
Attachment 9

RUNOFF DETENTION BY THE MODIFIED RATIONAL METHODData Entry: **PRESS TAB & ENTER DESIGN VALUES** SS Ver: 1.0

Site Location P60 Isoleth:	1.40	Fig. SWM-2 in County Design Criteria
Rational Coefficients Cpre:	0.30	See note # 2
Cpost:	0.90	See note # 2
Impervious Area:	19150 ft ²	See note # 2 and # 4

STRUCTURE DIMENSIONS FOR DETENTION806 ft³ storage volume calculated

40 % void space assumed

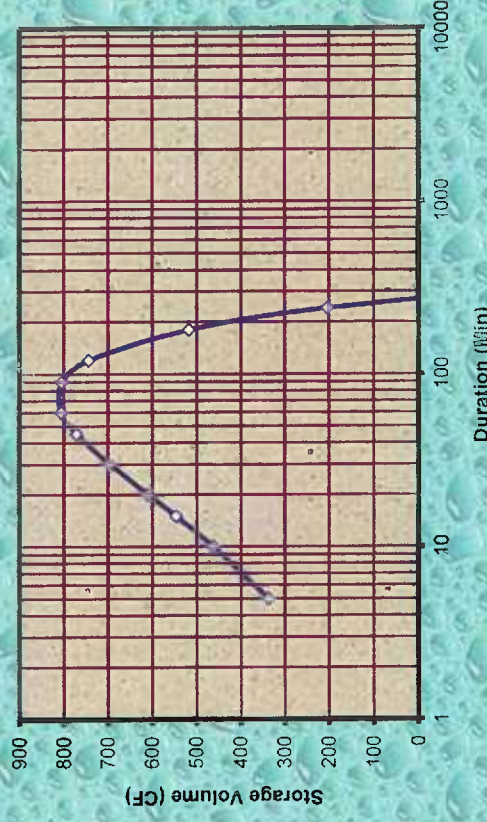
2016 ft³ excavated volume needed

Structure Ratios	Length	Width*	Depth*
	51.00	15.50	2.60
Dimen. (ft)	50.67	15.40	2.58

*For pipe, use the square root of the sectional area

10 - YEAR DESIGN STORM**DETENTION @ 15 MIN.**

Storm Duration (min)	10 - Year		5 - Yr.		Detention Rate To Storage (cfs)	Specified Storage Volume (cf)
	Intensity (in/hr)	Qpre (cfs)	Release Qpre (cfs)	10 - Year Qpost (cfs)		
1440	0.23	0.026	0.026	0.093	-0.099	-10658
1200	0.25	0.029	0.029	0.101	-0.091	-8189
960	0.28	0.032	0.032	0.111	-0.081	-5810
720	0.32	0.036	0.036	0.126	-0.066	-3558
480	0.38	0.043	0.043	0.150	-0.042	-1497
360	0.43	0.048	0.048	0.171	-0.022	-582
240	0.51	0.058	0.058	0.203	0.011	203
180	0.58	0.065	0.065	0.230	0.038	517
120	0.69	0.078	0.078	0.275	0.083	744
90	0.78	0.088	0.088	0.311	0.119	805
60	0.93	0.105	0.105	0.371	0.179	806
45	1.05	0.119	0.119	0.421	0.229	772
30	1.26	0.142	0.142	0.502	0.310	697
20	1.50	0.170	0.170	0.598	0.406	609
15	1.70	0.192	0.192	0.678	0.486	547
10	2.03	0.229	0.229	0.808	0.616	462
5	2.74	0.309	0.309	1.092	0.900	338

10-Yr Post-Development Detention Storage Volume
@ 5-Yr Pre-Development Release Rate**Notes & Limitations on Use:**

- 1) The modified rational method, and therefore the standard calculations are applicable in watersheds up to 20 acres in size.
- 2) Required detention volume determinations shall be based on all net new impervious are both on and off-site, resulting from the proposed project. Pervious areas shall not be included in detention volume sizing; an exception may be made for incidental pervious areas less than 10% of the total area.
- 3) Gravel packed detention chambers shall specify on the plans, aggregate that is washed, angular, and uniformly graded (of single size), assuring void space not less than 35%.
- 4) A map showing boundaries of both regulated impervious areas and actual drainage areas routed to the hydraulic control structure of the detention facility is to be provided, clearly distinguishing between the two areas, and noting the square footage.
- 5) The EPA defines a class V injection well as any bored, drilled, or driven shaft, or dug hole that is deeper than its widest surface dimension, or an improved sinkhole, or a subsurface fluid distribution system. Such storm water drainage wells are "authorized by rule". For more information on these rules, contact the EPA. A web site link is provided from the County DPW Stormwater Management web page.
- 6) Refer to the County of Santa Cruz Design Criteria, for complete method criteria.

PROJECT: 3800 Portola Drive - Area 1

Calc by: RCT

Date: 11/2/2015

RUNOFF RETENTION BY THE STORAGE PERCOLATION METHOD

Data Entry: **PRESS TAB KEY & ENTER DESIGN VALUES**

Notes & Limitations on Use:

SS Ver:1.0

Site Location P60 Isopleth:	1.40	Fig. SWM-2
Rational Coefficients Cpre:	0.30	
Cpost:	0.90	
Impervious Area:	23780	ft ²
Saturated Soil Permeability:	3.60	in/hr

Saturated soil permeability values may be used conservatively from the USDA-NRCS soil survey, or use actual test values.

Site selection and design shall give proper consideration to the path for excess flows downstream of the designated retention area.

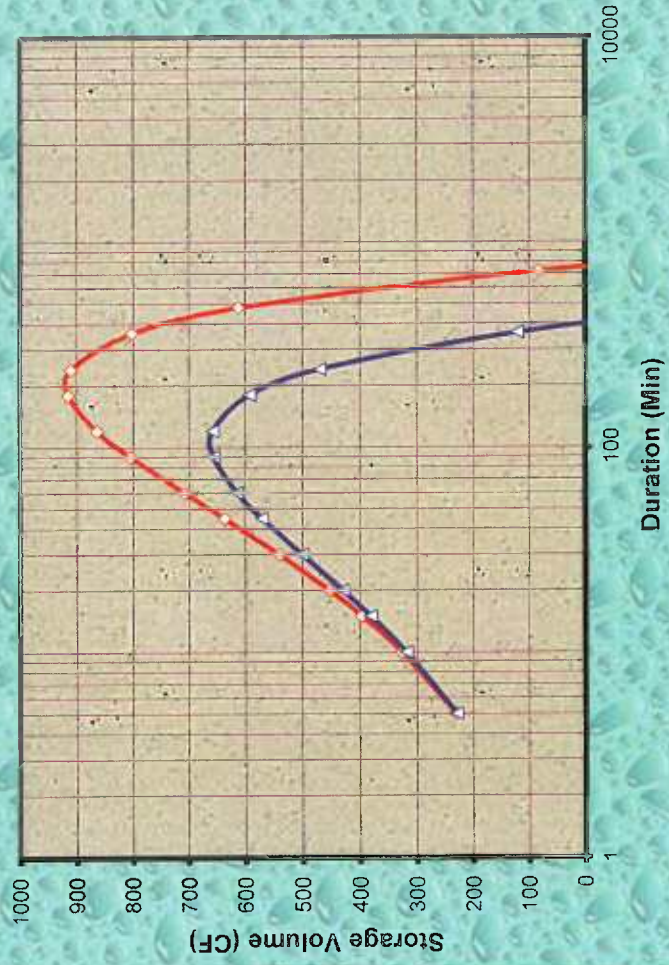
Retention site location on, or immediately above, slopes exceeding 15% will require consulting a geotechnical engineer.

Gravel packed structures shall use washed, angular, uniformly graded aggregate providing not less than 35% void space.

Refer to the County of Santa Cruz Design Criteria, Stormwater Management - Section H, for complete method criteria.

2 - YEAR DESIGN STORM					RETENTION @ 120 MIN.			STRUCTURE DIMENSIONS FOR RETENTION				DETENTION @ 60 MIN.	
Storm Duration (min)	2 - Year Intensity (in/hr)	Qpre (cfs)	Qpost (cfs)		Retention Rate To Storage (cfs)	Specified Retained Volume (cf)		659 ft³ storage volume calculated	% void space assumed	1647 ft³ excavated volume needed	Structure Length Width* Depth**	Detention Rate To Storage (cfs)	Specified Detained Volume (cf)
1440	0.15	0.025	0.074		0.001	-5005					Ratios 51.00 15.50 2.10	-0.024	-2085
1200	0.16	0.027	0.080		0.008	-3714					Dimen. (ft) 50.87 15.46 2.09	-0.018	-1298
960	0.18	0.030	0.089		0.016	-2483					1064 ft² internal surface area	-0.010	-567
720	0.20	0.033	0.100		0.027	-1335					745 ft² effective surface area	0.002	83
480	0.24	0.040	0.120		0.047	-313					2.9 hrs estimated structure drainage time	0.021	612
360	0.27	0.045	0.136		0.063	121						0.037	803
240	0.33	0.054	0.162		0.089	470						0.063	911
180	0.37	0.061	0.183		0.110	594						0.085	915
120	0.44	0.073	0.218		0.146	659						0.120	864
90	0.50	0.082	0.247		0.175	657						0.149	805
60	0.60	0.098	0.295		0.222	616						0.197	708
45	0.67	0.111	0.334		0.262	572						0.236	637
30	0.80	0.133	0.399		0.326	501						0.300	541
20	0.96	0.158	0.475		0.403	430						0.377	453
15	1.09	0.180	0.539		0.466	381						0.440	396
10	1.30	0.214	0.642		0.570	319						0.544	326
5	1.75	0.289	0.868		0.795	230						0.770	231
								STRUCTURE DIMENSIONS FOR DETENTION					
								915 ft³ storage volume calculated					
								40 % void space assumed					
								2288 ft³ excavated volume needed					
								Structure Length Width* Depth*					
								Ratios 25.00 2.00 2.00					
								Dimen. (ft) 70.98 5.68 5.68					

2 - Year Retention or Detention Storage Volume



RUNOFF DETENTION BY THE MODIFIED RATIONAL METHOD**Data Entry:** PRESS TAB & ENTER DESIGN VALUES SS Ver: 1.0

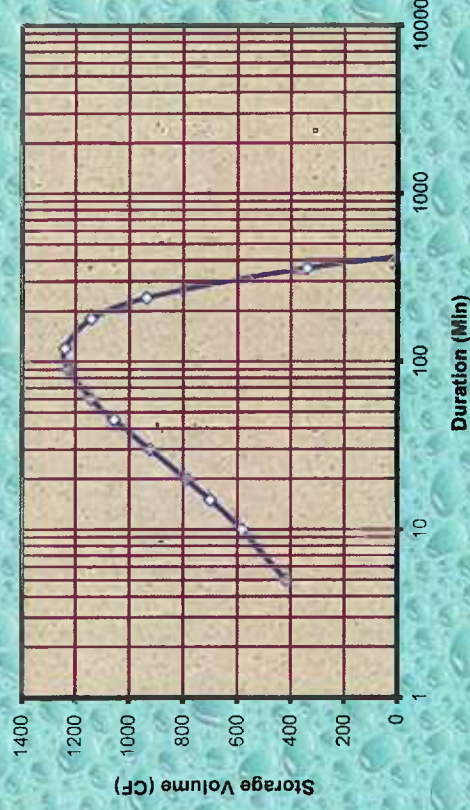
Site Location P60 Isoleth:	1.40	Fig. SWM-2 in County Design Criteria
Rational Coefficients Cpre:	0.30	See note # 2
Cpost:	0.90	See note # 2
Impervious Area:	19150 ft ²	See note # 2 and # 4

STRUCTURE DIMENSIONS FOR DETENTION

1239	ft ³ storage volume calculated		
40	% void space assumed		
3097	ft ³ excavated volume needed		
Structure Ratios	Length	Width*	Depth*
	40.50	16.00	4.90
Dimen. (ft)	40.16	15.87	4.86

*For pipe, use the square root of the sectional area

25 - YEAR DESIGN STORM				DETENTION @ 15 MIN.	
Storm Duration (min)	25 - Year Intensity (in/hr)	5 - Yr. Release Qpre (cfs)	25 - Year Qpost (cfs)	Detention Rate To Storage (cfs)	Specified Storage Volume (cf)
1440	0.28	0.026	0.112	-0.080	-8640
1200	0.30	0.029	0.121	-0.071	-6369
960	0.33	0.032	0.134	-0.058	-4207
720	0.38	0.036	0.151	-0.041	-2195
480	0.45	0.043	0.181	-0.011	-414
360	0.51	0.048	0.205	0.013	339
240	0.61	0.058	0.244	0.052	935
180	0.69	0.065	0.276	0.084	1140
120	0.83	0.078	0.330	0.138	1239
90	0.94	0.088	0.374	0.182	1225
60	1.12	0.105	0.446	0.253	1141
45	1.27	0.119	0.505	0.313	1056
30	1.51	0.142	0.602	0.410	922
20	1.80	0.170	0.718	0.526	789
15	2.04	0.192	0.813	0.621	699
10	2.43	0.229	0.970	0.778	584
5	3.29	0.309	1.311	1.119	420

25-Yr Post-Development Detention Storage Volume
@ 5-Yr Pre-Development Release Rate**Notes & Limitations on Use:**

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PROJECT: 3800 Portola Drive - Area 2

Calc by: RCT

Date: 11/2/2015

RUNOFF RETENTION BY THE STORAGE PERCOLATION METHOD

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SS Ver:1.0

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Rational Coefficients Cpre:	0.30	
Cpost:	0.90	
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2 - YEAR DESIGN STORM				RETENTION @ 120 MIN.		STRUCTURE DIMENSIONS FOR RETENTION				DETENTION @ 60 MIN.				
Storm Duration (min)	2 - Year Intensity (in/hr)	Qpre (cfs)	Qpost (cfs)	Retention Rate To Storage (cfs)	Specified Retained Volume (cf)	527	ft³ storage volume calculated				Detention Rate To Storage (cfs)	Specified Detained Volume (cf)		
1440	0.15	0.020	0.060	0.001	-4076	40	% void space assumed				-0.019	-1679		
1200	0.16	0.022	0.065	0.006	-3029	1317	ft³ excavated volume needed				-0.015	-1045		
960	0.18	0.024	0.071	0.013	-2030	Structure	Length	Width*	Depth**	-0.008	-457			
720	0.20	0.027	0.081	0.022	-1098	Ratios	40.50	16.00	2.10	0.002	67			
480	0.24	0.032	0.096	0.038	-268	Dimen. (ft)	40.06	15.83	2.08	0.017	493			
360	0.27	0.036	0.109	0.051	86	866	ft² internal surface area				0.030	646		
240	0.33	0.043	0.130	0.072	371	606	ft² effective surface area				0.051	733		
180	0.37	0.049	0.147	0.089	472	2.9	hrs estimated structure drainage time				0.068	737		
120	0.44	0.059	0.176	0.117	527	* For pipe, use the square root of the sectional area.							0.097	696
90	0.50	0.066	0.199	0.141	526	* If cell values displayed are corrupted, enter zero for depth, then re-enter a positive numeric value within allowed range.							0.120	648
60	0.60	0.079	0.238	0.179	494	STRUCTURE DIMENSIONS FOR DETENTION							0.158	570
45	0.67	0.090	0.269	0.211	459	737	ft³ storage volume calculated				0.190	513		
30	0.80	0.107	0.321	0.262	403	40	% void space assumed				0.242	435		
20	0.96	0.128	0.383	0.324	345	1843	ft³ excavated volume needed				0.304	364		
15	1.09	0.145	0.434	0.375	307	Structure	Length	Width*	Depth*	0.355	319			
10	1.30	0.172	0.517	0.459	256	Ratios	25.00	2.00	2.00	0.438	263			
5	1.75	0.233	0.699	0.640	185	Dimen. (ft)	66.03	5.28	5.28	0.620	186			

2 - Year Retention or Detention Storage Volume

