

# Appendix B

## Stormwater Report

(Lance Ryan Consulting Engineers, 2014)



**PROTEN**  
**CHICKEN SHEDS**

**EUROLEY**

**JOB NO 07W608**

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## 1.0 INTRODUCTION

Lance Ryan Consulting Engineers have been engaged by Proten to prepare a report detailing the capture and retention of stormwater runoff from the developed site.

The existing site is located at Euroley approximately half way between Narrandera and Darlington Point. The existing site is farmland and is relatively flat with the vast majority of the site having slopes between 0 and 1%.

## 2.0 PROPOSED DEVELOPMENT

The proposed development consists of 16 chicken sheds surrounded by an unsealed ring road and swale drains. Each site will have one retention dam located at each corner (4 dams in total) with each dam having a capacity of approximately 7,000 cu.m

Stormwater runoff is captured essentially in swale drains which direct the runoff to the 4 dams. Each site of 16 sheds is therefore providing 28,000 cu.m of on-site retention.

The layout of the site showing the proposed catchment Areas is attached to Appendix A.

The catchment areas are broken into 3 distinct sections each with a different runoff coefficient

1. Roofs and concrete pavements
2. Unsealed Roads
3. Swale drains and Dam



### 3.0 DESIGN

Each site consisting of 16 sheds has the following developed area.

Shed and concrete apron Area = 5.15 Ha

Unsealed Road Area = 2.27 Ha

Swale Drain and Dams Area = 6.15 Ha

Two methods were used to determine the total runoff volume generated from each site. The first was the rational formula method where runoff coefficients were applied to each of the above areas. The second method utilised design rates by applying initial losses and continuing losses to the pervious swale drain and dam areas.

#### Method One

Rational Method

The following fraction impervious figures were applied

Shed and Concrete Areas  $f = 1.0$

Unsealed Roads  $f = 0.9$

Swale drain and dam areas  $f = 0.5$

The total volume of runoff was determined for the 1 in 20, 50 and 100 year, 72 hour storm events.

The calculations and results can be seen in Appendix B.

The 1 in 20 year, 72 storm event produces 11,170 cu.m of runoff

The 1 in 50 year, 72 storm event produces 14,449 cu.m of runoff

The 1 in 100 year, 72 storm event produces 16,521 cu.m of runoff.

## Method Two

### Initial Loss and Continuing Loss Method

Initial losses and continuing losses of zero were applied to the sheds, concrete and unsealed road areas. From page 122 of Australian Rainfall and Runoff Table 6.2 initial losses of between 10 and 35mm can be adopted with continuing losses of 2.5mm/hr for areas east of the western slopes.

For the development the conservative 10mm initial losses was adopted. This lower figure provides the greater amount of runoff.

The total volume of runoff was determined for the 1 in 20, 50 and 100 year, 72 hour storm events.

The calculations and results can be seen in Appendix C.

The 1 in 20 year, 72 storm event produces 11,482 cu.m of runoff

The 1 in 50 year, 72 storm event produces 12,925 cu.m of runoff

The 1 in 100 year, 72 storm event produces 14,047 cu.m of runoff.

## 4.0 CONCLUSION

Each site of 16 sheds has four dams each with a capacity of 7,500 cu.m giving a total retention capacity at each site of 30,000cu.m.

Two methods were used to determine the total runoff capacity for the 1 in 20, 50 and 100 year, 72 hour storms.

The total runoff volume for both methods and the above storm events is shown in the table below

	<b>1 in 20 year 72 hour storm cu.m</b>	<b>1 in 50 year 72 hour storm cu.m</b>	<b>1 in 100 year 72 hour storm cu.m</b>
<b>Method 1</b>	<b>11,170</b>	<b>14,449</b>	<b>16,521</b>
<b>Method 2</b>	<b>11,483</b>	<b>12,925</b>	<b>14,047</b>

The 1 in 100 year, 72 storm event using Method 1 produces the greatest runoff volume of 16,521 cu.m. Total site retention provided is 28,000 cu.m which is 170% more than is required to prevent runoff escaping the retention dams.

Method 1 and Method 2 provide slightly different figures because the amount of runoff is sensitive to the fraction impervious figure adopted and also the initial losses and continuing losses figures adopted.

LANCE V. RYAN



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## 5.0 APPENDIX A

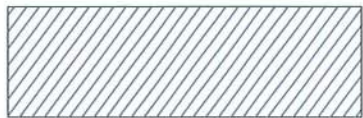
### Detention Areas



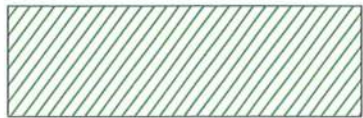
Legend



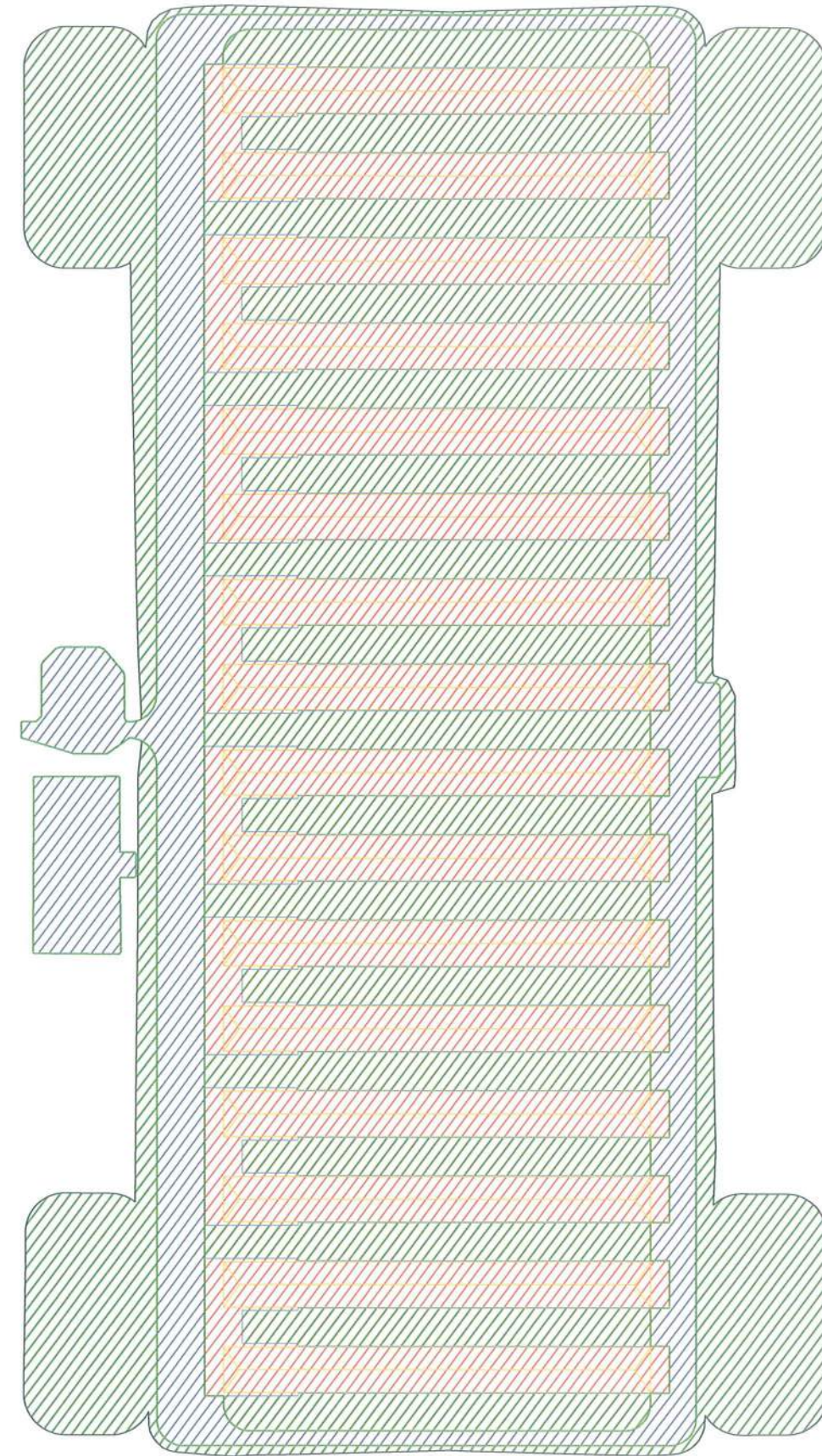
Roofs and Concrete Aprons = 51507sq.m




Unsealed roads and Platforms = 22,690sq.m



Pervious = 61,490 sq.m



								Copyright This drawing remains the property of Lance Ryan Consulting Engineers Pty Ltd. It may only be used for the purpose for which it was commissioned & in accordance with the terms of engagements for that commission. Unauthorised use of this drawing is prohibited		 North	<b>LRCE</b> Lance Ryan Consulting Engineers Pty Ltd Consulting Engineers Planners & Managers A.B.N. 53 631 529 091 52 Johnston Street WAGGA WAGGA NSW 2650 P.O. Box 7 WAGGA WAGGA NSW 2650 Ph: (02) 6921 1977 Fax: (02) 6921 7415 EMAIL: lance.ryan@gmail.com	Project Proten Chicken Sheds Narrandera		Drawing Title Catchment Area Plan	
1 Issued for Information		21.11.2014	L.V.R.	L.V.R.	L.V.R.			* Drawing Status Warning: Unless there is an authorised Lance Ryan Consulting Engineers Pty. Ltd. signature at *, this drawing is not authorised for issue.				Client Proten Architect / Project Manager		Scale 1:1200	
Revision	Amendment or reason for issue	Issue date	Drawing completed by	Designed & dwg. checked by	Verified by X = Not verified	Issue authorised (*)				Project Number 14W032		Dwg. No. C01	Sheet 01 of 01	Revision 1	



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**6.0 APPENDIX B**

**Retention Calculations Method One  
Rational Method**

PROTEN CHICKEN SHEDS								
NARRANDERA					Roof, Concrete Areas	5.1507		
ARI = 20 years					Fraction Impervious	1		
Recurrence Interval = 72					Runoff Coefficient	0.945		
			Developed Site					
I =	1.49	mm/hr	Effective Area		10.41	Roads	2.269	
P =	107.28	mm				Fraction Impervious	0.9	
						Runoff Coefficient	0.872	
						Pervious Areas	6.149	
						Fraction Impervious	0.5	
						Runoff Coefficient	0.58	
Time (minutes)	%	P mm	Total Runoff cu.m	Inflow cu.m/s	Undeveloped Storage cu.m	Developed Storage cu.m	Total Storage cu.m	
0	0	0	0	0.0000	0	0	0	
240	17.2	18.45	1921.31	0.1334	1921	0	1921	
480	35.4	37.98	3954.33	0.2746	5876	0	5876	
720	8.8	9.44	983.00	0.0683	6859	0	6859	
960	6.3	6.76	703.74	0.0489	7562	0	7562	
1200	6.2	6.65	692.57	0.0481	8255	0	8255	
1440	5	5.36	558.52	0.0388	8813	0	8813	
1680	3.8	4.08	424.48	0.0295	9238	0	9238	
1920	2.8	3.00	312.77	0.0217	9551	0	9551	
2160	1.5	1.61	167.56	0.0116	9718	0	9718	
2400	2.3	2.47	256.92	0.0178	9975	0	9975	
2640	1.3	1.39	145.22	0.0101	10120	0	10120	
2880	1.3	1.39	145.22	0.0101	10266	0	10266	
3120	1.9	2.04	212.24	0.0147	10478	0	10478	
3360	1.3	1.39	145.22	0.0101	10623	0	10623	
3600	1.3	1.39	145.22	0.0101	10768	0	10768	
3840	1.2	1.29	134.05	0.0093	10902	0	10902	
4080	1.2	1.29	134.05	0.0093	11036	0	11036	
4320	1.2	1.29	134.05	0.0093	11170	0	11170	
checksum	100	107.28						

PROTEN CHICKEN SHEDS								
NARRANDERA					Roof, Concrete Areas	5.1507		
ARI = 50 years					Fraction Impervious	1		
Recurrence Interval = 72					Runoff Coefficient	1.035		
			Developed Sie					
I =	1.76	mm/hr	Effective Area		11.40	Roads	2.269	
P =	126.72	mm				Fraction Impervious	0.9	
						Runoff Coefficient	0.955	
						Pervious Areas	6.149	
						Fraction Impervious	0.5	
						Runoff Coefficient	0.635	
Time (minutes)	%	P mm	Total Runoff cu.m	Inflow cu.m/s	Undeveloped Storage cu.m	Developed Storage cu.m	Total Storage cu.m	
0	0	0	0	0.0000	0	0	0	
240	16.3	20.66	2355.22	0.1636	2355	0	2355	
480	32.6	41.31	4710.45	0.3271	7066	0	7066	
720	8.6	10.90	1242.63	0.0863	8308	0	8308	
960	6.4	8.11	924.75	0.0642	9233	0	9233	
1200	6.4	8.11	924.75	0.0642	10158	0	10158	
1440	5.3	6.72	765.81	0.0532	10924	0	10924	
1680	4.1	5.20	592.42	0.0411	11516	0	11516	
1920	3.1	3.93	447.93	0.0311	11964	0	11964	
2160	1.8	2.28	260.09	0.0181	12224	0	12224	
2400	2.6	3.29	375.68	0.0261	12600	0	12600	
2640	1.4	1.77	202.29	0.0140	12802	0	12802	
2880	1.5	1.90	216.74	0.0151	13019	0	13019	
3120	2.2	2.79	317.88	0.0221	13337	0	13337	
3360	1.5	1.90	216.74	0.0151	13553	0	13553	
3600	1.6	2.03	231.19	0.0161	13785	0	13785	
3840	1.4	1.77	202.29	0.0140	13987	0	13987	
4080	1.6	2.03	231.19	0.0161	14218	0	14218	
4320	1.6	2.03	231.19	0.0161	14449	0	14449	
checksum	100	126.72						



PROTEN CHICKEN SHEDS								
NARRANDERA					Roof, Concrete Areas	5.1507		
ARI = 100 years					Fraction Impervious	1		
Recurrence Interval = 72					Runoff Coefficient	1.08		
			Developed Sie					
I =	1.97	mm/hr	Effective Area		11.65	Roads	2.269	
P =	141.84	mm				Fraction Impervious	0.9	
						Runoff Coefficient	0.996	
						Pervious Areas	6.149	
						Fraction Impervious	0.5	
						Runoff Coefficient	0.622	
Time (minutes)	%	P mm	Total Runoff cu.m	Inflow cu.m/s	UndevelopedStorage cu.m	Developed Storage cu.m	Total Storage cu.m	
0	0	0	0	0.0000	0	0	0	
240	16.3	23.12	2692.86	0.1870	2693	0	2693	
480	32.6	46.24	5385.72	0.3740	8079	0	8079	
720	8.6	12.20	1420.77	0.0987	9499	0	9499	
960	6.4	9.08	1057.32	0.0734	10557	0	10557	
1200	6.4	9.08	1057.32	0.0734	11614	0	11614	
1440	5.3	7.52	875.59	0.0608	12490	0	12490	
1680	4.1	5.82	677.35	0.0470	13167	0	13167	
1920	3.1	4.40	512.14	0.0356	13679	0	13679	
2160	1.8	2.55	297.37	0.0207	13976	0	13976	
2400	2.6	3.69	429.54	0.0298	14406	0	14406	
2640	1.4	1.99	231.29	0.0161	14637	0	14637	
2880	1.5	2.13	247.81	0.0172	14885	0	14885	
3120	2.2	3.12	363.45	0.0252	15249	0	15249	
3360	1.5	2.13	247.81	0.0172	15496	0	15496	
3600	1.6	2.27	264.33	0.0184	15761	0	15761	
3840	1.4	1.99	231.29	0.0161	15992	0	15992	
4080	1.6	2.27	264.33	0.0184	16256	0	16256	
4320	1.6	2.27	264.33	0.0184	16521	0	16521	
checksum			100	141.84				

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## 7.0 APPENDIX C

### Retention Calculations Method Two Initial Losses and Continuing Losses Method

PROTEN CHICKEN SHEDS								
NARRANDERA								
ARI = 20 years								
Recurrence Interval =		72	hr					
						DEVELOPED SITE		
I =	1.49	mm/hr					Impervious Area	7.42
P =	107.28	mm						
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Storage cu.m
0	0	0				0	0.0000	0
240	17.2	18.45			18.45	1369.15	0.0951	1369
480	35.4	37.98			37.98	2817.90	0.1957	4187
720	8.8	9.44			9.44	700.50	0.0486	4888
960	6.3	6.76			6.76	501.49	0.0348	5389
1200	6.2	6.65			6.65	493.53	0.0343	5883
1440	5	5.36			5.36	398.01	0.0276	6281
1680	3.8	4.08			4.08	302.49	0.0210	6583
1920	2.8	3.00			3.00	222.88	0.0155	6806
2160	1.5	1.61			1.61	119.40	0.0083	6925
2400	2.3	2.47			2.47	183.08	0.0127	7108
2640	1.3	1.39			1.39	103.48	0.0072	7212
2880	1.3	1.39			1.39	103.48	0.0072	7315
3120	1.9	2.04			2.04	151.24	0.0105	7467
3360	1.3	1.39			1.39	103.48	0.0072	7570
3600	1.3	1.39			1.39	103.48	0.0072	7674
3840	1.2	1.29			1.29	95.52	0.0066	7769
4080	1.2	1.29			1.29	95.52	0.0066	7865
4320	1.2	1.29			1.29	95.52	0.0066	7960
checksum	100	107.28						

PROTEN CHICKEN SHEDS										
NARRANDERA										
ARI = 20 years										
Recurrence Interval =		72		hr						
I =		1.49		mm/hr						
P =		107.28		mm						
				UNDEVELOPED SITE						
				Pervious Area						
				6.15						
				Total Initial Loss						
				10						
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Undeveloped Storage cu.m	Developed Storage cu.m	Total Storage cu.m
0	0	0				0	0.0000	0	0	0
240	17.2	18.45	10.00		8.45	519.81	0.0361	520	1369	1889
480	35.4	37.98			37.98	2335.59	0.1622	2855	4187	7042
720	8.8	9.44		2.50	6.94	426.85	0.0296	3282	4888	8170
960	6.3	6.76		2.50	4.26	261.91	0.0182	3544	5389	8933
1200	6.2	6.65		2.50	4.15	255.31	0.0177	3799	5883	9682
1440	5	5.36		2.50	2.86	176.14	0.0122	3976	6281	10256
1680	3.8	4.08		2.50	1.58	96.96	0.0067	4073	6583	10656
1920	2.8	3.00		2.50	0.50	30.99	0.0022	4104	6806	10910
2160	1.5	1.61		2.50	-0.89	-54.78	-0.0038	4049	6925	10974
2400	2.3	2.47		2.50	-0.03	-2.00	-0.0001	4047	7108	11155
2640	1.3	1.39		2.50	-1.11	-67.98	-0.0047	3979	7212	11191
2880	1.3	1.39		2.50	-1.11	-67.98	-0.0047	3911	7315	11226
3120	1.9	2.04		2.50	-0.46	-28.39	-0.0020	3882	7467	11349
3360	1.3	1.39		2.50	-1.11	-67.98	-0.0047	3814	7570	11385
3600	1.3	1.39		2.50	-1.11	-67.98	-0.0047	3746	7674	11420
3840	1.2	1.29		2.50	-1.21	-74.58	-0.0052	3672	7769	11441
4080	1.2	1.29		2.50	-1.21	-74.58	-0.0052	3597	7865	11462
4320	1.2	1.29		2.50	-1.21	-74.58	-0.0052	3523	7960	11483
checksum	100	107.28								

PROTEN CHICKEN SHEDS								
NARRANDERA								
ARI = 50 years								
Recurrence Interval =		72	hr					
						DEVELOPED SITE		
						Impervious Area		
I =	1.76	mm/hr						
P =	126.72	mm						
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Storage cu.m
0	0	0				0	0.0000	0
240	16.3	20.66			20.66	1532.63	0.1064	1533
480	32.6	41.31			41.31	3065.26	0.2129	4598
720	8.6	10.90			10.90	808.63	0.0562	5407
960	6.4	8.11			8.11	601.77	0.0418	6008
1200	6.4	8.11			8.11	601.77	0.0418	6610
1440	5.3	6.72			6.72	498.34	0.0346	7108
1680	4.1	5.20			5.20	385.51	0.0268	7494
1920	3.1	3.93			3.93	291.48	0.0202	7785
2160	1.8	2.28			2.28	169.25	0.0118	7955
2400	2.6	3.29			3.29	244.47	0.0170	8199
2640	1.4	1.77			1.77	131.64	0.0091	8331
2880	1.5	1.90			1.90	141.04	0.0098	8472
3120	2.2	2.79			2.79	206.86	0.0144	8679
3360	1.5	1.90			1.90	141.04	0.0098	8820
3600	1.6	2.03			2.03	150.44	0.0104	8970
3840	1.4	1.77			1.77	131.64	0.0091	9102
4080	1.6	2.03			2.03	150.44	0.0104	9252
4320	1.6	2.03			2.03	150.44	0.0104	9403
checksum	100	126.72						



PROTEN CHICKEN SHEDS										
NARRANDERA										
ARI = 50 years										
Recurrence Interval = 72 hr										
I =	1.76	mm/hr								
P =	126.72	mm								
						UNDEVELOPED SITE				
						Pervious Area	6.15			
			Total Initial Loss							
			10							
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Undeveloped Storage cu.m	Developed Storage cu.m	Total Storage cu.m
0	0	0				0	0.0000	0	0	0
240	16.3	17.49	10.00		7.49	460.43	0.0320	460	1533	1993
480	32.6	34.97			34.97	2150.86	0.1494	2611	4598	7209
720	8.6	9.23		2.50	6.73	413.65	0.0287	3025	5407	8431
960	6.4	6.87		2.50	4.37	268.50	0.0186	3293	6008	9302
1200	6.4	6.87		2.50	4.37	268.50	0.0186	3562	6610	10172
1440	5.3	5.69		2.50	3.19	195.93	0.0136	3758	7108	10866
1680	4.1	4.40		2.50	1.90	116.76	0.0081	3875	7494	11369
1920	3.1	3.33		2.50	0.83	50.78	0.0035	3925	7785	11711
2160	1.8	1.93		2.50	-0.57	-34.99	-0.0024	3890	7955	11845
2400	2.6	2.79		2.50	0.29	17.79	0.0012	3908	8199	12107
2640	1.4	1.50		2.50	-1.00	-61.38	-0.0043	3847	8331	12178
2880	1.5	1.61		2.50	-0.89	-54.78	-0.0038	3792	8472	12264
3120	2.2	2.36		2.50	-0.14	-8.60	-0.0006	3783	8679	12462
3360	1.5	1.61		2.50	-0.89	-54.78	-0.0038	3729	8820	12548
3600	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3680	8970	12651
3840	1.4	1.50		2.50	-1.00	-61.38	-0.0043	3619	9102	12721
4080	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3571	9252	12823
4320	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3523	9403	12925
checksum	100	107.28								

PROTEN CHICKEN SHEDS								
NARRANDERA								
ARI =100 years								
Recurrence Interval = 72 hr								
I =	1.97	mm/hr				DEVELOPED SITE		
P =	141.84	mm				Impervious Area	7.42	
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Storage cu.m
0	0	0				0	0.0000	0
240	16.3	23.12			23.12	1715.50	0.1191	1715
480	32.6	46.24			46.24	3431.00	0.2383	5146
720	8.6	12.20			12.20	905.11	0.0629	6052
960	6.4	9.08			9.08	673.57	0.0468	6725
1200	6.4	9.08			9.08	673.57	0.0468	7399
1440	5.3	7.52			7.52	557.80	0.0387	7957
1680	4.1	5.82			5.82	431.51	0.0300	8388
1920	3.1	4.40			4.40	326.26	0.0227	8714
2160	1.8	2.55			2.55	189.44	0.0132	8904
2400	2.6	3.69			3.69	273.64	0.0190	9177
2640	1.4	1.99			1.99	147.34	0.0102	9325
2880	1.5	2.13			2.13	157.87	0.0110	9483
3120	2.2	3.12			3.12	231.54	0.0161	9714
3360	1.5	2.13			2.13	157.87	0.0110	9872
3600	1.6	2.27			2.27	168.39	0.0117	10040
3840	1.4	1.99			1.99	147.34	0.0102	10188
4080	1.6	2.27			2.27	168.39	0.0117	10356
4320	1.6	2.27			2.27	168.39	0.0117	10525
checksum	100	141.84						

PROTEN CHICKEN SHEDS										
NARRANDERA										
ARI = 100 years										
Recurrence Interval =		72		hr						
I =		1.97		mm/hr						
P =		141.84		mm						
				UNDEVELOPED SITE						
				Pervious Area						
				6.15						
				Total Initial Loss						
				10						
Time (minutes)	%	P mm	Initial loss mm	Continuing Loss mm	Effective Rainfall mm	Total Runoff cu.m	Inflow cu.m/s	Undeveloped Storage cu.m	Developed Storage cu.m	Total Storage cu.m
0	0	0				0	0.0000	0	0	0
240	16.3	17.49	10.00		7.49	460.43	0.0320	460	1715	2176
480	32.6	34.97			34.97	2150.86	0.1494	2611	5146	7758
720	8.6	9.23		2.50	6.73	413.65	0.0287	3025	6052	9077
960	6.4	6.87		2.50	4.37	268.50	0.0186	3293	6725	10019
1200	6.4	6.87		2.50	4.37	268.50	0.0186	3562	7399	10961
1440	5.3	5.69		2.50	3.19	195.93	0.0136	3758	7957	11714
1680	4.1	4.40		2.50	1.90	116.76	0.0081	3875	8388	12263
1920	3.1	3.33		2.50	0.83	50.78	0.0035	3925	8714	12640
2160	1.8	1.93		2.50	-0.57	-34.99	-0.0024	3890	8904	12794
2400	2.6	2.79		2.50	0.29	17.79	0.0012	3908	9177	13086
2640	1.4	1.50		2.50	-1.00	-61.38	-0.0043	3847	9325	13172
2880	1.5	1.61		2.50	-0.89	-54.78	-0.0038	3792	9483	13275
3120	2.2	2.36		2.50	-0.14	-8.60	-0.0006	3783	9714	13498
3360	1.5	1.61		2.50	-0.89	-54.78	-0.0038	3729	9872	13601
3600	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3680	10040	13721
3840	1.4	1.50		2.50	-1.00	-61.38	-0.0043	3619	10188	13807
4080	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3571	10356	13927
4320	1.6	1.72		2.50	-0.78	-48.19	-0.0033	3523	10525	14047
checksum	100	107.28								