

DETENTION BASIN FLOW DATA								
Description	Direct Area (Acres)	Diverted Area (Acres)	Total Area (Acres)	Time of Conc. (min)	Coef. "c"	Intensity (In./Hr.)	100 Yr Flow Rate (cfs)	REMARKS
	2	3	4	5	6	7	8	9
I. SIDE DITCH DRAINAGE AREA ****								
PROPOSED CONDITIONS **	0.26		0.26	10	0.80	8.74	1.82	For design of West property line swale.
Including: Commercial Development	0.26		0.26	10	0.80	8.74	1.82	
II. OFFSITE AREA ****								
EXISTING CONDITIONS *	2.2		2.2	15	0.40	7.52	6.62	
III. STORM DRAIN LINE SD-1								
	2.46		2.46	15	0.44	7.52	8.18	Only for design of SD-1
IV. PROPOSED BUSINESS TRACT FLOW								
EXISTING CONDITIONS *	1.86		1.86	15	0.40	7.52	5.59	
PROPOSED CONDITIONS **	1.86		1.86	10	0.80	8.74	13	
Including: Commercial Development	1.86		1.86	10	0.80	8.74	13	
V. TOTAL ULTIMATE OUTFLOW ***								
EXISTING CONDITIONS	4.06		4.06	15	0.40	7.52	12.2	Flow for sizing the controlling structure.
PROPOSED CONDITIONS	4.06		4.06	15	0.58	7.52	17.8	Assumed with detained offsite flow.

Notes: * - Time of Concentration is estimated, based on single-family residential development land use.
 ** - Detention volume determined as a difference of the proposed Commercial and single-family residential land use.
 *** - Detention Basin Controlling structure sized based on ultimate combined outflow through detention basin.
 **** - Offsite area flows is assumed to be detained by others.

DETENTION BASIN CALCULATIONS														
Design Area	EXISTING			PROPOSED			Total Area		Rain Frequency	Qmain Existing (cfs)	Qmain Proposed (cfs)	Qmain Released (cfs)	High Water Elevation (FL)	Storage Volume (c.f.)
	Coef. "c"	Tc (min)	Intensity (in./hr.)	Coef. "c"	Tc (min)	Intensity (in./hr.)	Existing (Ac.)	Proposed (Ac.)						
I	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Addison Business Tract	0.40	15	7.52	0.58	15	7.52	4.06	4.06	100	12.2	17.8	12.2	632.14	5,663

DETENTION BASIN DESIGN
for 100 Year Storm

Project: Addison Business Tract
 Location: City of Addison, Texas
 Project No: 021313.00
 Date: 10/25/2005
 Designed By: PC
 Checked By: BP

Limitations set of a usage of the Modified Rational Method for this Design = 600 Ac.
Existing site condition: Watershed Area = 1.86 Ac. K = 1.00
 Rain Intensity I = 7.52 in/hr. C_u = 0.4 T_c = 15 min Storm Frequency = 100
 Peak Runoff = 5.59 cfs.

Proposed site condition: Watershed Area = 1.86 Ac. K = 1.00
 Rain Intensity I = 8.74 in/hr. C_u = 0.8 T_c = 10 min Storm Frequency = 100
 Peak Runoff Rate Q₄ = 13.00 cfs.

Rainfall Duration Interval = 31 min. Actual Rate of Release = 5.59 cfs.
 Total Design Rainfall (TR) = T_c + T₀ = 1.46 in. Total Design Runoff (R) = I * C * TR = 1.16 in.
 Total Design Runoff Volume @ Proposed Site Condition (V) = A * R * 3600 = 7,864 c.f.
 Peak Runoff Ratio (p₀ / q₀) = 0.43

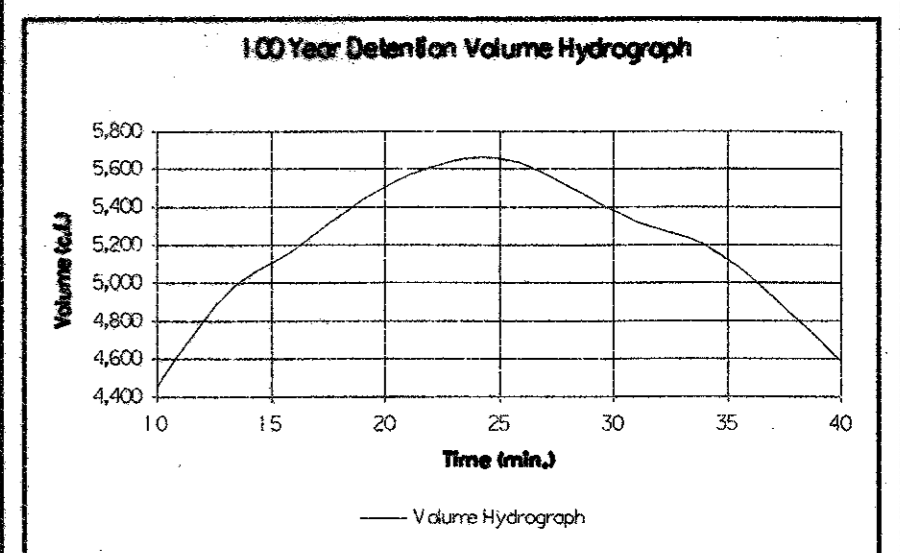
HYDROGRAPH SIMULATIONS
 Triangular pattern of Design Storm Duration (T_b = V / (Q₄ * 30)) = 20.2 min.
 Required Design Storm Duration (T_p = T_b * 3/8) = 7.6 min.
 Time Lag of Design Storm Duration (T_{lag} = T_c - T_p) = 2.4 min.
 Total Runoff Volume from project site at existing condition (V₀ = V₀ * Q₀ * 30) = 3018,388 c.f.
 Hydrograph Required Storage Volume per Modified Rational Method (S_{VH} = V₀ - V) = 3,576 c.f.
 The same in (acre-ft) = 0.08 acre-ft.

Required Detention Ratio to total Runoff Volume (V_s / V_r) = 0.314
 Hydrograph Required Storage Volume per Technical Release (TR-55) by USDA (S_{VH} = V₀ - V_r) = 0 c.f.
 The same in (acre-ft) = 0 acre-ft.

ROUTING SIMULATIONS							COMMENTS & ASSUMPTIONS
Line	Rainfall Duration (min.)	Rainfall Intensity (in./hr.)	Proposed Inflow Rate (cfs)	Volume (in) (c.f.)	Volume (out) (c.f.)	Required Storage Volume (c.f.)	
0							
1	10	8.74	13.01	7,806	3,354	4,452	1. Detention Design is based on Modified Rational Method.
2	13	8.01	11.92	9,298	4,360	4,937	2. Runoff rates for the Peak Runoff Ratio are calculated per Rational Method.
3	16	7.38	10.98	10,541	5,366	5,174	3. This spreadsheet is using data of City of Addison rain intensity duration.
4	19	6.96	10.36	11,810	6,373	5,438	
5	22	6.61	9.84	12,989	7,379	5,610	
6	25	6.29	9.36	14,040	8,385	5,655	
7	28	5.96	8.87	14,902	9,391	5,510	
8	31	5.68	8.45	15,717	10,397	5,320	
9	34	5.47	8.14	16,606	11,404	5,202	
10	37	5.25	7.81	17,338	12,410	4,928	
11	40	5.04	7.50	18,000	13,416	4,584	
12	43	4.86	7.23	18,653	14,422	4,231	
13	46	4.68	6.96	19,210	15,428	3,781	
14	49	4.50	6.70	19,698	16,435	3,263	
15	52	4.33	6.44	20,093	17,441	2,652	
16	55	4.18	6.22	20,526	18,447	2,079	
17	58	4.02	5.98	20,810	19,453	1,357	
18	61	3.88	5.77	21,118	20,459	659	
19	64	3.81	5.67	21,773	21,466	307	
20	67	3.73	5.55	22,311	22,472	-161	

Routing Required Storage Volume S_{VH} = Max(S_{VH}) = 5,655 c.f.
 The same in (acre-ft) = 0.13 acre-ft.

Required Storage Volume S_V = Max(S_V) = 5,655 c.f.
 Required Storage Volume in (acre-ft) = 0.13 acre-ft.
 Designed Storage Volume in (acre-ft) = 0.13 acre-ft.



OUTFLOW PIPE DESIGN

PROJECT: Addison Business Tract
 LOCATION: City of Addison
 Project No: 021313.00
 Date: 10/28/2005
 Designed By: PC
 Checked By: BP

CULVERT LOCATION: Detention Outflow System
 Inlet Control/Entrance Flow Coefficient: K = 1
 Culvert Length: L = 294 ft
 Culvert Slope: S = 0.4% = 0.004 ft/ft
 Inlet Control/Entrance Flow Coefficient: K = 0.03

Entrance Case No.	CULVERT DESCRIPTION (entrance type)	Design	SIZE	HEADWATER COMPUTATION										CONTROLLING OUTLET	COMMENTS	
				INLET CONTROL		OUTLET CONTROL (HW=H ₀ +LS ₀)										
				H ₀	H ₁	K ₁	H ₂	D ₁	TW	H ₃	L ₁	S ₁	H ₄			
1	Inlet			12.20	24	0.96	1.93	0.20	1.44	1.25	1.63	2.20	2.20	1.20	2.14	5.2

Controlling Orifice Design
 O = K * A * C_d * Q₀ * H₀^{1.5}
 Orifice Flow = 12.20 cfs.
 Required Area of Orifice (A_o) = 1.73 sq. ft.
 Required Diameter of Orifice (D_o) = 17.8 in.
 Water head prior to orifice (H₀) = 4.21 ft.
 Water head after orifice (H₁) = 2.50 ft.
 Flow Coefficient (K₁) = 0.62
 Weir Flow Elevation = 628.00
 Required Weir Elevation = 632.14
 Weir Controlling Flow Elevation = 632.14

Spillway Weir Analyses
 h = (Q₀ / C_w * L_w)^{2/3}
 Spillway Ultimate Flow (Q_u) = 5.60 cfs.
 Length of Weir (L_w) = 16 ft.
 Sides of Weir Contract: 1:2
 Head of Weir (H_w) = 0.22 ft.
 Height of Weir (H_w) = 4.30 ft.
 Coef. of Weir (C_w) = 3.25
 Weir Elevation = 632.14
 Spillway Weir Elevation = 632.35
 Size of Weir: 17' x 3' Grate Inlet

FINAL DESIGN
 N.T.S.
 HW ELEV. = 630.4
 HW ELEV. = 635.0
 HW ELEV. = 630.0
 HW ELEV. = 632.4
 HW ELEV. = 630.0
 SLOPE 0.4%
 COVER 3.5 ft.
 LENGTH 294 ft.
 VELOCITY 5.2 ft/s.
 FREE BOARD 3 ft.

OUTFLOW PIPE DESIGN

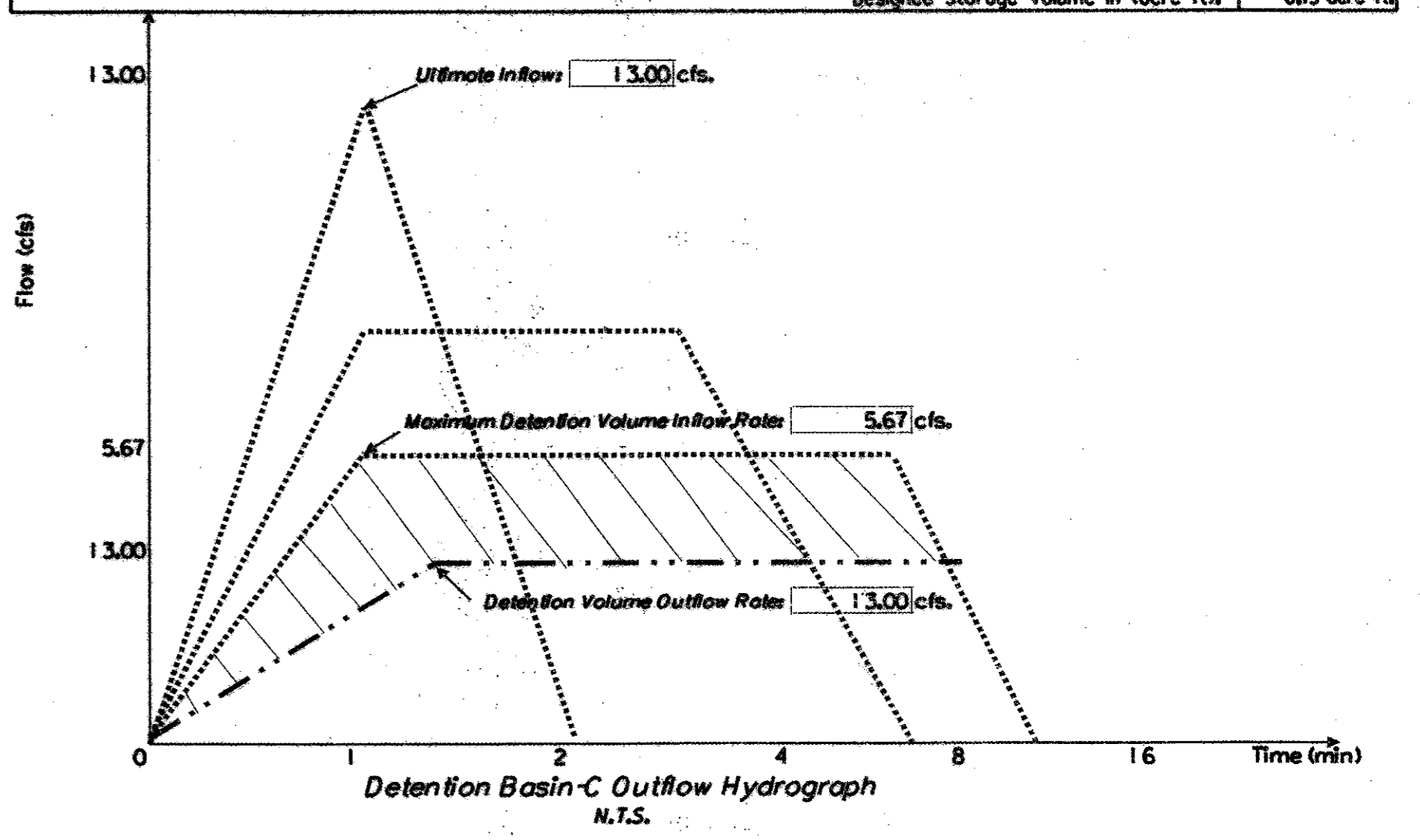
PROJECT: Addison Business Tract
 LOCATION: City of Addison
 Project No: 021313.00
 Date: 10/28/2005
 Designed By: PC
 Checked By: BP

CULVERT LOCATION: Backside Drainage, Line SD-1
 Inlet Control/Entrance Flow Coefficient: K = 1
 Culvert Length: L = 21 ft
 Culvert Slope: S = 4.76% = 0.0476 ft/ft
 Inlet Control/Entrance Flow Coefficient: K = 0.03

Entrance Case No.	CULVERT DESCRIPTION (entrance type)	Design	SIZE	HEADWATER COMPUTATION										CONTROLLING OUTLET	COMMENTS	
				INLET CONTROL		OUTLET CONTROL (HW=H ₀ +LS ₀)										
				H ₀	H ₁	K ₁	H ₂	D ₁	TW	H ₃	L ₁	S ₁	H ₄			
1	3" Drop Inlet			0.18	18	1.09	1.64	0.20	0.83	1.00	1.30	3.14	3.14	1.00	2.67	11.6

Channel approach open channel analysis
 Channel No: 0.030
 CHANNEL GEOMETRY
 No. 1
 CHANNEL LOCATION: UPSTREAM
 Rain Intensity: 100
 Design Flow (Q): 1.82
 Bottom Width (B): 0
 Side Slope (Z): 3
 Depth: 0.58
 Top Width (T): 0.77
 Slope (S): 0.27
 Hyd. Rad. (R): 1.8
 Vel. Flow (V): 1.0
 Flow Area (A): 1.0

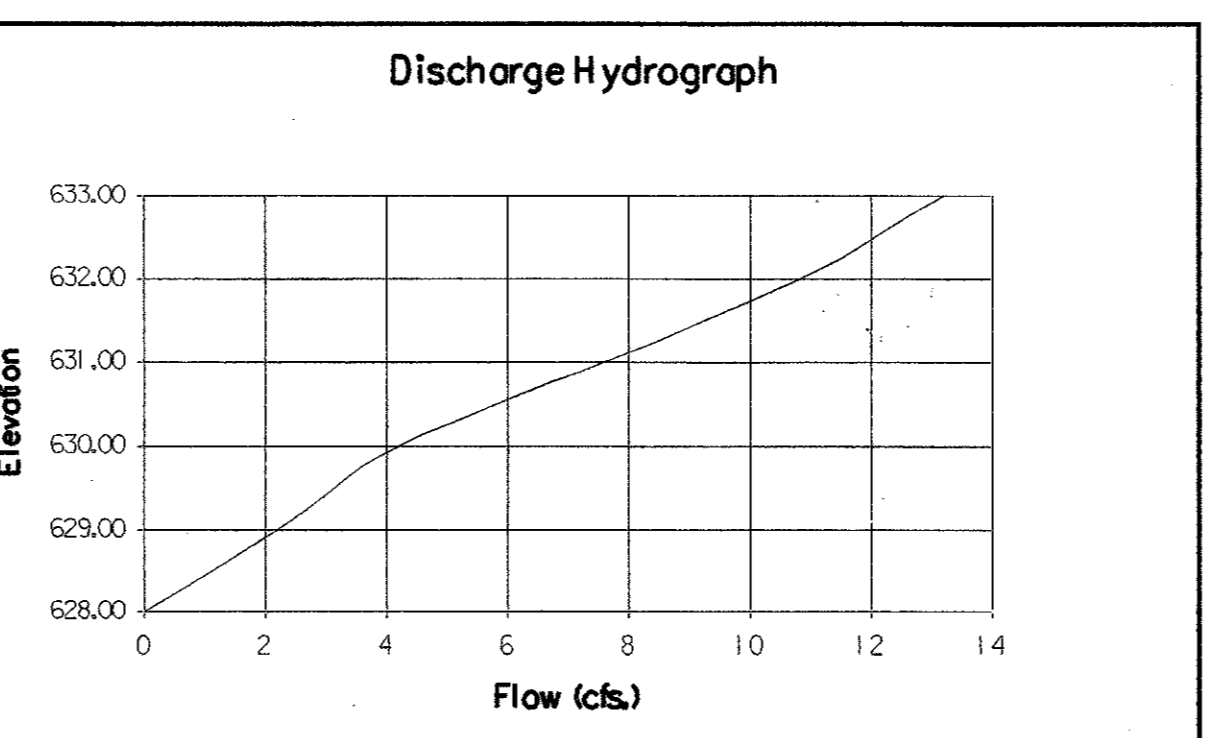
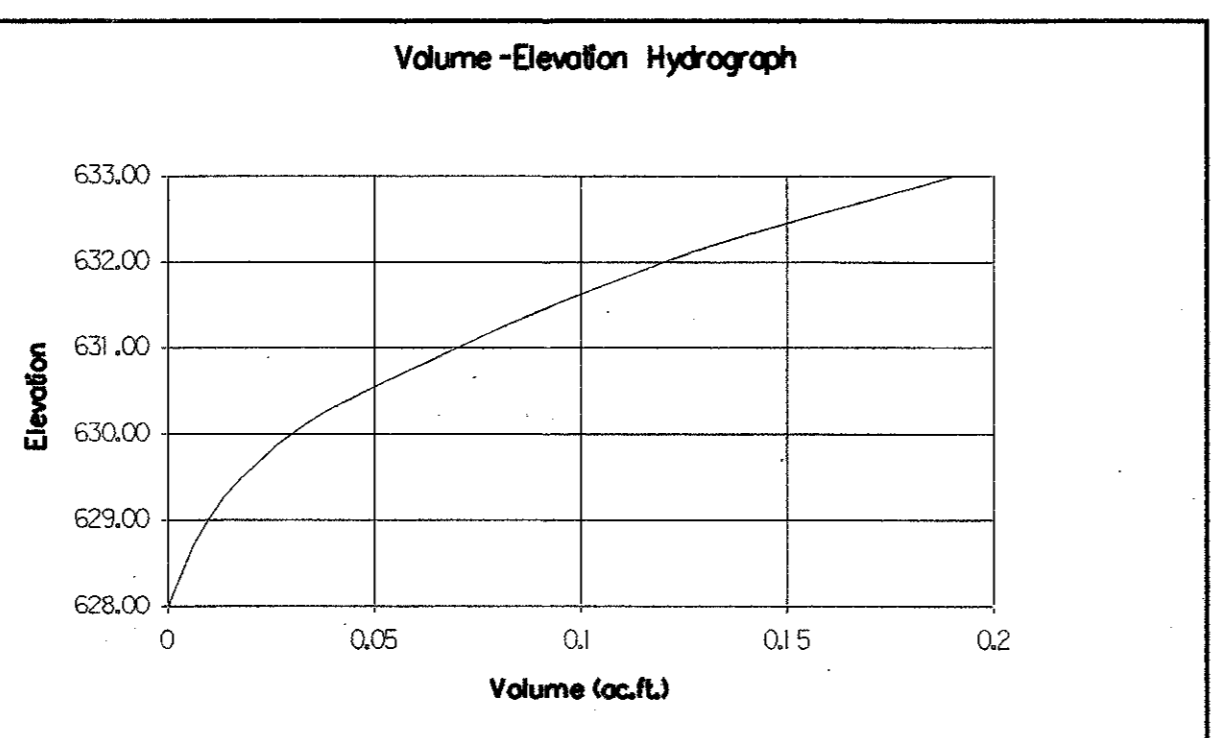
FINAL DESIGN
 N.T.S.
 HW ELEV. = 632.67
 HW ELEV. = 635.30
 HW ELEV. = 630.00
 HW ELEV. = 632.4
 HW ELEV. = 630.0
 SLOPE 4.76%
 COVER 3.5 ft.
 LENGTH 21 ft.
 VELOCITY 11.6 ft/s.
 FREE BOARD 2.6 ft.



DETENTION VOLUME ANALYSIS

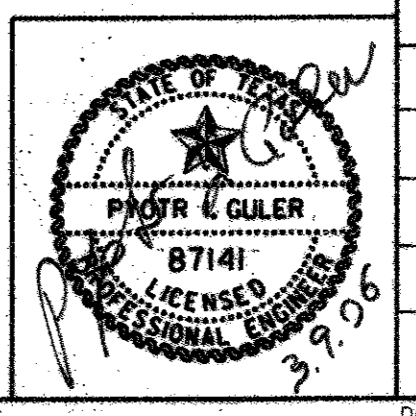
Volume Elev.	Area (sq.ft.)	Area (ac.)	Volume (ac.ft.)	Volume Sum	Flow
628.00	0	0.000	0.00	0.00	0
629.00	759	0.017	0.01	0.01	2.2
630.00	1,325	0.030	0.02	0.03	4.2
631.00	1,943	0.045	0.04	0.07	7.6
632.00	2,824	0.065	0.05	0.12	10.8
633.00	3,645	0.084	0.07	0.19	13.2

100 YEAR DETENTION VOLUME ANALYSIS
 Require Detention Volume = 0.13 ac.ft.
 Require High Water Elevation = 632.14
 Design High Water Elevation = 632.14
 Design Detention Volume = 0.13 ac.ft.



Notes:
 1. Incremental volume computed by the Conic Method for Reservoir Volumes.
 2. Volume = (1/3) * (EL2 - EL1) * (Area1 + Area2 + sq. rt. (Area1 * Area2))
 Where: EL1 - Lower elevation of increment; EL2 - Upper elevation of increment.
 Area1 - Lower area of increment; Area2 - Upper area of increment.

RECORD DRAWING
 THIS DRAWING HAS BEEN MODIFIED TO REFLECT CONSTRUCTION RECORDS PROVIDED TO THE ENGINEER



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DRAINAGE CALCULATIONS
ADDISON OFFICE CONDOS

TOWN OF ADDISON, DALLAS COUNTY, TEXAS

DATE	REVISION	MADE	CKD	APPD

DESIGN	DRAWN	CHECKED	SCALE	DATE	FILE	NO.
TIPTON	GUERN	POWELL	1" = 20'	MARCH/06	01-6628	16 OF 17