Liberty Livingston Road
Colerain Township, Hamilton County, Ohio
August 4, 2011
TGA # 7711

Watershed #1:

3.4 Acres, C = .35
tc: 700 feet at 8.4% = 20 minutes
i5 = 3.36 in/hr, i10 = 3.95 in/hr, i50 = 5.32 in/hr
Q5 = (.35)(3.4 ac)(3.36 in/hr) = 4.0 cfs
Q10 = (.35)(3.4 ac)(3.95 in/hr) = 4.7 cfs
Q50 = (.35)(3.4 ac)(5.32 in/hr) = 6.3 cfs

Watershed #2:

2.35 Acres, C = .35
tc: 500 feet at 5.6% = 20 minutes
i5 = 3.36 in/hr, i10 = 3.95 in/hr, i50 = 5.32 in/hr
Q5 = (.35)(2.45 ac)(3.36 in/hr) = 2.8 cfs
Q10 = (.35)(2.35 ac)(3.95 in/hr) = 3.2 cfs
Q50 = (.35)(2.35 ac)(5.32 in/hr) = 4.4 cfs

Watershed #3:

Pre-Development
16.5 Acres, C = .35
tc: 1300 feet at 6.0% = 25 minutes
i5 = 2.97 in/hr, i10 = 3.54 in/hr, i50 = 4.80 in/hr
Q5 = (.35)(16.5 ac)(2.97 in/hr) = 17.2 cfs
Q10 = (.35)(16.5 ac)(3.54 in/hr) = 20.4 cfs
Q50 = (.35)(16.5 ac)(4.80 in/hr) = 27.7 cfs

Post-Development (into basin)
16.5 Acres, C = .48
tc: 1600 feet at 5.0% = 20 minutes
i5 = 3.36 in/hr, i10 = 3.95 in/hr, i50 = 5.32 in/hr
Q5 = (.48)(16.5 ac)(3.36 in/hr) = 26.6 cfs
Q10 = (.48)(16.5 ac)(3.95 in/hr) = 31.3 cfs
Q50 = (.48)(16.5 ac)(5.32 in/hr) = 42.1 cfs

Post-Development (out of basin)
(See attached TR-55 routing)
Q5 = 8.9 cfs
Q10 = 11.8 cfs
Q50 = 20.1 cfs

Hamilton County Public Works - Exhibit 33

Project Name: Liberty Date: 08/02

Project Address: Livingston Designer: Tga

Exhibit 33 PRE Q1 to POST Q10 Stage One Volume and Q1 Release

EDIT GRAY CELLS - GREEN CELLS EQUAL RESULTS

Data Required:

a1	On-site pre-development drainage area (acres) section ST 711(d) (1)	15.00
a2	Off-site drainage area (acres) section ST 711 (d) (1)	1.50
a3	Total pre-development drainage area (acres)	16.50
a4	On-site post development drainage area to release structure	15.00
a5	Total post- development drainage area (acres) a2+a4	16.50
c1	On-site pre-development run-off coefficient, Section ST 711 (f)	0.35
c2	Off-site pre-development run-off coefficent, Section ST 711 (f)	0.35
c3	Adjusted pre-development run-off coefficent	0.35
c4	On-site post -development run-off coefficent, Section ST 711 (g)	0.48
c5	Off-site post-development run-off coefficent, Section ST 711 (g)	0.35
c6	Adjusted post-development runoff coefficent	0.47
tc1	Pre-development time of concentration. Exhibit No. 5	25.0
tc10	Post- development time of concentration, Exhibit No. 5	20.0

Pre-Development 1 Year Storm

I1 = 2.05 in/hr

Pre Q1 = 11.85 cfs **Maximum Release Rate**

Storm Duration Producing Stage One Detention Storage

Tc = 40.29 minutes

Rainfall Intensity

I10 = 2.69 in/hr

Post Q10 = 20.75 cfs **Peak Rate of Flow Post-Development Q10**

Volume = 22945 cu.ft. **Stage One Detention Storage Volume**

Volume = 0.53 acre ft.

WQV: $.34(.75\text{in})\frac{15\text{Ac}}{12\text{in/Ft}}(43{,}560\ \text{Ft}^2/\text{Ac}) = 13{,}884\ \text{CF}$

Size WQ orifice $Q_{wq} = \frac{13{,}884\ \text{CF}}{48\text{hr} \times 60\ \text{min/hr} \times 60\ \text{sec/min}} = 0.08\text{CFS}$

$\text{Orifice area} = \frac{0.08\text{CFS}}{.61\sqrt{64.4(2.75}} = 0.0007\ \text{Ft}^2$

Use 3" minimum size

Hamilton County Public Works - Exhibit 33

Project Name: Libert Date: 08/02

Project Address: Livingston Designer: TGA

Exhibit 33 PRE Q10 to POST Q100 Stage Two Volume and Q10 Release

EDIT GRAY CELLS - BLUE CELLS EQUAL RESULTS

Data Required:

a1	On-site pre-development drainage area (acres) section ST 711(d) (1)	15.00
a2	Off-site drainage area (acres) section ST 711 (d) (1)	1.50
a3	Total pre-development drainage area (acres)	16.50
a4	On-site post development drainage area to release structure	15.00
a5	Total post- development drainage area (acres) a2+a4	16.50
c1	On-site pre-development run-off coefficient, Section ST 711 (f)	0.35
c2	Off-site pre-development run-off coefficent, Section ST 711 (f)	0.35
c3	Adjusted pre-development run-off coefficent	0.35
c4	On-site post -development run-off coefficent, Section ST 711 (g)	0.48
c5	Off-site post-development run-off coefficent, Section ST 711 (g)	0.35
c6	Adjusted post-development runoff coefficent	0.47
tc10	Pre-development time of concentration. Exhibit No. 5	25.0
tc100	Post- development time of concentration, Exhibit No. 5	20.0

Pre-Development 10 Year Storm

I10 = 3.54 in/hr

Pre Q10 = 20.45 cfs **Maximum Release Rate**

Storm Duration Producing Maximum Detention Storage

Tc = 42.05 minutes

Rainfall Intensity

I100 = 3.97 in/hr

Post Q100 = 30.67 cfs **Peak Rate of Flow Post-Development Q100**

Volume = 29337 cu.ft. **Required Detention Storage Volume**

Volume = 0.67 acre ft.

THOMAS GRAHAM ASSOCIATES, INC.
Engineers • Surveyors

DATE: 6/25/2010

JOB #: 7711

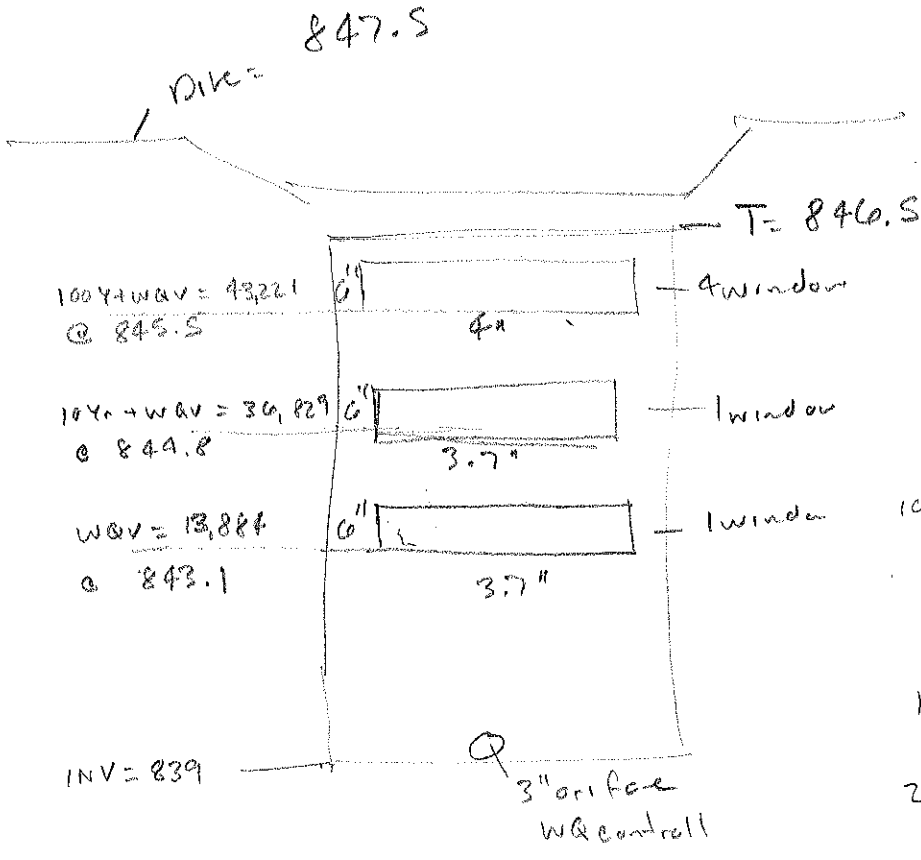
JOB NAME: Liberty Health Care
Livingston Rd.

DETENTION VOLUME

Elevation	Area (FT^2)	Incremental Storage (FT^3)	Cumulative Storage (FT^3)
839	1	0	0
840	4949.9	1,674	1,674
842	6665.8	11,573	13,247
844	8714.4	15,335	28,581
846	11355.5	20,012	48,593
848	14322.1	25,620	74,213
850	17282.4	31,558	105,772

41
43
45
47

20,914
38,587



Total Volume required
= WQV = 13,884 @ 843.1
+ 100yr = 29,337
43221 @ 845.5

10yr elev = 10yr vol = 22 945
+ WQV = 13 884
36,829
@ 844.8

10yr control
= 11.85 = .601 A $\sqrt{64.4(1.7}$
= 1.85 Ft^2 : use 18"
A = 1.767 Ft^2

100yr control

26,455 = .601(1.767)$\sqrt{64.4(2.4)}$ = 13.4
+ .601(A)$\sqrt{64.4(.7')}$ = 7.05

= 1,721 use

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Clermont

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.5000	Synthetic Curve	TypeII 24hr
25	4.7000	Synthetic Curve	TypeII 24hr
100	5.6000	Synthetic Curve	TypeII 24hr
2	2.9000	Synthetic Curve	TypeII 24hr
5	3.6000	Synthetic Curve	TypeII 24hr
10	4.1000	Synthetic Curve	TypeII 24hr
50	5.1000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*JUNC 10	JCT	1	.894		15.3500	.62		
*JUNC 10	JCT	25	3.034		12.3500	17.58		
*JUNC 10	JCT	100	4.045		12.3500	22.89		
*JUNC 10	JCT	2	1.231		12.7000	2.90		
*JUNC 10	JCT	5	1.886		12.4000	8.90		
*JUNC 10	JCT	10	2.393		12.4000	11.81		
*JUNC 10	JCT	50	3.477		12.3500	20.10		
POND 10 IN	POND	1	.894		12.1000	10.22		
POND 10 IN	POND	25	3.034		12.1000	38.35		
POND 10 IN	POND	100	4.045		12.1000	51.31		
POND 10 IN	POND	2	1.231		12.1000	14.72		
POND 10 IN	POND	5	1.886		12.1000	23.39		
POND 10 IN	POND	10	2.393		12.1000	30.03		
POND 10 IN	POND	50	3.477		12.1000	44.05		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
POND 10	OUT POND	1	.894		15.3500	.62	843.11	.488
POND 10	OUT POND	25	3.034		12.3500	17.58	845.51	.992
POND 10	OUT POND	100	4.045		12.3500	22.89	846.73	1.315
POND 10	OUT POND	2	1.231		12.7000	2.90	843.29	.521
POND 10	OUT POND	5	1.886		12.4000	8.90	844.00	.657
POND 10	OUT POND	10	2.393		12.4000	11.81	844.73	.810
POND 10	OUT POND	50	3.477		12.3500	20.10	846.04	1.126
SUBAREA 10	AREA	1	.894		12.1000	10.22		
SUBAREA 10	AREA	25	3.034		12.1000	38.35		
SUBAREA 10	AREA	100	4.045		12.1000	51.31		
SUBAREA 10	AREA	2	1.231		12.1000	14.72		
SUBAREA 10	AREA	5	1.886		12.1000	23.39		
SUBAREA 10	AREA	10	2.393		12.1000	30.03		
SUBAREA 10	AREA	50	3.477		12.1000	44.05		

7711

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	20.00	cfs

Results		
Depth	0.95	ft
Flow Area	5.6	ft²
Wetted Perim	9.02	ft
Top Width	8.71	ft
Critical Depth	0.84	ft
Critical Slope	0.016469	ft/ft
Velocity	3.59	ft/s
Velocity Head	0.20	ft
Specific Energ	1.15	ft
Froude Numb	0.79	
Flow Type	Subcritical	

50yr
North Side
Swale

5.5 Ac
C=.5
t_c=15min

i_{50}=5.95

Q_{50} = 5.5x(.5)x5.95

=16.4 cfs

check 20cfs