

PLANNING PROJECT MANAGEMENT ENGINEERING CERTIFICATION



# Kenthurst Construction Pty Ltd

# Stormwater Management Report

101 Residential Units

7 - 11 Bent Street, Gosford

April 2019

barkerryanstewart.com.au



Project No.	CC150124
Author	AD
Checked	IS
Approved	AD

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Rev No.	Status	Date	Comments
1	DA-Issue	29/02/2016	
2	Council Amendments	03/11/2017	
3	Revised OSD	28/11/18	

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# 1 Introduction

This report has been prepared to provide an overview of the stormwater management system proposed on the plans prepared by Barker Ryan Stewart, numbered CC150124E1 Revision F dated 28/11/2018, supporting a Development Application for a thirteen-storey residential development containing 101 apartments with three levels of basement parking to be constructed at 7-11 Bent Street, Gosford. Design of the stormwater management system and collection devices has been carried out in accordance with Gosford City Council's (GCC) DCP 2013 Part 6.7 – Water Cycle Management (and associated guidelines) and GCC Design Specification for Survey, Road and Drainage Works.

In determining the size and location of the stormwater system devices the following points have been considered:

- The existing site conditions, site constraints and the intended usage of the site.
- Consideration of the overland flow path.
- GCC DCP and relevant standards.

## 2 Site location & Development Proposal

#### 2.1 Site Location

The site is located at 7-11 Bent Street, Gosford. The land falls from the north east front boundary to the south west boundary at a grade of approximately 26%. The location of the site is shown in Figure 2.1 below.

### 2.2 Proposed Development

The proposed development will involve the demolition of existing structures and the construction of a residential flat building, including 102 units and basement car park.

The development site area is 1,788m<sup>2</sup>. The new building and hard landscaped areas form 69% of the site.



Figure 2.1: Locality Plan.

# 3 Calculation Method & Results

### 3.1 On-Site Detention

The DRAINS program was used to model the volume of OSD required for the development such that post development flows did not exceed pre-development flows for natural (undeveloped) conditions. The 1%, 5% and 20% AEP storm events were modelled for a range of storm durations ranging from 5 minutes to 3 hours. It was determined that a volume of 18.3m<sup>3</sup> is required to contain the 1% AEP peak storm duration of 1.5 hours.

Below is a list of points that impacted the sizing, location and calculation of the OSD system:

- The pre-developed impervious area was taken as natural vegetation with zero impervious area, in accordance with GCC Water Cycle Management Guidelines.
- The time of concentration was calculated using the kinematic wave equation.

- An ILSAX hydrological model was developed with specific IFD data obtained and input for the site.
- The development site has an impervious area of 69.1%.

As per GCC Water Cycle Management Guidelines, it is assumed that 50% of the rainwater re-use tank is empty and once full will overflow into the On-Site detention tank. A rainwater re-use volume of 34.2m<sup>3</sup> is proposed to be provided and 18.4m<sup>3</sup> On-Site Detention is required.

- The OSD and rainwater reuse tank are located below ground at the rear of the site in a landscaped area. The OSD is provided with a grated lid at surface level for ease of inspection and maintenance access.
- The OSD incorporates a 900mm wide high-level outflow weir. In the event of a blockage of the orifice plate any overflow will be directed to the outlet pipe and piped through a drainage easement to the Council drainage system in Faunce Street.
- The orifice plate and overflow weir were sized to ensure that post developed flow would not exceed pre-development flows as per GCC Water Cycle Management Guidelines.

Table 3.1 indicates the impervious portion modelled.

Table 3.1: Pre and Post Developed Hardstand Area									
	Impervious	Pervious							
Pre-Developed	(0% modelled)	(100% modelled)							
Post-Developed	69.1%	30.9%							

Table 3.2 below indicates the site discharge for pre and post developed site conditions.

Table 3.2: Pre and Post Developed Site Discharge

Storm Event (AEP)	Pre-Developed Site	Post-Developed
	Discharge (L/s)	Site Discharge (L/s)
20%	29	29
5%	61	32
1%	80	82

### 3.2 Stormwater Retention Volume

The stormwater retention volume for the development site area of 1,788m<sup>2</sup> has be calculated in accordance with "Table 2 Stormwater Retention Volume Target" from GCC DCP 2013 Section 6.7.7.2.4 Deemed to Comply. The calculations are attached in Appendix A.

The proposed development has a roof area of 497m<sup>2</sup> and roof top terraces and hard landscaped area of 738m<sup>2</sup> hence the Fraction Impervious for the site is 69.1%. This gives a Stormwater Retention Volume for the site of 34,121 litres. It is proposed to provide a 34.2KL below ground rainwater reuse tank. The Rainwater Reuse per Week, for this development, based on the rainwater tank being used only for garden irrigation is 3,479 litres.

# 4 Pollution and Nutrient Control

### 4.1 Roof Water

Roof water from the development will be collected via the roof drainage system & directed to a 34,200 litre below ground rainwater reuse tank. Pollutants & organic matter will be remove from the drainage system via a first flush device fitted to all downpipes discharging to the rainwater reuse tank. The first flush devices will be fitted with a removable end cap for maintenance. The first flush end cap should be removed, inspected and cleaned out if necessary every 6 months.

The proposed rainwater re-use tank is to be connected to garden irrigation systems only.

The rainwater reuse tank overflows directly into the OSD system via a 900mm wide weir before discharging to the council drainage system in Faunce Street.

### 4.2 Hardstand Areas

The lower basement drainage, roof top terraces and driveway areas will drain directly to the high early discharge pit of the on-site detention system. This pit contains a trash screen and sediment sump to remove gross pollutants and sediment before the stormwater is discharged to the Council drainage system.

# 5 Operation & Maintenance Plan

The OSD, surface inlet pits and first flush system have built in design features that help keep the inlets / outlets free of debris and provide resilience against blockages as well as removing contaminants from site runoff. Table 5.1 below provides information regarding the function of pollution control devices and operation & maintenance requirements.

Device or Structure Type	Pollution Control Design Attribute	Function	Frequency of Maintenance	Type of Maintenance
Rainwater Tank	Above-ground first flush device	Collects sediment / contaminants	6-12 months	End cap removed, inspection and clean out if necessary
OSD / Pits	Sump below outlet	Collects sediment / debris & keeps outlet clear	6-12 months	Inspect and clean out if necessary
OSD / Pits	Trash Screen	keeps outlet clear	6-12 months	Inspect and clean out if necessary

Table 5.1: Pollution Control Operation & Maintenance

During periods of increased rain fall it may be necessary to increase the period between inspections of the stormwater system.

The owner / Body Corporate will carry the responsibility of maintaining the stormwater system in accordance with this report.

# 6 Conclusion

This report assesses how OSD and stormwater retention for the development site has been calculated, how pollution control is to be implemented and gives evidence that the stormwater management system conforms to Gosford City Councils DCP 2013, Water Cycle Management requirements. This report is to be read in conjunction with the plans prepared by BRS.

The method of collecting rainwater for re-use for the proposed development provides an efficient means of controlling both site runoff and the quality of runoff leaving the site.

To maintain the level of quality of stormwater treatment it will be the responsibility of the owner to maintain the systems proposed periodically, as discussed in section 5 of this report.

# APPENDIX A Storm Water Retention Volume & Reuse Calculations

### Stormwater Management Plan

	Storm Water Retention Volume											
	Total Site Area (m2)	1,788										
	Fraction Impervious (%)	69.1										
	Stormwater Retention Volume (L)	34,121										
					Table	3	Rainwater	reuse plum	bing option	IS		
	Impervious Areas						Rair	water reuse	plumbing o	ptions		
	House / Building Roof Area	497		House	hold		Outdaws	Tailat 9	List	- Harris		
	Garage / Carport Roof Area	0		Water	Usage		Outdoor	Laundry	Water	House		
	Covered Pergolas & Aunings	0		Outdo	or	20%			1.101			
	Site Total Roof Area (m2)	497		Toilets		20%	×	~	~	V 1		
				Laundr	y (cold)	10%	*	1	~	×		
	Other / Paved Impervious Area (m2)	738		Hot Wa	ater	25%	×	×	~	× · · ·		
	Total Impervious Area (m2)	1.235		Kitchei	n & Bath	25%	×	×	×	· · · · ·		
	in the second of the second seco	2,233		lotal		100%	20%	50%	15%	100%	-	
	Reuse Plumbing Options - Table 3 %	20		Part 2	Minimum	separati	on between	infiltration d	levices & bi	uildings	-	
	Outdoor, Toilets & Laundry			Soil ty	ре		Hydrauli	c conductivi	ty Di	Distance to footing		
	L / week per m sq of roof area	35		Sand			>180 mm/hr		1.	notro		
	Rainwater Reuse per Week	3,479.0	L	Sanu			> 100 mm			2 metres 4 metres		
				Sandy	ciay		180 - 36	mm/nr	21			
	Rainwater Tank Provided	34,120	L	Mediur	n clay		36 - 3.6 r	nm/hr	4 r			
				Reactiv	ve clay		3.6 - 0.0	36 mm/hr	5 r	5 metres		
	Balance to be retained on site by											
	infiltration or slow release	1	L									
	Infiltration Volume During Storm Event	1/2 hr Sto	orm Event		Infiltrat	ion Are	a					
	Infiltration Area	3	m2		Length		1					
	Infiltration Rate	36	mm/hr		Width		3					
	Infitration Volume	54	L									
	Balance of retention to be stored &										_	
	slowly released after the storm	-52	1									
	slowly released after the storin	-33	L								_	
	Ponding Depth Required = Volume / Area	-18	mm									
	- shane began adan a - solanie / Area	10										

# APPENDIX B DRAINS Results

#### 20% AEP

DRAINS results prepare	d from Versio	on 2018.06									
PIT / NODE DETAILS	Marculaci	Mary David	Mary Crysferra	Version 8	N 41-1	0	Constant				
Name	IVIAX HGL			Iviax Pond	IVIIN	Overriow	Constra	aint			
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)					
	20.0	20.6	(cu.m/s)	(cu.m)	(m)						
Pit1	29.8	30.6	0	0	0.8	0	None				
Pit1/6	27.26	28.03	0.024	0	0.74	0	Inlet Ca	apacity			
Pit1/7	25.11		0.017		0.79	0	Inlet Ca	apacity			
Pit1/8	24.05		0		2.02		None				
N4	19.73		0								
SUB-CATCHIMENT DETA	Max	David	Crassed	David	Crassed	Supp	Duo to	Ctorm			
Name	IVIAX	Paveu	Grassed	Paveu	Grassed	Supp.	Due to	Storm			
	FIOW Q			(maim)	(min)	10					
Due Development	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	4000				
Pre Developed	0.029	0.02	0.029	0	9.7	0	AR&RS	year, 2 nd	ours storm,	, average 32.0	mm/n, Zone 1
	0.039	0.03	0.008	5	0.94	0	AR&R	year, 25 r	ninutes sto	orm, average i	6.0 mm/n, 20ne 1
	0.024	0.015	0.009	5.50	9.05	0	AR&R	year, 25 r	ninutes sto	orm, average /	'6.0 mm/n, Zone 1
	0.017	0.014	0.003	5.50	9.89	0	AR&R	year, 25 r	ninutes sto	orm, average /	6.0 mm/n, 20ne 1
ROOT	0.02	0.02	0	5	0	U	AR&RS	year, 25 r	ninutes sto	orm, average <i>i</i>	'6.0 mm/n, 20ne 1
PIPE DETAILS											
Name	Max O	Max V	Max U/S	Max D/S	Due to Stor	m					
	(cu m/s)	(m/s)	HGL (m)	HGL (m)	Due to Ston						
Pine1	0.029	0.95	29 802	29 799	AR&R 5 yea	r 25 minute	es storm	average	76 0 mm/h	Zone 1	
Pine2	0.029	4 42	29.688	27 368	AR&R 5 yea	r 25 minute	es storm	average	76.0 mm/h	Zone 1	
Pine3	0.052	3.61	27,155	25 113	AR&R 5 yea	r 25 minute	es storm	average	76.0 mm/h	70ne 1	
Pine4	0.069	3.03	25.027	24.05	AR&R 5 yea	r 25 minute	es storm	average	76.0 mm/h	Zone 1	
Pine6	0.069	4 61	23.027	19 733	AR&R 5 yea	r 25 minute	es storm	average	76.0 mm/h	Zone 1	
	0.005	-1.01	20.000	15.755	7 mart 5 yea			, average		, 20110 1	
OVERFLOW ROUTE DET	AILS										
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	n Max V	Due to St	orm		
OF1	0	0	0.319	0	0	0	0				
OF2	0	0	0.908	0	0	0	0				
OF-1/6	0	0	1.401	0	0	0	0				
OF-1/7	0	0	0.416	0	0	0	0				
RWT-OF	0.011	0.011	0.319	0.021	0.01	0.9	0.6	AR&R 5 y	ear, 2 houi	rs storm, avera	age 32.0 mm/h, Zon
DETENTION BASIN DETA	ALS										
Name	Max WL	MaxVol	Max Q	Max Q	Max Q						
			Total	Low Level	High Level						
OSD	30.06	1.8	0.029	0.029	0						
RWT	31.14	34	0.011	0	0.011						

#### 5% AEP

DRAINS results prepare	ed from Versio	on 2018.06										
				Version 8								
Name	May HGI	Max Pond	Max Surface	Max Pond	Min	Overflow	Constra	int				
Name	IVIAX TIGE		Elow Arriving	Volumo	Erooboard	(cum/c)	constra					
		HUL	(cum/s)	(cum)	(m)	(cu.iii/3)						
Di+1	29.81	30.6	(cu.iii/s)	0	0.79	0	None					
Pit1/6	27.29	28.04	0.039	0	0.75	0	Inlet Ca	nacity				
Pit1/7	25.14	20.04	0.025	Ū	0.76	0.002	Inlet Ca	nacity				
Pit1/8	24.08		0		1.99		None					
N4	19.74		0.002									
SUB-CATCHMENT DETA	AILS											
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to S	itorm				
	Flow Q	Max Q	Max Q	Тс	Tc	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
Pre Developed	0.061	0	0.061	0	6.23	0	AR&R 20	) year, 25 n	ninutes sto	rm, average 9	7.0 mm/h, Zone 1	
Post Developed	0.058	0.039	0.019	5	6.3	0	AR&R 20	) year, 25 n	ninutes sto	rm, average 9	7.0 mm/h, Zone 1	
Cat3/5	0.039	0.019	0.019	5.51	8.21	0	AR&R 20	) year, 25 n	ninutes sto	rm, average 9	7.0 mm/h, Zone 1	
Cat1/7	0.025	0.018	0.008	5.51	8.97	0	AR&R 20	) year, 25 n	ninutes sto	rm, average 9	7.0 mm/h, Zone 1	
Roof	0.026	0.026	0	5	0	0	AR&R 20	) year, 25 n	ninutes sto	rm, average 9	7.0 mm/h, Zone 1	
Name	Max O	Max V	Max U/S	Max D/S	Due to Stor	m						
Name	(cu m/s)	(m/s)	HGL (m)	HGL (m)	Due to Ston							
Pine1	0.032	0.99	29 811	29,809	AR&R 20 ve	ar. 2 hours st	orm ave	rage 41.6 n	nm/h. Zone	• 1		
Pine2	0.032	4 57	29.691	27.371	AR&R 20 ye	ar. 2 hours st	orm ave	rage 41.6 n	nm/h. Zone	• 1		
Pipe3	0.068	3.88	27.168	25.144	AR&R 20 ve	ar. 25 minute	es storm.	average 97	7.0 mm/h. Z	one 1		
Pipe4	0.092	3.28	25.043	24.082	AR&R 20 ve	ar. 25 minute	es storm.	average 97	7.0 mm/h. Z	one 1		
Pipe6	0.092	5	23.944	19.744	AR&R 20 ye	ar, 25 minute	es storm,	average 97	7.0 mm/h, Z	one 1		
OVERFLOW ROUTE DET	TAILS											
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to St	orm			
OF1	0	0	0.319	0	0	0	0					
OF2	0	0	0.908	0	0	0	0					
OF-1/6	0	0	1.401	0	0	0	0					
OF-1/7	0.002	0.002	0.416	0.015	0.02	0.18	1.21	AR&R 20	year, 25 mi	nutes storm,	average 97.0 mm/	h, Zone 1
RWT-OF	0.024	0.024	0.319	0.033	0.03	0.9	0.82	AR&R 20	year, 1.5 ho	ours storm, av	verage 48.9 mm/h,	, Zone 1
DETENTION BASIN DET	AILS											
Name	Max WL	MaxVol	Max Q	Max Q	Max Q							
			Total	Low Level	High Level							
OSD	31	16	0.032	0.032	0							
RWT	31.11	33.7	0.024	0	0.024							

#### 1% AEP

DRAINS results prepare	d from Versio	on 2018.06										
				Version 8								
Name	May HGI	Max Rond	Max Surface	Max Pond	Min	Overflow	Constra	int				
Name	IVIAX HOL	HGI	Flow Arriving	Volume	Ereeboard	(cum/s)	Constra					
		HOL	(cu m/s)	(cum)	(m)	(cu.iii/3)						
Pit1	30.11	30.65	0.048	0	0.49	0	Inlet Ca	nacity				
Pit1/6	27.6	28.05	0.048	0	0.4	0	Inlet Ca	pacity				
Pit1/7	25.22	20100	0.03		0.68	0.002	Inlet Ca	pacity				
Pit1/8	24.16		0		1.91	0.002	None					
N4	19.77		0.002									
SUB-CATCHMENT DETA	ILS											
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to S	Storm				
	Flow Q	Max Q	Max Q	Tc	Тс	Tc						
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)						
Pre Developed	0.080	0	0.08	0	7.87	0	AR&R 1	00 year, 2 h	ours storn	n, average 54.	.0 mm/h, Zo	ne 1
Post Developed	0.068	0.045	0.022	5	7.48	0	AR&R 1	00 year, 1.5	5 hours sto	rm, average 6	53.0 mm/h, Z	Zone 1
Cat3/5	0.048	0.022	0.026	5.6	9.75	0	AR&R 1	00 year, 1.5	5 hours sto	rm, average 6	53.0 mm/h, Z	Zone 1
Cat1/7	0.03	0.02	0.01	5.6	10.67	0	AR&R 1	00 year, 1.5	5 hours sto	rm, average 6	53.0 mm/h, Z	Zone 1
Roof	0.031	0.031	0	5	0	0	AR&R 1	00 year, 1.	5 hours sto	rm, average 6	53.0 mm/h, Z	Zone 1
PIPE DETAILS												
Name	Max O	May V	Max 11/S	Max D/S	Due to Storm	) 						
Name	(cu m/s)	(m/s)	HGL (m)	HGL (m)	Due to Storm							
Pine1	0.034	0 74	30 116	30 113	AR&R 100 ve	ar 2 hours st	torm ave	rage 54 0 r	nm/h Zon	e 1		
Pine2	0.079	5.9	29 721	27 603	AR&R 100 ye	ar 2 hours st	torm ave	rage 54.0 r	nm/h 7on	e 1		
Pine3	0.126	4.53	27.211	25,219	AR&R 100 ye	ar. 2 hours st	torm, ave	rage 54.0 r	nm/h. Zon	e 1		
Pine4	0.152	3.78	25.077	24 163	AR&R 100 ve	ar. 2 hours st	torm, ave	rage 54.0 r	nm/h Zon	e 1		
Pipe6	0.152	5.79	23,968	19.768	AR&R 100 ve	ar. 2 hours st	torm, ave	rage 54.0 r	nm/h Zon	e 1		
	0.102	0.75	201000	151700	7 11 10 1 200 9 0				,,			
OVERFLOW ROUTE DET	AILS											
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to St	orm		_	
OF1	0.048	0.048	0.319	0.05	0.05	0.9	1.06	AR&R 10	) year, 2 ho	ours storm, av	verage 54.0 r	nm/h, Zone 1
OF2	0	0	1.479	0	0	0	0		1			
OF-1/6	0	0	1.401	0	0	0	0					
OF-1/7	0.002	0.002	0.416	0.017	0.02	0.19	1.31	AR&R 10	) year, 1.5	hours storm,	average 63.0	0 mm/h, Zone 1
RWT-OF	0.029	0.029	0.319	0.037	0.03	0.9	0.88	AR&R 10	) year, 1.5	hours storm,	average 63.0	0 mm/h, Zone 1
DETENTION BASIN DET	AILS	N. 1. 1			N4: 0							
Name	Max WL	MaxVol	Max Q	Max Q	Max Q							
			Total	Low Level	High Level							
USD	31.16	18.3	0.082	0.034	0.048							
KWI	31.17	34.6	0.029	0	0.029							