

DETENTION POND CALCULATIONS MODIFIED RATIONAL METHOD

DRAINAGE AREA (A)	2.05	AC
TIME OF CONC. (T _c)	20	MIN
RAINFALL INTENSITY (I)	3.9	IN/HR
RUNOFF COEFFICIENT (C)	0.35	
ALLOW. SITE DISCHARGE	2.8	CFS

DETAILED RUNOFF:			OFF-SITE PASS THROUGH FLOW:		
DRAINAGE AREA (A)	1.87	AC	DRAINAGE AREA (A)	0.41	AC
TIME OF CONC. (T _c)	10	MIN	TIME OF CONC. (T _c)	10	MIN
RAINFALL INTENSITY (I)	5.3	IN/HR	RAINFALL INTENSITY (I)	5.3	IN/HR
RUNOFF COEFFICIENT (C)	0.90		RUNOFF COEFFICIENT (C)	0.90	
DETAILED RUNOFF	8.92	CFS	OFF-SITE PASS THROUGH FLOW:	1.96	CFS

UNDAINED RUNOFF:			ALLOWABLE POND DISCHARGE	3.90	CFS
DRAINAGE AREA (A)	0.18	AC	ACTUAL POND DISCHARGE	2.33	CFS
TIME OF CONC. (T _c)	10	MIN			
RAINFALL INTENSITY (I)	5.3	IN/HR			
RUNOFF COEFFICIENT (C)	0.90				
UNDAINED RUNOFF	0.86	CFS			

DURATION		RAINFALL INTENSITY	INFLOW RATE	INFLOW VOLUME	OUTFLOW RATE	OUTFLOW VOLUME	REQUIRED STORAGE (INFLOW - OUTFLOW)	
(MIN)	(HRS)	(IN/HR)	(CFS)	(CF)	(CFS)	(CF)	(AC-FT)	
5	0.08	6.1	12.52	3.75	3.30	1.753	2.002	
10	0.17	5.3	10.88	6.525	3.90	2.337	4.188	
15	0.25	4.5	9.23	8.311	3.90	2.922	5.389	
20	0.33	3.9	8.00	9.003	3.90	3.508	6.088	
30	0.50	3.3	6.77	12.189	3.90	4.674	7.514	
40	0.67	2.6	5.34	12.804	3.90	5.843	6.961	
50	0.83	2.3	4.47	14.159	3.90	7.012	7.147	
100	1.67	1.80	3.19	14.026	3.90	8.180	5.825	
70	1.17	1.8	3.68	15.513	3.90	9.694	6.164	
80	1.33	1.7	3.49	16.744	3.90	10.517	6.227	
90	1.50	1.68	3.19	17.723	3.90	11.686	6.043	
100	1.67	1.5	3.08	18.468	3.90	12.855	5.613	
MAXIMUM REQUIRED STORAGE =							7.514	0.17

DETENTION POND CALCULATIONS MODIFIED RATIONAL METHOD

DRAINAGE AREA (A)	2.05	AC
TIME OF CONC. (T _c)	20	MIN
RAINFALL INTENSITY (I)	5.9	IN/HR
RUNOFF COEFFICIENT (C)	0.35	
ALLOW. SITE DISCHARGE	4.2	CFS

DETAINED RUNOFF:			OFF-SITE PASS THROUGH FLOW:		
DRAINAGE AREA (A)	1.87	AC	DRAINAGE AREA (A)		0.41 AC
TIME OF CONC. (T _c)	10	MIN	TIME OF CONC. (T _c)		10 MIN
RAINFALL INTENSITY (I)	7.1	IN/HR	RAINFALL INTENSITY (I)		7.1 IN/HR
RUNOFF COEFFICIENT (C)	0.90		RUNOFF COEFFICIENT (C)		0.90
DETAINED RUNOFF	11.95	CFS	OFF-SITE PASS THROUGH FLOW:		2.62 CFS

UNDETAINED RUNOFF:			ALLOWABLE POND DISCHARGE	5.70	CFS
DRAINAGE AREA (A)	0.18	AC	ACTUAL POND DISCHARGE	3.87	CFS
TIME OF CONC. (T _c)	10	MIN			
RAINFALL INTENSITY (I)	7.1	IN/HR			
RUNOFF COEFFICIENT (C)	0.90				
UNDETAINED RUNOFF	1.15	CFS			

DURATION		RAINFALL INTENSITY	INFLOW RATE	INFLOW VOLUME	OUTFLOW RATE	OUTFLOW VOLUME	REQUIRED STORAGE (INFLOW - OUTFLOW)	
(MIN)	(HRS)	(MM/HR)	(CFS)	(CFT)	(CFS)	(CFT)	(AC-FT)	
5	0.08	5.4	17.24	5.171	5.70	2.566	2.605	
10	0.17	7.5	14.57	8.204	5.70	3.422	7.320	
15	0.25	6.1	13.44	12.642	5.70	4.277	7.727	
20	0.33	5.9	12.11	14.529	5.70	5.133	9.386	
30	0.50	4.8	9.85	17.729	5.70	6.844	10.886	
40	0.67	4.0	8.21	19.899	5.70	8.554	11.445	
50	0.83	3.5	7.18	21.546	5.70	10.265	11.281	
60	1.00	3.0	6.16	22.162	5.70	11.270	10.165	
70	1.17	2.8	5.75	24.132	5.70	13.687	10.444	
80	1.33	2.6	5.34	25.609	5.70	15.398	10.211	
90	1.50	2.3	4.72	27.702	5.70	17.109	10.663	
100	1.67	2.3	4.72	28.316	5.70	18.200	9.488	
MAXIMUM REQUIRED STORAGE =							11,281	0.26

DETENTION POND CALCULATIONS MODIFIED RATIONAL METHOD

DRAINAGE AREA (A)	2.05/AC
TIME OF CONC. (T _c)	20/MIN
RAINFALL INTENSITY (I)	6.6 IN/HR
RUNOFF COEFFICIENT (C)	0.35
ALLOW. SITE DISCHARGE	4.7/CFS

DETAILED RUNOFF:			OFF-SITE PASS THROUGH FLOW:		
DRAINAGE AREA (A)	1.87	AC	DRAINAGE AREA (A)	0.41	AC
TIME OF CONC. (T _c)	10	MIN	TIME OF CONC. (T _c)	10	MIN
RAINFALL INTENSITY (I)	8.3	IN/HR	RAINFALL INTENSITY (I)	8.3	IN/HR
RUNOFF COEFFICIENT (C)	0.90		RUNOFF COEFFICIENT (C)	0.90	
DETAILED RUNOFF	13.97	CFS	OFF-SITE PASS THROUGH FLOW:	3.06	CFS

UNDETAINED RUNOFF:		ALLOWABLE POND DISCHARGE	6.45	CFS
DRAINAGE AREA (A)	0.18	ACTUAL POND DISCHARGE	2.97	CFS
TIME OF CONC. (T _c)	10			
RAINFALL INTENSITY (I)	8.3			
RUNOFF COEFFICIENT (C)	0.90			
UNDETAINED RUNOFF	1.34			CFS

DURATION		RAINFALL INTENSITY	INFLOW RATE	INFLOW VOLUME	OUTFLOW RATE	OUTFLOW VOLUME	REQUIRED STORAGE (INFLOW - OUTFLOW)	
(MIN)	(HRS)	(IN/HHR)	(CFS)	(CF)	(CFS)	(CF)	(CF)	(AC-FT)
5	0.08	9.5	19.49	8.548	8.45	2.904	2.944	0.07
10	0.17	8.3	17.03	10.219	8.45	3.872	6.347	0.15
15	0.25	7.5	15.39	13.851	8.45	4.840	9.011	0.21
20	0.33	6.6	13.54	16.262	8.45	5.908	10.444	0.24
30	0.50	5.5	11.29	20.315	8.45	7.748	12.570	0.28
40	0.67	4.6	9.44	22.654	8.45	9.680	12.974	0.30
50	0.83	4.0	8.21	24.624	8.45	11.616	13.008	0.30
60	1.00	3.5	7.18	26.825	8.45	13.552	13.303	0.28
70	1.17	3.3	6.77	28.441	8.45	15.489	12.962	0.30
80	1.33	3.1	6.36	30.534	8.45	17.425	13.109	0.30
90	1.50	2.9	5.95	32.134	8.45	19.361	12.774	0.29
100	1.67	2.7	5.54	33.242	8.45	21.297	11.946	0.27
MAXIMUM REQUIRED STORAGE =							13,109	0.30

DETENTION POND CALCULATIONS MODIFIED RATIONAL METHOD

DRAINAGE AREA (A)	2.05	AC
TIME OF CONC. (T _c)	20	MIN
RAINFALL INTENSITY (I)	7.5	IN/HR
RUNOFF COEFFICIENT (C)	0.35	
ALLOW. SITE DISCHARGE	5.4	CFS

DETAILED RUNOFF:		OFF-SITE PASS THROUGH FLOW:	
DRAINAGE AREA (A)	1.87 AC	DRAINAGE AREA (A)	0.41 AC
TIME OF CONC. (T _c)	10 MIN	TIME OF CONC. (T _c)	10 MIN
RAINFALL INTENSITY (I)	9.0 IN/HR	RAINFALL INTENSITY (I)	9.0 IN/HR
RUNOFF COEFFICIENT (C)	0.90	RUNOFF COEFFICIENT (C)	0.90
DETAILED RUNOFF	15.15 CFS	OFF-SITE PASS THROUGH FLOW:	3.32 CFS

UNDETAINED RUNOFF:		ALLOWABLE POND DISCHARGE	7.24	CFS
DRAINAGE AREA (A)	0.18	ACTUAL POND DISCHARGE	4.38	CFS
TIME OF CONC. (T _c)	10			
RAINFALL INTENSITY (I)	9.0			
RUNOFF COEFFICIENT (C)	0.90			
UNDETAINED RUNOFF	1.46	CFS		

DURATION		RAINFALL INTENSITY	INFLOW RATE	INFLOW VOLUME	OUTFLOW RATE	OUTFLOW VOLUME	REQUIRED STORAGE (INFLOW - OUTFLOW)	
(MIN)	(HRS)	(MMHR)	(CFS)	(CF)	(CFS)	(CF)	(CF)	(AC-FT)
5	0.08	10.0	20.52	8.156	7.24	3.260	2.896	0.07
10	0.17	9.0	18.47	11.081	7.24	4.347	6.734	0.15
15	0.25	8.1	16.62	14.959	7.24	5.735	9.526	0.22
20	0.33	7.5	15.468	18.560	7.24	7.320	11.948	0.27
30	0.50	6.1	12.52	22.531	7.24	8.693	13.638	0.32
40	0.67	5.2	10.67	25.609	7.24	10.866	14.743	0.34
50	0.83	4.5	9.23	27.702	7.24	13.040	14.692	0.34
60	1.00	3.9	8.00	29.810	7.24	15.213	13.597	0.31
70	1.17	3.7	7.59	31.888	7.24	17.386	14.502	0.33
80	1.33	3.5	7.18	34.474	7.24	19.559	14.914	0.34
90	1.50	3.3	6.77	36.567	7.24	21.733	14.834	0.34
100	1.67	3.0	6.16	38.656	7.24	23.906	13.030	0.29
MAXIMUM REQUIRED STORAGE =							14,914	0.34

DETENTION POND CALCULATIONS MODIFIED RATIONAL METHOD

DRAINAGE AREA (A)	2.05 AC
TIME OF CONC. (T _c)	20 MIN
RAINFALL INTENSITY (I)	8.3 IN/HR
RUNOFF COEFFICIENT (C)	0.35
ALLOW. SITE DISCHARGE	5.96 CFS

DETAILED RUNOFF:			OFF-SITE PASS THROUGH FLOW:		
DRAINAGE AREA (A)	1.87	AC	DRAINAGE AREA (A)	0.41	AC
TIME OF CONC. (T _c)	10	MIN	TIME OF CONC. (T _c)	10	MIN
RAINFALL INTENSITY (I)	9.8	IN/HR	RAINFALL INTENSITY (I)	9.8	IN/HR
RUNOFF COEFFICIENT (C)	0.90		RUNOFF COEFFICIENT (C)	0.90	
DETAILED RUNOFF	16.49	CFS	OFF-SITE PASS THROUGH FLOW:	3.62	CFS

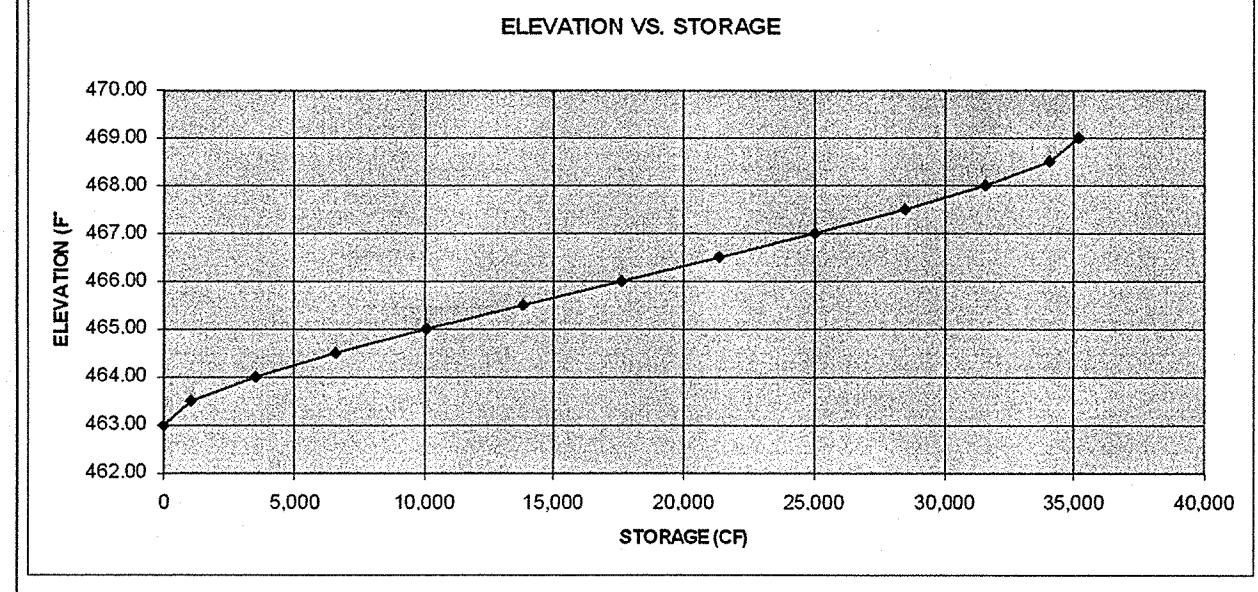
UNDETAINED RUNOFF:			ALLOWABLE POND DISCHARGE	7.98	CFS
DRAINAGE AREA (A)	0.18	AC	ACTUAL POND DISCHARGE	6.15	CFS
TIME OF CONC. (T _c)	10	MIN			
RAINFALL INTENSITY (I)	9.8	IN/HR			
RUNOFF COEFFICIENT (C)	0.90				
UNDETAINED RUNOFF	1.59	CFS			

DURATION		RAINFALL INTENSITY	INFLOW RATE	INFLOW VOLUME	OUTFLOW RATE	OUTFLOW VOLUME	REQUIRED STORAGE (INFLOW - OUTFLOW)	
(MIN)	(HRS)	(MM/HR)	(CFS)	(CUHR)	(CFS)	(CF)	(AC-FT)	
5	0.06	10.2	20.93	6.279	7.98	3.593	2.686	
10	0.17	9.6	20.11	12.066	7.98	4.790	7.275	
15	0.25	9.0	18.47	16.821	7.98	5.988	10.633	
20	0.33	8.3	17.03	20.433	7.98	7.185	13.252	
30	0.50	6.9	14.16	25.486	7.98	9.581	15.905	
40	0.67	5.8	11.96	28.564	7.99	11.976	16.588	
50	0.83	5.0	10.26	30.780	7.98	14.271	16.409	
60	1.00	4.5	9.23	33.242	7.98	16.768	16.476	
70	1.17	4.1	8.41	35.335	7.98	19.161	16.174	
80	1.33	3.9	8.00	36.413	7.98	21.556	16.257	
90	1.50	3.6	7.39	38.881	7.98	23.953	16.339	
100	1.67	3.4	6.98	41.861	7.98	26.347	15.514	
MAXIMUM REQUIRED STORAGE =							16,857	0.39

DETENTION POND VOLUME CALCULATIONS MODIFIED RATIONAL METHOD

	VOLUME = 0.5 * (AREA1 + AREA2) * (ELEV2 - ELEV1)	
GIVEN:	HIGH WATER ELEVATION + 1' FREEBOARD	470.00 FT
	HIGH WATER ELEVATION	469.00 FT
	OUTLET STRUCTURE INVERT ELEVATION	463.00 FT
GOAL:	REQUIRED DETENTION VOLUME	35,088 CF

ELEVATION		INCREMENTAL VOLUME		TOTAL VOLUME	
(FT)	AREA (SF)	(CF)	(AC-FT)	(CF)	(AC-FT)
463.00	0	0	0	0	0
463.50	4,241	1,060	0.02	1,060	0.02
464.00	5,718	2,490	0.06	3,550	0.08
464.50	6,644	3,091	0.07	6,641	0.15
465.00	7,233	3,469	0.08	10,110	0.23
465.50	7,564	3,699	0.08	13,809	0.32
466.00	7,482	3,762	0.09	17,571	0.40
466.50	7,664	3,763	0.09	21,333	0.49
467.00	7,233	3,699	0.08	25,031	0.57
467.50	6,644	3,469	0.08	28,501	0.65
468.00	5,718	3,091	0.07	31,591	0.73
468.50	4,241	2,490	0.06	34,081	0.78
469.00	0	1,060	0.02	35,141	0.81



DETENTION POND OUTFALL CALCULATIONS MODIFIED RATIONAL METHOD

METHOD:	Use multiple plate openings and utilize wet flow and orifice flow calculations to determine total outflow as a product of pond depth.					
GOAL:	Water surface elevation based upon volume required					
	2-yr storm requires	7.514	cfs of storage, which occurs at elev		464.60	
	10-yr storm requires	24.895	cfs of storage, which occurs at elev		466.98	
	25-yr storm requires	13.109	cfs of storage, which occurs at elev		465.44	
	50-yr storm requires	31.735	cfs of storage, which occurs at elev		468.03	
	100-yr storm requires	35.068	cfs of storage, which occurs at elev		469.00	

Given: Use weir equation to determine flow until opening is submerged.
 $Q = C^*b^*H^{3/2}$
 $C =$ discharge coefficient = 3.00
 $b =$ weir base width
 $H =$ water level height above center of weir

Use orifice equation to determine flow once opening is submerged.
 $Q = A^*C^*b^*h^{1/2}$
 $A =$ area of opening
 $C =$ discharge coefficient = 0.60
 $h =$ water level height above center of opening

Opening 1		Opening 2	
$b = 0.83 \text{ ft}$	$b = 1.90 \text{ ft}$		
$\text{Height} = 0.50 \text{ ft}$	$\text{Height} = 0.35 \text{ ft}$		
$A = 0.42 \text{ SF}$	$A = 0.66 \text{ SF}$		
base elev = 463.00 ft	base elev = 468.05 ft		

[illegible]

The image shows a vertical sheet of paper used for engineering drawings. On the left side, there is a vertical grid with horizontal lines and numbers 0, 5, and 10. At the bottom center, there is a rectangular box containing the following text:

RECORD DRAWING
THIS RECORD DRAWING HEREIN REFLECTS TO
THE BEST OF THE DESIGN ENGINEERS
KNOWLEDGE, THE APPROXIMATE LOCATION OF
THE CONSTRUCTED WORK, USING
INFORMATION AS PROVIDED BY THE

[illegible]