

ASBUILT DRAWINGS:
TO THE BEST OF OUR KNOWLEDGE TRIANGLE
ENGINEERING LLC., HEREBY STATES THAT THIS PLAN
IS ASBUILT. THE INFORMATION PROVIDED IS BASED
ON SURVEYING AT THE SITE AND INFORMATION
PROVIDED BY THE CONTRACTOR.

KARTAVYA S. PATEL P.E. NO. 97534

**TRIANGLE
ENGINEERING, LLC.**
TX PE FIRM # 11525
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STORAGE CALCULATIONS (100 YR RAINFALL EVENT)
CITY STANDARD RAINFALL INTENSITY-FIGURE 1
FOR 100 YEAR STORM FREQUENCY

ALLOWABLE RELEASE RATE EQUAL TO THE 100-YEAR PEAK RUNOFF RATE PRIOR TO SITE DEVELOPMENT
WHEN C=0.35, I=4.0 @ Tc 20 MIN.

TOTAL DRAINAGE AREA: 1.46 ACRES + 0.035 ACRES (OFFSITE) = 1.50 ACRES
BYPASS RUNOFF AREA "A", "F" & "DA-3" = 0.18 ACRES
ALLOWABLE RUNOFF FROM SITE: 0.35 X 8.3 X 1.5 = 4.36 CFS
BYPASS RUNOFF = 1.32+0.15+0.12 = 1.59 CFS
ALLOWABLE RELEASE FROM DETENTION POND: 4.36 CFS-1.59 CFS = 2.77 CFS
TOTAL DETAINED AREA = 1.32 ACRES

STORM DURATION DATA & DETENTION POND SYSTEM CALCULATIONS

TIME (Min)	C x Ct	I ₁₀₀ (100-Year)	TOTAL AREA (Acres)	Q (CFS)	INFLOW (CF)	OUTFLOW (CF)	STORAGE (CF)
10	0.90	9.0	1.32	11.64	6.985	1.652	5.333
20	0.90	8.3	1.32	9.86	11.832	2.453	9.379
30	0.90	6.9	1.32	8.20	14.755	3.324	11.431
40	0.90	5.8	1.32	6.89	16.537	4.155	12.382
50	0.90	5.0	1.32	5.94	17.820	4.986	12.834
60	0.90	4.5	1.32	5.35	19.246	5.817	13.429
70	0.90	4.0	1.32	4.78	20.058	6.648	13.410
80	0.90	3.7	1.32	4.35	20.871	7.479	13.392
90	0.90	3.4	1.32	4.02	21.683	8.310	13.373

REQUIRED STORAGE VOLUME SUMMARY:
REQUIRED STORAGE VOLUME = INFLOW-OUTFLOW
INFLOW = STORM DURATION X RESPECTIVE PEAK DISCHARGE X 60 SEC./MIN
OUTFLOW = HALF OF THE RESPECTIVE INFLOW DURATION X CONTROL RELEASE DISCHARGE X 60 SEC./MIN
100 YEAR STORM EVENT @ 60 MIN.
INFLOW = 0.9 X 4.5 X 1.32 X 60 X 60 = 19,246 CF
OUTFLOW = 0.5 X 2.77 X 70 X 60 = 5,817 CF
REQUIRED DETENTION SYSTEM STORAGE CAPACITY = INFLOW-OUTFLOW = 19,246-5,817 = 13,429 CF

STORAGE CALCULATIONS (50 YR RAINFALL EVENT)
CITY STANDARD RAINFALL INTENSITY-FIGURE 1
FOR 50 YEAR STORM FREQUENCY

ALLOWABLE RELEASE RATE EQUAL TO THE 50-YEAR PEAK RUNOFF RATE PRIOR TO SITE DEVELOPMENT
WHEN C=0.35, I=7.5 @ Tc 20 MIN.

TOTAL DRAINAGE AREA: 1.46 ACRES + 0.035 ACRES (OFFSITE) = 1.50 ACRES
BYPASS RUNOFF AREA "A", "F" & "DA-3" = 0.18 ACRES
ALLOWABLE RUNOFF FROM SITE: 0.35 X 7.5 X 1.5 = 3.93 CFS
BYPASS RUNOFF = 1.22+0.14+0.11 = 1.47 CFS
ALLOWABLE RELEASE FROM DETENTION POND: 3.93 CFS-1.47 CFS = 2.46 CFS
TOTAL DETAINED AREA = 1.32 ACRES

STORM DURATION DATA & DETENTION POND SYSTEM CALCULATIONS

TIME (Min)	C x Ct	I ₅₀ (50-Year)	TOTAL AREA (Acres)	Q (CFS)	INFLOW (CF)	OUTFLOW (CF)	STORAGE (CF)
10	0.90	9.00	1.32	10.89	6.415	1.476	4.939
20	0.90	7.50	1.32	8.91	10.892	2.214	8.678
30	0.90	6.20	1.32	7.37	13.238	2.952	10.286
40	0.90	5.25	1.32	6.24	14.969	3.690	11.279
50	0.90	4.50	1.32	5.35	16.618	4.428	12.190
60	0.90	3.90	1.32	4.63	18.080	5.166	12.914
70	0.90	3.48	1.32	4.13	17.384	5.904	11.480
80	0.90	3.17	1.32	3.77	18.077	6.642	11.435
90	0.90	2.90	1.32	3.45	18.004	7.380	11.224

REQUIRED STORAGE VOLUME SUMMARY:
REQUIRED STORAGE VOLUME = INFLOW-OUTFLOW
INFLOW = STORM DURATION X RESPECTIVE PEAK DISCHARGE X 60 SEC./MIN
OUTFLOW = HALF OF THE RESPECTIVE INFLOW DURATION X CONTROL RELEASE DISCHARGE X 60 SEC./MIN
50 YEAR STORM EVENT @ 60 MIN.
INFLOW = 0.9 X 4.5 X 1.32 X 60 X 60 = 16,038 CF
OUTFLOW = 0.5 X 2.46 X 60 X 60 = 4,428 CF
REQUIRED DETENTION SYSTEM STORAGE CAPACITY = INFLOW-OUTFLOW = 16,038-4,428 = 11,610 CF

STORAGE CALCULATIONS (25 YR RAINFALL EVENT)
CITY STANDARD RAINFALL INTENSITY-FIGURE 1
FOR 25 YEAR STORM FREQUENCY

ALLOWABLE RELEASE RATE EQUAL TO THE 25-YEAR PEAK RUNOFF RATE PRIOR TO SITE DEVELOPMENT
WHEN C=0.35, I=14.7 @ Tc 20 MIN.

TOTAL DRAINAGE AREA: 1.46 ACRES + 0.035 ACRES (OFFSITE) = 1.50 ACRES
BYPASS RUNOFF AREA "A", "F" & "DA-3" = 0.18 ACRES
ALLOWABLE RUNOFF FROM SITE: 0.35 X 14.7 X 1.5 = 7.64 CFS
BYPASS RUNOFF = 1.12+0.13+0.11 = 1.36 CFS
ALLOWABLE RELEASE FROM DETENTION POND: 7.64 CFS-1.36 CFS = 6.28 CFS
TOTAL DETAINED AREA = 1.32 ACRES

STORM DURATION DATA & DETENTION POND SYSTEM CALCULATIONS

TIME (Min)	C x Ct	I ₂₅ (25-Year)	TOTAL AREA (Acres)	Q (CFS)	INFLOW (CF)	OUTFLOW (CF)	STORAGE (CF)
10	0.90	14.70	1.32	21.16	5.916	1.308	4.608
20	0.90	12.60	1.32	18.02	8.623	1.962	6.661
30	0.90	10.50	1.32	15.33	11.781	2.616	9.165
40	0.90	9.00	1.32	13.23	14.830	3.270	11.560
50	0.90	8.00	1.32	11.64	16.256	3.624	12.632
60	0.90	7.35	1.32	10.46	14.889	4.378	10.511
70	0.90	6.75	1.32	9.36	16.216	5.232	10.984
80	0.90	6.25	1.32	8.40	16.622	5.886	10.736
90	0.90	5.85	1.32	7.65	16.680	6.540	10.140

REQUIRED STORAGE VOLUME SUMMARY:
REQUIRED STORAGE VOLUME = INFLOW-OUTFLOW
INFLOW = STORM DURATION X RESPECTIVE PEAK DISCHARGE X 60 SEC./MIN
OUTFLOW = HALF OF THE RESPECTIVE INFLOW DURATION X CONTROL RELEASE DISCHARGE X 60 SEC./MIN
25 YEAR STORM EVENT @ 60 MIN.
INFLOW = 0.9 X 7.64 X 1.32 X 60 X 60 = 26,160 CF
OUTFLOW = 0.5 X 6.28 X 60 X 60 = 11,610 CF
REQUIRED DETENTION SYSTEM STORAGE CAPACITY = INFLOW-OUTFLOW = 26,160-11,610 = 14,550 CF

STORAGE CALCULATIONS (10 YR RAINFALL EVENT)
CITY STANDARD RAINFALL INTENSITY-FIGURE 1
FOR 10 YEAR STORM FREQUENCY

ALLOWABLE RELEASE RATE EQUAL TO THE 10-YEAR PEAK RUNOFF RATE PRIOR TO SITE DEVELOPMENT
WHEN C=0.35, I=27.0 @ Tc 20 MIN.

TOTAL DRAINAGE AREA: 1.46 ACRES + 0.035 ACRES (OFFSITE) = 1.50 ACRES
BYPASS RUNOFF AREA "A", "F" & "DA-3" = 0.18 ACRES
ALLOWABLE RUNOFF FROM SITE: 0.35 X 27.0 X 1.5 = 14.18 CFS
BYPASS RUNOFF = 1.08+0.12+0.11 = 1.31 CFS
ALLOWABLE RELEASE FROM DETENTION POND: 14.18 CFS-1.31 CFS = 12.87 CFS
TOTAL DETAINED AREA = 1.32 ACRES

STORM DURATION DATA & DETENTION POND SYSTEM CALCULATIONS

TIME (Min)	C x Ct	I ₁₀ (10-Year)	TOTAL AREA (Acres)	Q (CFS)	INFLOW (CF)	OUTFLOW (CF)	STORAGE (CF)
10	0.90	27.00	1.32	40.50	5.702	1.020	4.682
20	0.90	22.50	1.32	33.75	8.128	1.530	6.598
30	0.90	19.50	1.32	29.25	9.623	2.040	7.583
40	0.90	17.00	1.32	25.38	10.855	2.550	8.305
50	0.90	15.00	1.32	22.50	11.761	3.060	8.701
60	0.90	13.50	1.32	20.25	12.403	3.570	8.833
70	0.90	12.60	1.32	19.02	12.973	4.080	8.893
80	0.90	11.70	1.32	17.85	13.686	4.590	9.096
90	0.90	11.00	1.32	16.74	14.113	5.100	9.013

REQUIRED STORAGE VOLUME SUMMARY:
REQUIRED STORAGE VOLUME = INFLOW-OUTFLOW
INFLOW = STORM DURATION X RESPECTIVE PEAK DISCHARGE X 60 SEC./MIN
OUTFLOW = HALF OF THE RESPECTIVE INFLOW DURATION X CONTROL RELEASE DISCHARGE X 60 SEC./MIN
10 YEAR STORM EVENT @ 60 MIN.
INFLOW = 0.9 X 14.18 X 1.32 X 60 X 60 = 26,160 CF
OUTFLOW = 0.5 X 12.87 X 60 X 60 = 23,166 CF
REQUIRED DETENTION SYSTEM STORAGE CAPACITY = INFLOW-OUTFLOW = 26,160-23,166 = 2,994 CF

STORAGE CALCULATIONS (5 YR RAINFALL EVENT)
CITY STANDARD RAINFALL INTENSITY-FIGURE 1
FOR 5 YEAR STORM FREQUENCY

ALLOWABLE RELEASE RATE EQUAL TO THE 5-YEAR PEAK RUNOFF RATE PRIOR TO SITE DEVELOPMENT
WHEN C=0.35, I=54.0 @ Tc 20 MIN.

TOTAL DRAINAGE AREA: 1.46 ACRES + 0.035 ACRES (OFFSITE) = 1.50 ACRES
BYPASS RUNOFF AREA "A", "F" & "DA-3" = 0.18 ACRES
ALLOWABLE RUNOFF FROM SITE: 0.35 X 54.0 X 1.5 = 28.58 CFS
BYPASS RUNOFF = 0.83+0.11+0.09 = 1.03 CFS
ALLOWABLE RELEASE FROM DETENTION POND: 28.58 CFS-1.03 CFS = 27.55 CFS
TOTAL DETAINED AREA = 1.32 ACRES

STORM DURATION DATA & DETENTION POND SYSTEM CALCULATIONS

TIME (Min)	C x Ct	I ₅ (5-Year)	TOTAL AREA (Acres)	Q (CFS)	INFLOW (CF)	OUTFLOW (CF)	STORAGE (CF)
10	0.90	54.00	1.32	81.00	4.918	900	4.018
20	0.90	45.00	1.32	67.50	7.128	1.350	5.778
30	0.90	39.00	1.32	58.50	8.340	1.950	6.390
40	0.90	34.50	1.32	51.75	9.408	2.550	6.858
50	0.90	30.60	1.32	45.90	9.975	2.700	7.275
60	0.90	27.00	1.32	40.50	10.650	3.150	7.500
70	0.90	24.00	1.32	36.00	10.977	3.600	7.377
80	0.90	21.60	1.32	32.40	11.425	4.050	7.375
90	0.90	19.80	1.32	29.70	11.189	4.500	7.689
100	0.90	18.00	1.32	27.00	12.118	4.950	7.168

REQUIRED STORAGE VOLUME SUMMARY:
REQUIRED STORAGE VOLUME = INFLOW-OUTFLOW
INFLOW = STORM DURATION X RESPECTIVE PEAK DISCHARGE X 60 SEC./MIN
OUTFLOW = HALF OF THE RESPECTIVE INFLOW DURATION X CONTROL RELEASE DISCHARGE X 60 SEC./MIN
5 YEAR STORM EVENT @ 60 MIN.
INFLOW = 0.9 X 27.55 X 1.32 X 60 X 60 = 26,160 CF
OUTFLOW = 0.5 X 27.55 X 60 X 60 = 4,950 CF
REQUIRED DETENTION SYSTEM STORAGE CAPACITY = INFLOW-OUTFLOW = 26,160-4,950 = 21,210 CF

100 YRS ORIFICE CALCULATIONS FOR DETENTION POND
FROM THE ORIFICE EQUATION
 $Q = CxAx(2xgH)^{1/2}$
WHERE
Q = RATE OF DISCHARGE (FT³/S)
A = ORIFICE AREA (FT²)
C = ORIFICE COEFFICIENT (USUALLY ABOUT 0.6)
g = GRAVITATIONAL CONSTANT (32.2 FT/S²)
H = DEPTH OF WATER ABOVE THE CENTROID OF THE ORIFICE (FT)
WHEN
Q = ALLOWABLE RELEASE FROM THE DETENTION POND
Q = 2.77 CFS
H = AVERAGE DEPTH OF WATER IN THE DETENTION SYSTEM = 4.7 FT
SO
 $A = \frac{Q}{C \times (2xgH)^{1/2}}$
 $= \frac{2.77}{0.6 \times (2 \times 32.2 \times 4.7)^{1/2}}$
 $= 0.27 \text{ FT}^2$
AREA PROVIDED = 0.27 SF.

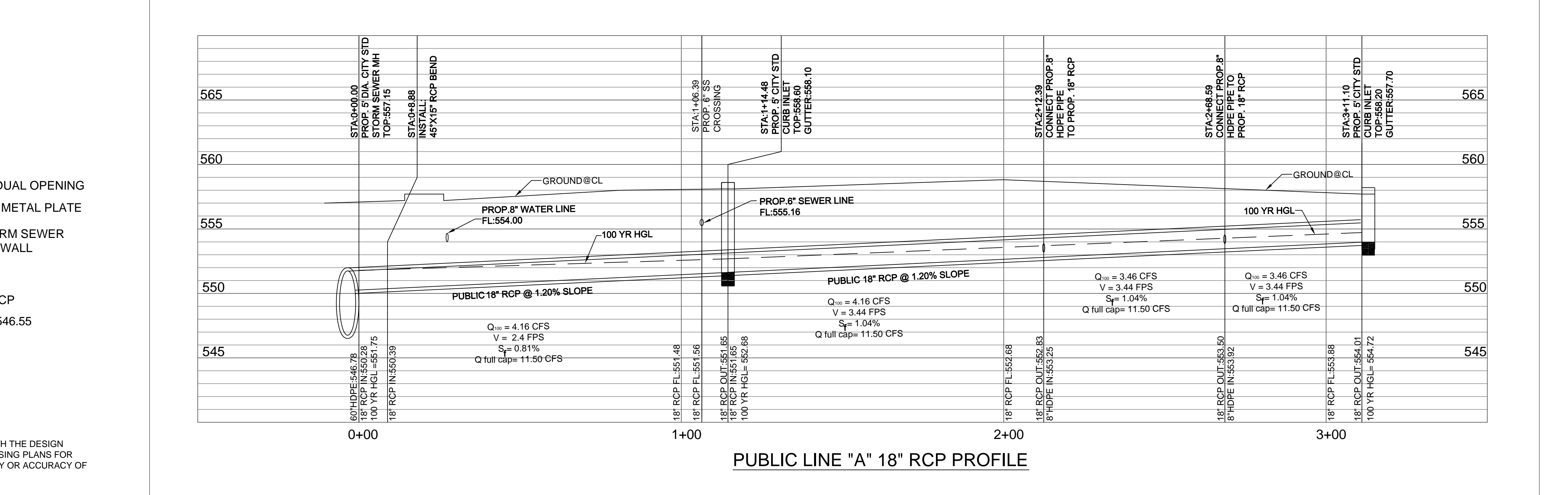
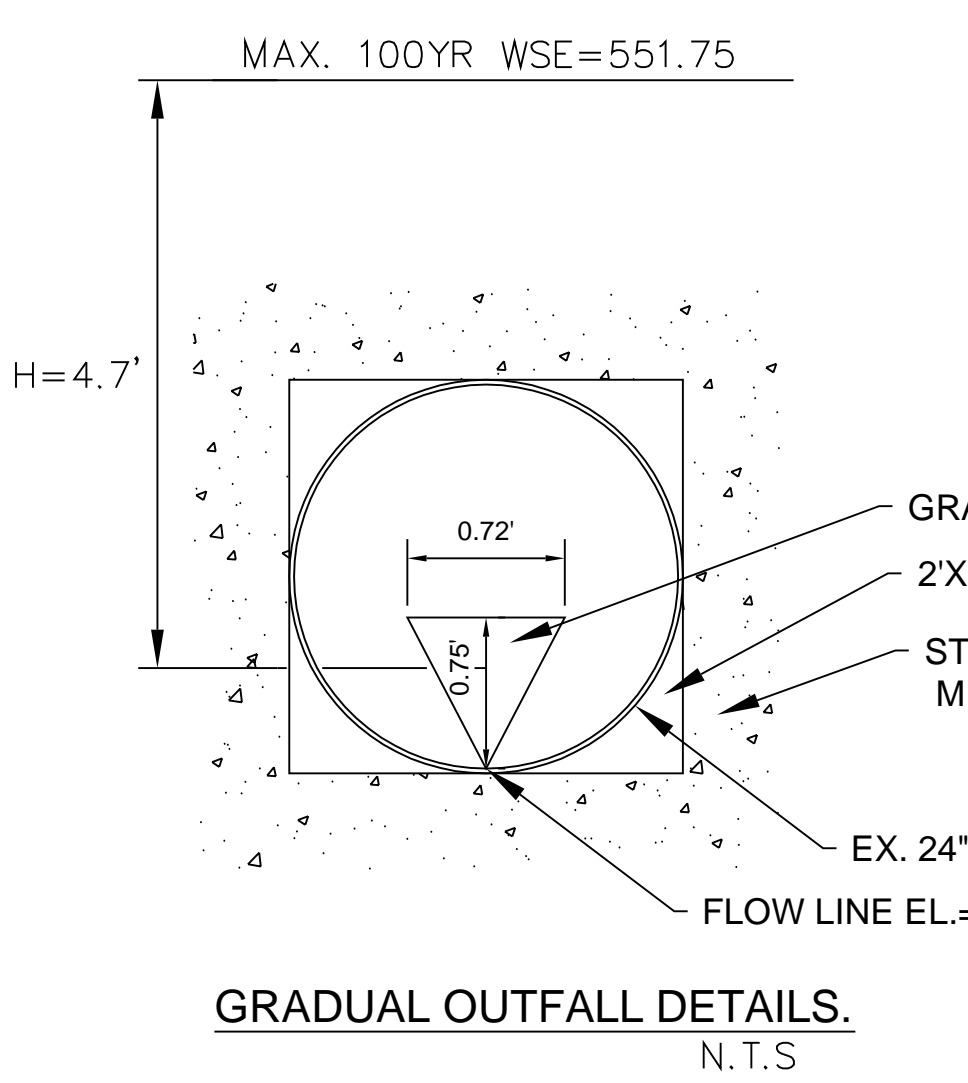
50 YRS ORIFICE CALCULATIONS FOR DETENTION POND
FROM THE ORIFICE EQUATION
 $Q = CxAx(2xgH)^{1/2}$
WHERE
Q = RATE OF DISCHARGE (FT³/S)
A = ORIFICE AREA (FT²)
C = ORIFICE COEFFICIENT (USUALLY ABOUT 0.6)
g = GRAVITATIONAL CONSTANT (32.2 FT/S²)
H = DEPTH OF WATER ABOVE THE CENTROID OF THE ORIFICE (FT)
WHEN
Q = ALLOWABLE RELEASE FROM THE DETENTION POND
H = AVERAGE DEPTH OF WATER IN THE DETENTION SYSTEM = 3.41 FT
SO
 $A = \frac{Q}{C \times (2xgH)^{1/2}}$
 $= \frac{2.46}{0.6 \times (2 \times 32.2 \times 3.41)^{1/2}}$
Q = 2.4 CFS

25 YRS ORIFICE CALCULATIONS FOR DETENTION POND
FROM THE ORIFICE EQUATION
 $Q = CxAx(2xgH)^{1/2}$
WHERE
Q = RATE OF DISCHARGE (FT³/S)
A = ORIFICE AREA (FT²)
C = ORIFICE COEFFICIENT (USUALLY ABOUT 0.6)
g = GRAVITATIONAL CONSTANT (32.2 FT/S²)
H = DEPTH OF WATER ABOVE THE CENTROID OF THE ORIFICE (FT)
WHEN
Q = ALLOWABLE RELEASE FROM THE DETENTION POND
H = AVERAGE DEPTH OF WATER IN THE DETENTION SYSTEM = 2.61 FT
SO
 $A = \frac{Q}{C \times (2xgH)^{1/2}}$
 $= \frac{6.28}{0.6 \times (2 \times 32.2 \times 2.61)^{1/2}}$
Q = 2.1 CFS

10 YRS ORIFICE CALCULATIONS FOR DETENTION POND
FROM THE ORIFICE EQUATION
 $Q = CxAx(2xgH)^{1/2}$
WHERE
Q = RATE OF DISCHARGE (FT³/S)
A = ORIFICE AREA (FT²)
C = ORIFICE COEFFICIENT (USUALLY ABOUT 0.6)
g = GRAVITATIONAL CONSTANT (32.2 FT/S²)
H = DEPTH OF WATER ABOVE THE CENTROID OF THE ORIFICE (FT)
WHEN
Q = ALLOWABLE RELEASE FROM THE DETENTION POND
H = AVERAGE DEPTH OF WATER IN THE DETENTION SYSTEM = 1.70 FT
SO
 $A = \frac{Q}{C \times (2xgH)^{1/2}}$
 $= \frac{12.87}{0.6 \times (2 \times 32.2 \times 1.70)^{1/2}}$
Q = 1.70 CFS

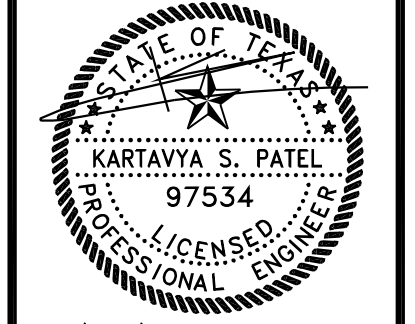
5 YRS ORIFICE CALCULATIONS FOR DETENTION POND
FROM THE ORIFICE EQUATION
 $Q = CxAx(2xgH)^{1/2}$
WHERE
Q = RATE OF DISCHARGE (FT³/S)
A = ORIFICE AREA (FT²)
C = ORIFICE COEFFICIENT (USUALLY ABOUT 0.6)
g = GRAVITATIONAL CONSTANT (32.2 FT/S²)
H = DEPTH OF WATER ABOVE THE CENTROID OF THE ORIFICE (FT)
WHEN
Q = ALLOWABLE RELEASE FROM THE DETENTION POND
H = AVERAGE DEPTH OF WATER IN THE DETENTION SYSTEM = 1.33 FT
SO
 $A = \frac{Q}{C \times (2xgH)^{1/2}}$
 $= \frac{27.55}{0.6 \times (2 \times 32.2 \times 1.33)^{1/2}}$
Q = 1.50 CFS

RAINFALL EVENT	ALLOWABLE DISCHARGE	DISCHARGE FROM DETENTION POND	WATER SURFACE ELEVATION
100-YEAR	2.77 CFS	2.77 CFS	551.75
50-YEAR	2.46 CFS	2.40 CFS	550.46
25-YEAR	2.18 CFS	2.10 CFS	549.66
10-YEAR	1.70 CFS	1.70 CFS	548.75
5-YEAR	1.50 CFS	1.50 CFS	548.38



DESCRIPTION: FINAL ASBUILT SUBMITTAL

No.	DATE	DESCRIPTION
1	05/25/2015	FINAL ASBUILT SUBMITTAL



06/25/2015

MEDICAL OFFICE
3018 RIDGE ROAD
ROCKWALL, TEXAS

DETECTION CALCULATION

PROJECT No:	DATE:	DRAWN BY:	CHECKED BY:
13-035	06/25/2015	KP	KP

SHEET # **6.1**

"ALL RESPONSIBILITY FOR ADEQUACY OF DESIGN REMAINS WITH THE DESIGN ENGINEER. THE CITY OF ROCKWALL, IN REVIEWING AND RELEASING PLANS FOR CONSTRUCTION, ASSUMES NO RESPONSIBILITY FOR ADEQUACY OR ACCURACY OF DESIGN."