

# DRAINAGE AREA CALCULATIONS 100-YR EVENT EXISTING/PROPOSED CONDITIONS

	AREA (acres)	C	TC (min)	I (in/hr)	Q (cfs)
EP-1	0.83	0.35	20.0	8.30	2.41
EP-2	0.64	0.35	20.0	8.30	1.86
EPS-1	0.07	0.35	20.0	8.30	0.20
EPS-2	0.62	0.35	20.0	8.30	1.80
EPS-2A	0.28	0.35	20.0	8.30	0.81
EPS-3	0.05	0.35	20.0	8.30	0.15
EPS-4	1.06	0.35	20.0	8.30	3.08
EPS-5	0.08	0.35	20.0	8.30	0.23
EPS-6	0.94	0.35	20.0	8.30	2.73
EPS-7	0.35	0.35	20.0	8.30	1.02
EPS-8	2.58	0.35	20.0	8.30	7.49
D-1	0.90	0.35	20.0	8.30	2.61
D-2	1.35	0.35	20.0	8.30	3.92
D-3	1.58	0.35	20.0	8.30	4.59
D-4	0.61	0.35	20.0	8.30	1.77
D-5	0.56	0.35	20.0	8.30	1.63
D-6	0.59	0.35	20.0	8.30	1.71
D-7	0.12	0.35	20.0	8.30	0.35
OS-1	1.16	0.35	20.0	8.30	3.37
OS-2	1.16	0.35	20.0	8.30	3.37
OS-3	0.54	0.35	20.0	8.30	1.57
OS-4	0.76	0.35	20.0	8.30	2.21
Area:	16.83				48.89
TOTAL:					

	AREA (acres)	C	TC (min)	I (in/hr)	Q (cfs)
EP-1	0.83	0.90	10.0	9.80	7.32
EP-2	0.64	0.90	10.0	9.80	5.64
EPS-1	0.07	0.90	10.0	9.80	0.62
EPS-2	0.62	0.90	10.0	9.80	5.47
EPS-2A	0.28	0.90	10.0	9.80	2.47
EPS-3	0.05	0.90	10.0	9.80	0.44
EPS-4	1.06	0.90	10.0	9.80	9.35
EPS-5	0.08	0.90	10.0	9.80	0.71
EPS-6	0.94	0.90	10.0	9.80	8.29
EPS-7	0.35	0.90	10.0	9.80	3.09
EPS-8	2.58	0.90	10.0	9.80	22.76
D-1	0.90	0.90	10.0	9.80	7.94
D-2	1.35	0.90	10.0	9.80	11.81
D-3	1.58	0.90	10.0	9.80	13.94
D-4	0.61	0.90	10.0	9.80	5.38
D-5	0.56	0.90	10.0	9.80	4.94
D-6	0.59	0.90	10.0	9.80	5.20
D-7	0.12	0.90	10.0	9.80	1.06
OS-1	1.16	0.90	10.0	9.80	10.23
OS-2	1.16	0.90	10.0	9.80	10.23
OS-3	0.54	0.90	10.0	9.80	4.76
OS-4	0.76	0.90	10.0	9.80	6.70
Area:	16.83				148.44
TOTAL:					

# HISTORICAL RAINFALL CONTAINMENT ANALYSIS

<b>Initial Conditions:</b>				
Existing Pond Contributing Area:	4.62 acres			
Under Construction Pond Contributing Area:	5.71 acres			
Existing Pond Containment Capacity:	68400 ft3			
Expected Fire Flow	6163 ft3			
Under Construction Pond Containment Capacity:	59200 ft3			
C factor:	0.9			
City of Rockwall's 25 YR 24 HR Storm	6.7 in			
<b>Assumptions:</b>				
Calculation assumes both ponds are dry before rain events and both sluice gates are closed until after the rain events				
Calculation uses historical information provided by the NOAA as recorded at station 41-2244 (Love Field) from 1948-2010				
<b>Containment Findings:</b>				
<b>Total Historical Rain Events</b>	<b>Average Contributing Volume Per Rain Event to Existing Pond (ft3)</b>	<b>Average Contributing Volume Per Rain Event to Pond Under Construction (ft3)</b>	<b>Percentage of Rain Events Not Contained by Existing Pond</b>	<b>Percentage of Rain Events Not Contained by Pond Under Construction</b>
4135	7300	9000	0.22%	1.09%
<b>Maximum Historical Rain Event (in)</b>	<b>Maximum Contributing Volume to Existing Pond (ft3)</b>	<b>Maximum Contributing Volume to Pond Under Construction (ft3)</b>	<b>Total Rain Events Not Contained by Existing Pond</b>	<b>Total Rain Events Not Contained by Pond Under Construction</b>
6.9	103300	127700	9	45
	<b>Rockwall 24hr 25yr to Existing Pond (ft3)</b>	<b>Rockwall 24hr 25yr to Pond Under Construction (ft3)</b>		
	101100	125000		

# NEW STORMWATER DETENTION CALCULATIONS (Q<sub>100</sub>, Q<sub>25</sub>, Q<sub>10</sub>, and Q<sub>5</sub>)

<b>EXISTING SITE CONDITIONS</b>						
Cf	i	Tc	A	Q		
0.35	8.3	20	3.8	11.04		
<b>FUTURE CONDITIONS</b>						
Cf	0.9					
Tc	10					
Is	9.8					
A	5.93					
Q <sub>100</sub>	52.30					
<b>CITY OF ROCKWALL DETENTION CALCULATION</b>						
Duration (minutes)	Intensity (in/hr)	Cf	Q (cfs)	Inflow (cu-ft)	Outflow (cu-ft)	Storage (cu-ft)
10	9.8	0.9	52.3	31381.6	6623.4	24758.2
15	9	0.9	48.0	43229.7	8279.3	34950.5
20	8.3	0.9	44.3	53156.5	9935.1	43221.4
30	6.9	0.9	36.8	66285.5	13246.8	53038.7
40	5.8	0.9	31.0	74291.0	16558.5	57732.5
50	5	0.9	26.7	80055.0	19870.2	60184.8
60	4.5	0.9	24.0	86459.4	23181.9	63277.5
70	4	0.9	21.3	89661.6	26493.6	63168.0
80	3.7	0.9	19.7	94785.1	29805.3	64979.8
90	3.5	0.9	18.7	100869.3	33117.0	67752.3
100	3.3	0.9	17.6	105672.6	36428.7	69243.9
110	2.9	0.9	15.5	102150.2	39740.4	62409.8

<b>EXISTING SITE CONDITIONS</b>						
Cf	i	Tc	A	Q		
0.35	6.6	20	3.8	8.78		
<b>FUTURE CONDITIONS</b>						
Cf	0.9					
Tc	10					
Is	8.3					
A	5.93					
Q <sub>25</sub>	44.30					
<b>CITY OF ROCKWALL DETENTION CALCULATION</b>						
Duration	Intensity	Cf	Q	Inflow	Outflow	Storage
10	8.3	0.9	44.3	26578.3	5266.8	21311.5
15	7.50	0.9	40.0	36024.8	6583.5	29441.3
20	6.80	0.9	35.2	42269.0	7900.2	34368.8
30	5.50	0.9	29.4	52836.3	10533.6	42302.7
40	4.60	0.9	24.6	58920.5	13167.0	45753.5
50	4.00	0.9	21.3	64044.0	15800.4	48243.6
60	3.50	0.9	18.7	67246.2	18433.8	48812.4
70	3.30	0.9	17.6	73970.8	21067.2	52903.6
80	3.10	0.9	16.5	79414.6	23700.6	55714.0
90	2.90	0.9	15.5	83577.4	26334.0	57243.4
100	2.70	0.9	14.4	86459.4	28967.4	57492.0
110	2.50	0.9	13.3	88060.5	31600.8	56459.7

<b>EXISTING SITE CONDITIONS</b>						
Cf	i	Tc	A	Q		
0.35	5.9	20	3.8	7.85		
<b>FUTURE CONDITIONS</b>						
Cf	0.9					
Tc	10					
Is	7.1					
A	5.93					
Q <sub>10</sub>	37.89					
<b>CITY OF ROCKWALL DETENTION CALCULATION</b>						
Duration	Intensity	Cf	Q	Inflow	Outflow	Storage
10	7.1	0.9	37.9	22735.6	4708.2	18027.4
15	6.5	0.9	34.7	31221.5	5885.3	25336.2
20	5.9	0.9	31.5	37786.0	7062.3	30723.7
30	4.8	0.9	25.6	46111.7	9416.4	36695.3
40	4	0.9	21.3	51235.2	11770.5	39464.7
50	3.5	0.9	18.7	56038.5	14124.6	41913.9
60	3	0.9	16.0	57639.6	16478.7	41160.9
70	2.8	0.9	14.9	62763.1	18832.8	43930.3
80	2.6	0.9	13.9	66605.8	21186.9	45418.9
90	2.5	0.9	13.3	72049.5	23541.0	48508.5
100	2.4	0.9	12.8	76852.8	25895.1	50957.7
110	2.3	0.9	12.3	81015.7	28249.2	52766.5

<b>EXISTING SITE CONDITIONS</b>						
Cf	i	Tc	A	Q		
0.35	4.9	20	3.8	6.52		
<b>FUTURE CONDITIONS</b>						
Cf	0.9					
Tc	10					
Is	6.1					
A	5.93					
Q <sub>5</sub>	32.56					
<b>CITY OF ROCKWALL DETENTION CALCULATION</b>						
Duration	Intensity	Cf	Q	Inflow	Outflow	Storage
10	6.1	0.9	32.6	19533.4	3910.2	15623.2
15	5.5	0.9	29.4	26418.2	4887.8	21530.4
20	4.9	0.9	26.2	31381.6	5865.3	25516.3
30	4.1	0.9	21.9	39387.1	7820.4	31566.7
40	3.4	0.9	18.1	43549.9	9775.5	33774.4
50	2.8	0.9	14.9	44830.8	11730.6	33100.2
60	2.6	0.9	13.9	49954.3	13685.7	36268.6
70	2.4	0.9	12.8	53797.0	15640.8	38156.2
80	2.3	0.9	12.3	58920.5	17595.9	41324.6
90	2.1	0.9	11.2	60521.6	19551.0	40970.6
100	1.9	0.9	10.1	60841.8	21506.1	39335.7
110	1.8	0.9	9.6	63403.6	23461.2	39942.4

# OUTFALL STRUCTURE CALCULATIONS

**5-yr Storm Calculations**

Q=CA(2gh)<sup>1/2</sup>  
 Q= Max allowable flowrate (cfs)  
 C= Entrance coefficient, Assumed to be 0.6  
 A= Cross sectional area (sqft)  
 g= gravity, 32.2 ft/sec<sup>2</sup>  
 h= Head; depth at outfall - centroid distance  
 \*Assume the head on the centroid is the 5-yr water surface elev.  
 \*Assume orifice height of 5 inches or 0.417 ft

Solving for cross sectional area of orifice

A= Q/(C\*2gh<sup>1/2</sup>)= 0.75 sqft

A=0.75 sqft  
 Orifice Dimensions = 1.8 ft X 0.417 ft H

**100-yr Storm Calculations**

Since the opening of the submerged orifice has been determined to have a cross sectional area of 0.75 sqft the flow for the 100-yr storm through the orifice can be determined based on the known amount of head which corresponds to the required volume in the pond.

Q<sub>o</sub>=CA(2gh)<sup>1/2</sup>  
 Q<sub>o</sub>= 7.44 cfs

Since the raised water surface elevation is above the top of the weir it acts as a second orifice during the 100-yr storm. So the orifice equation is used again to determine the head necessary for the remaining flow to pass through

Q<sub>o</sub>=CA(2gh)<sup>1/2</sup>  
 Q= Remainder of flow rate, Q<sub>o</sub>-Q<sub>c</sub> (cfs)  
 C= Entrance coefficient, Assumed 0.6  
 A= Cross sectional area (sqft)= 4(h-0.09)  
 h= Head; depth at outfall - centroid distance  
 g= gravity, 32.2 ft/sec<sup>2</sup>  
 \*Area is a function of height and 0.09ft is the depth of water above the top of the weir

Q<sub>o</sub>= Q<sub>o</sub>-Q<sub>c</sub> 3.60 cfs  
 h=(Q<sub>o</sub>/CA)<sup>2</sup>/(2g) 0.39 ft

Throat centroid= 561.45-0.39= 561.06  
 Throat elev.= 561.06-(0.39-.09)

From these calculations, it is determined that since the 100-yr water surface is at 561.45, the throat of the opening must be at an elevation of 560.76.

# STORAGE VOLUME REQUIRED vs. PROVIDED

Storm Frequency	Storage Required (cu-ft)	Water Surface Elev.	Storage Provided (cu-ft)
100 yr	69244	561.45	70300
25 yr	57492	561.00	57800
10 yr	52767	560.85	53600
5 yr	41325	560.45	43400

# OUTFALL STRUCTURE FLOW Q<sub>ACTUAL</sub> VS. Q<sub>ALLOWABLE</sub>

Storm Frequency	Allowable Flow (cfs)	Actual Flow (cfs)
100 yr	11.04	11.04
25 yr	8.78	7.80
10 yr	7.85	7.06
5 yr	6.52	6.52

**WHITMORE MANUFACTURING**  
 STORM WATER COLLECTION  
 AND TREATMENT EVALUATION  
 CITY OF ROCKWALL, TEXAS



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Revision No.	Date	Description
1	11-4-2013	As Built Revision

**RECORD DRAWING SUBMITTAL**  
 NOV. 04, 2013  
 This Record Drawing is based upon information provided by Hill & Wilkinson General Contractors, Halff Associates, Inc. survey dated 9-12-2013 and final visual observation. Texas Board of Professional Engineers-Firm #F-312.

BY: DAVID LITTLETON  
 DATE: NOV/04/2013

Project No.: 29023  
 Issued: MARCH, 2013  
 Drawn By: CAD  
 Checked By: DL  
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 Sheet Title  
 STORM DRAINAGE CALCULATIONS

**C3.03**  
 Sheet Number

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