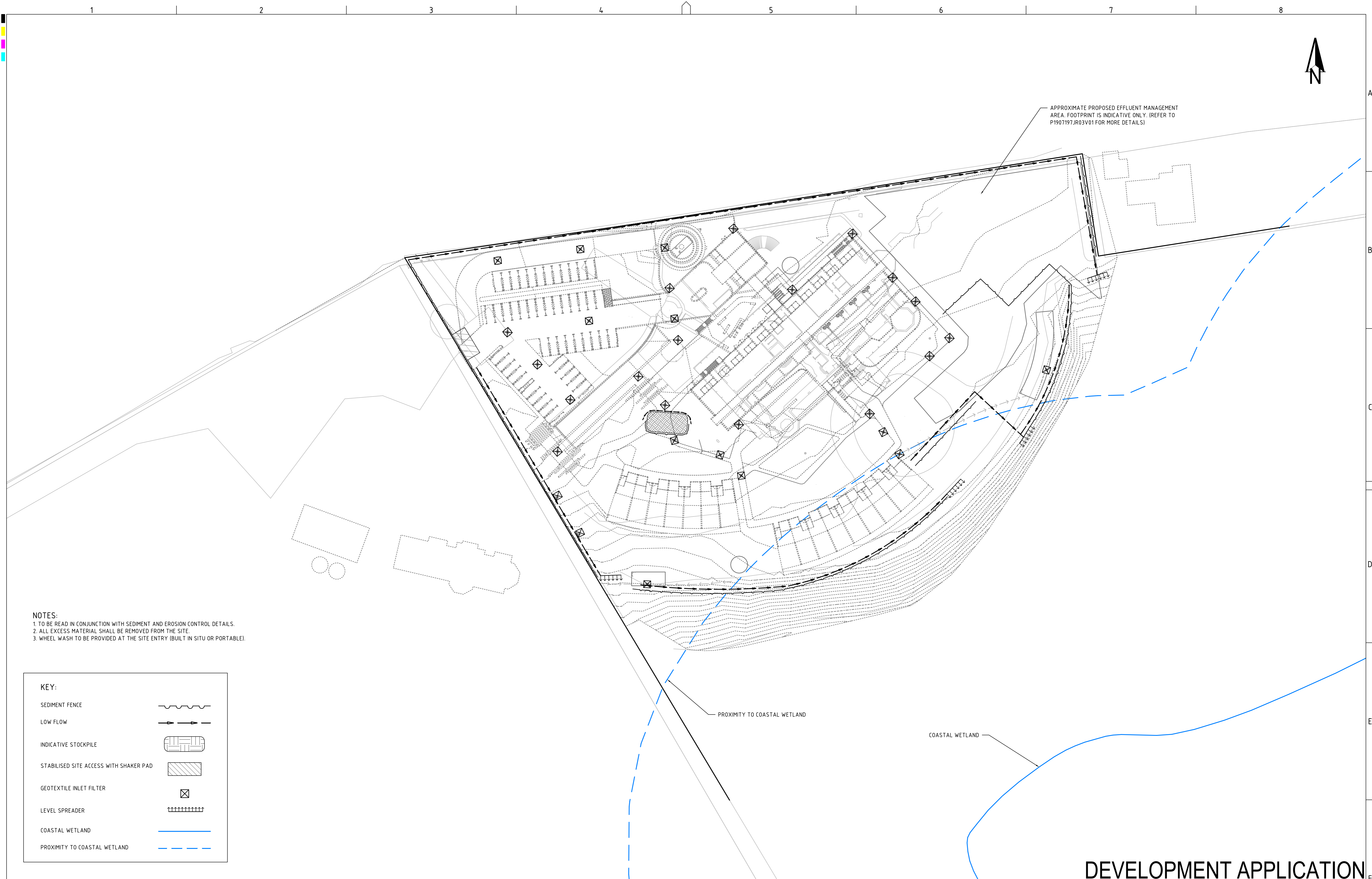
LOCALITY PLAN
NOT TO SCALE

LGA: SHELLHARBOUR COUNCIL

71 FIG HILL LANE, DUNMORE, NSW
LOT 3 DP717776

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	CLIENT	<div><div>Consulting Engineers Environment Water Geotechnical Civil</div></div> <div>Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: www.martens.com.au</div>	DRAWING TITLE			
G	MINOR AMENDMENT	21/10/2020	GM	SS/LZ	SL	MS		---	---	MS	CONTRACT PROPERTIES PTY LTD		COVER SHEET			
F	MINOR AMENDMENT	15/10/2020	GM	SS/LZ	SL	MS					PROJECT NAME/PLANSET TITLE PROPOSED ECO-TOURIST FACILITY CONCEPT STORMWATER MANAGEMENT PLAN 71 FIG HILL LANE, DUNMORE LOT 3 DP717776		<div><div>PROJECT NO.</div><div>PLANSET NO.</div><div>RELEASE NO.</div><div>DRAWING NO.</div><div>REVISION</div></div> <div><div>P1907197</div><div>PS01</div><div>R07</div><div>PS01-A000</div><div>G</div></div>			
E	DA SUBMISSION	03/10/2019	LL	SS	SL	MS										
D	DA SUBMISSION	02/10/2019	LL	SS	SL	MS										
C	PLANSET UPDATED WITH NEW SHEETS	27/09/2019	LL	SS	SL	MS										
B	PLANSET UPDATED WITH NEW SHEETS	25/09/2019	RK/LL	AVG/SS	SL											
A	INITIAL RELEASE	16/07/2019	RK	CG	SL											
A1 / A3 LANDSCAPE (A1/LC_v02.0.0)								DISCLAIMER & COPYRIGHT This plan must not be used for construction unless signed as approved by principal certifying authority. All measurements in millimetres unless otherwise specified. This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd. (C) Copyright Martens & Associates Pty Ltd								

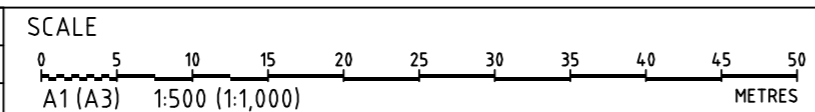


- NOTES:
- 1. TO BE READ IN CONJUNCTION WITH SEDIMENT AND EROSION CONTROL DETAILS.
 - 2. ALL EXCESS MATERIAL SHALL BE REMOVED FROM THE SITE.
 - 3. WHEEL WASH TO BE PROVIDED AT THE SITE ENTRY (BUILT IN SITU OR PORTABLE).

KEY:

SEDIMENT FENCE	
LOW FLOW	
INDICATIVE STOCKPILE	
STABILISED SITE ACCESS WITH SHAKER PAD	
GEOTEXTILE INLET FILTER	
LEVEL SPREADER	
COASTAL WETLAND	
PROXIMITY TO COASTAL WETLAND	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
E	MINOR AMENDMENT	15/10/2020	GM	SS/LZ	SL	MS
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A	INITIAL RELEASE	25/09/2019	RK/LL	AA	SL	



GRID	DATUM	PROJECT MANAGER
MGA	mAHD	MS
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PROJECT NAME/PLANSET TITLE
PROPOSED ECO-TOURIST FACILITY CONCEPT STORMWATER MANAGEMENT PLAN
71 FIG HILL LANE, DUNMORE LOT 3 DP711776

Consulting Engineers
Environment
Water
Geotechnical
Civil

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DRAWING TITLE				
SEDIMENT & EROSION CONTROL PLAN				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1907197	PS01	R07	PS01-B300	E

DEVELOPMENT APPLICATION

TYPE II SAP

STABILISED ACCESS POINT - TYPE 2



- IT SHOULD BE NOTED THAT THESE TYPES OF SAPS ARE CONSIDERED TO BE APPLICABLE FOR THE MAJORITY OF ACTIVITIES HOWEVER SOME SITES MAY REQUIRE SPECIAL CONSIDERATION.

A CORRECTLY DESIGNED AND INSTALLED SHAKER PAD WILL ASSIST IN PREVENTING SEDIMENT TRANSFER FROM A SITE. ANY STABILISED ACCESS POINT (SAP) CAN BE DESIGNED WITH A SHAKER PAD (COMPULSORY IN TYPE II SAP'S)

SHAKER PADS CAN BE DESIGNED AND CONSTRUCTED TO ENABLE RE-USE ON FUTURE PROJECTS

THE SHAKER PAD:

- MUST BE DESIGNED AND CERTIFIED BY A PRACTICING STRUCTURAL ENGINEER. THE CERTIFIED DESIGN SHOULD BE SUBMITTED WITH THE RELEVANT APPLICATION.
- CAN BE CONSTRUCTED FROM ANY SUITABLE MATERIAL.
- MUST BE LOCATED ON A SUITABLY PREPARED AND COMPACTED SUB-GRADE/BASE MATERIAL.
- MUST BE SITUATED SUCH THAT THE RUNGS OF THE SHAKER PAD ARE LEVEL WITH THE ADJOINING NATURAL SURFACE.
- MUST BE A MINIMUM OF 3.5m IN LENGTH.
- MUST BE A MINIMUM OF 3.5m IN WIDTH.
- MUST HAVE CLEAR SPACING BETWEEN RUNGS OF 200 – 250mm.
- RUNGS MUST HAVE A MAXIMUM WIDTH (BEARING AREA) OF 75mm.
- MUST HAVE A MINIMUM CLEAR DEPTH OF 300mm IE FORM THE TOP OF THE RUNG TO THE FINISHED SUB-GRADE/BASE LEVEL.

THE SHAKER PAD MUST BE PROVIDED WITH SUITABLE BARRIERS AT THE SIDES TO ENSURE THAT ALL TYERS OF VEHICLES LEAVING THE SIT TRAVERSE THE DEVICE.

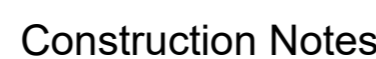


1. CONSTRUCT AT THE GRADIENT SPECIFIED ON THE ESCP OR SWMP, NORMALLY BETWEEN 1 AND 5 PERCENT
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM.
3. ENSURE THE STRUCTURES ARE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT COULD IMPEDE WATER FLOW.
4. BUILD THE DRAINS WITH CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTIONS, NOT V-SHAPED, AT THE DIMENSIONS SHOWN ON THE SWMP.
5. ENSURE THE BANKS ARE PROPERLY COMPACTED TO PREVENT FAILURE.
6. COMPLETE PERMANENT OR TEMPORARY STABILISATION WITHIN 10 DAYS OF CONSTRUCTION FOLLOWING TABLE 5.2 IN LANDCOM [2004].
7. WHERE DISCHARGING TO ERODIBLE LANDS, ENSURE THEY OUTLET THROUGH A PROPERLY CONSTRUCTED EROSION SPREADER.
8. CONSTRUCT THE LEVEL SPREADER AT THE GRADIENT SPECIFIED ON THE ESCP OR SWMP, NORMALLY LESS THAN 1 PERCENT OR LEVEL.
9. WHERE POSSIBLE, ENSURE THEY DISCHARGE WATERS ONTO EITHER STABILISED OR UNDISTURBED DISPOSAL SITES WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED. APPROVAL MIGHT BE REQUIRED TO DISCHARGE INTO OTHER SUBCATCHMENTS.

 SD 5-6

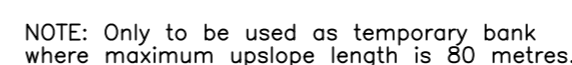
1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SD 6-8



1. Fabricate a sediment barrier made from geotextile or straw bales.
2. Follow Standard Drawing 6-7 and Standard Drawing 6-8 for installation procedures for the straw bales or geobarc. Reduce the picket spacing to 1 metre centres.
3. In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing.
4. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.

SD 6-12



1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction

EARTH BANK (LOW FLOW)



1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES

SD 4-1

DRAWING TITLE	SEDIMENT & EROSION CONTROL DETAILS
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DRAWING ID: P1907197-PS01-007-B310

A1 / A3 LANDSCAPE (A1) C v02.0.01

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EARTHWORKS SUMMARY		
	CUT	FILL
EARTHWORKS VOLUME (m³)	-1918	3135
EARTHWORKS BALANCE (m³)	-	1217

CUT-FILL DEPTH DESIGN TO EXISTING		
LOWER THAN	-2.000 m	
-2.000 to	-1.500 m	
-1.500 to	-1.000 m	
-1.000 to	-0.500 m	
-0.500 to	-0.100 m	
-0.100 to	0.100 m	
0.100 to	0.500 m	
0.500 to	1.000 m	
1.000 to	1.500 m	
1.500 to	2.000 m	
HIGHER THAN	2.000 m	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENT	15/10/2020	GM	SS/LZ	SL	MS
A	INITIAL RELEASE	16/07/2019	RK	CG	SL	

PRINTED: 15/10/2020 14:00:00
A1 / A3 LANDSCAPE (A1L_C_v02.0.01)

SCALE

0 5 10 15 20 25 30 35 40 45 50

A1 (A3) 1:500 (1:1,000) METRES

GRID	DATUM	PROJECT MANAGER	CLIENT
		MS	CONTRACT PROPERTIES PTY LTD

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PROJECT NAME/PLANSET TITLE

PROPOSED ECO-TOURIST FACILITY

CONCEPT STORMWATER MANAGEMENT PLAN

71 FIG HILL LANE, DUNMORE
LOT 3 DP711776

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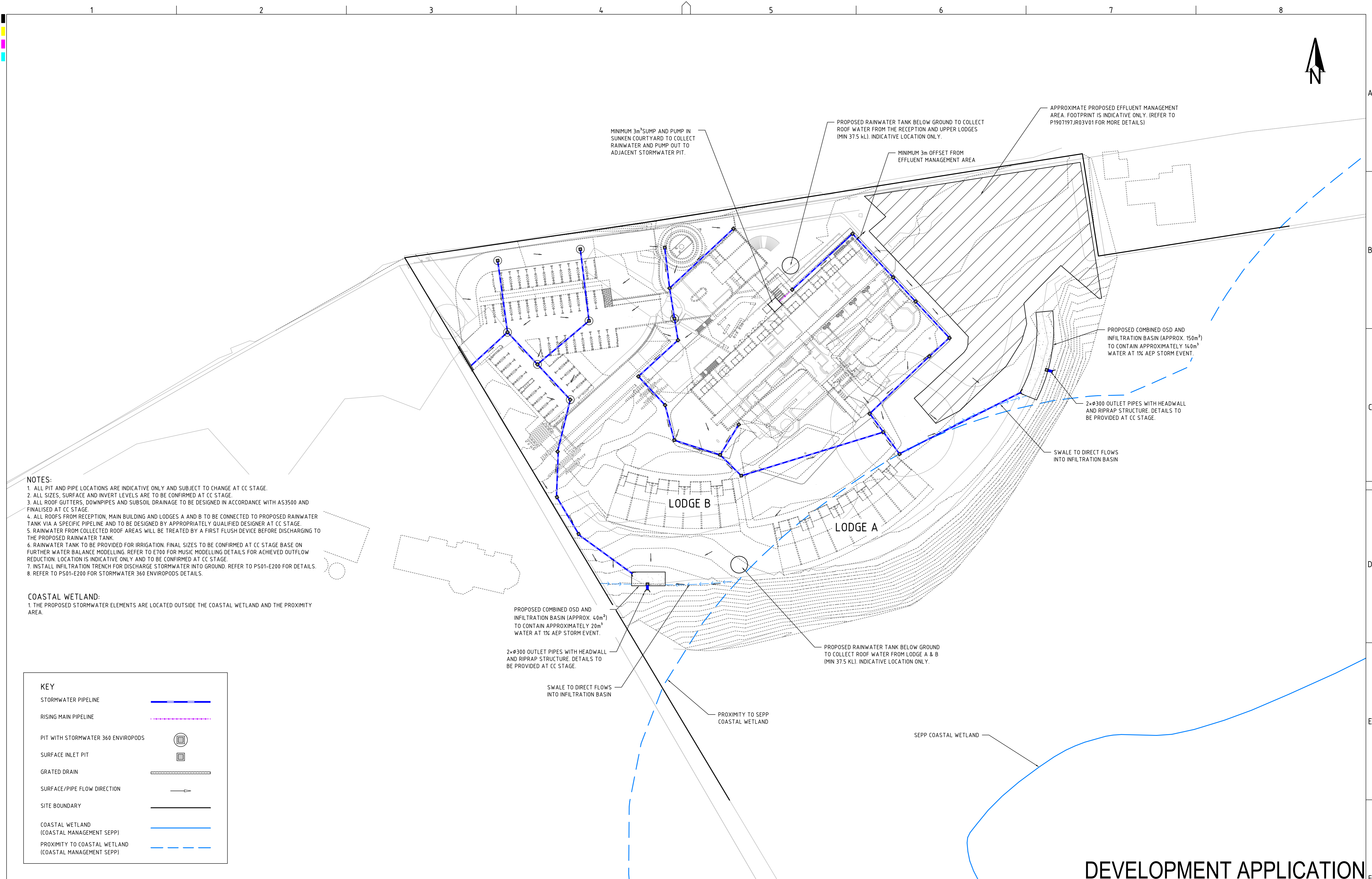
Consulting Engineers

Environment
Water
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Civil

DRAWING TITLE				
EARTHWORKS CUT-FILL PLAN				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1907197	PS01	R07	PS01-C500	B

DRAWING ID: P1907197-PS01-R07-C500

DEVELOPMENT APPLICATION



- NOTES:
1. ALL PIT AND PIPE LOCATIONS ARE INDICATIVE ONLY AND SUBJECT TO CHANGE AT CC STAGE.
 2. ALL SIZES, SURFACE AND INVERT LEVELS ARE TO BE CONFIRMED AT CC STAGE.
 3. ALL ROOF GUTTERS, DOWNPIPES AND SUBSOIL DRAINAGE TO BE DESIGNED IN ACCORDANCE WITH AS3500 AND FINALISED AT CC STAGE.
 4. ALL ROOFS FROM RECEPTION, MAIN BUILDING AND LODGES A AND B TO BE CONNECTED TO PROPOSED RAINWATER TANK VIA A SPECIFIC PIPELINE AND TO BE DESIGNED BY APPROPRIATELY QUALIFIED DESIGNER AT CC STAGE.
 5. RAINWATER FROM COLLECTED ROOF AREAS WILL BE TREATED BY A FIRST FLUSH DEVICE BEFORE DISCHARGING TO THE PROPOSED RAINWATER TANK.
 6. RAINWATER TANK TO BE PROVIDED FOR IRRIGATION. FINAL SIZES TO BE CONFIRMED AT CC STAGE BASE ON FURTHER WATER BALANCE MODELLING. REFER TO E700 FOR MUSIC MODELLING DETAILS FOR ACHIEVED OUTFLOW REDUCTION. LOCATION IS INDICATIVE ONLY AND TO BE CONFIRMED AT CC STAGE.
 7. INSTALL INFILTRATION TRENCH FOR DISCHARGE STORMWATER INTO GROUND. REFER TO PS01-E200 FOR DETAILS.
 8. REFER TO PS01-E200 FOR STORMWATER 360 ENVIROPODS DETAILS.

COASTAL WETLAND:

1. THE PROPOSED STORMWATER ELEMENTS ARE LOCATED OUTSIDE THE COASTAL WETLAND AND THE PROXIMITY AREA.

KEY

STORMWATER PIPELINE

RISING MAIN PIPELINE

PIT WITH STORMWATER 360 ENVIROPODS

SURFACE INLET PIT

GRATED DRAIN

SURFACE/PIPE FLOW DIRECTION

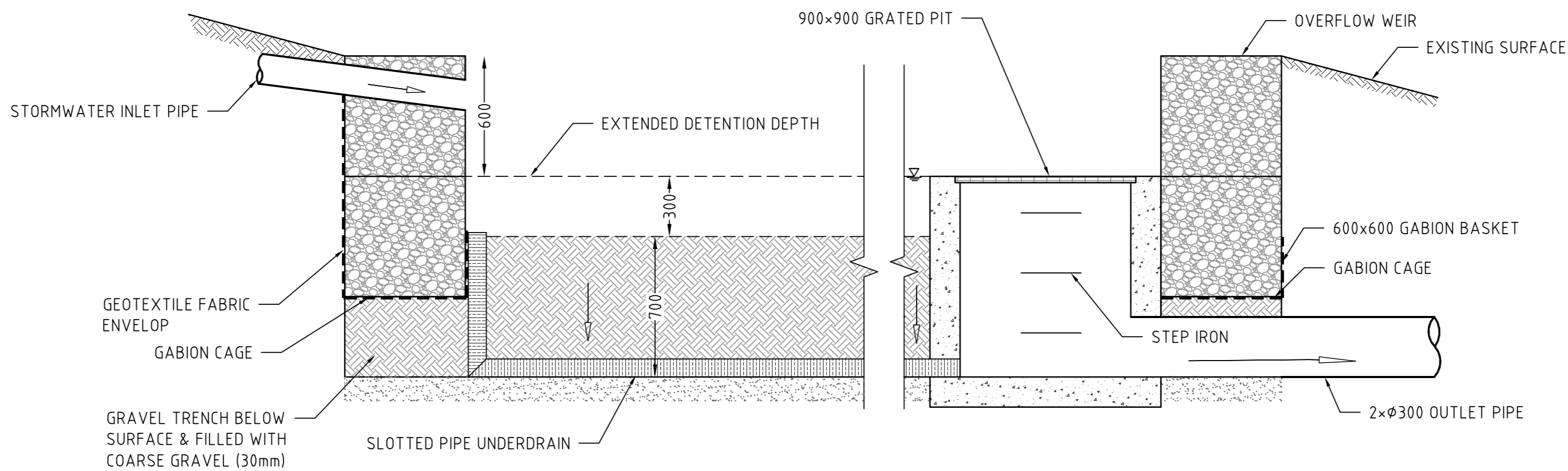
SITE BOUNDARY

COASTAL WETLAND
(COASTAL MANAGEMENT SEPP)

PROXIMITY TO COASTAL WETLAND
(COASTAL MANAGEMENT SEPP)

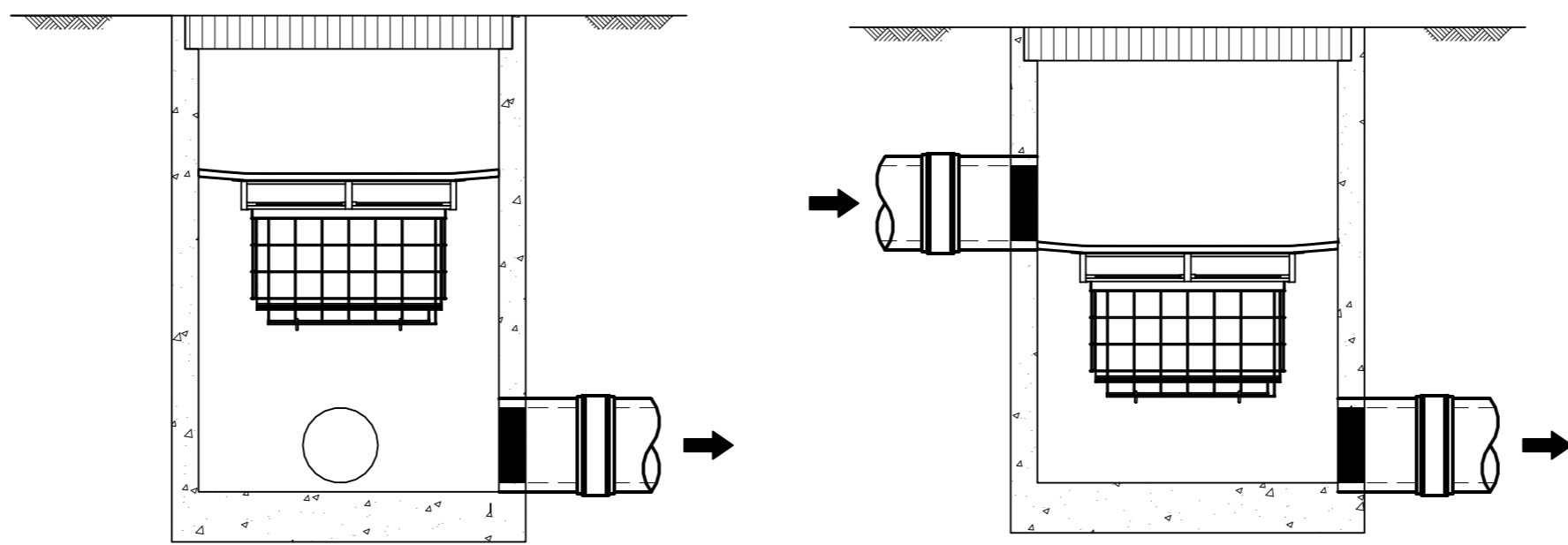
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F	MINOR AMENDMENT	21/10/2020	GM	SS/LZ	SL	MS		MGA	mAHD	MS	CONTRACT PROPERTIES PTY LTD	 Consulting Engineers Environment Water Geotechnical Civil	DRAINAGE PLAN		
E	MINOR AMENDMENT	15/10/2020	GM	SS/LZ	SL	MS					PROJECT NAME/PLANSET TITLE				
D	DA SUBMISSION	03/10/2019	LL	SS	SL	MS		DISCLAIMER & COPYRIGHT			PROPOSED ECO-TOURIST FACILITY				
C	DA SUBMISSION	02/10/2019	LL	SS	SL	MS		This plan must not be used for construction unless signed as approved by principal certifying authority.			CONCEPT STORMWATER MANAGEMENT PLAN				
B	PLANSET UPDATED WITH NEW SHEETS	27/09/2019	LL	SS	SL	MS		All measurements in millimetres unless otherwise specified.			71 FIG HILL LANE, DUNMORE				
A	INITIAL RELEASE	25/09/2019	RK/LL	AVG/SS	SL			This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.			LOT 3 DP717776				
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												PROJECT NO. P1907197	PLANSET NO. PS01	RELEASE NO. R07	DRAWING NO. PS01-E100
A1 / A3 LANDSCAPE [A1L_C_v02.0.0]											DRAWING ID: P1907197-PS01-R07-E100				

DEVELOPMENT APPLICATION



INFILTRATION TRENCH DETAILS

SCALE: NTS



ENVIROPOD INSTALLATION CONFIGURATIONS

SCALE: NTS

DEVELOPMENT APPLICATION

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B	PLANSET UPDATED WITH NEW SHEETS	27/09/2019	LL	SS	SL	MS
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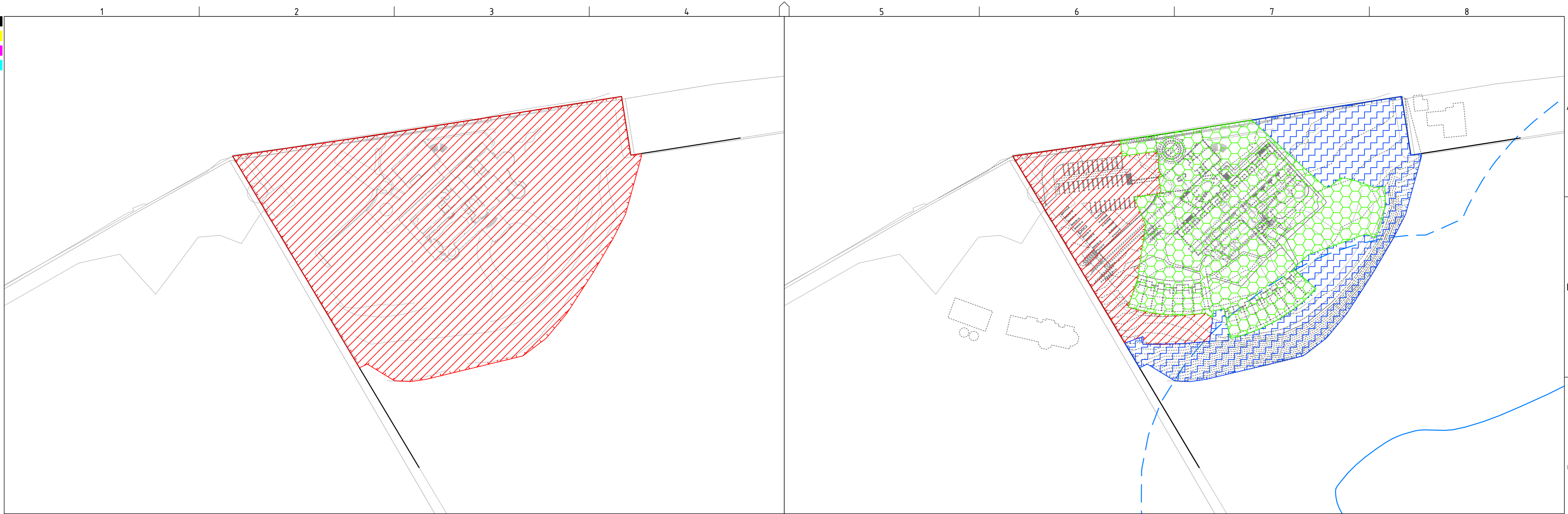
SCALE

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	MS
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DRAWING TITLE				
DRAINAGE DETAILS				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1907197	PS01	R07	PS01-E200	B



PRE-DEVELOPMENT OSD PLAN

SCALE - 1:1000

POST-DEVELOPMENT OSD PLAN

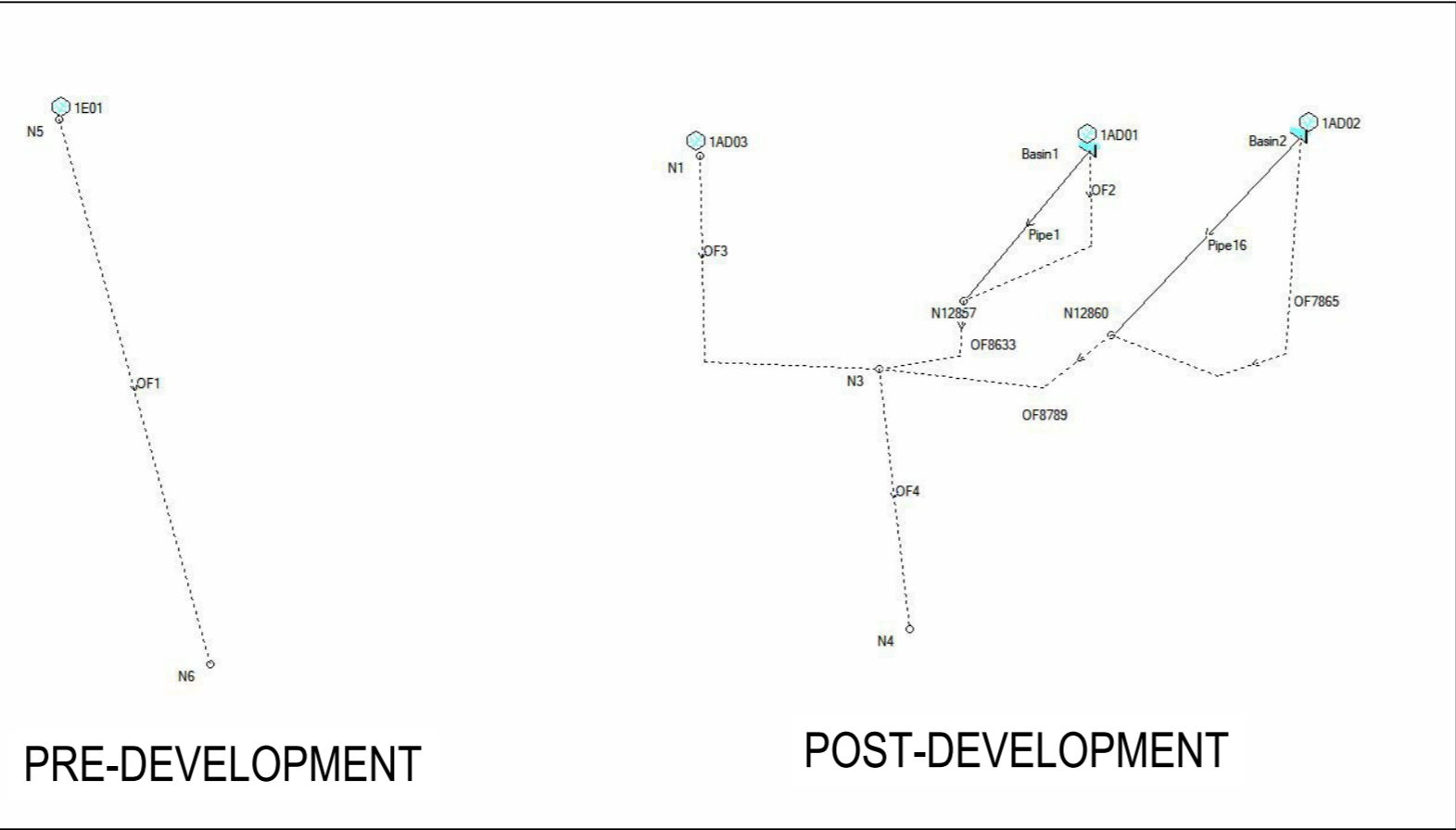
SCALE - 1:1000

PRE DEVELOPMENT DRAINS CATCHMENTS (P1907197DRN01V01)

KEY	DESCRIPTION	NODE ID	AREA (ha)	PAVED%	MUSIC NODE REFERENCE
		1AE01a	1976	31%	
	TOTAL SITE				
		TOTAL - OVERALL	1976		= 100 % OF OVERALL AREA
		TOTAL - IMPERVIOUS	0.627		= 32 % OF OVERALL AREA
		TOTAL - PERVIOUS	1349		= 68 % OF OVERALL AREA

POST DEVELOPMENT DRAINS CATCHMENTS (P1907197DRN01V01)

KEY	DESCRIPTION	NODE ID	AREA (ha)	PAVED%	MUSIC NODE REFERENCE
	AREA TO OSD1	1AD01	0.445	51%	
	AREA TO OSD2	1AD02	0.915	50%	
	AREA BYPASS OSD	1AD03	0.615	0%	
	TOTAL - OVERALL	1976			= 100 % OF OVERALL AREA
	TOTAL - IMPERVIOUS	0.685			= 35 % OF OVERALL AREA
	TOTAL - PERVIOUS	1291			= 65 % OF OVERALL AREA



DRAIN MODEL LAYOUT
(P1907197DRN01V01)

OSD MODELLING RESULTS (P1907197DRN01V01)

MODEL NAME																				
DURATION	0.2 EY				10% AEP				5% AEP				2% AEP				1% AEP			
	PRE	POST	DIFFERENCE	COMPLIES?	PRE	POST	DIFFERENCE	COMPLIES?	PRE	POST	DIFFERENCE	COMPLIES?	PRE	POST	DIFFERENCE	COMPLIES?	PRE	POST	DIFFERENCE	COMPLIES?
Max Q	0.412	0.391	0.021	Yes	0.505	0.466	0.039	Yes	0.639	0.586	0.053	Yes	0.822	0.732	0.090	Yes	0.969	0.966	0.003	Yes

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SCALE
0 10 20 30 40 50 60 70 80 90 100
A1 (A3) 1:1,000 (1:2,000) METRES

GRID	DATUM	PROJECT MANAGER	CLIENT
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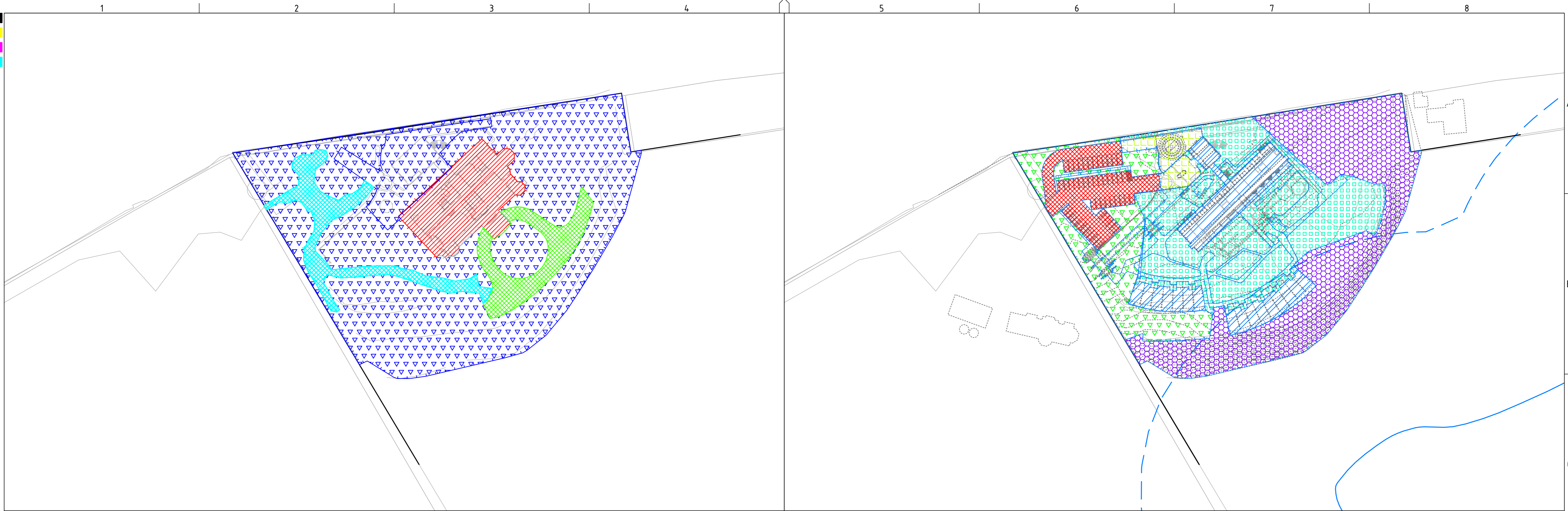
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DRAWING TITLE				
OSD CATCHMENT PLANS AND DETAILS				

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1907197	PS01	R07	PS01-E600	A

Document Set ID: 11554672
Version: 1, Version Date: 22/10/2020



PRE-DEVELOPMENT PLAN

SCALE - 1:1000

POST-DEVELOPMENT PLAN

SCALE - 1:1000

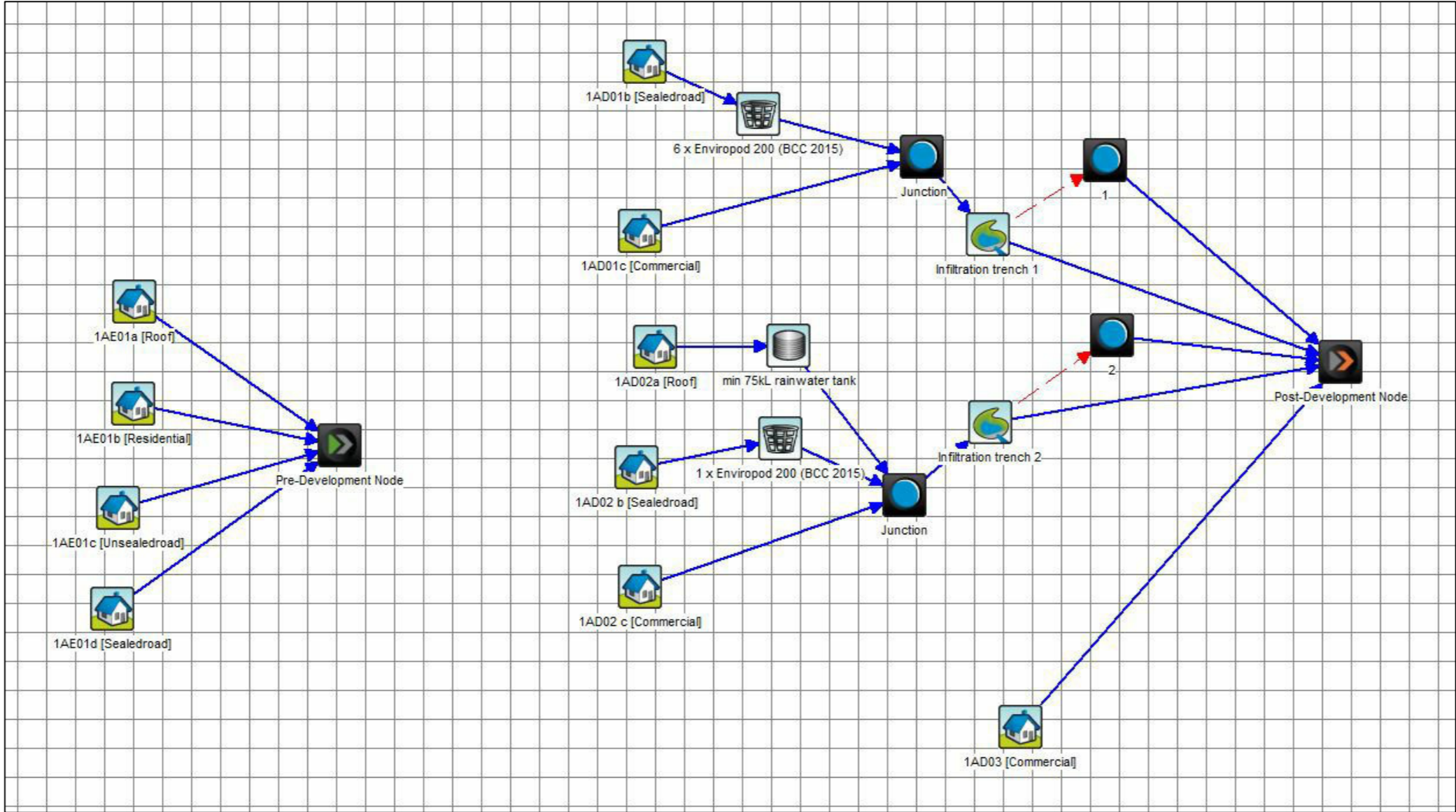
PRE DEVELOPMENT MUSIC CATCHMENTS (P1907197MUS01V07)

KEY	DESCRIPTION	MUSIC NODE ID	AREA (ha)	IMPERVIOUS %	MUSIC NODE REFERENCE
	ROOF	1AE01a	0.208	100	NSW MUSIC MODELLING GUIDELINES 2015
	RESIDENTIAL	1AE01b	1.500	10	NSW MUSIC MODELLING GUIDELINES 2015
	UNSEALED ROAD	1AE01c	0.142	100	NSW MUSIC MODELLING GUIDELINES 2015
	SEALED ROAD	1AE01d	0.126	100	NSW MUSIC MODELLING GUIDELINES 2015
	TOTAL SITE				
		TOTAL - OVERALL	1.976		= 100 % OF OVERALL AREA
		TOTAL - IMPERVIOUS	0.626		= 32 % OF OVERALL AREA
		TOTAL - PERVIOUS	1.350		= 68 % OF OVERALL AREA

POST DEVELOPMENT MUSIC CATCHMENTS (P1907197MUS01V07)

KEY	DESCRIPTION	MUSIC NODE ID	AREA (ha)	IMPERVIOUS %	MUSIC NODE REFERENCE
	SEALED ROAD	1AD01b	0.167	100	NSW MUSIC MODELLING GUIDELINES 2015
	COMMERCIAL	1AD01c	0.278	21	NSW MUSIC MODELLING GUIDELINES 2015
	TO INFILTRATION 1				
	ROOF	1AD02a	0.227	100	NSW MUSIC MODELLING GUIDELINES 2015
	SEALED ROAD	1AD02b	0.066	100	NSW MUSIC MODELLING GUIDELINES 2016
	COMMERCIAL	1AD02c	0.623	27	NSW MUSIC MODELLING GUIDELINES 2017
	TO INFILTRATION 2				
	BYPASS				
	BUSINESS (AREA BYPASSING)	1AD03	0.615	0	NSW MUSIC MODELLING GUIDELINES 2015
	TOTAL SITE				
		TOTAL - OVERALL	1.976		= 100 % OF OVERALL AREA
		TOTAL - IMPERVIOUS	0.682		= 35 % OF OVERALL AREA
		TOTAL - PERVIOUS	1.293		= 65 % OF OVERALL AREA

Notes:
1. ROOF WATER WILL BE DIRECTED TO 150 kL RAINWATER TANK WITH EXTERNAL REUSE.
2. EXTERNAL REUSE 9125 kL/YEAR BASED ON 5 l/m²/DAY FOR 5000 m² OF LANDSCAPE AREA TO BE IRRIGATED.



MUSIC MODEL LAYOUT

Mean Annual Loads - Post-Development Node		
	Pre	Post
Flow (ML/yr)	7.93	7.32
Total Suspended Solids (kg/yr)	2.52E3	627
Total Phosphorus (kg/yr)	2.55	1.53
Total Nitrogen (kg/yr)	17.2	13.0
Gross Pollutants (kg/yr)	163	0.00

MUSIC MODEL RESULT
(P1907197MUS01V07)

Properties of Infiltration trench 1	
Location	Infiltration trench 1
Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Storage and Infiltration Properties	
Pond Surface Area (square metres)	40.00
Extended Detention Depth (metres)	0.30
Filter Area (square metres)	40.00
Unlined Filter Media Perimeter (metres)	27.90
Depth of Infiltration Media (metres)	0.70
Exfiltration Rate (mm/hr)	3.60
Evaporative Loss as % of PET	100.00
Outlet Properties	
Overflow Weir Width (metres)	2.0

INFILTRATION BASIN 1

Properties of Infiltration trench 2	
Location	Infiltration trench 2
Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Storage and Infiltration Properties	
Pond Surface Area (square metres)	150.00
Extended Detention Depth (metres)	0.30
Filter Area (square metres)	150.00
Unlined Filter Media Perimeter (metres)	74.00
Depth of Infiltration Media (metres)	0.70
Exfiltration Rate (mm/hr)	3.60
Evaporative Loss as % of PET	100.00
Outlet Properties	
Overflow Weir Width (metres)	25.0

INFILTRATION BASIN 2

NOTE:
- MUSIC MODEL RESULTS INDICATED THAT NO INCREASE IN POLLUTANT LOAD AND FLOW RATES (PRE VS POST DEVELOPMENT) HAS BEEN ACHIEVED.

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	CLIENT	martens & Associates Pty Ltd		Consulting Engineers		DRAWING TITLE
C	MINOR AMENDMENT	15/10/2020	GM	SS/LZ	SL	MS	A1 (A3) 1:1,000 (1:2,000)			MS	CONTRACT PROPERTIES PTY LTD	PROJECT NAME/PLANSET TITLE		Environment Water Geotechnical Civil		WATER QUALITY CATCHMENT PLAN, MODEL & RESULTS
B	DA SUBMISSION	03/10/2019	LL	SS	SL	MS					PROPOSED ECO-TOURIST FACILITY CONCEPT STORMWATER MANAGEMENT PLAN	71 FIG HILL LANE, DUNMORE LOT 3 DP711776		Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: www.martens.com.au		PROJECT NO. P1907197
A	INITIAL RELEASE	27/09/2019	LL	SS	SL	MS								PLANSET NO. PS01	RELEASE NO. R07	DRAWING NO. PS01-E700
																REVISION C

Contract Properties Pty Ltd



Concept Stormwater Management Report

71 Fig Hill Lane, Dunmore, NSW

ENVIRONMENTAL



WATER



WASTEWATER



GEOTECHNICAL



CIVIL



PROJECT
MANAGEMENT



P1907197JR04V01
October 2020

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All enquiries regarding this project are to be directed to the Project Manager.



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1 Background

1.1 Scope

This concept stormwater management report has been prepared to support a development application (DA) for the construction of an eco-tourism facility and associated infrastructure at 71 Fig Hill Lane, Dunmore, NSW ('the Site').

This report has been prepared in response to the engineering comments received from council dated 29 April 2020 in relation to stormwater management (Point 6c and 6d).

This report is to be read in conjunction with the drawings by Martens and Associates (MA) planset P1907197PS01.

1.2 Relevant Guidelines

This report has been prepared in accordance with the following standards/guidelines:

- Shellharbour Development Control Plan (2017).
- Shellharbour Subdivision Design Code D05 (2004).
- BMT WBM (2015) NSW MUSIC Modelling Guidelines.

2 Site Description

2.1 Site Description and Location

Site description is provided in Table 1.

Table 1: Site description summary.

Item	Comment
Address / Lot / DP	71 Fig Hill Lane, Dunmore, NSW (Lot 3 DP 717776).
Local Government Area	Shellharbour City Council.
Site area (ha)	Approximately 59.2 ha (NSW LPI). Study area comprises approximately 2 ha located at the northern end of the lot.
Existing Development	Site contains an existing dwelling, retaining walls, driveway, water tank, gazebo, onsite wastewater management system and other infrastructure (e.g. telecommunications, electricity).
Typical slopes, aspect, elevation	Slopes in development area are generally <5% .
Vegetation	Grass in the vicinity of the existing dwelling.
Drainage	Minnamurra River and associated wetland at the base of the site slope. A coastal wetland is located adjacent to the Minnamurra River to the south.
Sub-surface soil / rock units	The Kiama 1:100,000 Geological Sheet 9028 (Hazelton, 1993) maps the site as being Bombo soil type in the vicinity of the existing dwelling, consisting of sandy clay loams overlying sandy light to medium clays then Bombo Latite bedrock. The lower portion of the site is mapped as being Mangrove Creek soil type.
Groundwater	Groundwater inflow was not observed in boreholes to 4.5 mBGL. A search of the WaterNSW groundwater bore database noted no existing bores within 250 m of potential effluent irrigation areas.
Climate	The nearest rainfall station with an appropriately long daily rainfall record is Albion Park (Wollongong Airport) (station 068241) and the nearest station with appropriate evaporation records is Nowra RAN (station 068076). Median rainfall is approximately 870 mm/year, median evaporation is 1,700 mm/year.

2.2 Proposed Development

We understand that the proposed development consists of:

1. Accommodation comprising 33 'lodges' located on three separate levels.
2. Restaurant and licensed bar facilities.
3. Gymnasium.

4. Day spa / beauty therapy rooms.
5. Reception area.
6. Car park and site access.
7. Associated infrastructure.
8. Conference rooms.
9. Swimming pool.

3 Stormwater Quality Assessment

3.1 Stormwater Quality Objectives

Shellharbour Council water quality treatment objective as stated in DCP (2017)_appendix 10_ Stormwater Management are outlined below:

"A10.3.1 As stormwater flows through a catchment it collects many substances including litter, sediment, nutrients, chemicals, oil and grease, depositing them further downstream. A coordinated and integrated approach, including the management of stormwater discharging from specific sites, is required if the quality of stormwater discharging into these waterways is to be of a standard that will not have a detrimental impact upon these waterways as well as maintaining or improving the quality of the natural environment.

A10.3.2 The philosophy of this Section is to manage the quality of stormwater at or near the source of potential pollutants. This will minimise the transportation of pollutants, thereby minimising potential environmental hazards. In practice this generally involves the design and installation of appropriate devices to treat stormwater before it leaves the subject site where deemed feasible."

3.2 Modelling Methodology

3.2.1 Overview

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC, Version 6.3) developed by the Cooperative Research Centre (CRC) for Catchment Hydrology was used to assess pre development and post development pollutant generated from the site to achieve at least zero net change.

Modelling has been undertaken in accordance with BMT WBM (2015) guidelines with the developed site based on design briefs and water quality treatment devices included to achieve adopted objectives.

The MUSIC model layout is provided in MA planset P1907197PS01 drawing PS01-E700.

3.2.2 Approach

An iterative approach was used for post-development modelling to determine appropriate sizes of stormwater treatment devices for the site to achieve adopted objectives.

The following modelling scenarios were considered:

- Pre development – the existing insitu site.
- Post development (treated) – the developed site with water quality improvement devices included to achieve stormwater quality objectives.

The MUSIC model includes all areas that are disturbed by the proposed development or drain to a treatment device. All other areas (i.e. where no development is proposed) have been excluded from the model.

Both individual source treatment and end of line structures were assessed to determine the most effective treatment option.

3.2.3 Rainfall Data

The nearest rainfall gauge to the site is the Bureau of Meteorology's (BOM) rainfall station 68131 located in Port Kembla Rainfall data was sourced from this gauge, the time period between 01/10/1995 – 31/12/2005 was used to run the MUSIC model.

For rates of average potential evapotranspiration data for Sydney was adopted.

3.2.4 Input Parameters

Input parameters for source and treatment nodes are consistent with BMT WBM (2015) guidelines, a summary of input parameters is provided in Attachment A. A summary of base and storm flow concentration inputs are displayed below in Table 2.

Table 2: Adopted base and storm flow concentrations for source nodes

Land Use	Parameter	Base Flow (mg/L)		Storm Flow (mg/L)	
		Log (mean)	Log (stdev)	Log (mean)	Log (stdev)
Roof	TSS	-	-	1.30	0.32
	TP	-	-	-0.89	0.25
	TN	-	-	-0.30	0.19
Sealed Road	TSS	1.20	0.17	2.43	0.32
	TP	-0.85	0.19	-0.30	0.25
	TN	0.11	0.12	0.34	0.19
Unsealed Road	TSS	1.20	0.17	3.00	0.32
	TP	-0.85	0.19	-0.30	0.25
	TN	0.11	0.12	0.34	0.19
Residential	TSS	1.20	0.17	2.15	0.32
	TP	-0.85	0.19	-0.60	0.25
	TN	0.11	0.12	0.30	0.19
Commercial	TSS	1.20	0.17	2.15	0.32
	TP	-0.85	0.19	-0.60	0.25
	TN	0.11	0.12	0.30	0.19

3.2.5 Catchment Areas

Catchment delineation and impervious fractions are based on the proposed development and project grading plans. Refer to MA planset P1907197PS01 drawing PS01-E700 for catchment boundaries.

3.3 Treatment Train Philosophy

The site stormwater treatment strategy uses at source controls and end of line treatment to ensure stormwater objectives are satisfied. Individual stormwater quality improvement devices are outlined in the following sections.

3.3.1 Rainwater Tank

A minimum 75 kL rainwater tank (2 x 37.5) will be provided to capture roof water for reuse. Captured water shall be used for outdoor irrigation. The following was included in the modelling:

- Rainwater tank were modelled at 80% of the volume capacity.

- An annual external reuse rate of 9125 kL/year based on 5 L/m²/day for 5000 m² of landscape area was applied (Attachment A).

3.3.2 Enviropod GPT

Seven Enviropod GPT (or equivalent) units are proposed to remove trash, debris and coarse sediments from stormwater runoff. This has been conceptually modelled with a modelled treatment flow of 0.14 m³/s based on 7 Enviropods proposed. Further amendments are to be provided at detailed design stage.

3.3.3 Infiltration Basin

Stormwater runoff from the proposed development shall be conveyed by way of pit and pipe to two infiltration basins. The infiltration basins will have unlined bases to allow treated low flows to percolate into the surrounding soils and restore groundwater, an underdrain in the drainage layer shall provide a flow path for treated low flows to be conveyed to the nominated outlet points when the soil is excessively saturated. The infiltration systems shall generally be designed in accordance with the proposed parameters nominated below and are subject to detailed design. Refer to MA planset P1907197PS01- E200 for details of two proposed basins with an area of 40 m² for the western catchment and 150 m² for the eastern catchment.

3.4 MUSIC Results

MUSIC modelling results showing no increase in pollutants from the proposed development have been provided in Table 3.

Table 3: Site development MUSIC results.

Parameter	Mean Annual Loads		Complies (Y/N)
	Pre development	Post development	
TSS (kg/year)	2520	627	Y
TP (kg/year)	2.55	1.53	Y
TN (kg/year)	17.2	13.0	Y
Gross Pollutants (kg/year)	163	0	Y

3.5 Conclusions

Results indicate that post development water quality objectives will be met by the proposed stormwater treatment train which includes:

- Rainwater tanks with reuse for site irrigation.
- GPT.

- Infiltration basins.

Further refinement of the model at detailed design stage may alter the sizes and locations of proposed treatment structures; however, performance outcomes of the final design are to achieve specification provided in this report.

4 OSD Assessment

4.1 OSD Objectives

As stated in Point 6d of council comments dated 29 April 2020, it is required to demonstrate that the pre and post development flows will be maintained the same. An OSD assessment has been processed to ensure the maximum post development discharge rate does not exceed the rate of run off for existing conditions up to 1% annual exceedance probability (AEP) storm event.

4.2 Modelling Methodology and Approach

4.2.1 Overview

This assessment has been completed to determine onsite detention (OSD) requirements for the proposed development. DRAINS modelling package was used to perform hydrological and hydraulic analysis.

4.2.2 Approach

Preliminary sizing of the OSD was completed through iterative modelling to achieve compliance with site objectives. Modelling was undertaken for all durations of the following storms:

- 0.2 EY.
- 10% AEP.
- 5% AEP.
- 2% AEP.
- 1% AEP.

4.2.3 Rainfall/IFD Data

Intensity Frequency Duration (IFD) parameters were obtained from BOM and storm temporal patterns from the AR&R 2016 datahub.

4.2.4 Catchment Areas

Catchment delineation was developed using site survey and based on the proposed design. Refer to MA planset P1907197PS01 drawing PS01-E600 for the catchment plan. Impervious fractions were based on aerial photography for existing conditions model and consistent with the proposed design for the post development model.

4.2.5 Proposed OSD Basin

Proposed two infiltration basins as mentioned in Section 3.3.3 will be utilised as an on-site detention system by providing a total storage volume of 160 m³.

4.3 Results

OSD storage has been modelled to limit post development peak discharge for storms up to the 1% AEP. Table 4 provides peak discharging results for each storm event modelled, refer to MA planset P1907197PS01 drawing PS01-E600 for the results of all storms.

Table 4: Results of DRAINS modelling.

Storm Event	Existing Peak Discharge (m ³ /s)	Post Development Peak Discharge (m ³ /s)	Change (m ³ /s)	Complies with Council's requirement
0.2 EY	0.412	0.391	-0.021	Yes
10% AEP	0.505	0.466	-0.039	Yes
5% AEP	0.639	0.586	-0.053	Yes
2% AEP	0.822	0.732	-0.090	Yes
1% AEP	0.969	0.966	-0.003	Yes

DRAINS modelling indicates that the site OSD basins requires total approximately 160 m³ of storage with two ø300 mm outlet pipes with associated overflow weirs.

The proposed OSD storage is sufficient to control post-development discharge rates to pre-development levels.

4.4 Conclusion

Preliminary hydraulic modelling indicates that the proposed OSD achieves the objectives stated in section 4.1. Detailed design of the site drainage system and OSD basin including size, position, dimensions, outlet control, overflow weir and final volume will need to be undertaken during the detailed design stage of the development.

5 **References**

BMT WBM (2015) NSW MUSIC Modelling Guidelines.

Shellharbour Development Control Plan (2017).

Shellharbour Subdivision Design Code D05 (2004).

6 Attachment A – Summary of MUSIC Input Parameters

Element	Factor	Input	Source
Setup	Climate File	Climate mlb file from Liverpool (Michael Wenden Centre)	eWater
Source Nodes	Rainfall Threshold	Based on surface type specified in Table 5-4	BMT WBM (2015)
	Base & Stormflow Properties	As per Table 5-6 & 5-7	BMT WBM (2015)
	Estimation Method	Stochastically generated	BMT WBM (2015)
Enviropd 200 (BCC2015)	Low Flow By-Pass	0 m ³ /s	Stormwater360 MUSIC node
	High Flow By-Pass	0.02 m ³ /s	Stormwater360 MUSIC node
	Treatment Efficiency	As per manufacture's specification	Stormwater360 MUSIC node
Rainwater Tank	Low Flow By-Pass	0 m ³ /s	By design
	High Flow By-Pass	0.02 m ³ /s	By design
	Volume below Overflow Pipe	60 kL	By design
	Depth Above Overflow Pipe	0.2 m	By design
	Surface Area	60 m ²	By design
	Initial Volume	60 kL	By design
	Reuse	9125 kL/yr for external irrigation	By design
Infiltration Basin 1	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	100 m ³ /s	By design
	Extended Detention Depth	0.30 m	By design
	Filter Area	40 m ²	By design
	Unlined Filter Media Perimeters	40 m ²	By design
	Exfiltration Rate	3.6 mm/h	MUSIC (6.3)
	Depth of infiltration Media	0.7 m	By design
	Overflow Weir Width	10 m	By design
Infiltration Basin 2	Low Flow By-Pass	0 m ³ /s	BMT WBM (2015)
	High Flow By-Pass	100 m ³ /s	By design
	Extended Detention Depth	0.30 m	By design
	Filter Area	150 m ²	By design
	Unlined Filter Media Perimeters	150 m ²	By design
	Exfiltration Rate	3.6 mm/h	MUSIC (6.3)
	Depth of infiltration Media	0.7 m	By design
	Overflow Weir Width	25 m	By design

