

Project No. 94140 Project Name QUIKTRIP # 643

Computation for STORM DRAINAGE & DETENTION VOLUME

By EK Date 9/21/94 Checked _____ Date _____ Sheet 1 of 6

Rev. 11/7/94

ESTIMATE REQ'D. DETENTION STORAGE VOLUME

* $VOLUME (V) = \text{Differential Runoff Rate } (R) \times \text{Area in Ac. } (A) \times 30 \text{ min} \times 60$

Pre-development Runoff Rate = 1.70 cfs/Ac (15yr.) 2.00 (25yr.)

Total Developed Roof Area = 0.09 Acres

Total Developed Paved Area = 0.95 Acres

Total Impervious Area = 1.04 Acres

0.30 @ 4.20 cfs/Ac = 1.26 @ 4.94 cfs/Ac = 1.48

0.84 @ 3.54 cfs/Ac = 2.97 @ 4.16 cfs/Ac = 3.49

Total 4.23 (15yr.) 4.97 (25yr.)

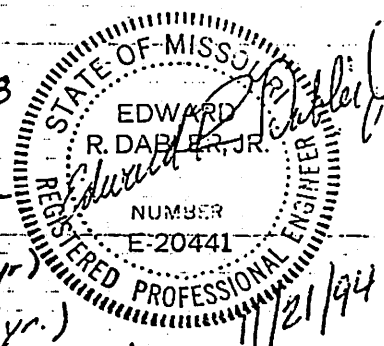
$\frac{4.23}{1.04} = 4.07 \text{ cfs/Ac Developed Rate (15yr.)}$

$\frac{4.97}{1.04} = 4.78 \text{ cfs/Ac Developed Rate (25yr.)}$

$R = 4.07 - 1.70 = 2.37 \text{ cfs/Ac (15yr.)}$ $R = 4.78 - 2.00 = 2.78 \text{ (25yr.)}$

$V = (2.37)(1.04)(30)(60) = 4437 \text{ ft}^3 \text{ (164 C.Y.) 15yr.}$

$V = (2.78)(1.04)(30)(60) = 5204 \text{ ft}^3 \text{ (193 C.Y.) 25yr.}$



* Source: Stormwater Detention Design Criteria & Guidelines -1975
St. Louis County Dept. of Public Works

Runoff rates from Metropolitan St. Louis Sewer District Design Criteria.
(See Sheet 2 of Calcs. for Summary)

See Sheet 2A of Plans (DRAINAGE AREA MAP) for Runoff Calcs.

See Sheets 3, 4, & 5 for Hydraulic Grade Line Calcs.

** Detention Storage Volume to be provided by additional
Excavation in Flood Plain Area (See Earthwork Calcs)

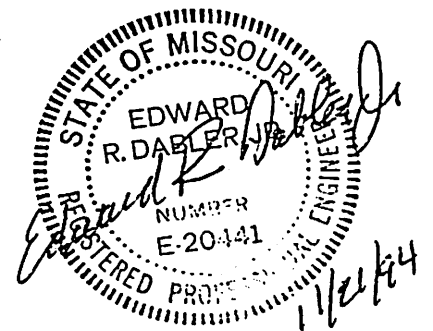
** Insufficient Area available for Flood Plain Compensation
Flood Plain Study ~~to be provided as available~~
Submitted 11/11/94.

JOB: 94140 FB: 1026 BY: EEK 11/08/94
 ID: 010
 QUIKTRIP
 QUIKTRIP # 643

THE CLAYTON ENGINEERING COMPANY
 12755 OLIVE BLVD - SUITE 100
 ST. LOUIS, MO 63141
 (314) 542-0009

<<<<< PIPE HYDRAULICS MODULE >>>>>

Description = HYD CALCS
 System Number = 1
 Return Period (yr) = 10
 Rainfall Duration (min) = 20
 Runoff Factor Multiplier = 1.00
 Starting HGL Elev. (ft) = 502.63



STRUCTURES UP/LOW	FLOWLINES UP/LOW	DIAH	LENGTH	n	AREA/PI	Qadd	Qtot/Qfull	CS/RS	Yn/Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C V/T		COND UP/LOW	HGL UP/LOW	UPPER STRUCT TOP/FREEBD
DCI 1-5	508.00	15	93	0.013	0.88	2.71	2.71	1.46	0.51	2.21	2.21	0.62	0.69	ND	509.20	512.00
CI 1-4	506.64				3.08		7.83	0.18	0.66	1.25	0.08	0.00	0.00	OJ	507.89	2.80
CI 1-4	506.64	15	42	0.013	0.35	1.04	3.75	2.00	0.56	3.06	3.06	0.14	0.52	OC	507.89	512.60
CI 1-3	505.80				2.97		9.16	0.34	0.78	1.40	0.14	0.00	0.04	FP	507.20	4.71
CI 1-3	505.80	15	54	0.013	0.21	0.64	4.39	2.00	0.61	3.58	3.58	0.93	0.10	OF	507.20	512.50
CI 1-2	504.72				3.06		9.16	0.46	0.85	1.40	0.20	0.00	0.05	FP	506.12	5.30
CI 1-2	504.72	15	47	0.013	0.18	0.60	4.99	5.79	0.49	8.05	4.07	3.34	0.11	OF	506.12	512.30
EP 1-1	502.00				3.31		15.59	0.59	0.91	0.63	0.26	0.00	0.04	OJ	502.63	6.18

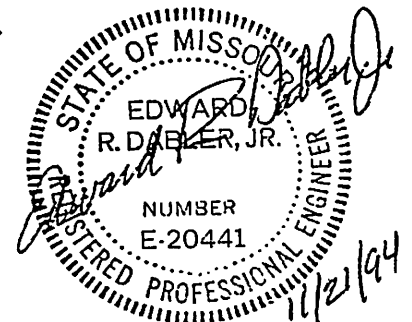
JOB: 94140 FB: 1026 BY: EEK 11/08/94
 ID: 015

QUIKTRIP
 QUIKTRIP # 643

THE CLAYTON ENGINEERING COMPANY
 12755 OLIVE BLVD - SUITE 100
 ST. LOUIS, MO 63141
 (314) 542-0009

<<<<< PIPE HYDRAULICS MODULE >>>>>

Description = HYD CALCS
 System Number = 1
 Return Period (yr) = 15
 Rainfall Duration (min) = 20
 Runoff Factor Multiplier = 1.00
 Starting HGL Elev. (ft) = 502.63

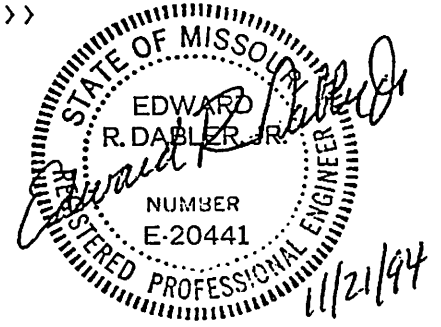


STRUCTURES UP/LOW	FLOWLINES UP/LOW	DIAM	LENGTH	n	AREA/PI	Qadd	Qtot/Qfull	CS/RS	Yn/Yc	PARTIAL V/Y	FULL V/Vhead	LOSSES F/C V/T		COND UP/LOW	HGL UP/LOW	UPPER STRUCT TOP/FREEBD
DCI 1-5	508.00	15	93	0.013	0.88	2.89	2.89	1.46	0.53	2.35	2.35	0.46	0.72	ND	509.25	512.00
CI 1-4	506.64				3.28		7.83	0.20	0.68	1.43	0.09	0.00	0.00	FP	508.07	2.75
CI 1-4	506.64	15	42	0.013	0.35	1.11	4.00	2.00	0.58	3.26	3.26	0.67	0.14	OF	508.07	512.60
CI 1-3	505.80				3.17		9.16	0.38	0.81	1.42	0.16	0.00	0.04	FP	507.22	4.53
CI 1-3	505.80	15	54	0.013	0.21	0.69	4.69	2.00	0.63	3.82	3.82	0.90	0.11	OF	507.22	512.50
CI 1-2	504.72				3.27		9.16	0.52	0.88	1.42	0.23	0.00	0.05	FP	506.14	5.28
CI 1-2	504.72	15	47	0.013	0.18	0.64	5.32	5.79	0.50	8.59	4.34	3.34	0.12	OF	506.14	512.30
EP 1-1	502.00				3.54		15.58	0.68	0.94	0.63	0.29	0.00	0.05	OJ	502.63	6.15

JOB:94140 ID:025	FB:1026	BY:EEK	11/08/94 9:39A
QUIKTRIP QUIKTRIP # 643			
THE CLAYTON ENGINEERING COMPANY 12755 OLIVE BLVD - SUITE 100 ST. LOUIS, MO 63141 (314) 542-0009			

<<<< PIPE HYDRAULICS MODULE >>>>

Description = HYD. CALCS
 System Number = 1
 Return Period (yr) = 25
 Rainfall Duration (min) = 20
 Runoff Factor Multiplier = 1.00
 Starting HGL Elev. (ft) = 502.63



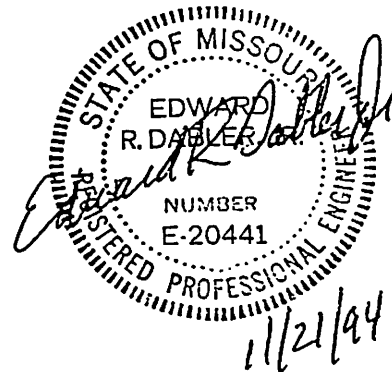
STRUCTURES UP/LOW	FLOWLINES UP/LOW	DIAM	LENGTH	n	AREA/PI	Qadd	Qtot/Qfull	CS/RS	Yn/Yc	PARTIAL	FULL	LOSSES		COND	HGL	UPPER STRUCT
										V/Y	V/Vhead	F/C	V/T	UP/LOW	UP/LOW	TOP/FREEBD
DCI 1-5	508.00	15	93	0.013	0.88	3.40	3.40	1.46	0.58	2.77	2.77	1.12	0.16	OF	509.41	512.00
CI 1-4	506.64				3.86		7.83	0.28	0.74	1.49	0.12	0.00	0.00	FP	508.13	2.59
CI 1-4	506.64	15	42	0.013	0.35	1.30	4.70	2.00	0.63	3.83	3.83	0.61	0.19	OF	508.13	512.60
CI 1-3	505.80				3.72		9.16	0.53	0.88	1.48	0.23	0.00	0.06	FP	507.28	4.47
CI 1-3	505.80	15	54	0.013	0.21	0.81	5.51	2.00	0.70	4.49	4.49	0.84	0.16	OF	507.28	512.50
CI 1-2	504.72				3.86		9.16	0.72	0.95	1.49	0.31	0.00	0.07	FP	506.21	5.22
CI 1-2	504.72	15	47	0.013	0.18	0.75	6.26	5.79	0.55	10.10	5.10	3.34	0.17	OF	506.21	512.30
EP 1-1	502.00				4.16		15.58	0.93	1.01	0.63	0.40	0.00	0.07	OJ	502.63	6.09

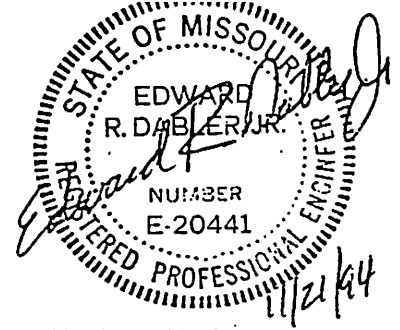
LEGEND

<p>UP - At upper end of pipe LOW - At lower end of pipe DIAM - Pipe diameter (in) LENGTH - Pipe length (ft) n - Manning's roughness factor AREA - Upper drainage area (ac) PI - Runoff factor (cfs/ac) Qadd - Added flowrate (cfs) Qtot - Total flowrate (cfs) Qfull - Pipe full capacity (cfs) CS - Construction slope of pipe (%) RS - Minimum required slope (%)</p>	<p>Yn - Normal depth (ft) Yc - Critical depth (ft) PARTIAL - Conditions at lower end of pipe FULL - Conditions assuming full pipe flow V - Velocity (fps) Y - Depth (ft) Vhead - Velocity head (ft) LOSSES - Major and minor head losses F - Friction in pipe (ft) C - Curve in pipe (ft) V - Velocities in upper structure (ft) T - Turns in upper structure (ft)</p>	<p>COND - Flow condition code at each end of pipe: FP - full pipe flow OC - open channel flow ND - set to normal depth CD - set to critical depth OJ - open channel flow but hydraulic jump will occur downstream OF - initially set to open channel depth then set to full pipe flow HGL - Hydraulic grade line elevation (ft) TOP - Elevation of top of upper structure (ft) FREEBD - Difference btwn upper HGL and TOP (ft)</p>
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Notes:

1. Friction losses computed with Manning's formula if full pipe flow or back-calculated if open channel flow (simulating flow profile)
2. HGL at upper structure includes structure losses calculated with actual inflowing velocities using iterative procedure
3. Velocity and turn structure loss components only computed for incoming pipes with invert elevations below outlet crown elevation



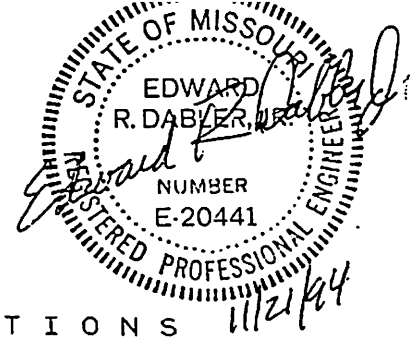


EARTHWORK VOLUME CALCULATIONS

FILL SHRINKAGE FACTOR = 10%

STATION	CUT A IN SF	FILL A IN SF	CUT V IN CY	FILL V IN CY	AD FVOL IN CY	CU YD BALANCE
0.00	0	0				+0
13.00	55	28	13	7	8	+5
22.00	69	180	21	35	39	-13
50.00	0	2248	36	1259	1385	-1362
66.00	0	2571	0	1428	1571	-2933
82.00	0	2771	0	1583	1741	-4674
92.00	0	2839	0	1039	1143	-5817
131.00	0	2599	0	3927	4320	-10137
143.00	0	2599	0	1155	1271	-11408
161.00	0	2300	0	1633	1796	-13204
176.00	0	1380	0	1022	1124	-14328
203.00	977	735	489	1058	1164	-15003
223.00	1287	604	839	496	546	-14710
248.00	1381	340	1235	437	481	-13956
273.00	1606	15	1383	164	180	-12753
298.00	1583	0	1476	7	8	-11285
323.00	790	0	1099	0	0	-10186
353.00	0	0	439	0	0	-9747

TOTAL EXCAVATION = 7030
 TOTAL EMBANKMENT = 15250
 TOTAL ADJUSTED EMB = 16777



FLOOD PLAIN

VOLUME CALCULATIONS

STATION	REMOVED A IN SF	ADDED A IN SF	REMOVED V IN CY	ADDED V IN CY	CU YD BALANCE
0.00	0	0			+0
13.00	0	0	0	0	+0
22.00	0	0	0	0	+0
50.00	1818	0	943	0	+943
66.00	2135	0	1171	0	+2114
82.00	2356	0	1331	0	+3445
92.00	2347	0	871	0	+4316
131.00	1996	0	3137	0	+7453
143.00	1959	0	879	0	+8332
161.00	1781	0	1247	0	+9579
176.00	1370	0	875	0	+10454
203.00	735	977	1053	489	+11018
223.00	604	1287	496	839	+10675
248.00	340	1381	437	1235	+9877
273.00	15	1606	164	1383	+8658
298.00	0	1583	7	1476	+7189
323.00	0	790	0	1099	+6090
353.00	0	0	0	439	+5651
					+ 193 FOR DETENTION
					5844 = TOTAL SHORTAGE
					(SEE FLOOD PLAIN) STUDY
	TOTAL AREA REMOVED FROM F.P.	=	12611		
	TOTAL AREA ADDED TO F.P.	=	6960		