

STORM SEWER CALCULATIONS

for

UNION CENTRE COMMERCE PARK PHASE 3, FLOER DRIVE

*SEC. 33, T3, R2
UNION TOWNSHIP
BUTLER COUNTY, OHIO*

DATE: September 21, 1999

DSD | CONSULTANTS, INC.
Civil Engineering

*9319 Cincinnati-Columbus Road • Suite 22
West Chester, Ohio 45069*

(phone 513-777-9111)

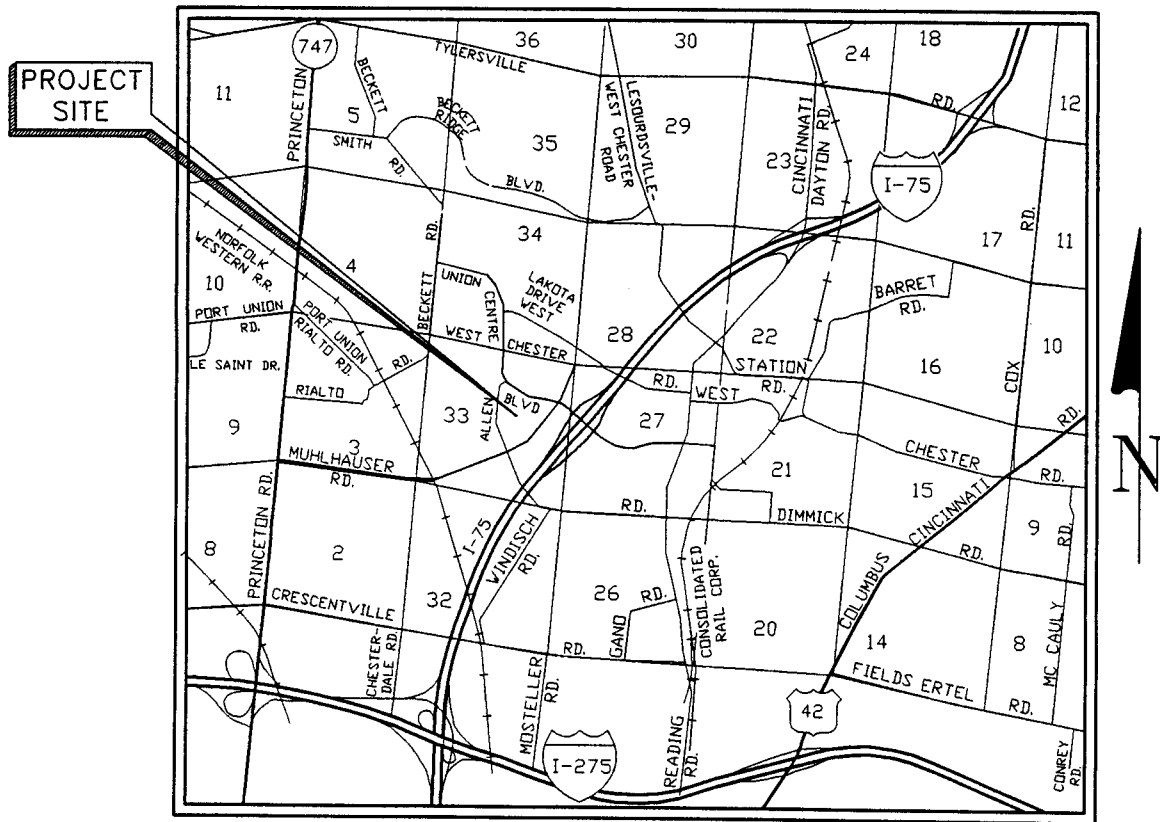
(fax 513-777-9778)

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UNION TOWNSHIP BUTLER COUNTY

SEC. 33, TOWN 3, RANGE 2

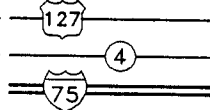


LOCATION MAP

0 1/2 1

SCALE IN MILES

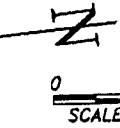
FUTURE PROPOSED _____
 PORTION TO BE IMPROVED _____
 U.S. ROUTES _____
 STATE ROUTES _____
 INTERSTATE HIGHWAYS _____



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LOCATION MAP
SEC. 33, T3, R2
UNION TOWNSHIP,
BUTLER COUNTY, OHIO



mplan548.dwg 8-23-99 9:44:33 am EST

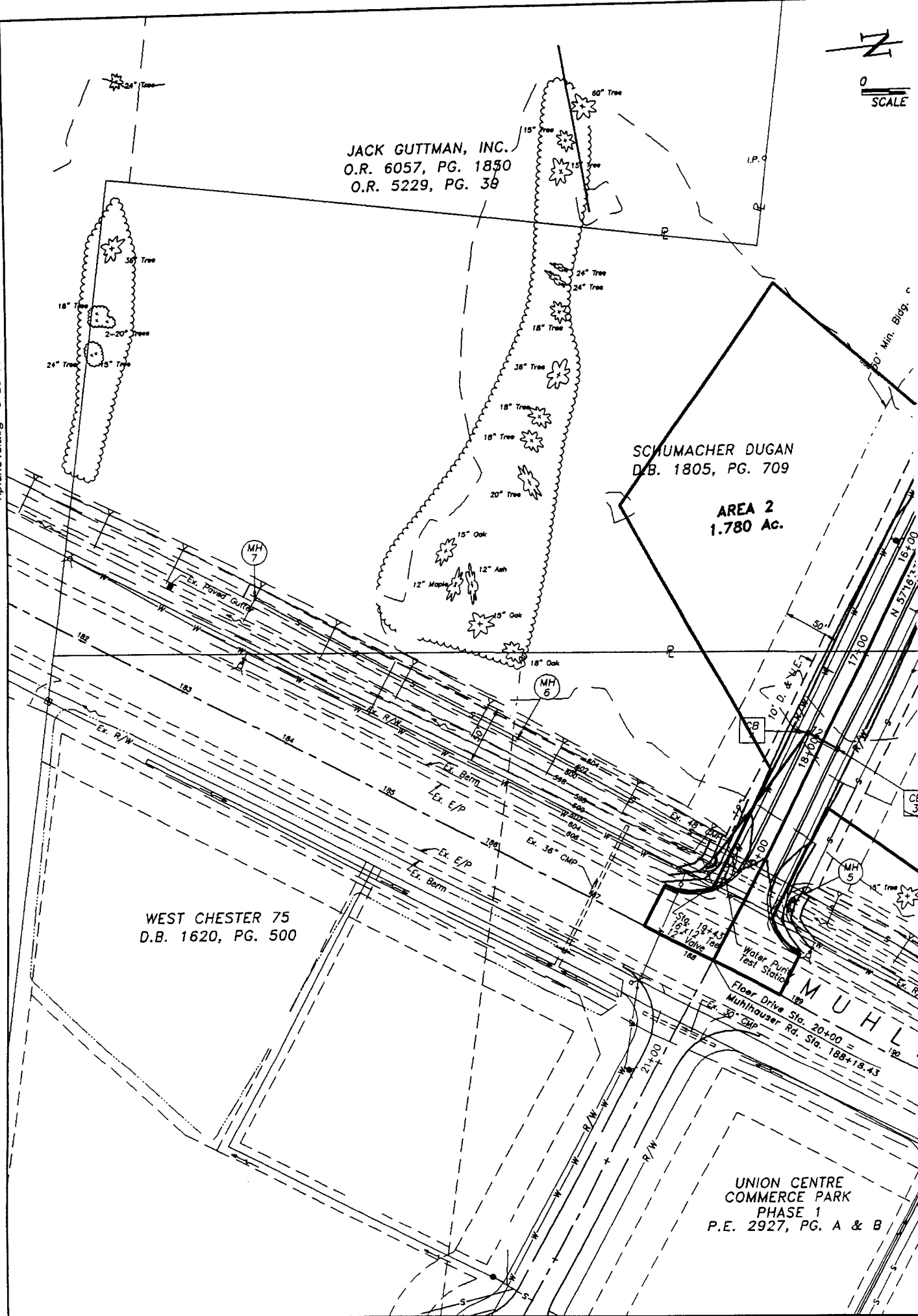
JACK GUTTMAN, INC.
O.R. 6057, PG. 1850
O.R. 5229, PG. 39

SCHUMACHER DUGAN
D.B. 1805, PG. 709

AREA 2
1.780 Ac.

WEST CHESTER 75
D.B. 1620, PG. 500

UNION CENTRE
COMMERCE PARK
PHASE 1
P.E. 2927, PG. A & B



50 100
IN FEET

36" Tree
15" Tree

24" Tree

Exist. 80'-42" CMP
Sta. 0+52.74, 0' Skew

AREA 3
0.486 Ac.

CB 1

Existing Retention Pond
W.S. Elevation 599.70

Floor Drive Sta. 8+31.61 =
U.C.B. Sta. 30+06.37

N 5°28'10"E, 527.40'

FLOOR DRIVE

AREA 4
0.878 Ac.

Inv. Outlet
El. 599.70

PC = 13+59.01
P.T. = 14+46.35
P.I. Sta. 14+46.35
R = 62°44'43"
L = 143.24'
T = 87.34'
L = 156.86'
Ch = N 25°54'12" W
149.14'

AREA 1
1.778 Ac.

WEST CHESTER 75
D.B. 1617, PG. 586

WEST CHESTER 75
D.B. 1743, PG. 604

Top of Dike

CINCINNATI BELL
EASEMENT

Ex. Paved Gutter

Existing Electric
Line Towers

Spillway

Proposed Retention Pond
W.S. Elevation 599.70 ±

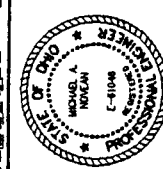
Exist. Temporary Ditch
(Earth Bottom)
(By Others)

UNION CENTRE
BLVD.



SCHUMACHER
DUGAN
CONSTRUCTION, INC.
6355 CENTRE PARK DRIVE,
WEST CHESTER, OHIO 45069,
513-777-9800

PLANS PREPARED BY:
DSD CONSULTANTS, INC.
Civil Engineering
8319 Occidental-Columbus Road, Suite 22
West Chester, Ohio 45069
Phone 513-777-9111



NO.	DATE	REVISIONS
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		

DRAINAGE MAP
UNION CENTRE COMMERCE PARK
PHASE 3

DESIGNED	M.A.N.
DRAWN	C.R.B.
CHECKED	M.A.N.
DATE	AUGUST 1999

2

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
 Rainfall file: butler

Run Date: 08-20-1999
 File:

LINE 1 / Q = 6.07 / HT = 18 / WID = 18 / N = .015 / L = 88 / JLC = 0

 HW to CB2 / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	600.94	10.83	600.04	5.46	601.41	17.63	-1.83	1.11
UPSTRM	601.82	10.83	600.92	5.46	602.29	17.63	1.57	1.11

Drainage area (ac) =	0.88	Slope of invert (%) =	1.0000
Runoff coefficient =	0.85	Slope energy grade line (%) =	1.0000
Time of conc (min) =	10.18	Critical depth (in) =	11.28
Inlet time (min) =	10.00	Natural ground elev. (ft) =	603.99
Intensity (in/hr) =	5.12	Upstream surcharge (ft) =	0.00
Cumulative C*A =	1.18	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	6.07	Line capacity (cfs) =	9.10

Q catchment (cfs) =	3.84	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	3.84	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	20.42

Note: Normal depth assumed

 LINE 2 / Q = 2.25 / HT = 12 / WID = 12 / N = .015 / L = 32 / JLC = 0

 CB2 to CB1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	602.06	7.64	601.42	4.27	602.34	9.57	1.57	0.53
UPSTRM	602.38	7.69	601.74	4.24	602.66	11.51	1.25	0.53

Drainage area (ac) =	0.49	Slope of invert (%) =	1.0000
Runoff coefficient =	0.90	Slope energy grade line (%) =	0.9997
Time of conc (min) =	10.00	Critical depth (in) =	7.64
Inlet time (min) =	10.00	Natural ground elev. (ft) =	603.99
Intensity (in/hr) =	5.15	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.44	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	2.25	Line capacity (cfs) =	3.09

Q catchment (cfs) =	2.25	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	2.25	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	14.28

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
 Rainfall file: butler

Run Date: 09-02-1999
 File: c:548-3-4.ST3

LINE 1 / Q = 15.50 / HT = 30 / WID = 30 / N = .015 / L = 140 / JLC = 0

HW to CB3 / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	601.32	21.54	599.52	4.11	601.58	25.42	-1.27	3.77
UPSTRM	601.65	17.13	600.22	5.35	602.09	29.70	1.31	2.90

Drainage area (ac) =	1.78	Slope of invert (%) =	0.5000
Runoff coefficient =	0.85	Slope energy grade line (%) =	0.3677
Time of conc (min) =	10.18	Critical depth (in) =	15.78
Inlet time (min) =	10.00	Natural ground elev. (ft) =	604.04
Intensity (in/hr) =	5.12	Upstream surcharge (ft) =	0.00
Cumulative C*A =	3.02	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	15.50	Line capacity (cfs) =	25.13

Q catchment (cfs) =	7.79	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	7.79	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	23.22

LINE 2 / Q = 7.79 / HT = 18 / WID = 18 / N = .015 / L = 32 / JLC = 0

CB3 to CB4 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	602.29	12.78	601.22	5.81	602.81	15.17	1.32	1.34
UPSTRM	602.61	12.86	601.54	5.77	603.13	16.26	1	1.35

Drainage area (ac) =	1.78	Slope of invert (%) =	1.0000
Runoff coefficient =	0.85	Slope energy grade line (%) =	0.9990
Time of conc (min) =	10.00	Critical depth (in) =	12.78
Inlet time (min) =	10.00	Natural ground elev. (ft) =	604.04
Intensity (in/hr) =	5.15	Upstream surcharge (ft) =	0.00
Cumulative C*A =	1.51	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	7.79	Line capacity (cfs) =	9.10

Q catchment (cfs) =	7.79	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	7.79	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	23.24

RETENTION SUMMARY

Reference: Original Calculations dated March 11, 1997, Drainage and Retention Calculations for
UNION CENTRE COMMERCE PARK

The original retention calculations for the site were completed based upon design assumptions about the future retention. The largest difference between the original calculations and the current changes thereto is the assumed stage-storage of retention ponds.

Our current design for the stage-storage curve is on sheet 6. The original design had a storage of 7.97 Acre-feet at a depth of 0.94 feet during the peak outflow of 4.7 cfs. The current design has a storage of 6.632 Acre-feet at a depth of 1.45 feet during the peak outflow of 11.18 cfs. However, during the construction staking of the retention ponds, we noticed that Schumacher Dugan had already excavated more material than we had planned. Therefore, the final as-built of the pond will determine the volume which should be larger than our design as shown.

From the predeveloped 10 year storm, the allowable release rate for the pond was 46 cfs. The total runoff from the ponds has been reduced over 4 times. This allows for some of the area to be released directly into the ditch along Muhlhauser Road.

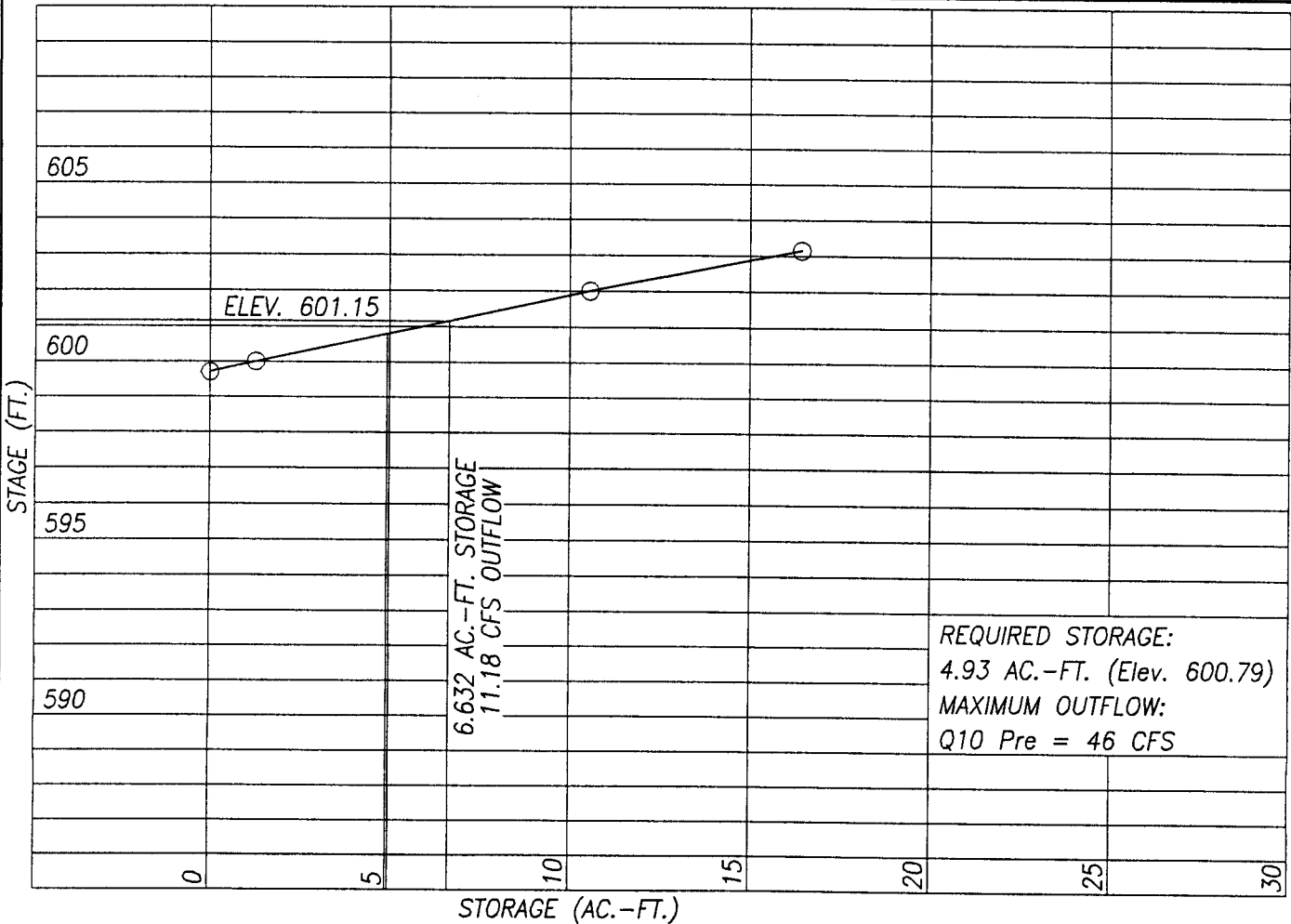
Additional detention is already in place at the culvert crossing under Allen Road in the Muhlhauser Road ditch by the calculations as approve by Greg Wilkens.

UNION CENTRE COMMERCE PARK
PHASE 3 RETENTION

JOB NUMBER: 548

S T A G E - S T O R A G E C U R V E

Elevation	Surface Area Acres	Average Acres	Elevation Difference	Storage Interval Ac.-Ft.	Summation Storage Ac.-Ft.
599.70	4.266				
		4.287	0.30	1.286	1.286
600	4.308				
		4.638	2.00	9.275	10.561
602	4.967				
		5.097	1.15	5.862	16.423
603.15	5.227				



MODIFIED PULS BASIN ROUTING FOR UNION CENTRE COMMERCE PARK PHASE 3

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

	INFLOW HYDROGRAPH FILENAME:				B:548-50D.HYD		
	BASIN STORAGE/ELEVATION DATA FILENAME:				B:548-RET3.ES		
	OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:				B:548-RET3.EO		
TIME	HYDROGRAPH	BASIN	STORAGE	ELEV. ABOVE	BASIN	TOTAL	RETENTION
hrs.	INFLOW, cfs	INFLOW, cfs	ac-ft.	MSL	OUTFLOW, cfs	OUTFLOW, cfs	TIME, hrs.
0.0	5.10	5.10	0.000	599.70	0.00	0.00	0.00
0.1	5.60	5.60	0.044	599.71	0.00	0.00	0.19
0.2	6.20	6.20	0.093	599.72	0.00	0.00	0.36
0.3	6.80	6.80	0.147	599.73	0.01	0.01	0.52
0.4	8.00	8.00	0.208	599.75	0.01	0.01	0.63
0.5	9.20	9.20	0.279	599.77	0.01	0.01	0.73
0.6	10.30	10.30	0.359	599.78	0.02	0.02	0.84
0.7	22.20	22.20	0.493	599.82	0.03	0.03	0.54
0.8	34.10	34.10	0.725	599.87	0.08	0.08	0.51
0.9	45.90	45.90	1.055	599.95	0.19	0.19	0.55
1.0	88.60	88.60	1.608	600.07	0.47	0.47	0.44
1.1	162.40	162.40	2.637	600.29	1.45	1.45	0.39
1.2	175.80	175.80	4.013	600.59	3.77	3.77	0.54
1.3	105.70	105.70	5.134	600.83	6.50	6.50	1.11
1.4	54.90	54.90	5.736	600.96	8.26	8.26	2.20
1.5	36.50	36.50	6.042	601.03	9.21	9.21	3.20
1.6	28.10	28.10	6.230	601.07	9.82	9.82	3.98
1.7	22.40	22.40	6.356	601.09	10.23	10.23	4.71
1.8	18.90	18.90	6.441	601.11	10.52	10.52	5.30
1.9	17.10	17.10	6.502	601.12	10.73	10.73	5.65
2.0	15.40	15.40	6.547	601.13	10.89	10.89	6.03
2.1	14.40	14.40	6.580	601.14	11.00	11.00	6.27
2.2	13.40	13.40	6.603	601.15	11.08	11.08	6.53
2.3	12.60	12.60	6.619	601.15	11.13	11.13	6.75
2.4	11.90	11.90	6.628	601.15	11.17	11.17	6.95
2.5	11.30	11.30	6.632	601.15	11.18	11.18	7.14
2.6	10.80	10.80	6.630	601.15	11.17	11.17	7.30
2.7	10.20	10.20	6.625	601.15	11.16	11.16	7.51
2.8	9.70	9.70	6.615	601.15	11.12	11.12	7.69
2.9	9.20	9.20	6.602	601.15	11.07	11.07	7.88
3.0	8.80	8.80	6.585	601.14	11.02	11.02	8.04
3.1	8.40	8.40	6.565	601.14	10.95	10.95	8.21
3.2	8.10	8.10	6.543	601.13	10.87	10.87	8.36
3.3	7.70	7.70	6.519	601.13	10.79	10.79	8.53
3.4	7.50	7.50	6.493	601.12	10.70	10.70	8.63
3.5	7.40	7.40	6.466	601.12	10.61	10.61	8.69
3.6	7.30	7.30	6.440	601.11	10.52	10.52	8.75
3.7	7.10	7.10	6.413	601.11	10.42	10.42	8.86
3.8	6.90	6.90	6.385	601.10	10.33	10.33	8.97
3.9	6.80	6.80	6.356	601.09	10.23	10.23	9.03
4.0	6.60	6.60	6.328	601.09	10.14	10.14	9.15
4.1	6.50	6.50	6.298	601.08	10.05	10.05	9.21
4.2	6.30	6.30	6.269	601.07	9.95	9.95	9.34
4.3	6.20	6.20	6.238	601.07	9.85	9.85	9.41
4.4	6.10	6.10	6.208	601.06	9.75	9.75	9.48
4.5	5.90	5.90	6.178	601.05	9.65	9.65	9.61
4.6	5.80	5.80	6.147	601.05	9.55	9.55	9.69
4.7	5.70	5.70	6.116	601.04	9.45	9.45	9.77
4.8	5.50	5.50	6.084	601.03	9.35	9.35	9.92
4.9	5.40	5.40	6.052	601.03	9.24	9.24	10.00
5.0	5.30	5.30	6.021	601.02	9.14	9.14	10.09
5.1	5.10	5.10	5.989	601.01	9.04	9.04	10.25
5.2	5.00	5.00	5.956	601.01	8.93	8.93	10.35
5.3	4.90	4.90	5.924	601.00	8.82	8.82	10.44
5.4	4.70	4.70	5.891	600.99	8.72	8.72	10.62
5.5	4.60	4.60	5.858	600.99	8.62	8.62	10.72
5.6	4.60	4.60	5.825	600.98	8.52	8.52	10.74
5.7	4.50	4.50	5.792	600.97	8.43	8.43	10.84
5.8	4.50	4.50	5.760	600.96	8.33	8.33	10.87
5.9	4.40	4.40	5.729	600.96	8.23	8.23	10.98
6.0	4.40	4.40	5.697	600.95	8.14	8.14	11.00

MODIFIED PULS BASIN ROUTING FOR UNION CENTRE COMMERCE PARK PHASE 3

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

INFLOW HYDROGRAPH FILENAME:

B:548-50D.HYD

BASIN STORAGE/ELEVATION DATA FILENAME:

B:548-RET3.ES

OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:

B:548-RET3.EO

TIME	HYDROGRAPH	BASIN	STORAGE	ELEV. ABOVE	BASIN	TOTAL	RETENTION
hrs.	INFLOW, cfs	INFLOW, cfs	ac-ft.	MSL	OUTFLOW, cfs	OUTFLOW, cfs	TIME, hrs.
6.1	4.40	4.40	5.667	600.94	8.04	8.04	11.02
6.2	4.30	4.30	5.637	600.94	7.95	7.95	11.13
6.3	4.30	4.30	5.607	600.93	7.86	7.86	11.16
6.4	4.20	4.20	5.577	600.93	7.77	7.77	11.27
6.5	4.20	4.20	5.548	600.92	7.68	7.68	11.30
6.6	4.10	4.10	5.519	600.91	7.60	7.60	11.42
6.7	4.10	4.10	5.491	600.91	7.51	7.51	11.45
6.8	4.00	4.00	5.463	600.90	7.42	7.42	11.57
6.9	4.00	4.00	5.435	600.89	7.34	7.34	11.59
7.0	4.00	4.00	5.407	600.89	7.27	7.27	11.61
7.1	3.90	3.90	5.380	600.88	7.19	7.19	11.74
7.2	3.90	3.90	5.353	600.88	7.12	7.12	11.76
7.3	3.80	3.80	5.327	600.87	7.04	7.04	11.89
7.4	3.80	3.80	5.300	600.87	6.97	6.97	11.91
7.5	3.70	3.70	5.274	600.86	6.89	6.89	12.05
7.6	3.70	3.70	5.248	600.85	6.82	6.82	12.07
7.7	3.60	3.60	5.222	600.85	6.75	6.75	12.21
7.8	3.60	3.60	5.196	600.84	6.67	6.67	12.24
7.9	3.60	3.60	5.171	600.84	6.60	6.60	12.26
8.0	3.50	3.50	5.146	600.83	6.53	6.53	12.41
8.1	3.50	3.50	5.121	600.83	6.46	6.46	12.44
8.2	3.40	3.40	5.097	600.82	6.40	6.40	12.59
8.3	3.30	3.30	5.072	600.82	6.33	6.33	12.75
8.4	3.30	3.30	5.047	600.81	6.26	6.26	12.78
8.5	3.20	3.20	5.023	600.81	6.19	6.19	12.95
8.6	3.10	3.10	4.998	600.80	6.12	6.12	13.12
8.7	3.10	3.10	4.973	600.80	6.05	6.05	13.15
8.8	3.00	3.00	4.948	600.79	5.99	5.99	13.32
8.9	2.90	2.90	4.924	600.78	5.93	5.93	13.50
9.0	2.90	2.90	4.899	600.78	5.87	5.87	13.52
9.1	2.80	2.80	4.874	600.77	5.80	5.80	13.71
9.2	2.80	2.80	4.850	600.77	5.74	5.74	13.74
9.3	2.80	2.80	4.826	600.76	5.68	5.68	13.77
9.4	2.80	2.80	4.802	600.76	5.62	5.62	13.80
9.5	2.80	2.80	4.779	600.75	5.56	5.56	13.83
9.6	2.80	2.80	4.756	600.75	5.50	5.50	13.86
9.7	2.80	2.80	4.734	600.74	5.45	5.45	13.89
9.8	2.80	2.80	4.713	600.74	5.39	5.39	13.92
9.9	2.80	2.80	4.691	600.73	5.34	5.34	13.95
10.0	2.70	2.70	4.670	600.73	5.28	5.28	14.16
10.1	2.70	2.70	4.649	600.73	5.23	5.23	14.19
10.2	2.70	2.70	4.628	600.72	5.18	5.18	14.22
10.3	2.70	2.70	4.608	600.72	5.13	5.13	14.25
10.4	2.70	2.70	4.588	600.71	5.08	5.08	14.28
10.5	2.70	2.70	4.569	600.71	5.03	5.03	14.31
10.6	2.70	2.70	4.550	600.70	4.98	4.98	14.34
10.7	2.70	2.70	4.531	600.70	4.93	4.93	14.37
10.8	2.70	2.70	4.513	600.70	4.89	4.89	14.39
10.9	2.60	2.60	4.495	600.69	4.85	4.85	14.61
11.0	2.60	2.60	4.476	600.69	4.81	4.81	14.63
11.1	2.60	2.60	4.458	600.68	4.76	4.76	14.65
11.2	2.50	2.50	4.440	600.68	4.72	4.72	14.87
11.3	2.40	2.40	4.421	600.68	4.68	4.68	15.11
11.4	2.40	2.40	4.403	600.67	4.64	4.64	15.14
11.5	2.30	2.30	4.384	600.67	4.60	4.60	15.38
11.6	2.20	2.20	4.365	600.66	4.55	4.55	15.64
11.7	2.20	2.20	4.346	600.66	4.51	4.51	15.67
11.8	2.10	2.10	4.326	600.66	4.47	4.47	15.95
11.9	2.00	2.00	4.306	600.65	4.42	4.42	16.23
12.0	2.00	2.00	4.287	600.65	4.38	4.38	16.27
12.1	1.90	1.90	4.267	600.64	4.33	4.33	16.57

MODIFIED PULS BASIN ROUTING FOR UNION CENTRE COMMERCE PARK PHASE 3

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

INFLOW HYDROGRAPH FILENAME:

B:548-50D.HYD

BASIN STORAGE/ELEVATION DATA FILENAME:

B:548-RET3.ES

OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:

B:548-RET3.EO

TIME	HYDROGRAPH	BASIN	STORAGE	ELEV. ABOVE	BASIN	TOTAL	RETENTION
hrs.	INFLOW, cfs	INFLOW, cfs	ac-ft.	MSL	OUTFLOW, cfs	OUTFLOW, cfs	TIME, hrs.
12.2	1.80	1.80	4.246	600.64	4.29	4.29	16.89
12.3	1.80	1.80	4.226	600.63	4.24	4.24	16.93
12.4	1.70	1.70	4.206	600.63	4.19	4.19	17.27
12.5	1.60	1.60	4.185	600.63	4.15	4.15	17.63
12.6	1.60	1.60	4.164	600.62	4.10	4.10	17.68
12.7	1.50	1.50	4.143	600.62	4.05	4.05	18.06
12.8	1.50	1.50	4.122	600.61	4.00	4.00	18.12
12.9	1.40	1.40	4.101	600.61	3.96	3.96	18.53
13.0	1.30	1.30	4.080	600.60	3.91	3.91	18.96
13.1	1.30	1.30	4.059	600.60	3.86	3.86	19.03
13.2	1.20	1.20	4.037	600.59	3.82	3.82	19.47
13.3	1.10	1.10	4.015	600.59	3.78	3.78	19.93
13.4	1.10	1.10	3.993	600.58	3.73	3.73	20.00
13.5	1.00	1.00	3.971	600.58	3.69	3.69	20.50
13.6	0.90	0.90	3.949	600.57	3.64	3.64	21.04
13.7	0.90	0.90	3.927	600.57	3.60	3.60	21.13
13.8	0.80	0.80	3.904	600.56	3.55	3.55	21.71
13.9	0.70	0.70	3.881	600.56	3.51	3.51	22.33
14.0	0.70	0.70	3.858	600.55	3.46	3.46	22.44
14.1	0.60	0.60	3.835	600.55	3.41	3.41	23.12
14.2	0.50	0.50	3.812	600.54	3.37	3.37	23.86
14.3	0.50	0.50	3.788	600.54	3.32	3.32	24.00
14.4	0.40	0.40	3.765	600.53	3.27	3.27	24.81
14.5	0.30	0.30	3.741	600.53	3.22	3.22	25.69
14.6	0.30	0.30	3.717	600.52	3.18	3.18	25.87
14.7	0.20	0.20	3.693	600.52	3.13	3.13	26.85
14.8	0.10	0.10	3.668	600.51	3.08	3.08	27.92
14.9	0.10	0.10	3.644	600.51	3.03	3.03	28.17
15.0	0.00	0.00	3.619	600.50	2.98	2.98	29.38
TOTAL ROUTING MASS BALANCE DISCREPANCY -0.08%							
PEAK INFLOW = 175.8 cfs.		PEAK OUTFLOW= 11.2 cfs					
ROUTING TIME STEP = 0.10 hours.		NUMBER OF OUTFLOW HYDROGRAPH POINTS = 150					

STORM SEWER CALCULATIONS

for

UNION CENTRE COMMERCE PARK PHASE 3, FLOER DRIVE

*SEC. 33, T3, R2
UNION TOWNSHIP
BUTLER COUNTY, OHIO*

DATE: September 21, 1999

DSD | CONSULTANTS, INC.
Civil Engineering

*9319 Cincinnati-Columbus Road • Suite 22
West Chester, Ohio 45069*

(phone 513-777-9111)

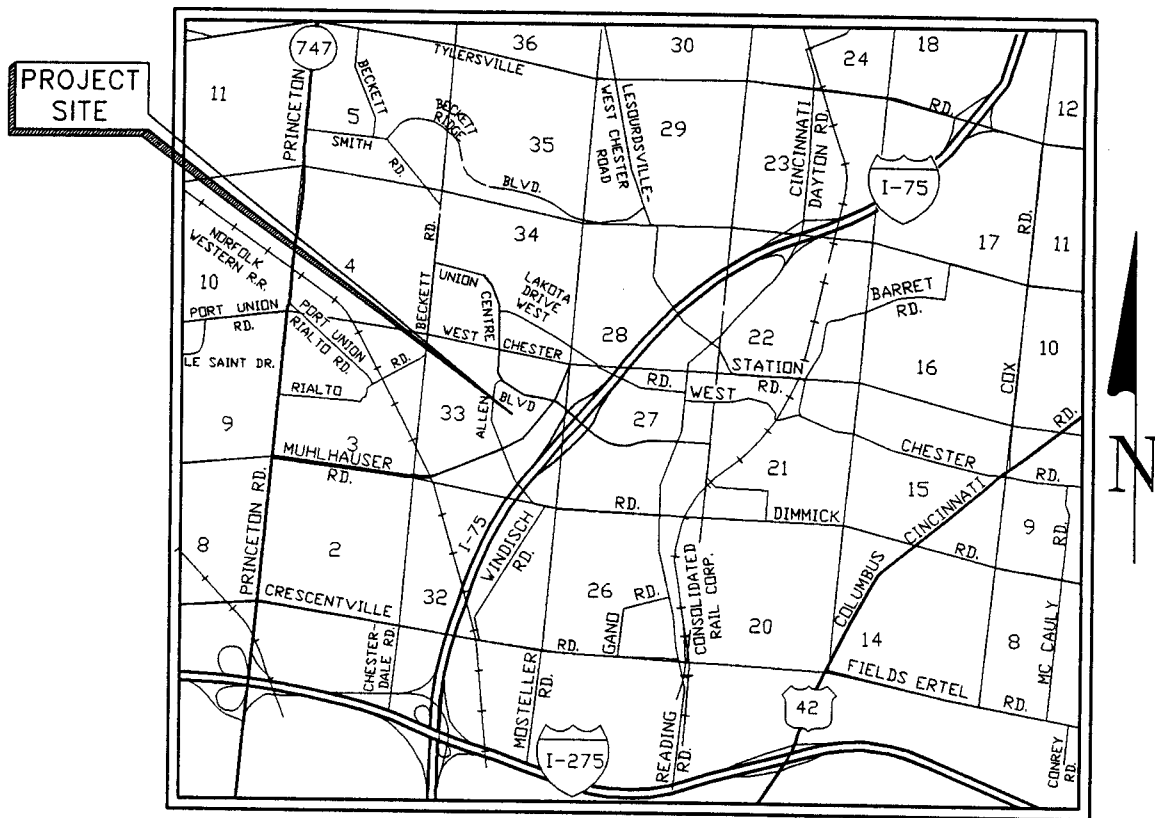
(fax 513-777-9778)

INDEX

DESCRIPTION	PAGE
LOCATION MAP.....	1
DRAINAGE MAP.....	2
STORM SEWER CALCULATIONS STA. 11+50.....	3
STORM SEWER CALCULATIONS STA. 17+84.....	4
RETENTION SUMMARY (CHANGES from Original Calcs.)	
Summary of changes.....	5
Stage-Storage Curve.....	6
Revised retention outflow table.....	7-9

UNION TOWNSHIP BUTLER COUNTY

SEC. 33, TOWN 3, RANGE 2



LOCATION MAP

0 1/2 1

SCALE IN MILES

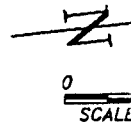
FUTURE PROPOSED	_____	_____
PORTION TO BE IMPROVED	_____	_____
U.S. ROUTES	_____	127
STATE ROUTES	_____	4
INTERSTATE HIGHWAYS	_____	75

DSD CONSULTANTS, INC.
Civil Engineering

9319 Cincinnati-Columbus Road • Suite 22
West Chester, Ohio 45069

LOCATION MAP
SEC. 33, T3, R2
UNION TOWNSHIP,
BUTLER COUNTY, OHIO

mplan548.dwg 8-23-99 9:44:33 am EST



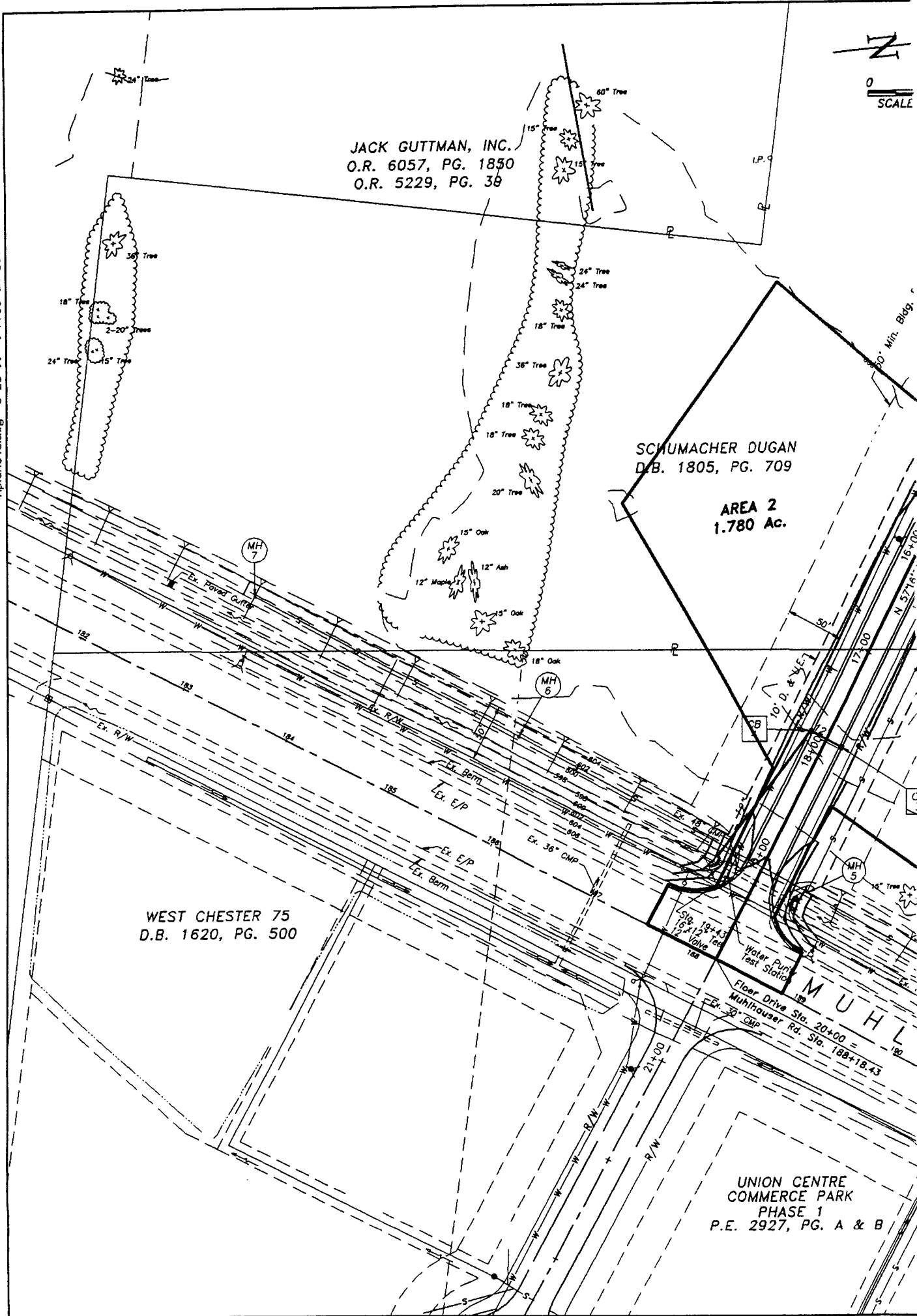
JACK GUTTMAN, INC.
O.R. 6057, PG. 1850
O.R. 5229, PG. 38

SCHUMACHER DUGAN
D.B. 1805, PG. 709

AREA 2
1.780 Ac.

WEST CHESTER 75
D.B. 1620, PG. 500

UNION CENTRE
COMMERCE PARK
PHASE 1
P.E. 2927, PG. A & B



50 100
IN FEET

36" Tree
15" Tree
24" Tree

Exist. 80'-42" CMP
Sta. 0+52.74, 0' Skew

AREA 3
0.486 Ac.

AREA 4
0.878 Ac.

AREA 1
1.778 Ac.

WEST CHESTER 75
D.B. 1617, PG. 586

WEST CHESTER 75
D.B. 1743, PG. 604

HAUSER RD.
S32°43'27"W

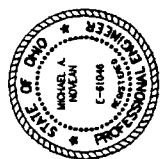
Top of Dike
CINCINNATI BELL
EASEMENT

Ex. Paved Gutter

Spillway

Existing Electric
Line Towers

UNION CENTRE
BLVD.



PLANS PREPARED BY:
DSD CONSULTANTS, INC.
Civil Engineering
9319 Columbia Road, Suite 22
Cincinnati, Ohio 45241
Phone 513-777-9111

**SCHUMACHER
DUGAN**
CONSTRUCTION, INC.
6355 CENTRE PARK DRIVE,
WEST CHESTER, OHIO 45069,
513-777-9800

**DRAINAGE MAP
UNION CENTRE COMMERCE PARK
PHASE 3**

DESIGNED	M.A.N.
DRAWN	C.R.B.
CHECKED	M.A.N.
DATE	AUGUST 1999

REVISIONS

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
Rainfall file: butler

Run Date: 08-20-1999
File:

LINE 1 / Q = 6.07 / HT = 18 / WID = 18 / N = .015 / L = 88 / JLC = 0

HW to CB2 / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	600.94	10.83	600.04	5.46	601.41	17.63	-1.83	1.11
UPSTRM	601.82	10.83	600.92	5.46	602.29	17.63	1.57	1.11

Drainage area (ac) =	0.88	Slope of invert (%) =	1.0000
Runoff coefficient =	0.85	Slope energy grade line (%) =	1.0000
Time of conc (min) =	10.18	Critical depth (in) =	11.28
Inlet time (min) =	10.00	Natural ground elev. (ft) =	603.99
Intensity (in/hr) =	5.12	Upstream surcharge (ft) =	0.00
Cumulative C*A =	1.18	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	6.07	Line capacity (cfs) =	9.10

Q catchment (cfs) =	3.84	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	3.84	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	20.42

Note: Normal depth assumed

LINE 2 / Q = 2.25 / HT = 12 / WID = 12 / N = .015 / L = 32 / JLC = 0

CB2 to CB1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	602.06	7.64	601.42	4.27	602.34	9.57	1.57	0.53
UPSTRM	602.38	7.69	601.74	4.24	602.66	11.51	1.25	0.53

Drainage area (ac) =	0.49	Slope of invert (%) =	1.0000
Runoff coefficient =	0.90	Slope energy grade line (%) =	0.9997
Time of conc (min) =	10.00	Critical depth (in) =	7.64
Inlet time (min) =	10.00	Natural ground elev. (ft) =	603.99
Intensity (in/hr) =	5.15	Upstream surcharge (ft) =	0.00
Cumulative C*A =	0.44	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	2.25	Line capacity (cfs) =	3.09

Q catchment (cfs) =	2.25	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	2.25	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	14.28

STORM SEWER DESIGN / ANALYSIS

Return Period = 10 Yrs
 Rainfall file: butler

Run Date: 09-02-1999
 File: c:548-3-4.ST3

LINE 1 / Q = 15.50 / HT = 30 / WID = 30 / N = .015 / L = 140 / JLC = 0

 HW to CB3 / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	601.32	21.54	599.52	4.11	601.58	25.42	-1.27	3.77
UPSTRM	601.65	17.13	600.22	5.35	602.09	29.70	1.31	2.90

Drainage area (ac) =	1.78	Slope of invert (%) =	0.5000
Runoff coefficient =	0.85	Slope energy grade line (%) =	0.3677
Time of conc (min) =	10.18	Critical depth (in) =	15.78
Inlet time (min) =	10.00	Natural ground elev. (ft) =	604.04
Intensity (in/hr) =	5.12	Upstream surcharge (ft) =	0.00
Cumulative C*A =	3.02	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	15.50	Line capacity (cfs) =	25.13

Q catchment (cfs) =	7.79	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	7.79	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	23.22

 LINE 2 / Q = 7.79 / HT = 18 / WID = 18 / N = .015 / L = 32 / JLC = 0

 CB3 to CB4 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	602.29	12.78	601.22	5.81	602.81	15.17	1.32	1.34
UPSTRM	602.61	12.86	601.54	5.77	603.13	16.26	1	1.35

Drainage area (ac) =	1.78	Slope of invert (%) =	1.0000
Runoff coefficient =	0.85	Slope energy grade line (%) =	0.9990
Time of conc (min) =	10.00	Critical depth (in) =	12.78
Inlet time (min) =	10.00	Natural ground elev. (ft) =	604.04
Intensity (in/hr) =	5.15	Upstream surcharge (ft) =	0.00
Cumulative C*A =	1.51	Additional Q (cfs) =	0.00
Q = CA * I (cfs) =	7.79	Line capacity (cfs) =	9.10

Q catchment (cfs) =	7.79	Inlet length (ft) =	6.00
Q carryover (cfs) =	0.00	Gutter slope (ft/ft) =	0.0000
Q captured (cfs) =	7.79	Cross slope (ft/ft) =	0.0208
Q bypassed (cfs) =	0.00	Ponding width (ft) =	23.24

RETENTION SUMMARY

Reference: Original Calculations dated March 11, 1997, Drainage and Retention Calculations for
UNION CENTRE COMMERCE PARK

The original retention calculations for the site were completed based upon design assumptions about the future retention. The largest difference between the original calculations and the current changes thereto is the assumed stage-storage of retention ponds.

Our current design for the stage-storage curve is on sheet 6. The original design had a storage of 7.97 Acre-feet at a depth of 0.94 feet during the peak outflow of 4.7 cfs. The current design has a storage of 6.632 Acre-feet at a depth of 1.45 feet during the peak outflow of 11.18 cfs. However, during the construction staking of the retention ponds, we noticed that Schumacher Dugan had already excavated more material than we had planned. Therefore, the final as-built of the pond will determine the volume which should be larger than our design as shown.

From the predeveloped 10 year storm, the allowable release rate for the pond was 46 cfs. The total runoff from the ponds has been reduced over 4 times. This allows for some of the area to be released directly into the ditch along Muhlhauser Road.

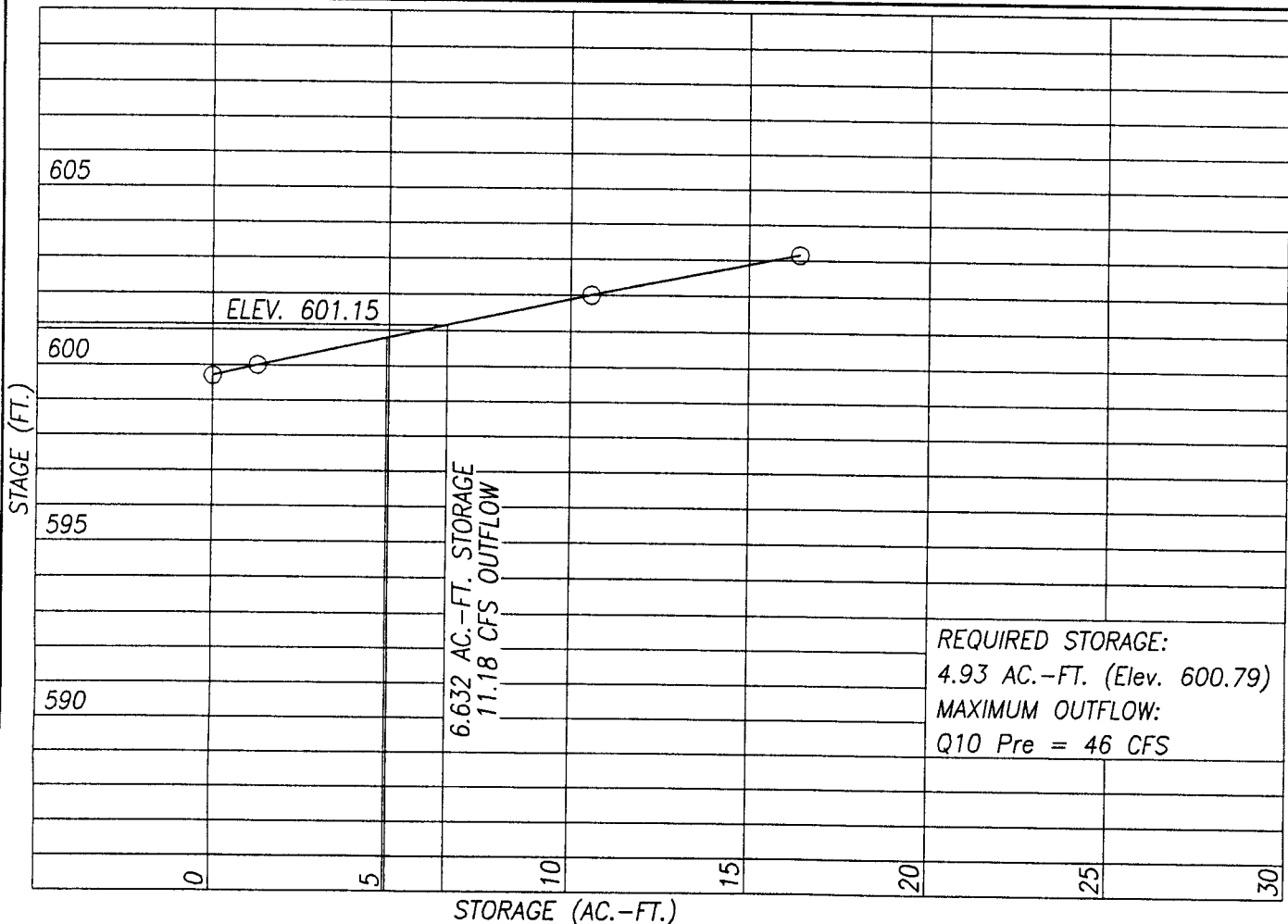
Additional detention is already in place at the culvert crossing under Allen Road in the Muhlhauser Road ditch by the calculations as approve by Greg Wilkens.

UNION CENTRE COMMERCE PARK
PHASE 3 RETENTION

JOB NUMBER: 548

S T A G E - S T O R A G E C U R V E

Elevation	Surface Area Acres	Average Acres	Elevation Difference	Storage Interval Ac.-Ft.	Summation Storage Ac.-Ft.
599.70	4.266				
		4.287	0.30	1.286	1.286
600	4.308				
		4.638	2.00	9.275	10.561
602	4.967				
		5.097	1.15	5.862	16.423
603.15	5.227				



MODIFIED PULS BASIN ROUTING FOR UNION CENTRE COMMERCE PARK PHASE 3

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

INFLOW HYDROGRAPH FILENAME:

B:548-50D.HYD

BASIN STORAGE/ELEVATION DATA FILENAME:

B:548-RET3.ES

OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:

B:548-RET3.EO

TIME	HYDROGRAPH	BASIN	STORAGE	ELEV. ABOVE	BASIN	TOTAL	RETENTION
hrs.	INFLOW, cfs	INFLOW, cfs	ac-ft.	MSL	OUTFLOW, cfs	OUTFLOW, cfs	TIME, hrs.
0.0	5.10	5.10	0.000	599.70	0.00	0.00	0.00
0.1	5.60	5.60	0.044	599.71	0.00	0.00	0.19
0.2	6.20	6.20	0.093	599.72	0.00	0.00	0.36
0.3	6.80	6.80	0.147	599.73	0.01	0.01	0.52
0.4	8.00	8.00	0.208	599.75	0.01	0.01	0.63
0.5	9.20	9.20	0.279	599.77	0.01	0.01	0.73
0.6	10.30	10.30	0.359	599.78	0.02	0.02	0.84
0.7	22.20	22.20	0.493	599.82	0.03	0.03	0.54
0.8	34.10	34.10	0.725	599.87	0.08	0.08	0.51
0.9	45.90	45.90	1.055	599.95	0.19	0.19	0.55
1.0	88.60	88.60	1.608	600.07	0.47	0.47	0.44
1.1	162.40	162.40	2.637	600.29	1.45	1.45	0.39
1.2	175.80	175.80	4.013	600.59	3.77	3.77	0.54
1.3	105.70	105.70	5.134	600.83	6.50	6.50	1.11
1.4	54.90	54.90	5.736	600.96	8.26	8.26	2.20
1.5	36.50	36.50	6.042	601.03	9.21	9.21	3.20
1.6	28.10	28.10	6.230	601.07	9.82	9.82	3.98
1.7	22.40	22.40	6.356	601.09	10.23	10.23	4.71
1.8	18.90	18.90	6.441	601.11	10.52	10.52	5.30
1.9	17.10	17.10	6.502	601.12	10.73	10.73	5.65
2.0	15.40	15.40	6.547	601.13	10.89	10.89	6.03
2.1	14.40	14.40	6.580	601.14	11.00	11.00	6.27
2.2	13.40	13.40	6.603	601.15	11.08	11.08	6.53
2.3	12.60	12.60	6.619	601.15	11.13	11.13	6.75
2.4	11.90	11.90	6.628	601.15	11.17	11.17	6.95
2.5	11.30	11.30	6.632	601.15	11.18	11.18	7.14
2.6	10.80	10.80	6.630	601.15	11.17	11.17	7.30
2.7	10.20	10.20	6.625	601.15	11.16	11.16	7.51
2.8	9.70	9.70	6.615	601.15	11.12	11.12	7.69
2.9	9.20	9.20	6.602	601.15	11.07	11.07	7.88
3.0	8.80	8.80	6.585	601.14	11.02	11.02	8.04
3.1	8.40	8.40	6.565	601.14	10.95	10.95	8.21
3.2	8.10	8.10	6.543	601.13	10.87	10.87	8.35
3.3	7.70	7.70	6.519	601.13	10.79	10.79	8.53
3.4	7.50	7.50	6.493	601.12	10.70	10.70	8.63
3.5	7.40	7.40	6.466	601.12	10.61	10.61	8.69
3.6	7.30	7.30	6.440	601.11	10.52	10.52	8.75
3.7	7.10	7.10	6.413	601.11	10.42	10.42	8.86
3.8	6.90	6.90	6.385	601.10	10.33	10.33	8.97
3.9	6.80	6.80	6.356	601.09	10.23	10.23	9.03
4.0	6.60	6.60	6.328	601.09	10.14	10.14	9.15
4.1	6.50	6.50	6.298	601.08	10.05	10.05	9.21
4.2	6.30	6.30	6.269	601.07	9.95	9.95	9.34
4.3	6.20	6.20	6.238	601.07	9.85	9.85	9.41
4.4	6.10	6.10	6.208	601.06	9.75	9.75	9.48
4.5	5.90	5.90	6.178	601.05	9.65	9.65	9.61
4.6	5.80	5.80	6.147	601.05	9.55	9.55	9.69
4.7	5.70	5.70	6.116	601.04	9.45	9.45	9.77
4.8	5.50	5.50	6.084	601.03	9.35	9.35	9.92
4.9	5.40	5.40	6.052	601.03	9.24	9.24	10.00
5.0	5.30	5.30	6.021	601.02	9.14	9.14	10.09
5.1	5.10	5.10	5.989	601.01	9.04	9.04	10.25
5.2	5.00	5.00	5.956	601.01	8.93	8.93	10.35
5.3	4.90	4.90	5.924	601.00	8.82	8.82	10.44
5.4	4.70	4.70	5.891	600.99	8.72	8.72	10.62
5.5	4.60	4.60	5.858	600.99	8.62	8.62	10.72
5.6	4.60	4.60	5.825	600.98	8.52	8.52	10.74
5.7	4.50	4.50	5.792	600.97	8.43	8.43	10.84
5.8	4.50	4.50	5.760	600.96	8.33	8.33	10.87
5.9	4.40	4.40	5.729	600.96	8.23	8.23	10.98
6.0	4.40	4.40	5.697	600.95	8.14	8.14	11.00

MODIFIED PULS BASIN ROUTING FOR UNION CENTRE COMMERCE PARK PHASE 3

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

INFLOW HYDROGRAPH FILENAME:

B:548-50D.HYD

BASIN STORAGE/ELEVATION DATA FILENAME:

B:548-RET3.ES

OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:

B:548-RET3.EO

TIME	HYDROGRAPH	BASIN	STORAGE	ELEV. ABOVE	BASIN	TOTAL	RETENTION
hrs.	INFLOW, cfs	INFLOW, cfs	ac-ft.	MSL	OUTFLOW, cfs	OUTFLOW, cfs	TIME, hrs.
6.1	4.40	4.40	5.667	600.94	8.04	8.04	11.02
6.2	4.30	4.30	5.637	600.94	7.95	7.95	11.13
6.3	4.30	4.30	5.607	600.93	7.86	7.86	11.16
6.4	4.20	4.20	5.577	600.93	7.77	7.77	11.27
6.5	4.20	4.20	5.548	600.92	7.68	7.68	11.30
6.6	4.10	4.10	5.519	600.91	7.60	7.60	11.42
6.7	4.10	4.10	5.491	600.91	7.51	7.51	11.45
6.8	4.00	4.00	5.463	600.90	7.42	7.42	11.57
6.9	4.00	4.00	5.435	600.89	7.34	7.34	11.59
7.0	4.00	4.00	5.407	600.89	7.27	7.27	11.61
7.1	3.90	3.90	5.380	600.88	7.19	7.19	11.74
7.2	3.90	3.90	5.353	600.88	7.12	7.12	11.76
7.3	3.80	3.80	5.327	600.87	7.04	7.04	11.89
7.4	3.80	3.80	5.300	600.87	6.97	6.97	11.91
7.5	3.70	3.70	5.274	600.86	6.89	6.89	12.05
7.6	3.70	3.70	5.248	600.85	6.82	6.82	12.07
7.7	3.60	3.60	5.222	600.85	6.75	6.75	12.21
7.8	3.60	3.60	5.196	600.84	6.67	6.67	12.24
7.9	3.60	3.60	5.171	600.84	6.60	6.60	12.26
8.0	3.50	3.50	5.146	600.83	6.53	6.53	12.41
8.1	3.50	3.50	5.121	600.83	6.46	6.46	12.44
8.2	3.40	3.40	5.097	600.82	6.40	6.40	12.59
8.3	3.30	3.30	5.072	600.82	6.33	6.33	12.75
8.4	3.30	3.30	5.047	600.81	6.26	6.26	12.78
8.5	3.20	3.20	5.023	600.81	6.19	6.19	12.95
8.6	3.10	3.10	4.998	600.80	6.12	6.12	13.12
8.7	3.10	3.10	4.973	600.80	6.05	6.05	13.15
8.8	3.00	3.00	4.948	600.79	5.99	5.99	13.32
8.9	2.90	2.90	4.924	600.78	5.93	5.93	13.50
9.0	2.90	2.90	4.899	600.78	5.87	5.87	13.52
9.1	2.80	2.80	4.874	600.77	5.80	5.80	13.71
9.2	2.80	2.80	4.850	600.77	5.74	5.74	13.74
9.3	2.80	2.80	4.826	600.76	5.68	5.68	13.77
9.4	2.80	2.80	4.802	600.76	5.62	5.62	13.80
9.5	2.80	2.80	4.779	600.75	5.56	5.56	13.83
9.6	2.80	2.80	4.756	600.75	5.50	5.50	13.86
9.7	2.80	2.80	4.734	600.74	5.45	5.45	13.89
9.8	2.80	2.80	4.713	600.74	5.39	5.39	13.92
9.9	2.80	2.80	4.691	600.73	5.34	5.34	13.95
10.0	2.70	2.70	4.670	600.73	5.28	5.28	14.16
10.1	2.70	2.70	4.649	600.73	5.23	5.23	14.19
10.2	2.70	2.70	4.628	600.72	5.18	5.18	14.22
10.3	2.70	2.70	4.608	600.72	5.13	5.13	14.25
10.4	2.70	2.70	4.588	600.71	5.08	5.08	14.28
10.5	2.70	2.70	4.569	600.71	5.03	5.03	14.31
10.6	2.70	2.70	4.550	600.70	4.98	4.98	14.34
10.7	2.70	2.70	4.531	600.70	4.93	4.93	14.37
10.8	2.70	2.70	4.513	600.70	4.89	4.89	14.39
10.9	2.60	2.60	4.495	600.69	4.85	4.85	14.61
11.0	2.60	2.60	4.476	600.69	4.81	4.81	14.63
11.1	2.60	2.60	4.458	600.68	4.76	4.76	14.65
11.2	2.50	2.50	4.440	600.68	4.72	4.72	14.87
11.3	2.40	2.40	4.421	600.68	4.68	4.68	15.11
11.4	2.40	2.40	4.403	600.67	4.64	4.64	15.14
11.5	2.30	2.30	4.384	600.67	4.60	4.60	15.38
11.6	2.20	2.20	4.365	600.66	4.55	4.55	15.64
11.7	2.20	2.20	4.346	600.66	4.51	4.51	15.67
11.8	2.10	2.10	4.326	600.66	4.47	4.47	15.95
11.9	2.00	2.00	4.306	600.65	4.42	4.42	16.23
12.0	2.00	2.00	4.287	600.65	4.38	4.38	16.27
12.1	1.90	1.90	4.267	600.64	4.33	4.33	16.57

RETENTION PONDS 2 & 3, 36" RELEASE PIPE

INFLOW HYDROGRAPH FILENAME:	B:548-50D.HYD
BASIN STORAGE/ELEVATION DATA FILENAME:	B:548-RET3.ES
OUTLET STRUCTURE DISCHARGE/ELEVATION DATA FILENAME:	B:548-RET3.EO

TIME hrs.	HYDROGRAPH INFLOW, cfs	BASIN INFLOW, cfs	STORAGE ac-ft.	ELEV. ABOVE MSL	BASIN OUTFLOW, cfs	TOTAL OUTFLOW, cfs	RETENTION TIME, hrs.
12.2	1.80	1.80	4.246	600.64	4.29	4.29	16.89
12.3	1.80	1.80	4.226	600.63	4.24	4.24	16.93
12.4	1.70	1.70	4.206	600.63	4.19	4.19	17.27
12.5	1.60	1.60	4.185	600.63	4.15	4.15	17.63
12.6	1.60	1.60	4.164	600.62	4.10	4.10	17.68
12.7	1.50	1.50	4.143	600.62	4.05	4.05	18.06
12.8	1.50	1.50	4.122	600.61	4.00	4.00	18.12
12.9	1.40	1.40	4.101	600.61	3.96	3.96	18.53
13.0	1.30	1.30	4.080	600.60	3.91	3.91	18.96
13.1	1.30	1.30	4.059	600.60	3.86	3.86	19.03
13.2	1.20	1.20	4.037	600.59	3.82	3.82	19.47
13.3	1.10	1.10	4.015	600.59	3.78	3.78	19.93
13.4	1.10	1.10	3.993	600.58	3.73	3.73	20.00
13.5	1.00	1.00	3.971	600.58	3.69	3.69	20.50
13.6	0.90	0.90	3.949	600.57	3.64	3.64	21.04
13.7	0.90	0.90	3.927	600.57	3.60	3.60	21.13
13.8	0.80	0.80	3.904	600.56	3.55	3.55	21.71
13.9	0.70	0.70	3.881	600.56	3.51	3.51	22.33
14.0	0.70	0.70	3.858	600.55	3.46	3.46	22.44
14.1	0.60	0.60	3.835	600.55	3.41	3.41	23.12
14.2	0.50	0.50	3.812	600.54	3.37	3.37	23.86
14.3	0.50	0.50	3.788	600.54	3.32	3.32	24.00
14.4	0.40	0.40	3.765	600.53	3.27	3.27	24.81
14.5	0.30	0.30	3.741	600.53	3.22	3.22	25.69
14.6	0.30	0.30	3.717	600.52	3.18	3.18	25.87
14.7	0.20	0.20	3.693	600.52	3.13	3.13	26.85
14.8	0.10	0.10	3.668	600.51	3.08	3.08	27.92
14.9	0.10	0.10	3.644	600.51	3.03	3.03	28.17
15.0	0.00	0.00	3.619	600.50	2.98	2.98	29.38

TOTAL ROUTING MASS BALANCE DISCREPANCY -0.08%	
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PEAK INFLOW = 175.8 cfs.	PEAK OUTFLOW= 11.2 cfs
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ROUTING TIME STEP = 0.10 hours. NUMBER OF OUTFLOW HYDROGRAPH POINTS = 150