

10.ii APPENDIX B – RELEVANT ENGINEERING CALCULATIONS

 MAVEN ASSOCIATES M A V E N		Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitooopuni Developments Limited							Author	Date	Checked
		147007	1	A	Calc Title: Catchment and Swale 10-yr Capacity check for Stage 1-5							WY	13/02/2025	KH

<table> <tr> <td>Rainfall Depth</td><td>ARI 10YR (mm)</td></tr> <tr> <td>TP108 rainfall data</td><td>130</td></tr> <tr> <td>Climate Increase 2.1°</td><td>152.1</td></tr> </table>	Rainfall Depth	ARI 10YR (mm)	TP108 rainfall data	130	Climate Increase 2.1°	152.1	<table> <tr> <td>Impervious area</td><td>CN Number</td></tr> <tr> <td></td><td>98</td></tr> <tr> <td>Pervious</td><td>74</td></tr> </table>	Impervious area	CN Number		98	Pervious	74
Rainfall Depth	ARI 10YR (mm)												
TP108 rainfall data	130												
Climate Increase 2.1°	152.1												
Impervious area	CN Number												
	98												
Pervious	74												

Swale has 0.3m bottom width with the side slope 1:4 and 1:3										Maximum Capacity based on the Minnum Slope					
Swale number	Catchment letter	Catchment Area m2	CN	rate - l/s	Flow cms	Top Width m	Bottom Width m	Depth m	A m2	P m	R m/m	N Grass	Minimum S m/m	Capacity cms	Percent Capacity %
SW1	1	11691	80.4	222.9	0.22	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	32.2%
SW2	2	8728	81.0	168.9	0.17	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	24.4%
SW3	3	12864	79.6	240.6	0.24	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	27.3%
SW4	4A	3810	81.0	73.8	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	13.7%
	4B	13581	82.0	269.4	0.27	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	50.2%
	4	17391	80.0	328.6	0.33	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	61.2%
SW5	5	20539	85.0	435.1	0.44	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	49.4%
SW6	6	17549	85.0	371.7	0.37	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	42.2%
SW7	7	6017	85.0	127.5	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	14.5%
SW8	8	2409	79.2	44.6	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	8.6%
SW9	9	2839	83.7	58.5	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.3%
SW10	10	1530	98.0	38.5	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	7.4%
SW11	11	2342	98.0	59.0	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.3%
SW12	12	2769	98.0	69.7	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	13.4%
SW13	13	3924	98.0	98.8	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	19.0%
SW14	14	2315	98.0	58.3	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.2%
SW15	15	4820	98.0	121.4	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	23.3%
SW16	16	9318	98.0	234.7	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	45.1%

MAVEN ASSOCIATES

M A V E N

Job Number

147007

Sheet

1

Rev

A

147007 Development of Riverhead Forest For Rangitooopuni Developments Limited

Author

WY

Date

13/02/2025

Checked

KH

Rainfall Depth

ARI 100YR (mm)

TP108 rainfall data

190

Climate Increase 3.8*

252.1

Impervious area

Pervious

CN Number

98

74

Swale has 0.3m bottom width with the side slope 1:4 and 1:3

Swale number	Catchment letter	Catchment Area m2	CN	rate - l/s	Flow cms	Top Width m	Bottom Width m	Depth m	A m2	P m	R m/m	N Grass	Minimum S m/m	Capacity cms	Percent Capacity %
SW1	1	11691	85.0	451.8	0.45	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	65.2%
SW2	2	8728	85.0	337.3	0.34	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	48.6%
SW3	3	12864	85.0	497.1	0.50	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	71.7%
SW4	4A	3810	81.0	140.6	0.14	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	26.2%
	4B	13581	82.0	507.6	0.51	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	94.5%
	4	17391	80.0	633.7	0.63	Refer to Culvert 3-2 Calculation									
SW5	5	20539	80.0	748.4	0.75	Refer to Culvert 3-3 Calculation									
SW6	6	17549	80.0	639.5	0.64	Refer to Culvert 3-4 Calculation									
SW7	7	6017	85.0	232.5	0.23	Refer to Culvert 3-5 Calculation									
SW8	8	2409	95.0	100.0	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.4%
SW9	9	2839	95.0	117.8	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	17.0%
SW10	10	1530	95.0	63.5	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.2%
SW11	11	2342	95.0	97.2	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.0%
SW12	12	2769	95.0	114.9	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.6%
SW13	13	3924	95.0	162.9	0.16	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	23.5%
SW14	14	2315	95.0	96.1	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	13.9%
SW15	15	4820	95.0	200.1	0.20	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	28.9%
SW16	16	9318	95.0	386.8	0.39	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	55.8%



MAVEN ASSOCIATES

Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitooopuni Developments Limited	Author	Date	Checked
147007	1	A	Calc Title: Catchment and Swale 10-yr Capacity check for Stage 6-14	WY	13/02/2025	KH

Rainfall Depth	ARI 10YR (mm)
TP108 rainfall data	130
Climate Increase 2.1*	152.1

Impervious area	CN Number
	98
Pervious	74

All proposed road Swale have 0.3m bottom width with the side slope 1:4 and 1:3

Maximum Capacity based on the Minnum Slope

Swale number	Catchment letter	Catchment Area m2	CN	rate - l/s	Flow cms	Top Width m	Bottom Width m	Depth m	A m2	P m	R m/m	N Grass	Minimum S m/m	Capacity cms	Percent Capacity %
SW17	17	5461	95.0	134.7	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.4%
SW18	18	7934	95.0	195.7	0.20	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	28.2%
SW19	19	679	95.0	16.8	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.4%
SW20	20	3947	95.0	97.4	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.0%
SW21	21	28845	85.0	611.0	0.61	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	88.1%
SW22	22	3189	95.0	78.7	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	11.3%
SW23	23	4421	95.0	109.1	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	15.7%
SW24	24	3550	95.0	87.6	0.09	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	12.6%
SW25	25	3381	95.0	83.4	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	12.0%
SW26	26	4629	95.0	114.2	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.5%
SW27	27	4443	95.0	109.6	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	15.8%
SW28	28	1571	95.0	38.8	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	5.6%
SW29	29	955	95.0	23.6	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	3.4%
SW30	30	4763	95.0	117.5	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.9%
SW31	31	812	95.0	20.0	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.9%
SW32	32	1826	95.0	45.0	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	6.5%
SW33	33	1141	95.0	28.2	0.03	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	4.1%
SW34	34	2561	95.0	63.2	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.1%
SW35	35	1831	95.0	45.2	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	6.5%
SW36	36	3043	95.0	75.1	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.8%
SW37	37	5137	95.0	126.7	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.3%
SW38	38	570	95.0	14.1	0.01	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.0%
SW39	39	1520	95.0	37.5	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	5.4%
SW40	40	9197	95.0	226.9	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	32.7%
SW41	41	4935	95.0	121.8	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	17.6%
SW42	42	9323	95.0	230.0	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	33.2%
SW43	43	2067	95.0	51.0	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	7.4%
SW44	44	2298	95.0	56.7	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	8.2%
SW45	45	15672	95.0	386.7	0.39	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	55.8%
SW46	46	2636	95.0	65.0	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.4%
SW47	47	3071	95.0	75.8	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.9%
SW48	48	17142	95.0	422.9	0.42	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	61.0%
SW49	49	19455	95.0	480.0	0.48	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	69.2%
SW50	50	5252	95.0	129.6	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.7%
SW51	51	3003	95.0	74.1	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.7%
SW52	52	6017	95.0	148.5	0.15	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	21.4%
SW53	53	5565	95.0	137.3	0.14	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.8%
SW54	54	5182	95.0	127.8	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.4%
SW55	55	5389	96.0	134.1	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.3%



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Job Number

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Rev

147007 Development of Riverhead Forest For Rangitōopuni Developments Limited

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Date

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147007

1

A

Calc Title: Catchment and Swale 100-yr Capacity check for Stage 6-14

WY

13/02/2025

KH

Rainfall Depth	ARI 100YR (mm)
TP108 rainfall data	190
Climate Increase 3.8*	252.1

Impervious area	CN Number
	98
Pervious	74

Swale has 0.3m bottom width with the side slope 1:4 and 1:3

Swale number	Catchment letter	Catchment Area m ²	CN	rate - l/s	Flow cms	Top Width m	Bottom Width m	Depth m	A m ²	P m	R m/m	N Grass	Minimum S m/m	Capacity cms	Percent Capacity %
SW17	17	5461	95.0	226.7	0.23	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	31.9%
SW18	18	7934	95.0	329.4	0.33	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	46.4%
SW19	19	679	95.0	28.2	0.03	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	4.0%
SW20	20	3947	95.0	163.8	0.16	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	23.1%
SW21	21	28845	96.0	1201.7	1.26	100 year Q=1.26 cms from Culvert 6-6 HY-8 Report									
SW22	22	3189	95.0	132.4	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	18.7%
SW23	23	4421	95.0	183.5	0.18	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	25.9%
SW24	24	3550	95.0	147.3	0.15	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	20.8%
SW25	25	3381	95.0	140.3	0.14	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	19.8%
SW26	26	4629	95.0	192.2	0.19	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	27.1%
SW27	27	4443	95.0	184.4	0.18	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	26.0%
SW28	28	1571	95.0	65.2	0.07	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	9.2%
SW29	29	955	95.0	39.6	0.04	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	5.6%
SW30	30	4763	95.0	197.7	0.20	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	27.9%
SW31	31	812	95.0	33.7	0.03	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	4.7%
SW32	32	1826	95.0	75.8	0.08	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	10.7%
SW33	33	1141	95.0	47.4	0.05	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	6.7%
SW34	34	2561	95.0	106.3	0.11	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	15.0%
SW35	35	1831	95.0	76.0	0.08	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	10.7%
SW36	36	3043	95.0	126.3	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	17.8%
SW37	37	5137	95.0	213.3	0.21	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.0%
SW38	38	570	95.0	23.7	0.02	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	3.3%
SW39	39	1520	95.0	63.1	0.06	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	8.9%
SW40	40	9197	95.0	381.8	0.38	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	53.8%
SW41	41	4935	95.0	204.9	0.20	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	28.9%
SW42	42	9323	95.0	387.0	0.39	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	54.5%
SW43	43	2067	95.0	85.8	0.09	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	12.1%
SW44	44	2298	95.0	95.4	0.10	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	13.4%
SW45	45	15672	95.0	650.6	0.65	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	91.7%
SW46	46	2636	95.0	109.4	0.11	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	15.4%
SW47	47	3071	95.0	127.5	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	18.0%
SW48	48	17142	85.0	662.5	0.66	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	93.3%
SW49	49	19455	80.0	708.9	0.71	100 year Q=1.56 cms from Culvert 13-4 HY-8 Report									
SW50	50	5252	95.0	218.0	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.7%
SW51	51	3003	95.0	124.7	0.12	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	17.6%
SW52	52	6017	95.0	249.8	0.25	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	35.2%
SW53	53	5565	95.0	231.0	0.23	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	32.5%
SW54	54	5182	95.0	215.1	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.3%
SW55	55	5389	96.0	224.5	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	31.6%



MAVEN ASSOCIATES

Job Number
147007

Sheet
1

Rev
A

Job Title
Title Development of Riverhead Forest
SW 100-year Circular Culvert Size Calculation

Author
WY

Date
13/05/2024

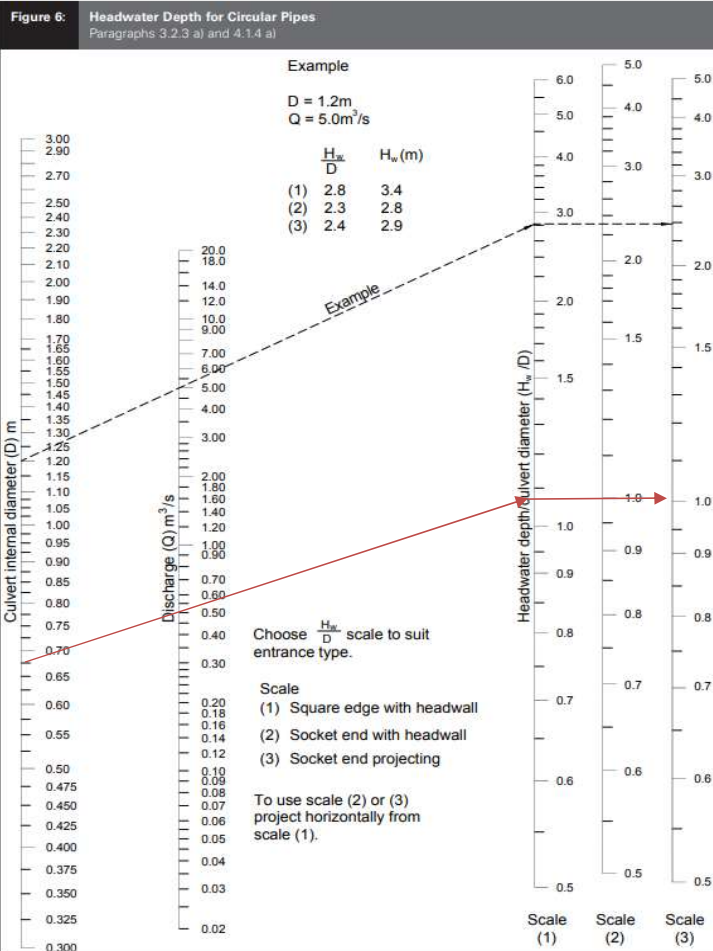
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-1

Q	0.5	m ³ /s	Catchment 3
D	0.675	m	Pipe Diameter
	Hw/D	Hw	
(1)	1.08	0.73	
(2)	1	0.68	
(3)	1.02	0.69	

Circular Pipe with 675 mm diameter would have a headwater of 0.73 m depth





MAVEN ASSOCIATES

Job Number
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Sheet
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Job Title
Title Development of Riverhead Forest
SW 100-year Circular Culvert Size Calculation

Author
WY

Date
13/05/2024

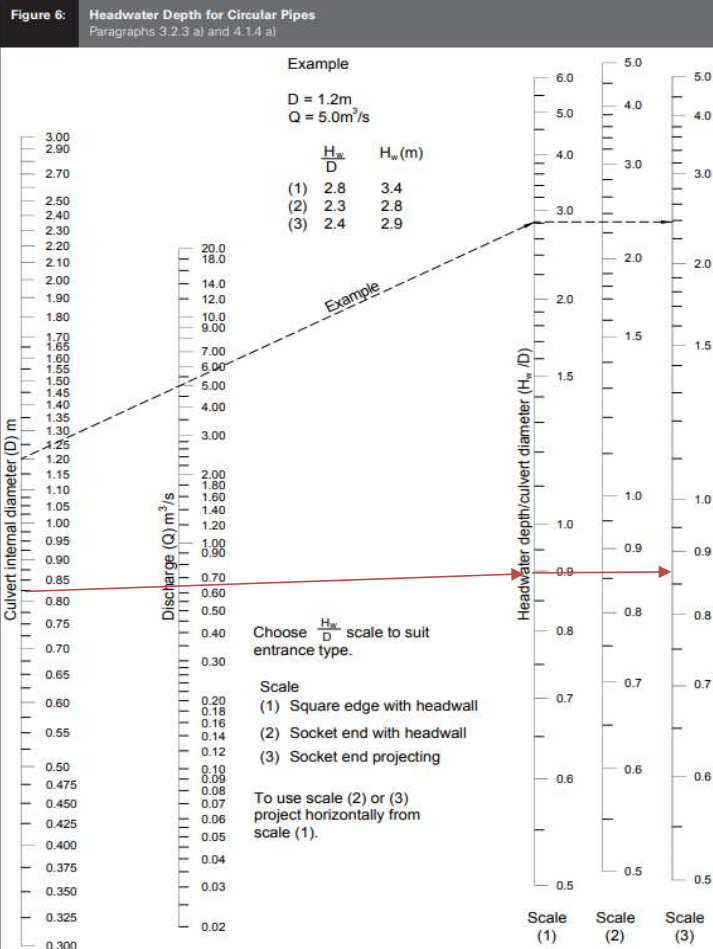
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-2

Q	0.63	m ³ /s	Catchment 4
D	0.825	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.9	0.74	
(2)	0.86	0.71	
(3)	0.87	0.72	

Circular Pipe with 825 mm diameter would have a headwater of 0.7 m depth





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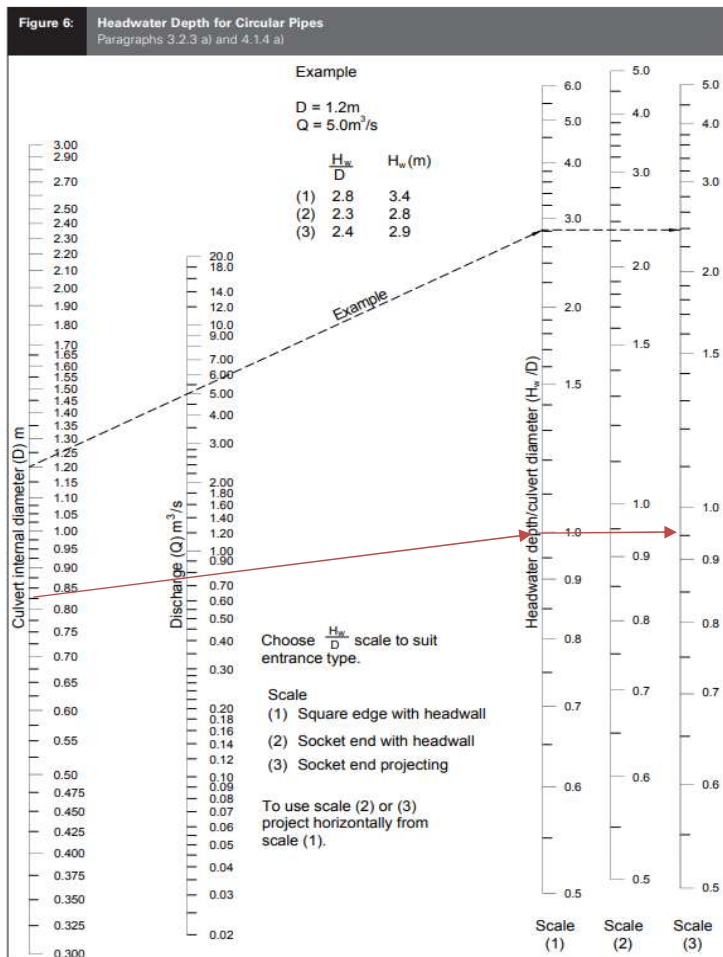
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-3

Q	0.75	m ³ /s	Catchment 5
D	0.825	m	Pipe Diameter
(1)	1	0.83	
(2)	0.94	0.78	
(3)	0.96	0.79	

Circular Pipe with 0.825m Diameter would have a headwater of 0.83m depth

Circular Pipe with 825 mm diameter would have a headwater of 0.83 m depth





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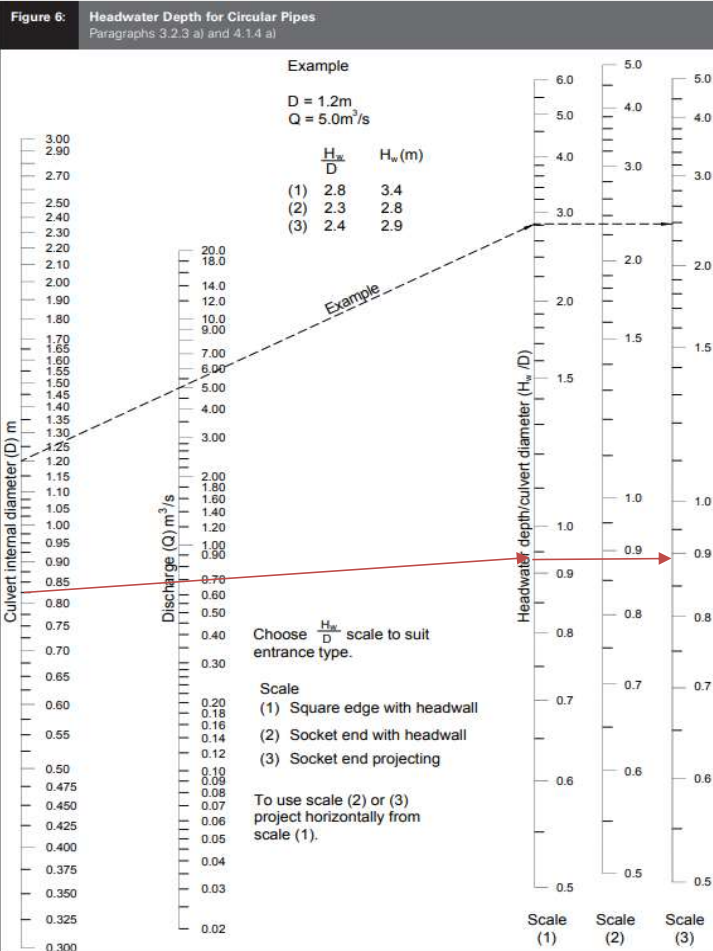
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-4

Q	0.68	m ³ /s	Catchment 6
D	0.825	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.93	0.77	
(2)	0.88	0.73	
(3)	0.89	0.73	

Circular Pipe with 825 mm diameter would have a headwater of 0.8 m depth





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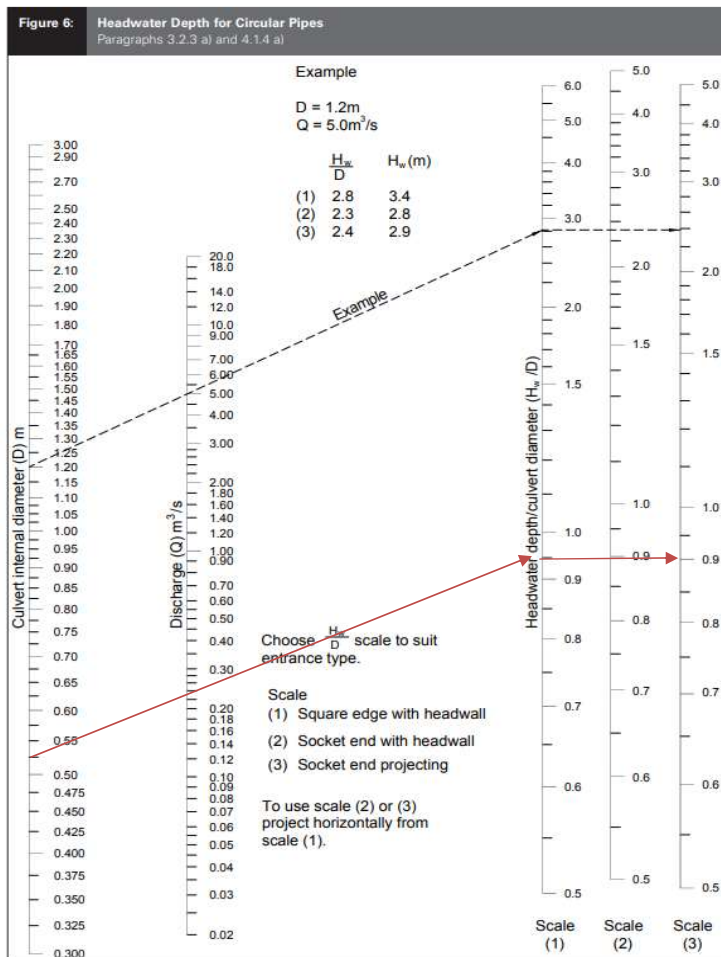
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-5

Q	0.23	m ³ /s	Catchment 7
D	0.525	m	Pipe Diameter
(1)	0.95	0.50	
(2)	0.9	0.47	
(3)	0.9	0.47	

Circular Pipe with 0.525m Diameter would have a headwater of 0.49m depth

Circular Pipe with 525 mm diameter would have a headwater of 0.5 m depth





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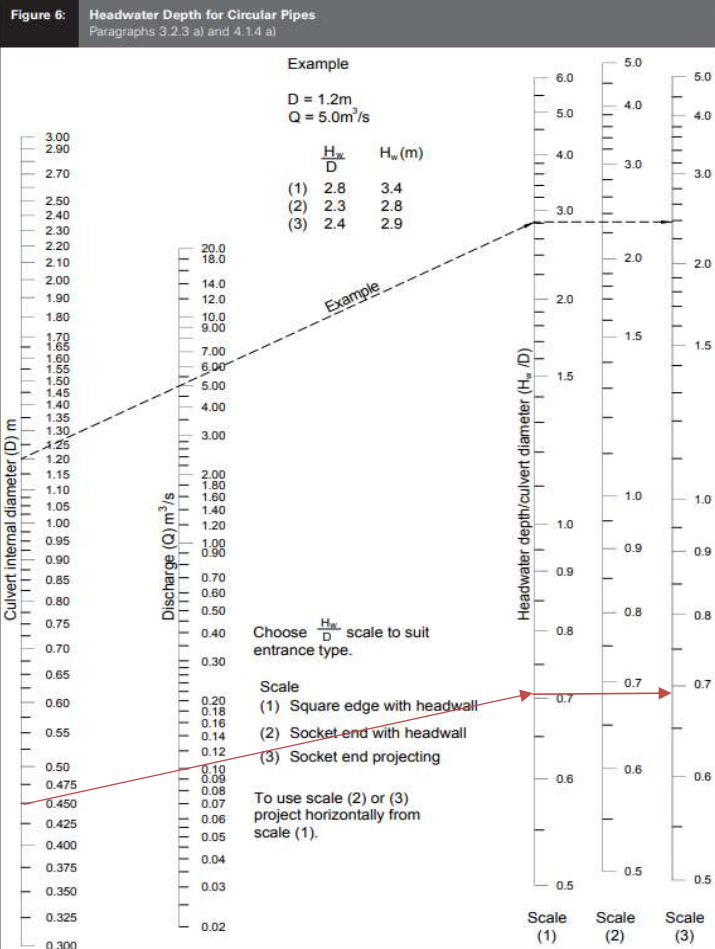
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 4-1

Q	0.1	m ³ /s	Catchment 14
D	0.45	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.71	0.32	
(2)	0.68	0.31	
(3)	0.69	0.31	

Circular Pipe with 450 mm diameter would have a headwater of 0.3 m depth





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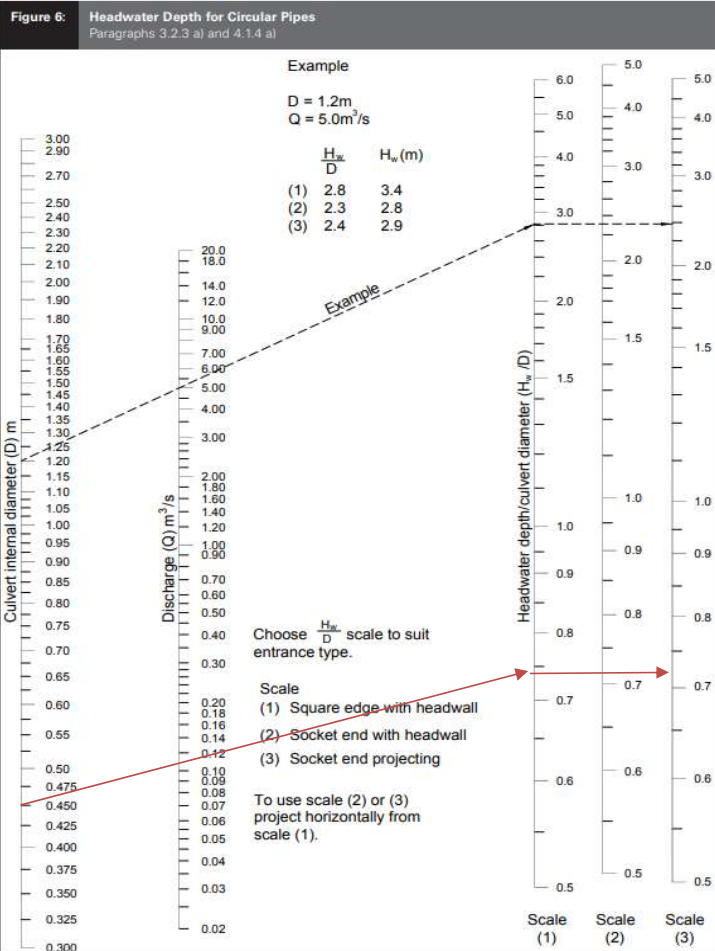
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Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 5-1

Q	0.11	m ³ /s	Catchment 12
D	0.45	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.74	0.33	
(2)	0.72	0.32	
(3)	0.73	0.33	

Circular Pipe with 450 mm diameter would have a headwater of 0.3 m depth





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SW 100-year Circular Culvert Size Calculation

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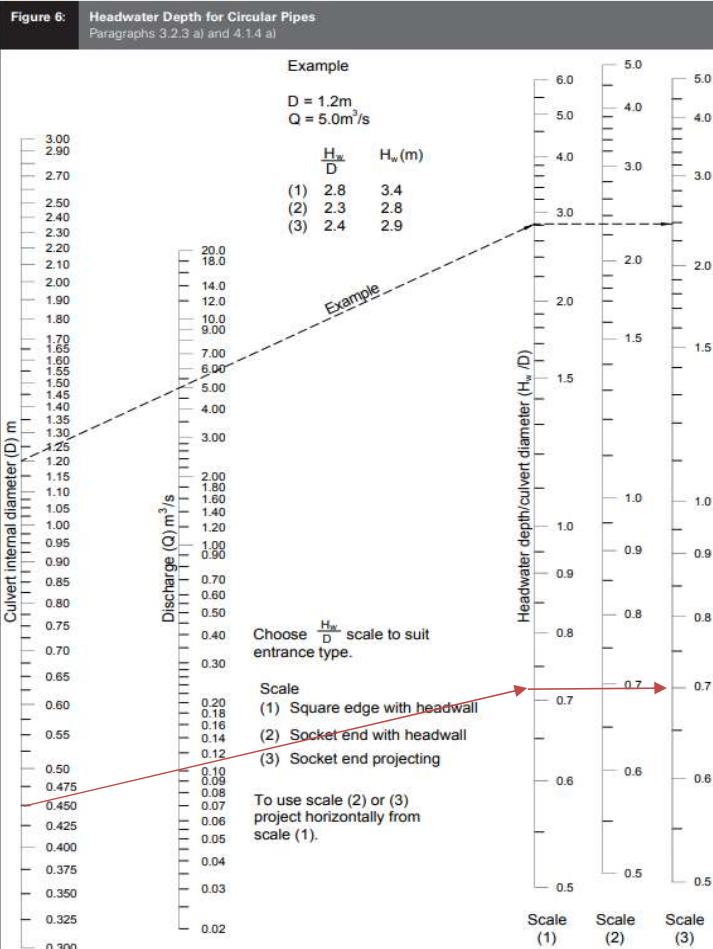
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 5-2

Q	0.1	m ³ /s	Catchment 8
D	0.45	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.72	0.32	
(2)	0.69	0.31	
(3)	0.7	0.32	

Circular Pipe with 450 mm diameter would have a headwater of 0.3 m depth





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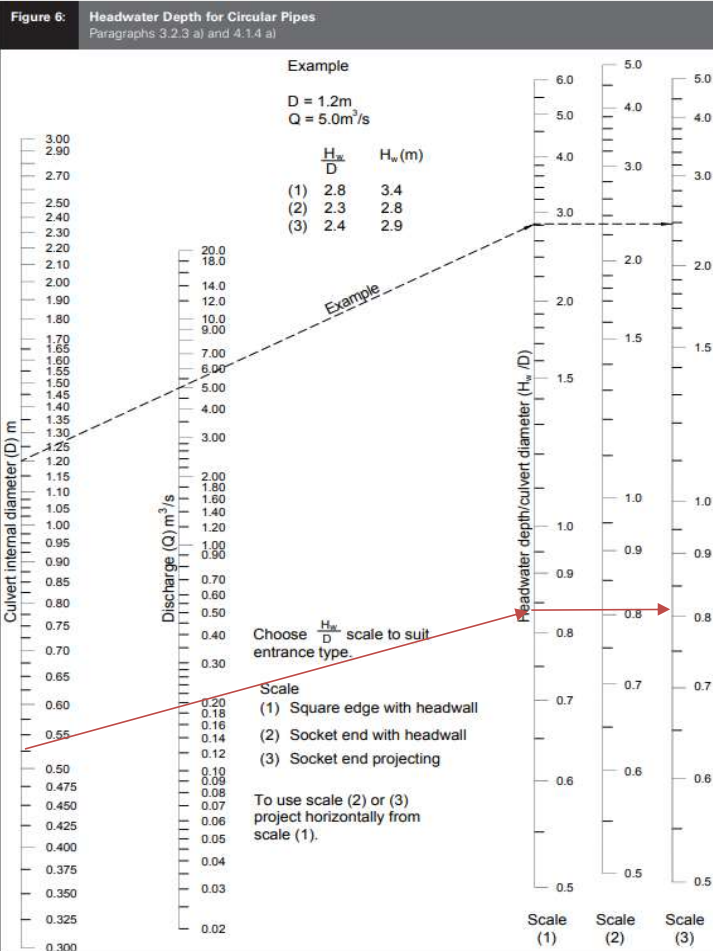
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 9-1

Q	0.19	m ³ /s	Catchment 25
D	0.525	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.84	0.44	
(2)	0.81	0.43	
(3)	0.81	0.43	

Circular Pipe with 525 mm diameter would have a headwater of 0.4 m depth





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Development of Riverhead Forest For Rangitooopuni
Developments Limited
SW 100-year Circular Culvert Size Calculation

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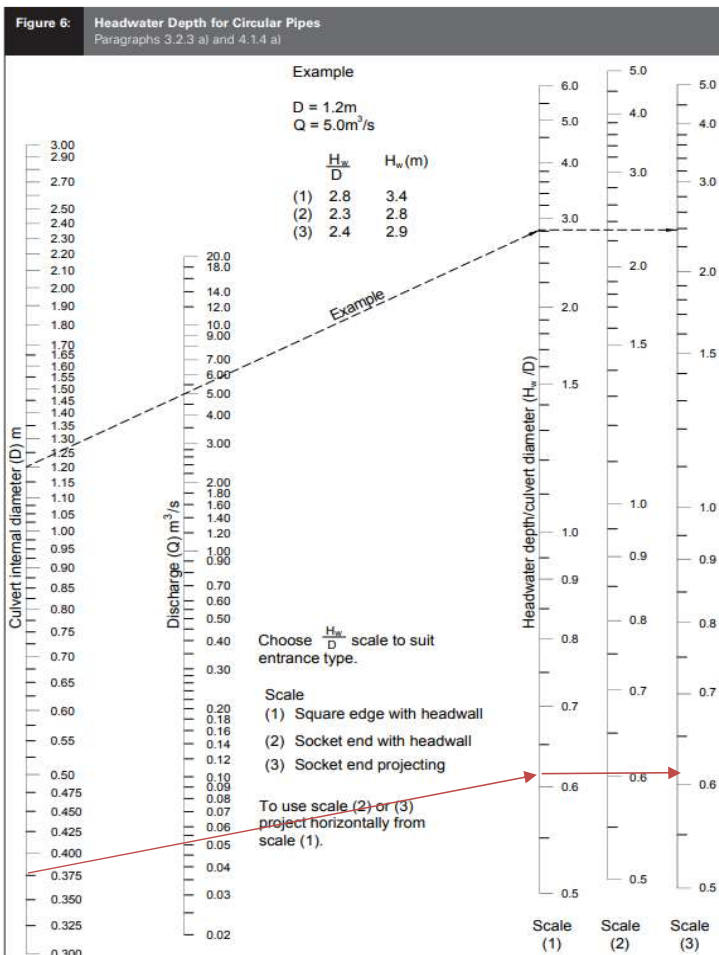
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 12-1

Q	0.05	m ³ /s	Catchment 33
D	0.375	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.62	0.23	
(2)	0.61	0.23	
(3)	0.62	0.23	

Circular Pipe with 375 mm diameter would have a headwater of 0.2 m depth





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Development of Riverhead Forest For Rangitooopuni
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13/05/2024

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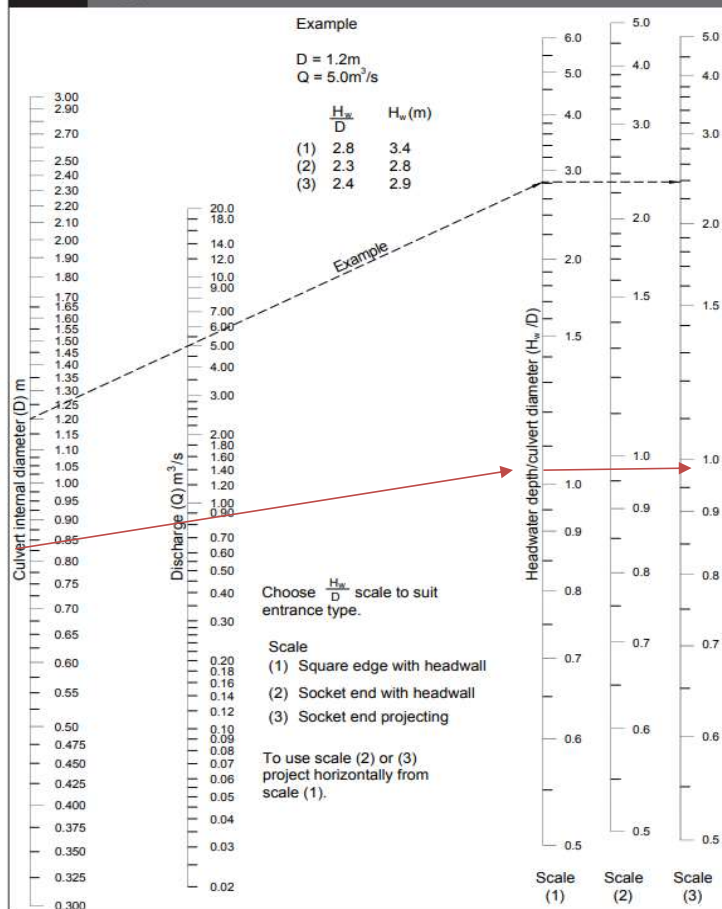
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 14-2

Q	0.83	m ³ /s	Catchment 45
D	0.825	m	Pipe Diameter
	Hw/D	Hw	
(1)	1.05	0.87	
(2)	0.98	0.81	
(3)	0.99	0.82	

Circular Pipe with 825 mm diameter would have a headwater of 0.81 m depth

Figure 6: Headwater Depth for Circular Pipes
Paragraphs 3.2.3 a) and 4.1.4 a)





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Development of Riverhead Forest For Rangitooopuni
Developments Limited
SW 100-year Circular Culvert Size Calculation

Author
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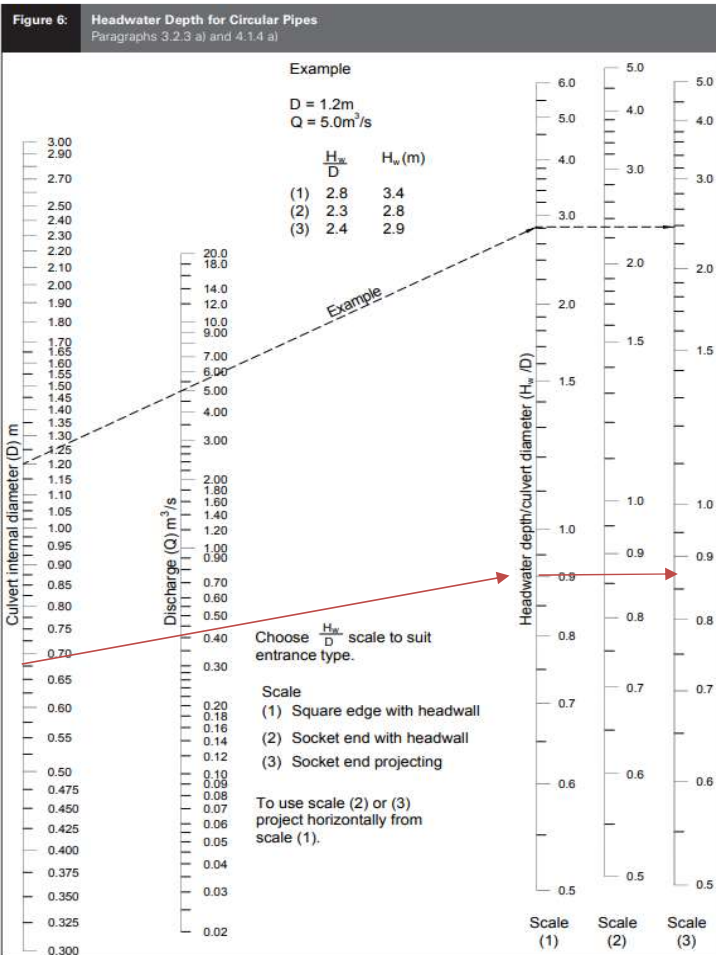
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KH

Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 14-4

Q	0.39	m ³ /s	Catchment 42
D	0.675	m	Pipe Diameter
	Hw/D	Hw	
(1)	0.9	0.61	
(2)	0.86	0.58	
(3)	0.87	0.59	

Circular Pipe with 675 mm diamter would have a headwater of 0.58 m depth



		Maven Associates		Job Number 147016	Sheet 1	Rev A	
Job Title		Development of Riverhead Retirement Village For Rangitootuni Developments Limited		Author	Date		Checked
Title		Retirement Village-Raingarden Sizing Calculations		AO	Mar-25		KH
Outfall/ RG	Catchment	Proposed Raingarden Footprint area m ²		Treatment Type	Number of Cartridges Required	StormFilter Drawing	
						Online	Peak Diversion
1-0	1+50	113.0		Storm Filter	12	Storm Filter Vault	2800W X 3650L X 2150 D
2-0	2	34.0		Storm Filter	4	SF-MH-69-1500-T-20	SF-MHPD-69-1800-T-20
3-0	3	11.0		no treatment proposed, less than 10 lots.			
4-0	7	7.0		no treatment proposed, less than 10 lots.			
5-0	6	100.0		Communal RG			
6-0	5	89.0		JELLYFISH	3	JF-MH-54-1200-T-OFF-20	
7-0	4	13.0		no treatment proposed, less than 10 lots.			
8-0	8	54.0		Communal RG			
9-0	9	140.0		Communal RG			
10-0	10+51	17.0		no treatment proposed , serving less than 10 carparks, if required stormfilter			

	Maven Associates	Job Number 147016	Sheet 2	Rev A
Job Title Title	Development of Riverhead Retirement Village For Rangitooopuni Developments Limited Forest Road-Raingarden Sizing Calculations	Author AO	Date Mar-25	Checked KH

Outfall/ RG	Catchment	Proposed Raingarden Footprint area m ²		Treatment Type	Number of Cartridges Required	Drawing	
						Online	Peak Diversion
15	1254.92	44.0				Public Raingarden	
16	294.07	11.0				Public Raingarden	
17	913.11	32.00				Public Raingarden	
18	794.77	28.00				Public Raingarden	
19	658.65	24.00				Public Raingarden	
20	379.49	14.00				Public Raingarden	
21	1061.14	38.00				Public Raingarden	
22	944.38	34.00				Public Raingarden	
23	1172.16	42.0				Public Raingarden	
24	2224.46	78.0		Jelly Fish	5	JF-MH-54-1800-T-OFF-20	



Maven Associates

Job Number
147016

Sheet
3

Rev
A

Job Title
Title

Development of Riverhead Retirement Village For
Rangitootuni Developments Limited
Preliminary Raingarden Sizing Calculations

Author
AO

Date
Mar-25

Checked
KH

GD01 Bioretention Device Sizing Criteria for WQV :

Device footprint	2%
Ponding depth	0.1
Media depth	0.5
Transition layer	0.1
Drainage layer	0.3

Design parameters

water quality treatment only
The volume of water stored in the ponding area (100% @ Void space)
The volume of water stored in the void space of the bioretention media Media Depth (@ 30% Void space)
The volume of water stored in the void space of 50mm Transition Layer (@ 30% Void space)
The volume of water stored in the void space of the drainage layer, above the underdrain invert. (@ 35% Void Space)

1

					Alternative Solutions						
RG No	Road Catchment Area	Min Ponding Footprint Required (m2)	Proposed Raingarden Footprint area m²		Notes	Number of Cartridges Required	StormFilter Drawing				
Rain Gardens							Online	Peak Diversion			
1	5643.3	112.87	113.00		Storm Filter	12	Storm Filter Vault	2800W X 3650L X 2150 D			
2	1698.1	33.962	34		Storm Filter	4	SF-MH-69-1500-T-20	SF-MHPD-69-1800-T-20			
3	502	10.04	11.00		no treatment proposed, less than 10 lots.						
4	311.2	6.22	7.00		no treatment proposed, less than 10 lots.						
5	4975	99.50	100.00		Communal RG						
6	4401.3	88.03	89.00		JELLYFISH	3	JF-MH-54-1200-T-OFF-20				
7	612.2	12.24	13.00		no treatment proposed, less than 10 lots.						
8	2655.9	53.12	54.00		Communal RG						
9	6970.3	139.41	140.00		Communal RG						
10	810.2	16.20	17.00		no treatment proposed , serving less than 10 carparks, if required stormfilter						

Proprietary device due to proposed location constraints



Maven Associates

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Rev
A

Job Title
Title
Development of Riverhead Retirement Village For Rangitootuni
Developments Limited
Raingarden Sizing Calculations

Author
AO

Date
Mar-25

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KH

GD01 Bioretention Device Sizing Criteria for SMAF 2 :

Device footprint	3.5%
Ponding depth	0.15
Media depth	0.5
Transition layer	0.1
Drainage layer	0.3
Storage layer	0.45

Design parameters

water quality treatment only
The volume of water stored in the ponding area (100% @ Void space)
The volume of water stored in the void space of the bioretention media Media Depth (@ 30% Void space)
The volume of water stored in the void space of 50mm Transition Layer (@ 30% Void space)
The volume of water stored in the void space of the drainage layer, above the underdrain invert. (@ 35% Void Space)
The volume of water stored in the void space of the storage layer

1.5

Alternative Solutions

Notes

Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment
Existing Road no Proposed Treatment

Public Raingarden

Public Raingarden

Catchment No	Road Catchment Area	Imp %	Min Ponding Footprint Required (m2)	Proposed Raingarden Footprint area m ²
Rain Gardens		0.9		
300	835.063	751.56	26.30	27.00
301	900.923	810.83	28.38	29.00
302	877.686	789.92	27.65	28.00
303	243.834	219.45	7.68	8.00
304	414.518	373.07	13.06	14.00
305	670.222	603.20	21.11	22.00
306	610.3	549.27	19.22	20.00
307	578.996	521.10	18.24	19.00
308	579.907	521.92		
309	536.527	482.87		
310	533.283	479.95		
311	324.544	292.09		
Outlet 15		1254.92	43.92	44.00
312	326.741	294.07	10.29	11.00
Outlet 16				
313	1014.57	913.11	31.96	32.00
Outlet 17				

314	883.08	794.77	27.82	28.00
Outlet 18				
315	480.953	432.86		
Outlet 19				
316	250.882	225.79		
Outlet 19		658.65	23.05	24.00
317	421.656	379.49	13.28	14.00
Outlet 20				
318	489	440.10		
319	281.767	253.59		
320	408.275	367.45		
outlet 21		1061.14	37.14	38.00
321	605.679	545.11		
322	443.635	399.27		
outlet 22		944.38	33.05	34.00
323	309.93	278.94		
324	992.465	893.22		
outlet 23		1172.16	41.03	42.00
325	1192.701	1073.43		
335	375.672	338.10		
336	419.038	377.13		
337	484.208	435.79		
outlet 24		2224.46	77.86	78.00

Public Raingarden

Public Raingarden

Public Raingarden

Public Raingarden

Public Raingarden

Private Road to be Proprietary device

MAVEN ASSOCIATES

Job Number

147016

Sheet

1

Rev

A

Development of Riverhead Retirement Village For Rangitoopuni Developments Limited

Calc Title: Pipe Capacity Check

Author

AYC

Date

1/04/2025

Checked

KH

Rainfall Depth

TP108 rainfall data

Climate change Increase

ARI 10YR (mm)

130.2

152.334

(from TP108 Maps)

CN Number

Impervious area

98

Proposed Roads

96.8

CN Number

90.8

Equivalent CN - (95% impervious coverage, 10% pervious coverage)

Equivalent CN - (70% impervious coverage, 30% pervious coverage)

Pipe ks factor =

0.6 mm (pipes up to 1.0m dia)

0.6 mm (pipes over 1.0m dia)

Line number	MH to MH	Catchment letter	Catchment Area m2	CN	Peak Flow rate - 10YR ARI l/s	Cum. Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Percent Capacity %	Remaining l/s	Velocity m/s	Check OK	
OUTLET 1														
S1	ROAD LOTS	1-4-2-4 to 1-4	24,25 26,27	531 4686	96.8 90.8	13.3 110.1	13.3 123.4	0.300	1.60	141.6	87.2%	18.2	2.00	OK
S2	ROAD LOTS	1-4-1-11 to 1-4-1-9	32 43,38	526 3774	96.8 90.8	13.2 88.7	13.2 101.9	0.300	2.00	158.4	64.3%	56.5	2.24	OK
	ROAD LOTS	1-4-1-9 to 1-4-1-7	31 37	368 1562	96.8 90.8	9.2 36.7	9.2 147.8	0.375	2.00	284.9	51.9%	137.1	2.58	OK
	ROAD LOTS	1-4-1-7 to 1-4-1-5	30 36	410 1785	96.8 90.8	10.3 41.9	10.3 200.0	0.375	2.00	284.9	70.2%	84.8	2.58	OK
	ROAD LOTS	1-4-1-5 to 1-4-1-3	29 35,40	426 2972	96.8 90.8	10.7 69.8	10.7 280.5	0.450	2.00	459.9	61.0%	179.4	2.89	OK
	ROAD LOTS	1-4-1-3 to 1-4-1-1	33,34,39	4609	96.8 90.8	0.0 108.3	0.0 388.9	0.450	2.00	459.9	84.5%	71.1	2.89	OK
	ROAD LOTS	1-4-1-1 to 1-4	28	389 0	96.8 90.8	9.7 0.0	9.7 398.6	0.525	1.00	487.4	81.8%	88.8	2.25	OK
S3	ROAD LOTS	1-6-1 to 1-6	41,44,408	4382	96.8 90.8	0.0 103.0	0.0 103.0	0.300	1.10	117.4	87.7%	14.4	1.66	OK
S4	ROAD LOTS	1-9 to 1-8	6	524	96.8 90.8	13.1 0.0	13.1 13.1	0.225	2.00	74.2	17.7%	61.0	1.87	OK
	ROAD LOTS	1-8 to 1-7	5	395	96.8 90.8	9.9 0.0	9.9 23.0	0.225	2.00	74.2	31.0%	51.1	1.87	OK
	ROAD LOTS	1-7 to 1-6	4	1217	96.8 90.8	30.5 0.0	30.5 53.5	0.225	2.00	74.2	72.2%	20.6	1.87	OK
	ROAD LOTS	1-6 to 1-5	42 + S3 S3	417	96.8 90.8	10.5 0.0	10.5 167.0	0.375	2.00	284.9	58.6%	117.9	2.58	OK
	ROAD LOTS	1-5 to 1-4	2	1698	96.8 90.8	42.6 0.0	42.6 209.5	0.375	2.00	284.9	73.6%	75.3	2.58	OK
TOTAL	ROAD LOTS	1-4 to 1-0	1 + S1&2 S1&2	570	96.8 90.8	14.3 0.0	14.3 745.8	0.600	1.50	847.4	88.0%	101.5	3.00	OK

OUTLET 2														
S1	ROAD	2-8 to 2-6	48	405	96.8	10.2	10.2							
	LOTS		55,56	5398	90.8	126.9	137.0	0.300	4.00	224.0	61.2%	87.0	3.17	OK
	ROAD	2-6 to 2-2	49,47	827	96.8	20.7	20.7							
	LOTS		53,52	3434	90.8	80.7	238.4	0.375	2.00	284.9	83.7%	46.4	2.58	OK
S2	ROAD	2-2-1 to 2-2			96.8	0.0	0.0							
	LOTS		387,54	4690	90.8	110.2	110.2	0.300	2.00	158.4	69.6%	48.1	2.24	OK
TOTAL	ROAD	2-2 to 2-1	45,46 + S1&2	711	96.8	17.8	17.8							
	LOTS		S1&2		90.8	0.0	366.5	0.450	1.60	411.4	89.1%	44.9	2.59	OK

OUTLET 3	ROAD	3-2 to 3-1	407,398,396	576	96.8	14.4	14.4									
	LOTS		406	2178	90.8	51.2	65.6	0.225	8.98	157.2	41.7%	91.6	3.95	OK		

[illegible]

OUTLET 5															
S1	ROAD LOTS	5-13 to 5-12			96.8	0.0	0.0								
			97,102	4599	90.8	108.1	108.1	0.300	1.20	122.6	88.1%	14.6	1.73	OK	
	ROAD LOTS	5-12 to 5-10	92	454	96.8	11.4	11.4								
			415,414,96	3379	90.8	79.4	198.9	0.375	2.00	284.9	69.8%	86.0	2.58	OK	
ROAD LOTS	5-10 to 5-9	91	511	96.8	12.8	12.8									
				95	2062	90.8	48.5	260.1	0.450	2.00	459.9	56.6%	199.8	2.89	OK
ROAD LOTS	5-9 to 5-5	90,89	1232	96.8	30.9	30.9									
				393,99,98	6939	90.8	163.1	454.1	0.525	1.10	511.2	88.8%	57.1	2.36	OK
S2	ROAD LOTS	5-5-3 to 5-5-2	370	602	96.8	15.1	15.1								
			100,101	6077	90.8	142.8	157.9	0.375	1.00	201.4	78.4%	43.5	1.82	OK	
ROAD LOTS	5-5-2 to 5-5	10,11	1500	96.8	37.6	37.6									
				90.8	0.0	195.5	0.375	2.00	284.9	68.6%	89.4	2.58	OK		
S3	ROAD LOTS	5-5 to 5-4	9, S1&2	1227	96.8	30.8	30.8								
			S1&2		90.8	0.0	680.3	0.600	2.00	978.5	69.5%	298.2	3.46	OK	
ROAD LOTS	5-4 to 5-1	8	1993	96.8	49.9	49.9									
				88,87	3256	90.8	76.5	806.8	0.600	1.80	928.3	86.9%	121.5	3.28	OK
FLOW DIVERSION	ROAD	5-1 to 6-2-2-1	7	1585	96.8	39.7	846.5	0.675	1.50	1153.8	73.4%	307.4	3.22	OK	
WATER QUALITY	ROAD LOTS	5-1 to RG5 to 5-0	10 mm/hr for water quality flow	9104	96.8	24.480	24.5								
				26312	90.8	66.365	90.8	0.300	1.00	111.9	81.2%	21.1	1.58	OK	

OUTLET 6-P														
S1	ROAD LOTS	8-1 to 6-14 to 6-11	OUTLET 8 86,74 + OUTLET 8	3869	96.8 90.8	0.0 90.9	0.0 618.6	0.525	2.50	770.8	80.3%	152.2	3.56	OK
	ROAD LOTS	6-11 to 6-10	65 416	400 1733	96.8 90.8	10.0 40.7	10.0 669.3	0.600	2.00	978.5	68.4%	309.2	3.46	OK
	ROAD LOTS	6-10 to 6-7	64 73	508 1699	96.8 90.8	12.7 39.9	12.7 722.0	0.600	2.00	978.5	73.8%	256.5	3.46	OK
	ROAD LOTS	6-7 to 6-6	63 85,72	628 9340	96.8 90.8	15.7 219.5	15.7 957.2	0.675	2.00	1332.4	71.8%	375.2	3.72	OK
	ROAD LOTS	6-6 to 6-4	62 71,80,70,79	454 6963	96.8 90.8	11.4 163.6	11.4 1132.2	0.750	2.00	1755.9	64.5%	623.7	3.97	OK
	ROAD LOTS	6-4 to 6-2	61,60 78	638 1405	96.8 90.8	16.0 33.0	16.0 1181.2	0.750	1.49	1515.5	77.9%	334.3	3.43	OK
S2	ROAD LOTS	6-2-5 to 6-2-3	76,84 82,81,83	1056 7188	96.8 90.8	26.5 168.9	26.5 195.4	0.375	1.50	246.7	79.2%	51.3	2.23	OK
	ROAD LOTS	6-2-3 to 6-2-2	75 77	857 1233	96.8 90.8	21.5 29.0	21.5 245.8	0.450	1.00	325.2	75.6%	79.3	2.04	OK
S3	ROAD LOTS	6-2-2 to 6-2	57 +S2 311,327 +S2 + OUTLET 5	395 3522	96.8 90.8	9.9 82.8	9.9 1185.0	0.750	1.50	1520.6	77.9%	335.6	3.44	OK
TOTAL	ROAD LOTS	6-2 to 6-P-1	58,59 +S1+S3 S1+ S3	815	96.8 90.8	20.4 0.0	20.4 2386.6	0.825	4.50	3380.7	70.6%	994.1	6.32	OK

OUTLET 6-0														
WATER QUALITY	ROAD LOTS	6-2 to 6-0	10 mm/hr for water quality flow	5751 36952	96.8 90.8	15.464 93.201	15.5 108.7	0.300	1.33	129.1	84.2%	20.4	1.83	OK

OUTLET 7	ROAD LOTS	7-4 to 7-0	68,390,392 66,67,69	820 4521	96.8 90.8	20.6 106.2	20.6 126.8	0.300	2.00	158.4	80.1%	31.6	2.24	OK
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OUTLET 8	ROAD LOTS	8-8 to 8-7	374 114,115,124	546 5488	96.8 90.8	13.7 129.0	13.7 142.7	0.300	3.55	211.0	67.6%	68.4	2.99	OK
	ROAD LOTS	8-7 to 8-6	106 113,119	510 3962	96.8 90.8	12.8 93.1	12.8 248.5	0.450	2.00	459.9	54.0%	211.4	2.89	OK
	ROAD LOTS	8-6 to 8-4	105 111,112,118	545 5614	96.8 90.8	13.7 131.9	13.7 394.1	0.450	2.28	491.1	80.3%	97.0	3.09	OK
	ROAD LOTS	8-4 to 8-3	104 110,117	486 2829	96.8 90.8	12.2 66.5	12.2 472.8	0.525	2.00	689.4	68.6%	216.6	3.18	OK
	ROAD LOTS	8-3 to 8-2	109,116	0 1820	96.8 90.8	0.0 42.8	0.0 515.6	0.525	2.00	689.4	74.8%	173.8	3.18	OK
FLOW DIVERSION	ROAD LOTS	8-2 to 8-1 to 6-14	103,12	482	96.8 90.8	12.1 0.0	12.1 527.6	0.525	2.00	689.4	76.5%	161.7	3.18	OK
WATER QUALITY	ROAD LOTS	8-1 to RG8 to 8-0	10 mm/hr for water quality flow	2569 19713	96.8 90.8	6.908 49.721	6.9 56.6	0.300	1.00	111.9	50.6%	55.3	1.58	OK

OUTLET 9															
S1	ROAD LOTS	9-2-10 to 9-2-8	154,153	3279	96.8 90.8	0.0 77.1	0.0 77.1	0.300	2.00	158.4	48.7%	81.3	2.24	OK	
	ROAD LOTS	9-2-8 to 9-2-7	142 134,152	595 6065	96.8 90.8	14.9 142.5	14.9 234.5	0.375	2.00	284.9	82.3%	50.4	2.58	OK	
	ROAD LOTS	9-2-7 to 9-2-6	141, 133,394	548 1134	96.8 90.8	13.7 26.6	13.7 274.9	0.450	2.00	459.9	59.8%	185.1	2.89	OK	
	ROAD LOTS	9-2-6 to 9-2-4	132,395,131	1208 3395	96.8 90.8	30.3 79.8	30.3 384.9	0.525	1.00	487.4	79.0%	102.4	2.25	OK	
	ROAD LOTS	9-2-4 to 9-2-3	140 130	1208 1203	96.8 90.8	30.3 28.3	30.3 443.5	0.600	1.00	691.8	64.1%	248.3	2.45	OK	
	ROAD LOTS	9-2-3 to 9-2	139 409,129	635 1605	96.8 90.8	15.9 37.7	15.9 497.1	0.600	1.00	691.8	71.9%	194.7	2.45	OK	
S2	ROAD LOTS	9-13 to 9-12	23,159 158,157	686 3460	96.8 90.8	17.2 81.3	17.2 98.5	0.300	2.00	158.4	62.2%	59.8	2.24	OK	
	ROAD LOTS	9-12 to 9-11	22 156	383 1889	96.8 90.8	9.6 44.4	9.6 152.5	0.375	2.00	284.9	53.5%	132.4	2.58	OK	
	ROAD LOTS	9-11 to 9-9	21 155,150	419 1655	96.8 90.8	10.5 38.9	10.5 201.9	0.375	2.00	284.9	70.9%	83.0	2.58	OK	
	ROAD LOTS	9-9 to 9-8	358 135,149	441 3686	96.8 90.8	11.1 86.6	11.1 299.6	0.450	1.26	365.0	82.1%	65.5	2.30	OK	
	ROAD LOTS	9-8 to 9-6	19 148,138	424 2747	96.8 90.8	10.6 64.6	10.6 374.7	0.450	2.00	459.9	81.5%	85.2	2.89	OK	
	ROAD LOTS	9-6 to 9-5	18 147,137	433 3056	96.8 90.8	10.9 71.8	10.9 457.4	0.525	1.67	629.9	72.6%	172.5	2.91	OK	
	ROAD LOTS	9-5 to 9-3	17 136,146	338 3709	96.8 90.8	8.5 87.2	8.5 553.0	0.525	2.00	689.4	80.2%	136.3	3.18	OK	
S3	ROAD LOTS	9-3-3 to 9-3-2	128,126	0 3079	96.8 90.8	0.0 72.4	0.0 72.4	0.300	1.00	111.9	64.6%	39.6	1.58	OK	
	ROAD LOTS	9-3-2 to 9-3	271 411,412	383 2179	96.8 90.8	9.6 51.2	9.6 133.2	0.300	2.10	162.3	82.1%	29.1	2.30	OK	
S4	ROAD LOTS	9-1-6 to 9-1-5	120,121,125	0 3931	96.8 90.8	0.0 92.4	0.0 92.4	0.300	1.45	134.8	68.5%	42.4	1.91	OK	
	ROAD LOTS	9-1-5 to 9-1-4	108 122	540 1443	96.8 90.8	13.5 33.9	13.5 139.8	0.375	2.00	284.9	49.1%	145.0	2.58	OK	
	ROAD LOTS	9-1-4 to 9-1-1	410 123	396 1978	96.8 90.8	9.9 46.5	9.9 196.2	0.375	2.00	284.9	68.9%	88.6	2.58	OK	
	ROAD LOTS	9-1-1 to 9-1	273	347 0	96.8 90.8	8.7 0.0	8.7 204.9	0.375	2.00	284.9	71.9%	79.9	2.58	OK	
S5	ROAD LOTS	9-3 to 9-2	16,161 +S2&3 S2&3	793	96.8 90.8	19.9 0.0	19.9 706.1	0.600	2.00	978.5	72.2%	272.4	3.46	OK	
	ROAD LOTS	9-2 to 9-1	15 + S1&2&3 S1&2&3	932	96.8 90.8	23.4 0.0	23.4 1206.7	0.750	2.00	1755.9	68.7%	549.2	3.97	OK	
	ROAD LOTS	9-1 to 9-0	14,15,16,161 + S1&2&3&4 S1&2&3&4	2588	96.8 90.8	64.9 0.0	64.9 1453.1	0.750	2.00	1755.9	82.8%	302.8	3.97	OK	

OUTLET 10	ROAD LOTS	10-1 to 10-0	144,143 145,151	885 2826	96.8 90.8	22.2 66.4	22.2 88.6	0.300	1.78	149.4	59.3%	60.8	2.11	OK
OUTLET 11	ROAD LOTS	11-3 to PR CULVERT 1	300	835	96.8 90.8	20.9 0.0	20.9 20.9	0.225	1.00	52.4	39.9%	31.5	1.32	OK
OUTLET 12	ROAD LOTS	EX CULVERT 12	301,302	1777	96.8 90.8	44.5 0.0	44.5 44.5	0.300	5.18	254.9	17.5%	210.4	3.61	OK
OUTLET 13	ROAD LOTS	EX CULVERT 13	303	243	96.8 90.8	6.1 0.0	6.1 6.1	0.300	5.41	260.5	2.3%	254.4	3.69	OK
OUTLET 14	ROAD LOTS	14-6 to PR CULVERT 2	307,306,305,304	2272	96.8 90.8	56.9 0.0	56.9 56.9	0.300	0.60	86.7	65.7%	29.7	1.23	OK
OUTLET 15														
S1	ROAD LOTS	15-1-4 TO RG15	309,310,311	1393	96.8 90.8	34.9 0.0	34.9 34.9	0.300 0.225	0.50 1.00	79.1 52.4	44.1% 66.6%	44.2 52.4	1.12 1.32	OK OK
S2	ROAD LOTS	15-2-1 TO RG15	308	579	96.8 90.8	14.5 0.0	14.5 14.5	0.225	1.00	52.4	27.7%	37.9	1.32	OK
	ROAD LOTS	RG15 TO 15-0	S1+S2	1972	96.8 90.8	49.4 0.0	49.4 49.4	0.300	1.00	111.9	44.1%	62.5	1.58	OK
OUTLET 16	ROAD LOTS	16-1 TO 16-0	312	326	96.8 90.8	8.2 0.0	8.2 8.2	0.225	1.00	52.4	15.6%	44.3	1.32	OK
OUTLET 17	ROAD LOTS	17-1 TO 17-0	313	1014	96.8 90.8	25.4 0.0	25.4 25.4	0.225	1.00	52.4	48.5%	27.0	1.32	OK
OUTLET 18	ROAD LOTS	18-1 TO 18-0	314	883	96.8 90.8	22.1 0.0	22.1 22.1	0.225	1.00	52.4	42.2%	30.3	1.32	OK
OUTLET 19	ROAD LOTS	19-2 TO 19-0	315,316	730	96.8 90.8	18.3 0.0	18.3 18.3	0.225	1.00	52.4	34.9%	34.1	1.32	OK
OUTLET 20	ROAD LOTS	20-1 TO 20-0	317	421	96.8 90.8	10.6 0.0	10.6 10.6	0.225	1.00	52.4	20.1%	41.9	1.32	OK
OUTLET 21	ROAD LOTS	21-3 TO 21-0	318,319,320	1178	96.8 90.8	29.5 0.0	29.5 29.5	0.225	0.90	49.7	59.3%	20.2	1.25	OK



MAVEN ASSOCIATES

Job Number
147016

Sheet
1

Rev
A

Job Title
Title

Development of Riverhead Retirement Village For
Rangitootuni Developments Limited
Roof Run off pipe sizing

Author
AO

Date
18/03/2025

Checked
KH

For the roof stormwater pipe calculation the following assumption are made based on what's available:

Proposed total tank storage for drinking water, 600 cubic m (target)
Assumed 150 sq m of roof per unit
Total of 296 units

$600 \text{ m}^3 = 150 \text{ sq m of roof} \times 296 \text{ units} \times \text{required rainfall depth to fill tanks}$
 $600 / (150 \times 296) = 0.013 \text{m required rainfall depth to fill tanks} = 13 \text{mm}$

Based on this, it is assumed the 95th rainfall event (35mm over 24 hours) would be used to size the roof stormwater pipes

Run-off from one unit 0.82 l/s *colebrook white, ks 0.6 and CN 98*

DN	Assumed Grade (%)	Pipe Capacity (m ³ /s)	Max no of Units
150	2	0.0254	30
225	2	0.0742	90
300	2	0.1584	193
375	2	0.2849	347

assumed pipes are to be uPVC SN16

**MAVEN ASSOCIATES**Job Number
147016Sheet
1Rev
AJob Title
Development of Riverhead Retirement
Village For Rangitooopuni Developments
LimitedCalc Title
Outlet Structure Riprap CalculationsAuthor
AODate
19-MarChecked
KH**ROCK RIPRAP DIMENSION SUMMARY**

TABLE OF RIPRAP DIMENSIONS			
OUTFALL NUMBER	L (m)	W (m)	D _A (m)
1-0	6.4	1.8	0.44
2-0	5.8	1.4	0.44
3-0	3.5	0.7	0.30
4-0	3.3	0.7	0.28
5-0	7.3	2.1	0.50
6-0	3.0	0.8	0.20
6-P-0	11.8	2.5	0.98
7-0	4.2	0.9	0.34
8-0	6.3	1.6	0.46
9-0	8.1	2.3	0.56
10-0	3	0.9	0.20
15-0	2.3	0.9	0.14
16-0	2.3	0.9	0.14
17-0	2.3	0.9	0.14
18-0	2.3	0.9	0.14
19-0	2.3	0.9	0.14
20-0	2.3	0.9	0.14
21-0	2.3	0.9	0.14
22-0	2.3	0.9	0.14
23-0	2.3	0.9	0.14
24-0	3	0.9	0.20
25-0	2.9	1.2	0.18

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Calc Title Outlet Structure Riprap Calculations				

OUTLET STRUCTURE 1-0 - ROCK RIPRAP

Pipe diameter = 0.600 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 3.45 m/s

Froude Number Fo = 1.42

Rock diameter = 213 mm => Use **440** mm (min 2x Dia)

Outfall width = 1.8 m => Use **1.80** m (min)

Outfall length = 6.36 m => Use **6.40** m (min)

OUTLET STRUCTURE 2-0 - ROCK RIPRAP

Pipe diameter = 0.450 m ks= 0.6

Pipe gradient = 0.040 m/m

Velocity = 4.08 m/s

Froude Number Fo = 1.94

Rock diameter = 218 mm => Use **440** mm (min 2x Dia)

Outfall width = 1.35 m => Use **1.40** m

Outfall length = 5.80 m => Use **5.80** m

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OUTLET STRUCTURE 3-0 - ROCK RIPRAP

Pipe diameter = 0.225 m ks= 0.6

Pipe gradient = 0.090 m/m

Velocity = 3.95 m/s

Froude Number Fo = 2.66

Rock diameter = 149 mm => Use 300 mm (min 2x Dia)

Outfall width = 0.675 m => Use 0.70 m (min)

Outfall length = 3.42 m => Use 3.50 m (min)

OUTLET STRUCTURE 4-0 - ROCK RIPRAP

Pipe diameter = 0.225 m ks= 0.6

Pipe gradient = 0.070 m/m

Velocity = 3.48 m/s

Froude Number Fo = 2.34

Rock diameter = 132 mm => Use 280 mm (min 2x Dia)

Outfall width = 0.675 m => Use 0.70 m

Outfall length = 3.21 m => Use 3.30 m

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OUTLET STRUCTURE 5-0 - ROCK RIPRAP

Pipe diameter = 0.675 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 3.71 m/s

Froude Number Fo = 1.44

Rock diameter = 243 mm => Use **500** mm (min 2x Dia)

Outfall width = 2.025 m => Use **2.10** m (min)

Outfall length = 7.23 m => Use **7.30** m (min)

OUTLET STRUCTURE 6-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 2.23 m/s

Froude Number Fo = 1.30

Rock diameter = 97 mm => Use **200** mm (min 2x Dia)

Outfall width = 0.9 m => Use **0.90** m

Outfall length = 2.98 m => Use **3.00** m

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OUTLET STRUCTURE 6-P-0 - ROCK RIPRAP

Pipe diameter = 0.825 m ks= 0.6

Pipe gradient = 0.050 m/m

Velocity = 6.66 m/s

Froude Number Fo = 2.34

Rock diameter = 483 mm => Use **980** mm (min 2x Dia)

Outfall width = 2.475 m => Use **2.50** m (min)

Outfall length = 11.78 m => Use **11.80** m (min)

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OUTLET STRUCTURE 7-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.060 m/m

Velocity = 3.87 m/s

Froude Number Fo = 2.26

Rock diameter = 169 mm => Use **340** mm (min 2x Dia)

Outfall width = 0.9 m => Use **0.90** m (min)

Outfall length = 4.20 m => Use **4.20** m (min)

OUTLET STRUCTURE 8-0 - ROCK RIPRAP

Pipe diameter = 0.525 m ks= 0.6

Pipe gradient = 0.030 m/m

Velocity = 3.89 m/s

Froude Number Fo = 1.71

Rock diameter = 225 mm => Use **460** mm (min 2x Dia)

Outfall width = 1.575 m => Use **1.60** m

Outfall length = 6.29 m => Use **6.30** m

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OUTLET STRUCTURE 9-0 - ROCK RIPRAP

Pipe diameter = 0.750 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 3.96 m/s

Froude Number Fo = 1.46

Rock diameter = 274 mm => Use 560 mm (min 2x Dia)

Outfall width = 2.25 m => Use 2.30 m (min)

Outfall length = 8.10 m => Use 8.10 m (min)

OUTLET STRUCTURE 10-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 2.23 m/s

Froude Number Fo = 1.30

Rock diameter = 97 mm => Use 200 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m

Outfall length = 2.98 m => Use 3.00 m

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OUTLET STRUCTURE 15-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m (min)

Outfall length = 2.21 m => Use 2.30 m (min)

OUTLET STRUCTURE 16-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m

Outfall length = 2.21 m => Use 2.30 m

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OUTLET STRUCTURE 17-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m (min)

Outfall length = 2.21 m => Use 2.30 m (min)

OUTLET STRUCTURE 18-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m

Outfall length = 2.21 m => Use 2.30 m

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OUTLET STRUCTURE 19-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m (min)

Outfall length = 2.21 m => Use 2.30 m (min)

OUTLET STRUCTURE 20-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m

Outfall length = 2.21 m => Use 2.30 m

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OUTLET STRUCTURE 21-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use **140** mm (min 2x Dia)

Outfall width = 0.9 m => Use **0.90** m (min)

Outfall length = 2.21 m => Use **2.30** m (min)

OUTLET STRUCTURE 22-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use **140** mm (min 2x Dia)

Outfall width = 0.9 m => Use **0.90** m

Outfall length = 2.21 m => Use **2.30** m

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OUTLET STRUCTURE 23-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.57 m/s

Froude Number Fo = 0.92

Rock diameter = 69 mm => Use 140 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m (min)

Outfall length = 2.21 m => Use 2.30 m (min)

OUTLET STRUCTURE 24-0 - ROCK RIPRAP

Pipe diameter = 0.300 m ks= 0.6

Pipe gradient = 0.020 m/m

Velocity = 2.23 m/s

Froude Number Fo = 1.30

Rock diameter = 97 mm => Use 200 mm (min 2x Dia)

Outfall width = 0.9 m => Use 0.90 m

Outfall length = 2.98 m => Use 3.00 m

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OUTLET STRUCTURE 25-0 - ROCK RIPRAP

Pipe diameter = 0.375 m ks= 0.6

Pipe gradient = 0.010 m/m

Velocity = 1.81 m/s

Froude Number Fo = 0.94

Rock diameter = 89 mm => Use **180** mm (min 2x Dia)

Outfall width = 1.125 m => Use **1.20** m (min)

Outfall length = 2.84 m => Use **2.90** m (min)

HY-8 CULVERT RESULTS SUMMARY										
CULVERT No.	TYPE	SIZE	CULVERT LENGTH (m)	Flow (m3/s)	VELOCITY (m/s)	RIP-RAP THICKNESS (m)	POOL LENGTH (m)	APRON LENGTH (m)	BASIN LENGTH(m)	BASIN WIDTH (m)
1	BOX CULVERT	5m x 2m	13.57	15.67	3.65	0.30	15.00	5.00	20.00	18.30
2	BOX CULVERT	1.5m x 1.5m	12.43	1.56	3.46	0.45	4.50	1.50	6.00	5.50
3	BOX CULVERT	4m x 2m	14.84	9.33	3.17	0.45	12.00	4.00	16.00	14.67
4	BOX CULVERT	6m x 2m	14.16	16.69	4.15	0.45	18.00	6.00	24.00	22.00
5	BOX CULVERT	2m x 1m	15.82	1.68	2.65	0.15	6.00	2.00	8.00	7.33
6	BOX CULVERT	1.5m x 2m	14.99	7.52	3.66	0.45	12.32	6.16	18.49	13.82
7	PRIMARY-CIR-CULVERT	0.6mø	29.08	1.22	4.34	0.45	4.57	2.28	6.85	5.17
COUNTRYSIDE										
13-4	CIR-CULVERT	1.20mø	14.33	1.58	3.35	0.30	5.58	2.79	8.36	6.78
14-1	BOX CULVERT	1.5m x 1.5m	13.31	4.07	5.28	0.45	9.11	4.56	13.67	10.61
6-6	CIR-CULVERT	1.05mø	13.41	1.26	3.13	0.36	3.15	1.46	4.61	4.12
1-1	PRIMARY-CIR-CULVERT	1.20mø	15.09	3.41	3.89	0.36	3.60	1.20	4.80	4.40
1-1	SECONDARY-BOX CULVERT	4m x 1.5m	12.36	Specific energy dissipation arrangement to be confirmed for the secondary culvert						