Appendix F

Drainage

DILLON CONSULTING

APPENDIX F – DRAINAGE

As part of the drainage review for the Sixth Concession Road/North Talbot Road Class Environmental Assessment, we reviewed the Provincial/Division Road Drainage Study and Sanitary Sewer Functional Design Report (Aecon – May 2011) and the Southwood Lakes Development – Hydraulic Design Report (HGS – June 1990) and have compared the impacts of this study's Preferred Design to the outcomes identified in these reports.

Sixth Concession Road

The Provincial/Division Road Drainage Study and Storm and Sanitary Sewer Functional Design Report (Aecom – May 2011), Sixth Concession Road was assumed to consist of 13.0m of hard surface within a 21.9m right-of-way. This resulted in a runoff coefficient of 0.62.

The Preferred Design for Sixth Concession Road as determined by this document results in a hard surface of 13.2m within a 21.9m right-of-way. The corresponding runoff coefficient is 0.62.

There is an increase of 0.2m (13.0m vs. 13.2m) in hard surface width between the Provincial/Divison Road study and the Preferred Design. This increase in hard surface in not large enough to have an adverse effect on the assumptions made in the Provincial/Division Road Drainage study and the corresponding drainage design of downstream facilities.

North Talbot Road

Runoff Coffecient

Using the current hard surfaced area for the North Talbot Road corridor, it was determined that the existing runoff coefficient is 0.50. The existing hard surface averages 8.25m in width.

Based on the recommended cross section for the corridor, there will be a hard surface of 13.6m width, a runoff coefficient of 0.57 was calculated.

Runoff Quantity

An increase in hard surface area will typically produce an increase in the quantity of runoff produced. Since the size of the North Talbot Road corridor is a small percentage (2.0%) of the larger Southwood Lakes drainage area and is located very close to the downstream outlets of the sewer system, the increase to the flowrates are minor in comparison to the total expected flowrate (avg. increase of 2.1%).

The following calculations illustrate the impacts to the expected flowrates at the storm water management facilities due to the improvements of the North Talbot Road corridor.

Sixth Concession / North Talbot Environmental Assesment
Appendix F
Storm Flowrate Increase at Southwood Lakes

Lake Laguna (Lake 2)

Total Area	3.2	ac	(HGS Report at c = 0.35)
North Talbot Area	2.61	ac	(ESR at c = 0.57)
Remaining Area	0.59	ac	(HGS Report at c = 0.35)

Incremental A x C

0.59 x 0.35 = .21
2.61 x 0.57 = 1.49
1.7

Total A x C for Drainage Area

North Talbot = 1.7
Upstream = 25.2
26.9

Total A x C for Lake #2 (Lake Como) = 34.5

Q = CiA
= 34.5 x 1.89
Q = 65.2 cfs

Percentage Increase in Flows

Existing expected flowrate at Lake #2	= 65.2	cfs	(from MH 33 sewer)
Proposed flowrate at Lake #2	= 63.9	cfs	

$$\% \text{ change in flowrate} = \frac{65.2 - 63.9}{63.9}$$

= 2.0 % increase

Sixth Concession / North Talbot Environmental Assesment
Appendix F
Storm Flowrate Increase at Southwood Lakes

Lake Grande (Lake 3)

Total Area	15.6	ac	(HGS Report at c = 0.35)
North Talbot Area	3.1	ac	(ESR at c = 0.57)
Remaining Area	12.5	ac	(HGS Report at c = 0.35)

Incremental A x C

12.5 x 0.35 = 4.37
3.1 x 0.57 = 1.77
6.14

Total A x C for Drainage Area

North Talbot = 6.14
Upstream = 15.8
21.9

Total A x C for Lake #3 (Lake Grande) 28.3

Q = CiA
= 28.3 x 2.02
Q = 57.2 cfs

Percentage Increase in Flows

Existing expected flowrate at Lake #3	= 56	cfs	(from MH 23 sewer)
Proposed flowrate at Lake #3	= 57.2	cfs	

$$\% \text{ change in flowrate} = \frac{57.2 - 56}{56}$$

= 2.1 % increase

Sixth Concession / North Talbot Environmental Assesment
Appendix F
Storm Flowrate Increase at Southwood Lakes

Lake Como (Lake 4)

Total Area	18.4	ac	(HGS Report at c = 0.35)
North Talbot Area	3.09	ac	(ESR at c = 0.57)
Remaining Area	15.31	ac	(HGS Report at c = 0.35)

Incremental A x C

15.31 x 0.35 = 5.34
3.09 x 0.57 = 1.76
7.12

Total A x C for Drainage Area

North Talbot = 7.12
Upstream = 17.5
24.62

Total A x C for Lake #4 (Lake Laguna) = 27.68

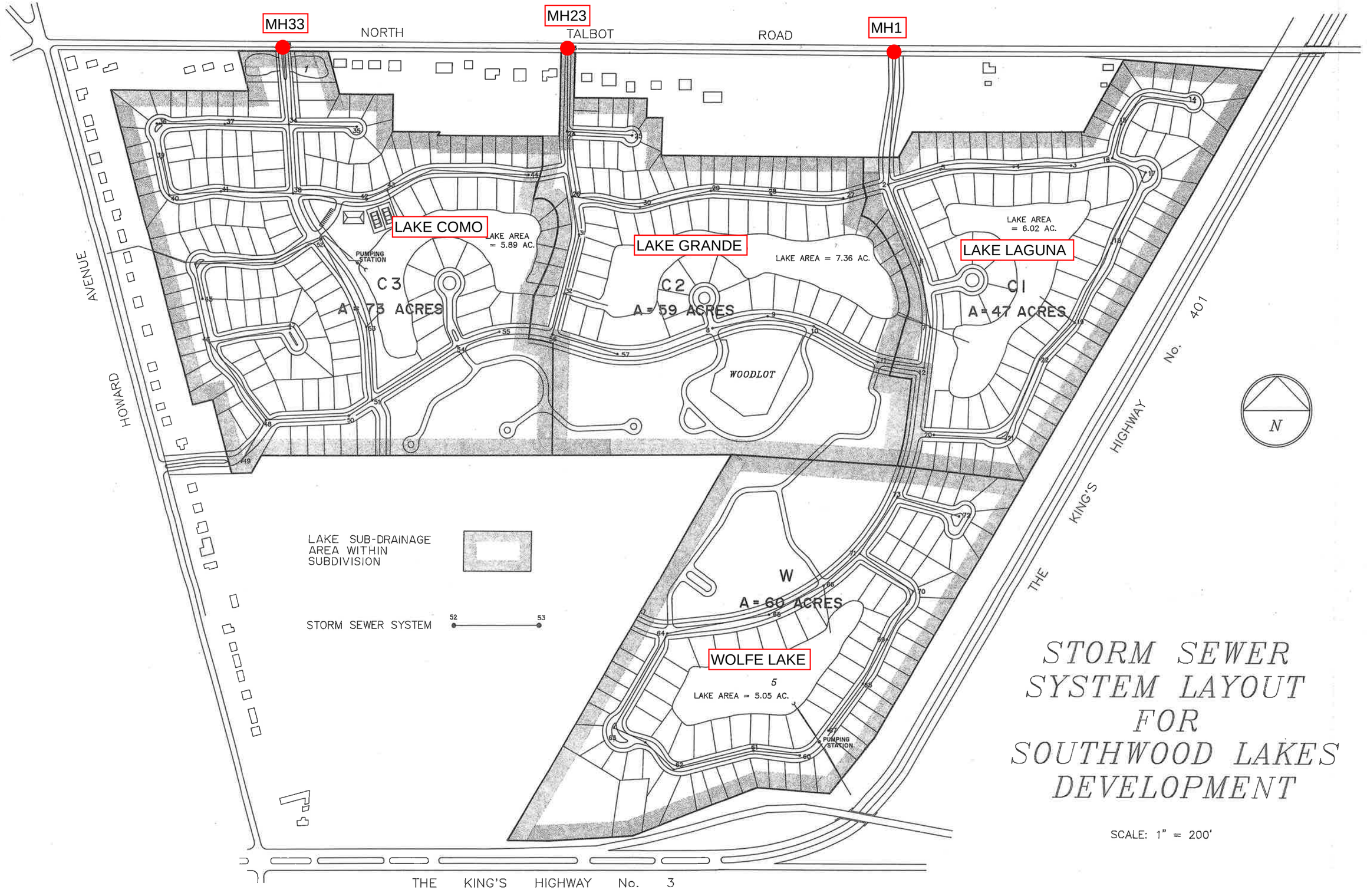
Q = CiA
= 27.68 x 1.97
Q = 54.5 cfs

Percentage Increase in Flows

Existing expected flowrate at Lake #4	= 53.3	cfs	(from MH 1 sewer)
Proposed flowrate at Lake #4	= 54.5	cfs	

$$\% \text{ change in flowrate} = \frac{54.5 - 53.3}{53.3}$$

= 2.3 % increase



STORM SEWER SYSTEM LAYOUT FOR SOUTHWOOD LAKES DEVELOPMENT

SCALE: 1" = 200'

MARCH 1990

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2.5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS		- 0.20
RESIDENTIAL	SINGLE & DUPLEX	- 0.35
	ROW HOUSING	- 0.50
	APARTMENTS	- 0.60
COMMERCIAL & INDUSTRIAL		- 0.70
DENSELY BUILT, PAVED		- 0.95

PROJECT NAME
SOUTHWOOD LAKES SUBDIVISION
PRELIMINARY DESIGN

STORM SEWER DESIGN CHART

MADE BY RCS SHEET Nº 1 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 JANUARY 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	COLLECTOR ROAD	MH 1	MH2		18.4	68.4	0.35/0.57	7.12	17.5	24.62	2.6	40	2.08	49.8	48	0.13	51.6	.013	4.1	650	2.6		0.85	615.0	614.15
	LOCAL ROAD	MH3	MH4	300x300	2.1	2.1	0.35	0.72	—	0.72	1.7	20	3.13	2.26	12	0.42	2.3	"	2.9	300	1.7		1.26	619.0	617.74
	" "	MH4	MH5	350x300	2.4	4.5	0.35	0.84	0.72	1.56	1.5	21.7	3.00	4.68	15	0.53	4.7	"	3.8	350	1.5		1.86	617.74	615.88
	" "	MH5	MH2	250x300	1.7	6.2	0.35	0.60	1.56	2.16	1.2	23.2	2.89	6.25	18	0.36	6.3	"	3.5	250	1.2		0.90	615.88	614.98
	COLLECTOR ROAD	MH2	MH6	250x250	1.4	76.0	0.35	0.49	26.11	26.6	1.6	42.6	2.01	53.5	48	0.14	53.5	"	4.2	400	1.6		0.56	614.15	613.59
	" "	MH6	MH7	200x250	1.1	77.1	0.35	0.40	26.6	27.0	1.0	44.2	1.97	53.3	48	0.14	53.5	"	4.2	250	1.0		0.35	613.59	613.24
	PARK	MH7	LAKE #4			77.1				27.68		45.2	1.97	54.5	48	0.14	53.5	"	4.2	200	0.7		0.28	610.28	610.00
	COLLECTOR ROAD	MH8	MH9	500x200	2.3	2.3	0.35	0.80	—	0.8	1.4	20	3.13	2.51	12	0.50	2.51	.013	3.2	270	1.4		1.35	618.50	617.15
	" "	MH9	MH10	200x230	1.1		0.35	0.37																	
				450x300	3.1	6.5	0.20	0.62	0.80	1.79	0.9	21.4	3.02	5.40	15	0.72	5.46	"	4.4	230	0.9		1.65	617.15	615.50
	" "	MH10	MH11	200x350	1.6	8.1	0.35	0.56	1.79	2.35	1.5	22.3	2.96	6.94	18	0.44	6.94	"	3.9	350	1.5		1.54	615.50	613.96
	" "	MH11	MH12	200x200	0.9	9.0	0.35	0.32	2.35	2.67	0.8	23.8	2.85	7.62	18	0.53	7.62	"	4.3	200	0.8		1.06	613.96	612.90
	" "	MH12	MH7	—	—	9.0				2.67	0.8	24.6	2.80	7.48	18	0.53	7.62	'	4.3	200	0.8		1.06	612.90	611.84
	PARK	MH7	LAKE #3																						
	LOCAL ROAD	MH20	MH21	300x400	2.8	2.8	0.35	0.96		0.96	2.3	20	3.13	3.01	15	0.23	3.08	.013	2.5	350	2.3		0.80	617.00	616.20
	" "	MH21	MH22	450x300	3.1	5.9	0.35	1.08	0.96	2.04	1.9	22.3	2.96	6.03	18	0.34	6.10	"	3.4	400	1.9		1.36	616.20	614.84
	" "	MH22	MH19	150x300	1.0	6.9	0.35	0.36	2.04	2.40	1.1	24.2	2.83	6.79	18	0.43	6.86	"	3.9	250	1.1		1.08	614.84	613.76
	" "	MH14	MH15	½x600x(330+400)	5.0	5.0	0.35	1.75		1.75	2.1	20	3.13	5.47	18	0.28	5.53	"	3.1	400	2.1		1.12	620.00	618.88
	" "	MH15	MH16	—		5.0				1.75	0.8	22.1	2.97	5.27	18	0.28	5.53	"	3.1	150	0.8		0.42	618.88	618.46
	" "	MH16	MH17	600x270	3.7	8.7	0.35	1.30	1.75	3.05	0.6	22.9	2.91	8.88	18	0.72	8.88	"	5.0	180	0.6		1.30	618.46	617.16
	" "	MH17	MH18	350x350	2.8	11.5	0.35	0.98	3.05	4.03	1.4	23.5	2.87	11.6	21	0.55	11.7	"	4.8	400	1.4		2.20	617.16	614.96
	" "	MH18	MH19	400x300	2.8	14.3	0.35	0.96	4.03	4.99	1.5	24.9	2.78	13.9	24	0.38	13.9	"	4.4	400	1.5		1.52	614.96	613.44
	EASEMENT	MH19	LAKE #2	—		21.2				7.39	0.8	26.4	2.69	19.9	30	0.24	20.0	"	4.0	200	0.8		0.48	613.44	612.96
	LOCAL ROAD	N. TALBOT MH23	MH24		15.6	60.6	0.35/0.57	6.14	15.8	21.9	1.8	36.7	2.20	46.9	48	0.11	47.4	.013	3.7	400	1.8		0.44	613.00	612.56
	" " -CULDESAC	MH25	MH24	350x450	3.6	3.6	0.35	1.3		1.3	1.0	20	3.13	3.95	12	1.25	3.97	"	5.0	300	1.0		3.75	616.50	612.75
	" "	MH24	MH26	150x300	1.0	65.2	0.35	0.4	22.6	23.0	1.5	38.5	2.15	49.5	48	0.12	49.6	"	3.9	350	1.5		0.42	612.56	612.14
	" "	MH27	MH28	300x320	2.2	2.2	0.35	0.77		0.77	1.4	20	3.13	2.41	12	0.46	2.41	"	3.0	250	1.4		1.15	618.50	617.35
	" "	MH28	MH29	400x320	2.9	5.1	0.35	1.03	0.77	1.80	2.2	21.4	3.02	5.43	18	0.28	5.53	"	3.1	400	2.2		1.12	617.35	616.23
	" "	MH29	MH30	350x300	2.4	7.5	0.35	0.84	1.80	2.64	1.4	23.6	2.87	7.57	18	0.53	7.62	"	4.3	350	1.4		1.86	616.23	614.37
	" "	MH30	MH26	350x300	2.4	9.9	0.35	0.84	2.64	3.48	1.0	25.0	2.78	9.67	18	0.86	9.70	"	5.4	320	1.0		2.75	614.37	611.62
	" "	MH26	MH31	—		75.1			26.48	26.5	0.7	40.0	2.08	55.2	48	0.15	55.4	"	4.4	180	0.7		0.27	611.50	611.23
	" "	MH31	MH32	270x330	2.0	77.1	0.35	0.71	26.48	27.2	1.1	40.7	2.06	56.0	48	0.16	57.2	"	4.5	300	1.1		0.48	611.23	610.75
	PARK	MH 32	LAKE #3			78.6				28.3	0.7	41.8	2.02	57.2	48	0.16	57.2	"	4.5	200	0.7		0.32	609.32	609.00
	PARK	MH7	LAKE #4			86.1				29.67	0.7	45.2	1.92	56.9	48	0.16	57.2	"	4.5	200	0.7		0.32	611.32	611.0

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2.5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS		- 0.20
RESIDENTIAL	SINGLE & DUPLEX	- 0.35
	ROW HOUSING	- 0.50
	APARTMENTS	- 0.60
COMMERCIAL & INDUSTRIAL		- 0.70
DENSELY BUILT, PAVED		- 0.95

PROJECT NAME
SOUTHWOOD LAKES SUBDIVISION
PRELIMINARY DESIGN

STORM SEWER DESIGN CHART

MADE BY RCS SHEET Nº 2 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 JANUARY 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	COLLECTOR ROAD	N. TWEST MH33	MH34	350X400	3.2	75.2		1.7	25.2	26.9	1.9	40	2.08	54.7	54	0.08	55.4	.013	3.5	400	1.9		0.32	609.00	608.68
	LOCAL ROAD	MH35	MH34		2.4	2.4	0.35	0.8		0.8	1.6	20	3.13	2.64	12	0.56	2.65	"	3.4	330	1.6		1.85	613.50	611.65
	" "	MH36	MH37	350X270	2.2	2.2	0.35	0.8		0.8	1.8	20	3.13	2.37	12	0.45	2.38	"	3.0	330	1.8		1.49	611.00	609.51
	" "	MH37	MH34	300X320	2.2	4.4	0.35	0.8	0.8	1.6	1.3	21.8	2.99	4.78	15	0.56	4.81	"	3.9	300	1.3		1.68	609.51	607.83
	COLLECTOR ROAD	MH34	MH38	300X250	1.7	83.7	0.35	0.6	28.7	29.3	1.4	41.9	2.03	59.6	54	0.10	61.9	"	3.8	330	1.4		0.33	607.83	607.50
	LOCAL ROAD	MH 39	MH40		1.6	1.6	0.35	0.6		0.6	1.2	20	3.13	1.73	12	0.30	1.94	"	2.5	180	1.2		0.54	610.54	610.00
	" "	MH40	MH41		2.0	3.6	0.35	0.7	0.6	1.3	1.3	21.2	3.03	3.94	15	0.38	3.97	"	3.2	250	1.3		0.95	610.00	609.05
	" "	MH41	MH38		2.0	5.6	0.35	0.7	1.3	2.0	1.8	22.5	2.94	5.88	18	0.32	5.92	"	3.3	350	1.8		1.12	609.05	607.93
	" "	MH38	MH42		1.9	91.2	0.35	0.7	31.3	32.0	1.5	43.3	1.97	63.2	54	0.11	65.0	"	4.0	350	1.5		0.39	607.50	607.11
	" "	MH42	MH43		2.0	93.2	0.35	0.7	32.0	32.7	0.6	44.8	1.93	63.0	54	0.11	65.0	"	4.0	150	0.6		0.17	606.17	606.00
	" "	MH44	MH43	300X500	3.4	3.4	0.35	1.2		1.2	3.2	20	3.13	3.77	15	0.35	3.81	"	3.1	600	3.2		2.10	614.10	612.00
	EASEMENT	MH43	LAKE #2			96.6			33.9	34.5	0.8	45.4	1.89	65.2	54	0.11	65.0	"	4.0	200	0.8		0.22	603.22	603.00
	" "	MH47	MH46		3.5	3.5	0.35	1.2		1.2	2.2	20	3.13	3.82	15	0.36	3.86	.013	3.1	400	2.2		1.44	610.44	609.00
	" "	MH46	MH48	250X400	2.3	5.8	0.35	0.8	1.2	2.0	2.5	22.2	2.96	5.92	18	0.32	5.92	"	3.3	470	2.5		1.50	609.00	607.50
	COLLECTOR ROAD	MH49	MH48		2.3	2.3	0.35	0.8		0.8	1.2	20	3.13	2.52	12	0.51	2.53	"	3.2	230	1.2		1.18	610.00	608.82
	" "	MH48	MH50	380X360	3.1	11.2	0.35	1.1	2.8	3.9	1.9	24.7	2.80	10.92	24	0.24	11.0	"	3.5	400	1.9		0.96	607.50	606.54
	" "	MH50	MH51	240X380	2.1	13.3	0.35	0.7	3.9	4.6	0.5	26.8	2.67	12.3	24	0.30	12.3	"	3.9	130	0.5		0.51	606.59	606.08
	" "	MH55	MH54	150X240	0.8	0.8	0.35	0.3		0.3	1.3	20	3.13	0.94	12	0.30	1.94	"	2.5	200	1.3		0.60	615.00	614.40
	" "	MH54	MH51		3.7	4.5	0.35	1.3	0.3	1.6	3.0	21.3	3.03	4.84	18	0.22	4.91	"	2.8	500	3.0		1.10	614.40	613.30
	" "	MH51	MH53	300X210	1.4	19.2	0.35	0.5	6.2	6.7	1.2	27.3	2.64	17.7	24	0.62	17.7	"	5.6	400	1.2		2.48	606.08	603.60
	LOCAL ROAD	MH45	MH52	600X350	4.8	4.8	0.35	1.7		1.7	3.3	20	3.13	5.27	15	0.67	5.27	"	4.3	850	3.3		5.70	610.20	604.50
	COLLECTOR ROAD	MH52	MH53	200X400	1.8	6.6	0.35	0.6	1.7	2.3	1.8	23.3	2.89	6.65	18	0.41	6.7	"	3.8	400	1.8		1.64	604.50	602.86
	PARK	MH53	LAKE #2			25.8	0.35			9.0	0.4	28.5	2.58	23.2	30	0.33	23.5	"	4.7	120	0.4		0.40	602.86	602.46
	COLLECTOR ROAD	MH57	MH56		1.5	1.5	0.35	0.5		0.5	2.3	20	3.13	1.68	12	0.30	1.94	.013	2.5	350	2.3				
	LOCAL ROAD	MH56	MH36		—	1.5	0.35	—	0.5	0.5	1.3	22.3	3.13	1.68	12	0.30	1.94	"	2.5	200	1.3				

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2.5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS		- 0.20
RESIDENTIAL	SINGLE & DUPLEX	- 0.35
	ROW HOUSING	- 0.50
	APARTMENTS	- 0.60
COMMERCIAL & INDUSTRIAL		- 0.70
DENSELY BUILT, PAVED		- 0.95

PROJECT NAME
SOUTHWOOD LAKES SUBDIVISION
PRELIMINARY DESIGN

STORM SEWER DESIGN CHART

MADE BY RCS SHEET Nº 3 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 JANUARY 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	LOCAL ROAD	MH60	MH61	330X300	2.3	2.3	0.35	0.8		0.8	1.5	20	3.13	2.49	15	0.23	3.08	.013	2.5	230	1.5		0.53	611.53	611.00
	" "	MH61	MH62	350X400	3.2	5.5	0.35	1.1	0.8	1.9	2.1	21.5	3.01	5.72	18	0.30	5.73	"	3.2	400	2.1		1.20	611.00	609.80
	" "	MH62	MH63	300X260	1.8	7.3	0.35	0.6	1.9	2.5	1.9	23.6	2.86	7.16	21	0.21	7.23	"	3.0	350	1.9		0.74	609.80	609.06
	" "	MH63	MH64	430X300	3.0	10.3	0.35	1.0	2.5	3.5	3.0	25.5	2.75	9.62	24	0.19	9.82	"	3.1	550	3.0		1.05	609.06	608.01
	COLLECTOR ROAD	MH64	MH65	180X650	2.7	13.0	0.35	0.9	3.5	4.4	2.9	28.5	2.58	11.3	27	0.14	11.5	"	2.9	500	2.9		0.70	608.01	607.31
	" "	MH65	MH66	250X200	1.1	14.1	0.35	0.4	4.4	4.8	2.2	31.4	2.43	11.7	27	0.15	11.9	"	3.0	400	2.2		0.60	607.31	606.71
	LOCAL ROAD	MH72	MH73	550X400	5.0	5.0	0.35	1.8		1.8	1.1	20	3.13	5.52	15	0.75	5.57	.013	4.5	300	1.1		2.25	614.00	611.75
	COLLECTOR ROAD	MH73	MH71	—		5.0				1.8	1.1	21.1	3.04	5.47	15	0.75	5.57	"	4.5	300	1.1		2.25	611.75	609.50
	LOCAL ROAD	MH67	MH68	350X330	2.7	2.7	0.35	0.9		0.9	1.9	20	3.13	2.90	15	0.23	3.08	"	2.5	280	1.9		0.64	612.00	611.36
	" "	MH68	MH69	250X300	1.7	4.4	0.35	0.6	0.9	1.5	1.2	21.9	2.98	4.47	15	0.49	4.50	"	3.6	250	1.2		1.23	611.36	610.13
	" "	MH69	MH70	250X300	1.7	6.1	0.35	0.6	1.5	2.1	1.2	23.1	2.90	6.09	18	0.34	6.10	"	3.4	250	1.2		0.85	610.13	609.28
	" "	MH70	MH71	½X480X350	1.9	8.0	0.35	0.7	2.1	2.8	1.6	24.3	2.82	7.90	21	0.26	8.05	"	3.3	320	1.6		0.83	609.28	608.45
	COLLECTOR ROAD	MH71	MH66	—		13.0				4.6	0.6	25.9	2.72	12.5	24	0.31	12.5	"	4.0	150	0.6		0.47	608.45	607.98

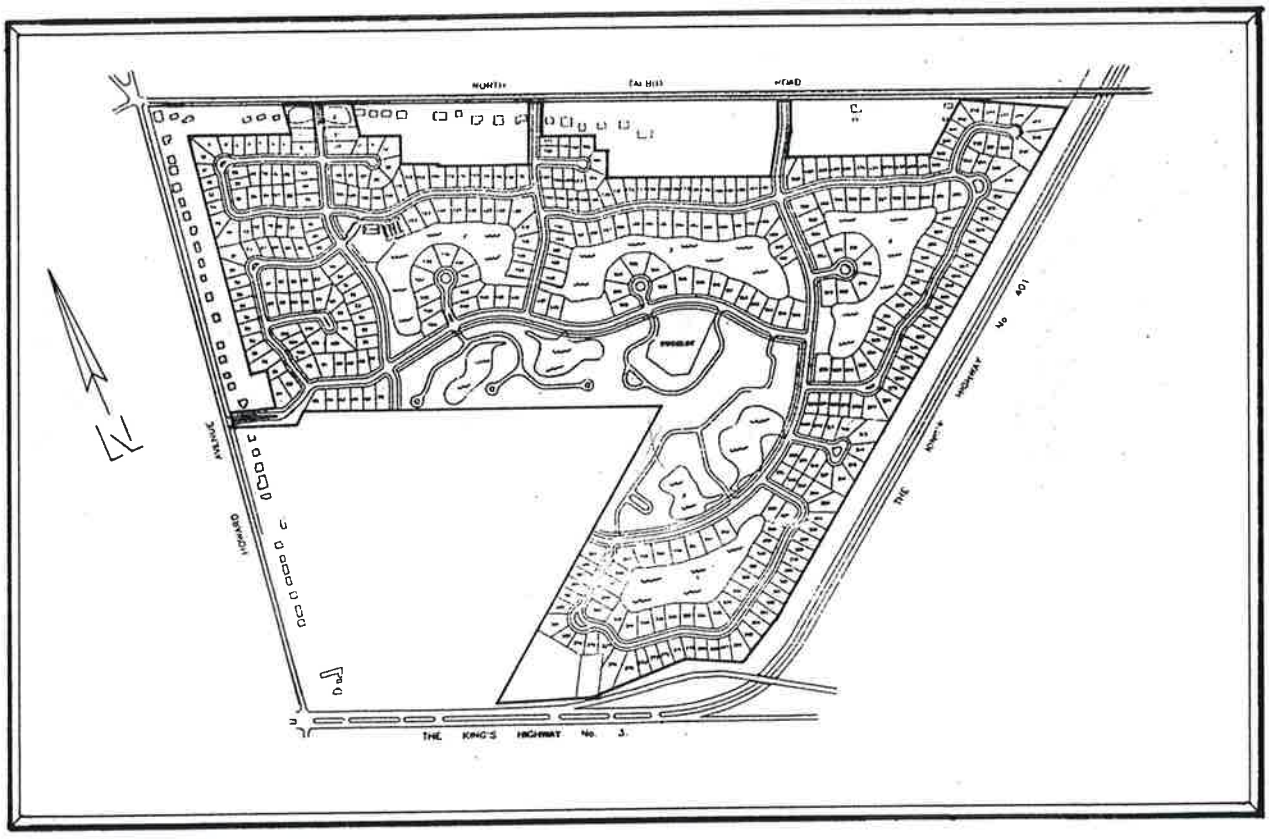
APPENDIX

HGS REPORT

SOUTHWOOD LAKES DEVELOPMENT

SOUTHWOOD LAKES DEVELOPMENT

HYDRAULIC DESIGN REPORT



MADY DEVELOPMENT CORPORATION

HANNA GHOBRIAL & ASSOCIATES
CONSULTING ENGINEERS

HANNA, GHOBRIAL & ASSOCIATES LTD.
CONSULTING ENGINEERS

939 Goyeau St. Windsor, Ontario Canada N9A 1H7
(519) 253-1188 Fax: (519) 253-1242

June 6, 1990

Our File No. 89-1284

Mr. G.T. Harding, B.S.C.E., P.Eng.
Commissioner of Works
P.O. Box 1607
Windsor, Ontario
N9A 6S1

Attention: Ms. L.G. Carkner, P.Eng.

Re: **HYDRAULIC DESIGN REPORT FOR SOUTHWOOD LAKES DEVELOPMENT**

Dear Sirs:

On behalf of the Mady Development Corporation, we are pleased to submit eight copies of our final report for the Southwood Lakes Subdivision.

We understand that copies will be forwarded by you to the Essex Region Conservation Authority and MacLaren Engineers.

The report addresses storage/retention requirements and recommends a stormwater management scheme in association with the development of these lands. The comments received at the review meeting of 20 April 1990 have been considered in this final report.

Our report has been prepared in co-operation with Lakescape International Ltd., particularly with respect to lake level fluctuations and location of storm sewer inlets to the lakes.

Yours truly,
HANNA GHOBRIAL & ASSOCIATES LTD.

Richard C. Spencer, P.Eng.
Principal

cc+encl: Dan McCulloch

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LIST OF FIGURES, TABLES AND APPENDICES

1. INTRODUCTION

In the Spring of 1989, the Mady Development Corporation proceeded with the required planning and engineering for the development of a 240 acre parcel of land located in the South Roseland area of the City of Windsor. The area is bounded by Howard Avenue on the west, North Talbot Road on the north, Highway No. 401 on the east and Highway No. 3 on the south.

The proposal evolved into an estate residential subdivision including four permanent lakes over 24 acres in total area. The project, as shown on Figure 1, is now known as the Southwood Lakes Residential Subdivision.

Because of the significant area of these lakes and the recognized need for a central storm detention/retention facility to serve the South Roseland area, the concept of using these "wet ponds" as stormwater management retention facilities was accepted by the City of Windsor. The recommendations of City Administration for approval of this development therefore included the requirement that a hydraulic design report, addressing not only storage/retention requirements but environmental design considerations, be submitted.

2. BACKGROUND

On 30 June 1989, MacLaren Engineers submitted their report entitled "Stormwater Management Alternatives for the Turkey Creek Watershed" to the Essex Region Conservation Authority. The report describes alternative stormwater management strategies for controlling runoff from proposed development in the watershed. These measures would be required if channel improvements to handle the future 1:100 year flood are not carried out for the major watercourses. Design criteria and methodologies are also discussed and can be applied to this proposed development.

NORTH TALBOT ROAD

AVENUE

HOWARD

LEGEND

THE KING'S HIGHWAY No. 3

WOODLOT

THE KING'S HIGHWAY No. 401

N

SOUTHWOOD LAKES DEVELOPMENT

SCALE: 1" = 500'

LAKE AREAS	
#1	0.71 ac.
#2	5.89 ac.
#3	7.36 ac.
#4	6.02 ac.
#5	5.05 ac.
#6	1.35 ac.
#7	1.82 ac.
#8	2.55 ac.
#9	1.48 ac.
TOTAL	32.23 ac.

GREEN SPACE DEDICATION 10 ac
(INCLUDES LINEAR PARK SYSTEM & WOODLOT AREA)

7,432' of LINEAR PATHS (1.4 mi.)

2932 X 4

6 JUNE 1989
REV. 15 AUGUST 1989

FPB\2360-00

FIGURE 1

In negotiations with the City of Windsor and discussions with the Authority, it was decided that the lakes should provide sufficient storage for the lands north of North Talbot Road up to Highway 401 from Howard Avenue to east of the Sixth Concession Road at Highway 401. This area comprises 167 acres and generally falls southerly and westerly.

Since the topography is flat in this area, flood routing of the 1:100 year storm runoff from the lands north of North Talbot Road after development to the lakes will not be practical. Storage can be effected by making use of the available volume created in the low points along the roadways, i.e. adjacent to the catchbasins.

Therefore, the minor drainage system should be able to accommodate the 1:5 year storm and direct the runoff to the lakes via gravity. The lake levels should be established low enough to ensure that the hydraulic gradient is not higher than existing ground for the minor storm event.

3. METHODOLOGY/CRITERIA

The U.S. Army Corps of Engineering package on watershed simulation, HEC 1, was used to model the hydrologic processes of the watershed.

The hydrologic parameters for land use, CN for existing and future conditions, were obtained from Table 1 of the Stormwater Management Alternatives for the Turkey Creek Watershed by MacLaren Engineers (June 1989). Topographical maps were utilized to estimate runoff, travel length and slope for existing conditions. Developed parameters were estimated based on the preliminary storm sewer design (Charts and drawing in Appendix A).

The Soil Conservation Service (SCS) approaches were used to estimate the runoff hydrograph for the design storms given in Table 2 of the MacLaren Report (June 1989) for 5 and 100 year frequencies and 6 hours duration.

4. PRE AND POST DEVELOPMENT CONDITIONS

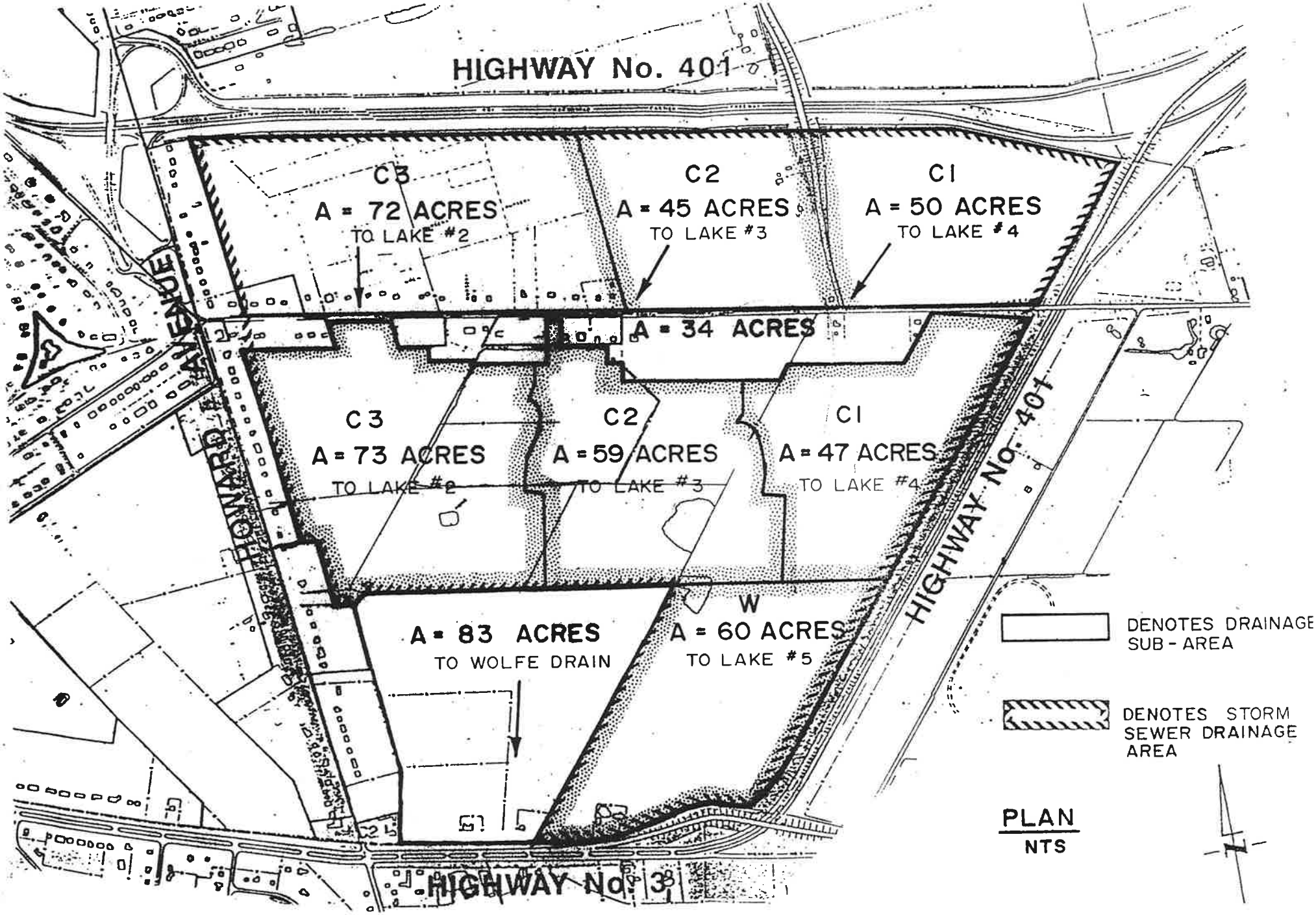
In simulating pre and post development conditions, individual sub-areas were considered based on existing topographical conditions.

As shown on Figure 2, the lands considered to be served by the lakes are tributary to the Wolfe and Cahill Drains. Of the total 524 acres of land bounded by Howard Avenue, Highway No. 3 and Highway No. 401, 381 acres drain to the Cahill Drain. Only 60 acres of the Southwood Lakes Subdivision lands are tributary to the Wolfe Drain.

For the 5 year developed condition, it is assumed that the 83 acre parcel of land in the southwest corner of this area will not outlet to Lake #4 because of the fall of the land but will drain directly to the Wolfe Drain independent of the lake system. As noted on Table 1, the 5 and 100 year pre-development flows from these two parcels of land (143 acres total) are 13 cfs and 52 cfs respectively. Considering that the outflow from Lake #4 for the 60 acres of the Southwood Lakes Subdivision lands is restricted to 1 cfs via pumping, the post-development flows for the 83 acre parcel should be restricted to 12 cfs and 51 cfs for the 5 and 100 year conditions respectively.

The immediate areas surrounding the individual lakes are assumed to drain overland to their respective lake for the 100 year developed condition. As shown on Table 2, the streets provide storage capacity up to 15.17 acre-feet, which is more than sufficient to handle the excess from the 1:100 year storm peak value. In the event of no outflow from the lakes into the receiving streams (i.e. power failure or mechanical malfunction of the pumps, etc.), it is determined that for every inch of runoff on the drainage area, the rise in the level of the lakes will be 8.26 inches or, if street storage is considered, 5.09 inches.

Therefore, for the full duration of the 100 year storm, the total rise in the lakes will not exceed 31 inches (no street storage considered and 100 per cent of the 1:100 year rainfall entering the lakes). This level will provide an average freeboard of 4 feet to the finished grade of lands abutting the proposed lakes.



STORM SEWER DRAINAGE AREA

FIGURE 2

TABLE 1

SUBDIV	DESIGN AREA	EX. 5 YRS (CFS)	COND. 100 YRS (CFS)	MAX.ELEV (FT)	WEIR ELEV (FT)	WLENGTH (FT)	DEV. 5 YRS (CFS)	COND. ELEV (FT)	OVERF	DEV. 100 YRS (CFS)	COND. ELEV (FT)	OVERF
EXISTING CONDITIONS												
W - S	0.094 ~~60.16~~	4	19									
C1 - S	0.09 57.6	4	17									
C2 - S	0.06 38.4	7	28									
C3 - S	0.07 44.8	13	55									
W - T	0.25 ~~160~~	13	52									
C1 - T	0.168 ~~107~~	6	28									
C2 - T	0.13 ~~83~~	12	52									
C3 - T	0.179 ~~115~~	21	90									
DEVELOPED CONDITIONS												
W - S	0.094			610	609	0.33				23	610.04	0.04
C1 - S	0.09			618	617	0.33				13	618.03	0.03
C2 - S	0.06			616	615	0.33				2	616.01	0.01
C3 - S	0.07			611.5	610.5	0.33				4	611.51	0.01
W - T	0.25			610	609	0.33	15	610.03	0.03			
C1 - T	0.168			618	617	0.33	1	617.75	0			
C2 - T	0.13			616	615	0.33	0.5	615.54	0			
C3 - T	0.179			611.5	610.5	0.33	1	611.33	0			
W - S	0.094			610	608.25	0.12				1	609.92	0
C1 - S	0.09			618	616.5	0.12				0.7	617.87	0
C2 - S	0.06			616	615	0.12				0.3	615.78	0
C3 - S	0.07			611.5	610.25	0.12				0.5	611.34	0
W - T	0.25			610	608.25	0.12	1	609.66	0			
C1 - T	0.168			618	616.5	0.12	0.3	617.32	0			
C2 - T	0.13			616	615	0.12	0.2	615.52	0			
C3 - T	0.179			611.5	610.25	0.12	0.3	611.12	0			
NO FLOW LEAVING THE DEVELOPMENT AT CAHILL OR WOLFE DRAINS												
W - S	0.094			610	608.25	0.12				0	609.99	0
C1 - S	0.09			618	616.5	0.12				1	617.87	0
C2 - S	0.06			616	615	0.12				0.3	615.78	0
C3 - S	0.07			611.5	610.25	0				1	611.38	0
W - T	0.25			610	608.25	0.12	0	609.71	0			
C1 - T	0.168			618	616.5	0.12	0.3	617.32	0			
C2 - T	0.13			616	615	0.12	0.2	615.52	0			
C3 - T	0.179			611.5	610.25	0	0	611.15	0			
THE SYSTEM IS LIMITED BY THE 5 YR. DESIGN STORM PLUS OVERLAND FROM IMMEDIATE AREA SURROUNDING EACH LAKE (- 1/3 OF TOTAL AREA)												
W - S	0.04			610	608.25	0.12				0.3	609	0
C1 - S	0.06			618	616.5	0.12				0.4	617.44	0
C2 - S	0.04			616	615	0.12				0.2	615.53	0
C3 - S	0.04			611.5	610.25	0.12				0.2	610.9	0

TABLE 2

STREET STORAGE SUMMARY

Average street storage capacity = 28 square feet/foot

	AREA C3	AREA C2	AREA C1	AREA W
STREET LENGTH (feet)	8833	5490	5197	4073
STORAGE (acre-feet)	5.68	3.53	3.34	2.62
LAKE STORAGE (acre-feet)	5.89	7.36	6.02	5.05
TOTAL STORAGE (acre-feet)	11.57	10.89	9.36	7.67

Total available street storage = 15.17 acre-feet
Total available lake storage = 24.32 acre-feet

Total area available for storage = 39.49 acres
Total developable area = 201.0 acres

Orifice detention plates will be installed in the street catchbasins to effect this storage requirement. It is also suggested by the environmental design consultant, Lakescape International Ltd., that the catchbasins have deeper sumps in order to provide greater sedimentation of silts in the catchbasins and reduce inflow thereof into the lakes.

The lake levels are established to accommodate gravity flow from the lands north of North Talbot Road for the 5 year developed condition. Since all outlets from the sewer system into the lakes will be submerged, the sewers are sized in concert with the maximum lake level setting to provide a hydraulic gradient which will not exceed original ground elevations throughout the sewer system. During the condition of street storage, the hydraulic gradient for the sewer system will not increase beyond that for the 5 year condition since the increase in hydraulic head (6 inches at the catchbasins) will be negated by the rise in the outlet lake level as shown on Table 1.

Outflow from lake to lake is accomplished through the use of weirs, limiting the maximum lake level rise to 12 inches in every lake for the 1:100 year event. Lake levels are set in relation to the natural fall of the land (0.20%) from east to west and discharge from one to another occurs by gravity.

Because of the shallow depth of the Cahill Drain system adjacent to Lake #2, it will be necessary to pump the outflow from this lowest lake to the ditch on the east side of Howard Avenue, which drains to the Cahill Drain to the north thereof. The pumping rate has been reduced to a rate significantly less than pre-development conditions, thereby effecting a cost savings for the pumping station, taking advantage of the significant available storage and reducing runoff to the receiving watercourses.

The Hydrological Summary of Watershed Parameters for existing and developed conditions is described in Appendix B.

5. STORMWATER MANAGEMENT SCHEME

As noted, the preliminary storm sewer design charts and sewer layout drawing for the Subdivision is provided in Appendix A.

In dimensioning the lake weirs, minimum openings were chosen for economy and to keep the lake level fluctuations within the limits recommended by the environmental design consultant, Lakescape International Ltd.

Figure 3 and Table 1 describe the lake configurations and the HEC 1 results respectively. As noted in Table 1, the maximum outflow from the lakes for either the 5 year or 100 year storm event is 1.0 cfs, as little as 2.5% of the 100 year undeveloped flow. From lake to lake this can be accomplished with small diameter piping. At the outlets from Lake #2 and Lake #5 into the Cahill and Wolfe Drains respectively, a small three phase submersible pumping station can easily handle the outflow.

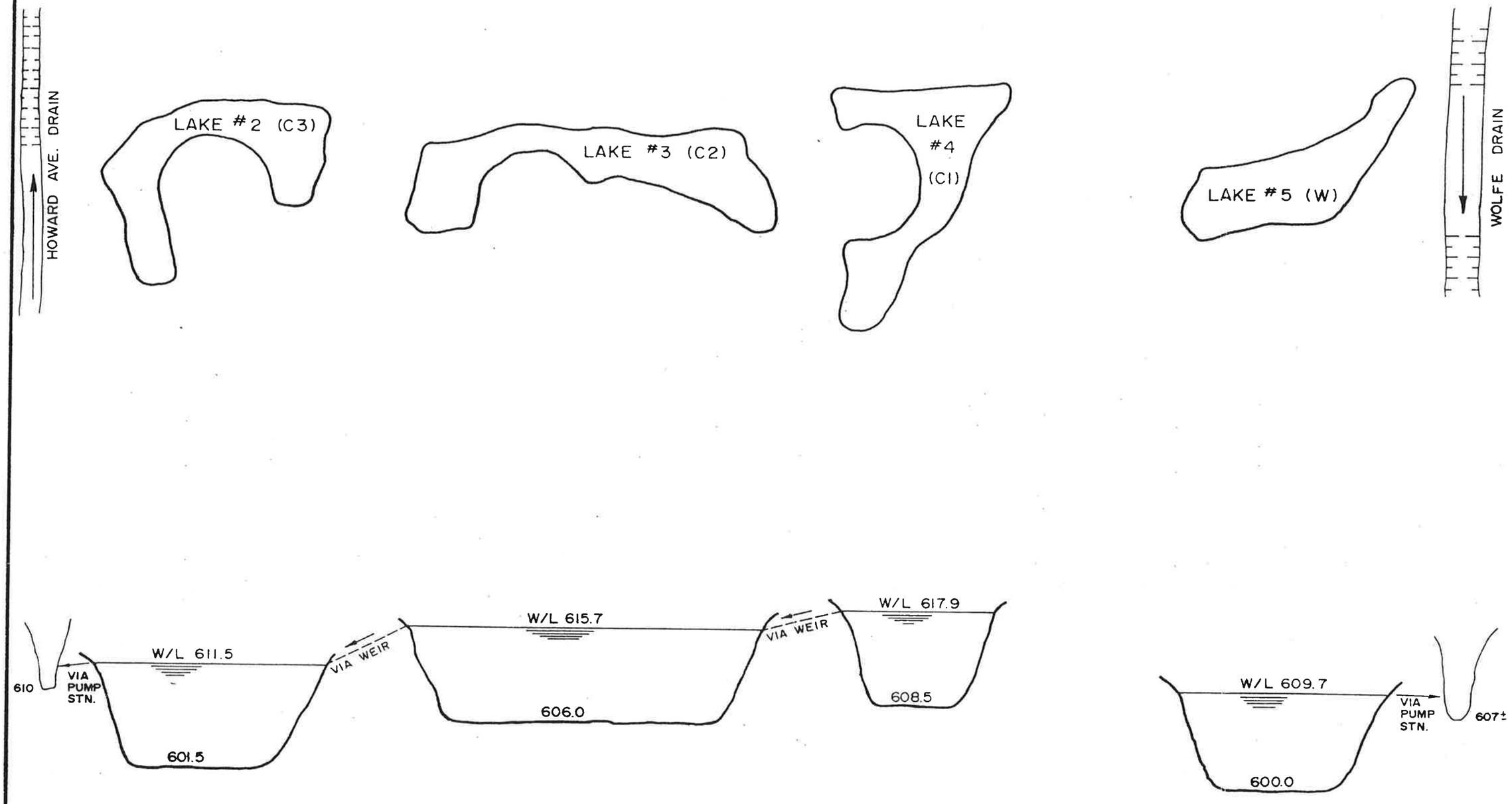
The use of a pump at the outlets will permit draining of the lakes for maintenance purposes. The upstream interconnecting lakes can be drained one at a time to the lower lakes by temporary pumping.

6. PROJECT PHASING

Figure 4 describes the phasing plan of the Mady Development Corporation for the Southwood Lakes Residential Subdivision.

As shown on Figure 2, the development of the sub-drainage areas north of North Talbot Road will be dependent on the phasing of Lakes 2,3 and 4 which are included in Phases 1,3 and 4 of the Subdivision. A ten year development plan for the subdivision is envisaged by Mady.

As can also be seen on Figure 4, the phases involving the construction of a lake must precede the development of the other phases within the drainage area for that particular lake as described on Figure 2.



SOUTHWOOD LAKES RESIDENTIAL SUBDIVISION
HYDRAULIC CONFIGURATION OF LAKES

FIGURE 3

NORTH TALBOT ROAD

HOWARD AVENUE

THE KING'S HIGHWAY No. 3

THE KING'S HIGHWAY No. 401

PHASE 1

PHASE 1A

PHASE 2

PHASE 3

PHASE 3A

PHASE 3B

PHASE 4

PHASE 5

PHASE 6

PHASE 6A

PHASE 7

WOODLOT

N

PHASING PLAN

FIGURE 4

SOUTHWOOD LAKES DEVELOPMENT

GREEN SPACE DEDICATION 10 ac.
(INCLUDES LINEAR PARK SYSTEM & WOODLOT AREA
7,432' of LINEAR PATHS (1.4 mi.)

6 JUNE 1989
REV. 8 JANUARY, 1990

FPB\2360-00

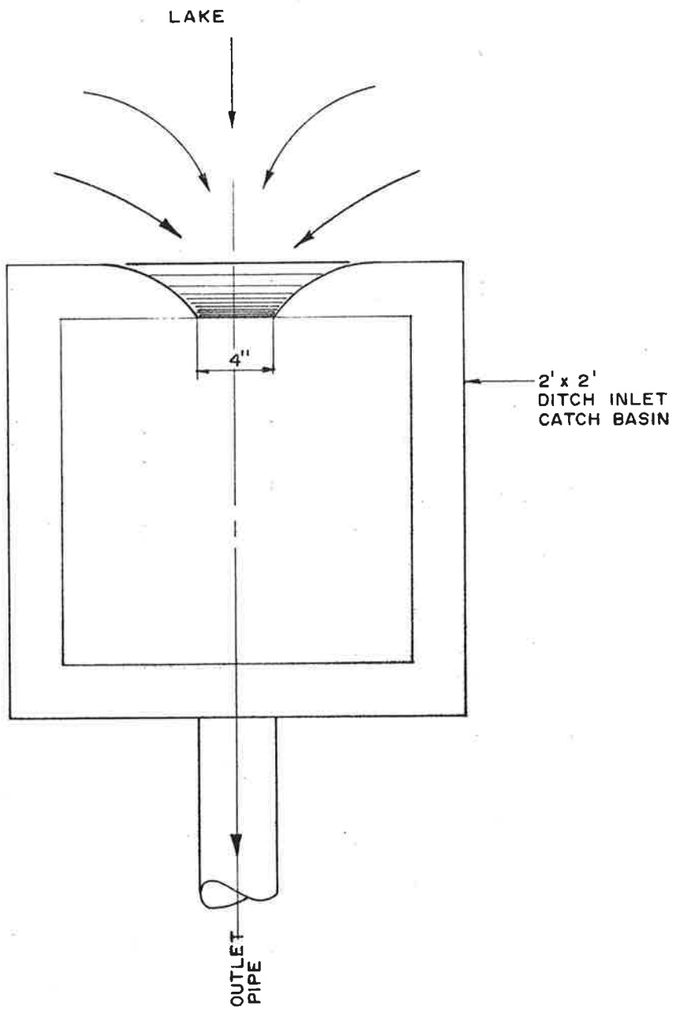
7. RECOMMENDATIONS

As described in Table 1, all weirs are proposed to be 4 inches wide, effective width. Figure 5 shows views of the suggested weir concept. Each weir should include a bar screen for cleaning purposes. A standard 2'x2' catchbasin with an adequately sized outlet pipe (12 inch diameter at 0.36%) to discharge outflow from lake to lake is recommended. Proper edge rounding is also denoted for the weir in Figure 5.

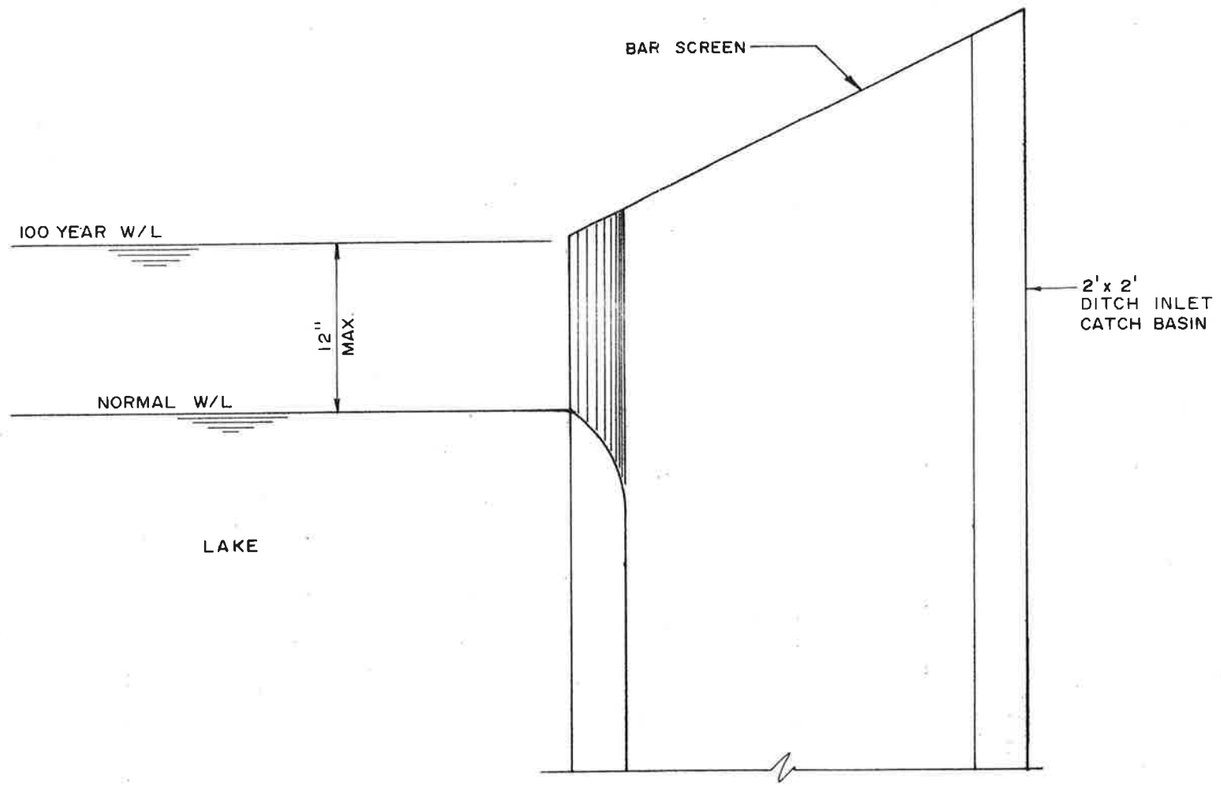
Preliminary sizing of the pumping stations at the outlets for Lake #2 and Lake #5 suggests that a three phase Flygt C3085 pump or equal is sufficient for discharging the 1.0 cfs. outflow. A gravity overflow in the case of power failure or lake levels higher than anticipated is not recommended because of high water levels in the receiving watercourses i.e. the Cahill and Wolfe Drains.

Proper grading of the subdivision along with the contours of the lakes is essential to ensure that adequate street storage is provided and that the lakes function as proposed. Deeper sumps for sedimentation control and orifice plate installation will be required features of the roadway catchbasins. Side slopes of the lakes will be determined considering the environmental characteristics of the lake.

Cost sharing for the construction of the trunk sewers to serve the lands north of North Talbot Road must also be determined at the final design stage of this project.



PLAN VIEW



SIDE VIEW

FIGURE 5

APPENDIX A

NORTH TALBOT ROAD

HOWARD AVENUE

THE KING'S HIGHWAY No. 401

THE KING'S HIGHWAY No. 3

C3
A = 73 ACRES

C2
A = 59 ACRES

C1
A = 47 ACRES

W
A = 60 ACRES

LAKE AREA = 5.89 AC.

LAKE AREA = 7.36 AC.

LAKE AREA = 6.02 AC.

LAKE AREA = 5.05 AC.

WOODLOT

PUMPING STATION

PUMPING STATION

LAKE SUB-DRAINAGE AREA WITHIN SUBDIVISION

STORM SEWER SYSTEM 52 — 53

N

STORM SEWER SYSTEM LAYOUT FOR SOUTHWOOD LAKES DEVELOPMENT

SCALE: 1" = 200'

MARCH 1990

STORM SEWER DESIGN CHART

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2.5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS	- 0.20
RESIDENTIAL SINGLE & DUPLEX	- 0.35
ROW HOUSING	- 0.50
APARTMENTS	- 0.60
COMMERCIAL & INDUSTRIAL	- 0.70
DENSELY BUILT, PAVED	- 0.95

PROJECT NAME
SOUTHWOOD LAKES SUBDIVISION
PRELIMINARY DESIGN

MADE BY RCS SHEET Nº 1 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 JANUARY 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	COLLECTOR ROAD	MH 1	MH2		18.4	68.4	0.35	6.44	17.5	23.94	2.6	40	2.08	49.8	48	0.13	51.6	.013	4.1	650	2.6		0.85	615.0	614.15
	LOCAL ROAD	MH3	MH4	300 x 300	2.1	2.1	0.35	0.72	—	0.72	1.7	20	3.13	2.26	12	0.42	2.3	"	2.9	300	1.7		1.26	619.0	617.74
	" "	MH4	MH5	350 x 300	2.4	4.5	0.35	0.84	0.72	1.56	1.5	21.7	3.00	4.68	15	0.53	4.7	"	3.8	350	1.5		1.86	617.74	615.88
	" "	MH5	MH2	250 x 300	1.7	6.2	0.35	0.60	1.56	2.16	1.2	23.2	2.89	6.25	18	0.36	6.3	"	3.5	250	1.2		0.90	615.88	614.98
	COLLECTOR ROAD	MH2	MH6	250 x 250	1.4	76.0	0.35	0.49	26.11	26.6	1.6	42.6	2.01	53.5	48	0.14	53.5	"	4.2	400	1.6		0.56	614.15	613.59
	" "	MH6	MH7	200 x 250	1.1	77.1	0.35	0.40	26.6	27.0	1.0	44.2	1.97	53.3	48	0.14	53.5	"	4.2	250	1.0		0.35	613.59	613.24
	PARK	MH7	LAKE #4			77.1				27.0		45.2	1.97	53.3	48	0.14	53.5	"	4.2	200	0.7		0.28	610.28	610.00
	COLLECTOR ROAD	MH8	MH9	500 x 200	2.3	2.3	0.35	0.80	—	0.8	1.4	20	3.13	2.51	12	0.50	2.51	.013	3.2	270	1.4		1.35	618.50	617.15
	" "	MH9	MH6	200 x 230	1.1		0.35	0.37																	
				450 x 300	3.1	6.5	0.20	0.62	0.80	1.79	0.9	21.4	3.02	5.40	15	0.72	5.46	"	4.4	230	0.9		1.65	617.15	615.50
	" "	MH10	MH11	200 x 350	1.6	8.1	0.35	0.56	1.79	2.35	1.5	22.3	2.96	6.94	18	0.44	6.94	"	3.9	350	1.5		1.54	615.50	613.96
	" "	MH11	MH12	200 x 200	0.9	9.0	0.35	0.32	2.35	2.67	0.8	23.8	2.85	7.62	18	0.53	7.62	"	4.3	200	0.8		1.06	613.96	612.90
	" "	MH12	MH7	—	—	9.0				2.67	0.8	24.6	2.80	7.48	18	0.53	7.62	"	4.3	200	0.8		1.06	612.90	611.84
	PARK	MH7	LAKE #3																						
	LOCAL ROAD	MH20	MH21	300 x 400	2.8	2.8	0.35	0.96		0.96	2.3	20	3.13	3.01	15	0.23	3.08	.013	2.5	350	2.3		0.80	617.00	616.20
	" "	MH21	MH22	450 x 300	3.1	5.9	0.35	1.08	0.96	2.04	1.9	22.3	2.96	6.03	18	0.34	6.10	"	3.4	400	1.9		1.36	616.20	614.84
	" "	MH22	MH19	150 x 300	1.0	6.9	0.35	0.36	2.04	2.40	1.1	24.2	2.83	6.79	18	0.43	6.86	"	3.9	250	1.1		1.08	614.84	613.76
	" "	MH14	MH15	½ x 600 x (300+400)	5.0	5.0	0.35	1.75		1.75	2.1	20	3.13	5.47	18	0.28	5.53	"	3.1	400	2.1		1.12	620.00	618.88
	" "	MH15	MH16	—		5.0				1.75	0.8	22.1	2.97	5.27	18	0.28	5.53	"	3.1	150	0.8		0.42	618.88	618.46
	" "	MH16	MH17	600 x 270	3.7	8.7	0.35	1.30	1.75	3.05	0.6	22.9	2.91	8.88	18	0.72	8.88	"	5.0	180	0.6		1.30	618.46	617.16
	" "	MH17	MH18	350 x 350	2.8	11.5	0.35	0.98	3.05	4.03	1.4	23.5	2.87	11.6	21	0.55	11.7	"	4.8	400	1.4		2.20	617.16	614.96
	" "	MH18	MH19	400 x 300	2.8	14.3	0.35	0.96	4.03	4.99	1.5	24.9	2.78	13.9	24	0.38	13.9	"	4.4	400	1.5		1.52	614.96	613.44
	EASEMENT	MH19	LAKE #2	—		21.2				7.39	0.8	26.4	2.69	19.9	30	0.24	20.0	"	4.0	200	0.8		0.48	613.44	612.96
	LOCAL ROAD	N. TALBOT MH 23	MH24		15.6	60.6	0.35	5.5	15.8	21.3	1.8	36.7	2.20	46.9	48	0.11	47.4	.013	3.7	400	1.8		0.44	613.00	612.56
	" " - CULDESAC	MH25	MH24	350 x 450	3.6	3.6	0.35	1.3		1.3	1.0	20	3.13	3.95	12	1.25	3.97	"	5.0	300	1.0		3.75	616.50	612.75
	" "	MH24	MH26	150 x 300	1.0	65.2	0.35	0.4	22.6	23.0	1.5	38.5	2.15	49.5	48	0.12	49.6	"	3.9	350	1.5		0.42	612.56	612.14
	" "	MH27	MH28	300 x 320	2.2	2.2	0.35	0.77		0.77	1.4	20	3.13	2.41	12	0.46	2.41	"	3.0	250	1.4		1.15	618.50	617.35
	" "	MH28	MH29	400 x 320	2.9	5.1	0.35	1.03	0.77	1.80	2.2	21.4	3.02	5.43	18	0.28	5.53	"	3.1	400	2.2		1.12	617.35	616.23
	" "	MH29	MH30	350 x 300	2.4	7.5	0.35	0.84	1.80	2.64	1.4	23.6	2.87	7.57	18	0.53	7.62	"	4.3	350	1.4		1.86	616.23	614.37
	" "	MH30	MH26	350 x 300	2.4	9.9	0.35	0.84	2.64	3.48	1.0	25.0	2.78	9.67	18	0.86	9.70	"	5.4	320	1.0		2.75	614.37	611.62
	" "	MH26	MH31	—		75.1			26.48	26.5	0.7	40.0	2.08	55.2	48	0.15	55.4	"	4.4	180	0.7		0.27	611.50	611.23
	" "	MH31	MH32	270 x 330	2.0	77.1	0.35	0.71	26.48	27.2	1.1	40.7	2.06	56.0	48	0.16	57.2	"	4.5	300	1.1		0.48	611.23	610.75
	PARK	MH32	LAKE #3			78.6				27.7	0.7	41.8	2.02	56.0	48	0.16	57.2	"	4.5	200	0.7		0.32	609.32	609.00
	PARK	MH7	LAKE #4			86.1				29.67	0.7	45.2	1.92	56.9	48	0.16	57.2	"	4.5	200	0.7		0.32	611.32	611.0

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2.5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS	- 0.20
RESIDENTIAL SINGLE & DUPLEX	- 0.35
ROW HOUSING	- 0.50
APARTMENTS	- 0.60
COMMERCIAL & INDUSTRIAL	- 0.70
DENSELY BUILT, PAVED	- 0.95

PROJECT NAME
Southwood Lakes Subdivision
Preliminary Design

STORM SEWER DESIGN CHART

MADE BY RCS SHEET Nº 2 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 January 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	Collector Road	N. Talbot MH33	MH34	350x400	3.2	75.2	0.35	1.1	25.2	26.3	1.9	40	2.08	54.7	54	0.08	55.4	.013	3.5	400	1.9		0.32	609.00	608.68
	Local Road	MH35	MH34		2.4	2.4	0.35	0.8		0.8	1.6	20	3.13	2.64	12	0.56	2.65	"	3.4	330	1.6		1.85	613.50	611.65
	" "	MH36	MH37	350x270	2.2	2.2	0.35	0.8		0.8	1.8	20	3.13	2.37	12	0.45	2.38	"	3.0	330	1.8		1.49	611.00	609.51
	" "	MH37	MH34	300x320	2.2	4.4	0.35	0.8	0.8	1.6	1.3	21.8	2.99	4.78	15	0.56	4.81	"	3.9	300	1.3		1.68	609.51	607.83
	Collector Road	MH34	MH38	300x250	1.7	83.7	0.35	0.6	28.7	29.3	1.4	41.9	2.03	59.6	54	0.10	61.9	"	3.8	330	1.4		0.33	607.83	607.50
	Local Road	MH39	MH40		1.6	1.6	0.35	0.6		0.6	1.2	20	3.13	1.73	12	0.30	1.94	"	2.5	180	1.2		0.54	610.54	610.00
	" "	MH40	MH41		2.0	3.6	0.35	0.7	0.6	1.3	1.3	21.2	3.03	3.94	15	0.38	3.97	"	3.2	250	1.3		0.95	610.00	609.05
	" "	MH41	MH38		2.0	5.6	0.35	0.7	1.3	2.0	1.8	22.5	2.94	5.88	18	0.32	5.92	"	3.3	350	1.8		1.12	609.05	607.93
	" "	MH38	MH42		1.9	91.2	0.35	0.7	31.3	32.0	1.5	43.3	1.97	63.2	54	0.11	65.0	"	4.0	350	1.5		0.39	607.50	607.11
	" "	MH42	MH43		2.0	93.2	0.35	0.7	32.0	32.7	0.6	44.8	1.93	63.0	54	0.11	65.0	"	4.0	150	0.6		0.17	606.17	606.00
	" "	MH44	MH43	300x500	3.4	3.4	0.35	1.2		1.2	3.2	20	3.13	3.77	15	0.35	3.81	"	3.1	600	3.2		2.10	614.10	612.00
	Easement	MH43	Lake #2			96.6			33.9	33.9	0.8	46.4	1.89	63.9	54	0.11	65.0	"	4.0	200	0.8		0.22	603.22	603.00
	" "	MH47	MH46		3.5	3.5	0.35	1.2		1.2	2.2	20	3.13	3.82	15	0.36	3.86	.013	3.1	400	2.2		1.44	610.44	609.00
	" "	MH46	MH48	250x400	2.3	5.8	0.35	0.8	1.2	2.0	2.5	22.2	2.96	5.92	18	0.32	5.92	"	3.3	470	2.5		1.50	609.00	607.50
	Collector Road	MH49	MH48		2.3	2.3	0.35	0.8		0.8	1.2	20	3.13	2.52	12	0.51	2.53	"	3.2	230	1.2		1.18	610.00	608.82
	" "	MH48	MH50	380x360	3.1	11.2	0.35	1.1	2.8	3.9	1.9	24.7	2.80	10.92	24	0.24	11.0	"	3.5	400	1.9		0.96	607.50	606.54
	" "	MH50	MH51	240x380	2.1	13.3	0.35	0.7	3.9	4.6	0.5	26.8	2.67	12.3	24	0.30	12.3	"	3.9	130	0.5		0.51	606.59	606.08
	" "	MH55	MH54	150x240	0.8	0.8	0.35	0.3		0.3	1.3	20	3.13	0.94	12	0.30	1.94	"	2.5	200	1.3		0.60	615.00	614.40
	" "	MH54	MH51		3.7	4.5	0.35	1.3	0.3	1.6	3.0	21.3	3.03	4.84	18	0.22	4.91	"	2.8	500	3.0		1.10	614.40	613.30
	" "	MH51	MH53	300x210	1.4	19.2	0.35	0.5	6.2	6.7	1.2	27.3	2.64	17.7	24	0.62	17.7	"	5.6	400	1.2		2.48	606.08	603.60
	Local Road	MH45	MH52	600x350	4.8	4.8	0.35	1.7		1.7	3.3	20	3.13	5.27	15	0.67	5.27	"	4.3	850	3.3		5.70	610.20	604.50
	Collector Road	MH52	MH53	200x400	1.8	6.6	0.35	0.6	1.7	2.3	1.8	23.3	2.89	6.65	18	0.41	6.7	"	3.8	400	1.8		1.64	604.50	602.86
	Park	MH53	Lake #2			25.8	0.35			9.0	0.4	28.5	2.58	23.2	30	0.33	23.5	"	4.7	120	0.4		0.40	602.86	602.46
	Collector Road	MH51	MH54		1.5	1.5	0.35	0.5		0.5	2.3	20	3.13	1.68	12	0.30	1.94	.013	2.5	350	2.3				
	Local Road	MH54	MH53		—	1.5	0.35	—	0.5	0.5	1.3	22.3	3.13	1.68	12	0.30	1.94	"	2.5	200	1.3				

DESIGN CRITERIA

STORM CURVE 5 YRS
ENTRY TIME 20 MINS.
VELOCITY RANGE - 2·5 to 10 F.P.S
MIN. PIPE SIZE - 12" DIA.

PARKS & PLAYGROUNDS	- 0·20
RESIDENTIAL SINGLE & DUPLEX	- 0·35
ROW HOUSING	- 0·50
APARTMENTS	- 0·60
COMMERCIAL & INDUSTRIAL	- 0·70
DENSELY BUILT, PAVED	- 0·95

PROJECT NAME
SOUTHWOOD LAKES SUBDIVISION
PRELIMINARY DESIGN

STORM SEWER DESIGN CHART

MADE BY RCS SHEET Nº 3 OF 3
CHECKED BY _____ PROJECT Nº 89-1284
DATE 3 JANUARY 1990

SEWER LOCATION				AREA			A x C				RAINFALL INTENSITY			Q	SEWER DESIGN							PROFILE			
DWG. NO.	STREET	FROM	TO	LAND USE & REMARKS	AREA "A" (ACRES)	TOTAL AREA (ACRES)	RUNOFF COEF. "C"	INCR. A x C	TOTAL LAT. A x C	TOTAL SEW. A x C	FLOW TIME SECT.	FLOW TIME ACCUM.	INTENSITY IN./HR.	REQUIRED C.F.S.	PIPE SIZE	SLOPE %	ACT. CAP. C.F.S.	n	VELOC. F.P.S.	LENGTH (FT.)	FLOW TIME (MIN.)	LOSSES IN MH.	FALL IN SEWER	INVERT U.S.	ELEV. D.S.
	LOCAL ROAD	MH60	MH61	330X300	2.3	2.3	0.35	0.8		0.8	1.5	20	3.13	2.49	15	0.23	3.08	.013	2.5	230	1.5		0.53	611.53	611.00
	" "	MH61	MH62	350X400	3.2	5.5	0.35	1.1	0.8	1.9	2.1	21.5	3.01	5.72	18	0.30	5.73	"	3.2	400	2.1		1.20	611.00	609.80
	" "	MH62	MH63	300X260	1.8	7.3	0.35	0.6	1.9	2.5	1.9	23.6	2.86	7.16	21	0.21	7.23	"	3.0	350	1.9		0.74	609.80	609.06
	" "	MH63	MH64	430X300	3.0	10.3	0.35	1.0	2.5	3.5	3.0	25.5	2.75	9.62	24	0.19	9.82	"	3.1	550	3.0		1.05	609.06	608.01
	COLLECTOR ROAD	MH64	MH65	180X650	2.7	13.0	0.35	0.9	3.5	4.4	2.9	28.5	2.58	11.3	27	0.14	11.5	"	2.9	500	2.9		0.70	608.01	607.31
	" "	MH65	MH66	250X200	1.1	14.1	0.35	0.4	4.4	4.8	2.2	31.4	2.43	11.7	27	0.15	11.9	"	3.0	400	2.2		0.60	607.31	606.71
	LOCAL ROAD	MH72	MH73	550X400	5.0	5.0	0.35	1.8		1.8	1.1	20	3.13	5.52	15	0.75	5.57	.013	4.5	300	1.1		2.25	614.00	611.75
	COLLECTOR ROAD	MH73	MH71	—		5.0				1.8	1.1	21.1	3.04	5.47	15	0.75	5.57	"	4.5	300	1.1		2.25	611.75	609.50
	LOCAL ROAD	MH67	MH68	350X330	2.7	2.7	0.35	0.9		0.9	1.9	20	3.13	2.90	15	0.23	3.08	"	2.5	280	1.9		0.64	612.00	611.36
	" "	MH68	MH69	250X300	1.7	4.4	0.35	0.6	0.9	1.5	1.2	21.9	2.98	4.47	15	0.49	4.50	"	3.6	250	1.2		1.23	611.36	610.13
	" "	MH69	MH70	250X300	1.7	6.1	0.35	0.6	1.5	2.1	1.2	23.1	2.90	6.09	18	0.34	6.10	"	3.4	250	1.2		0.85	610.13	609.28
	" "	MH70	MH71	½X480X350	1.9	8.0	0.35	0.7	2.1	2.8	1.6	24.3	2.82	7.90	21	0.26	8.05	"	3.3	320	1.6		0.83	609.28	608.45
	COLLECTOR ROAD	MH71	MH66	—		13.0				4.6	0.6	25.9	2.72	12.5	24	0.31	12.5	"	4.0	150	0.6		0.47	608.45	607.98

HYDROLOGICAL SUMMARY OF WATERSHED PARAMETERS
SOUTHWOOD LAKE DEVELOPMENT, WINDSOR, ONTARIO

EXISTING CONDITIONS

SUB CATCHMENT	AREA ACRES	AREA SQ MI	SLOPE FT/MI	SLOPE %	LENGTH MI	*LENGTH FT	CN	S	TL TIME LAG
W1	60	0.09375	12.672	0.24	0.473	2497.44	70	4.285714	1.800152
W2	97.83	0.152859	18.86	0.357196	0.53	2798.4	71.22	4.040999	1.563442
W	157.83	0.246609	16.50759	0.312643	0.53	2798.4	70.75620	4.133035	1.692432
C10	57.3	0.089531	8.8	0.166666	0.4545	2399.76	70.64	4.156285	2.056326
A10	50	0.078125	2.78	0.052651	0.36	1900.8	70	4.285714	3.089318
C1	107.3	0.167656	5.994780	0.113537	0.4545	2399.76	70.34177	4.216304	2.511683
C20	38.1	0.059531	13.2	0.25	0.152	802.56	70.5	4.184397	0.701693
A20	45.0	0.070312	9.183	0.173920	0.348	1837.44	70	4.285714	1.654299
C2	83.1	0.129843	11.02472	0.208801	0.348	1837.44	70.22924	4.239082	1.500474
C30	42.4	0.06625	17.6	0.333333	0.17	897.6	70.38	4.208581	0.666771
A30	.72	0.1125	14.15	0.267992	0.495	2613.6	70	4.285714	1.766643
C3	114.4	0.17875	15.42867	0.292209	0.495	2613.6	70.14083	4.257029	1.685422

DEVELOPED CONDITIONS

SUB CATCHMENT	AREA ACRES	AREA SQ MI	SLOPE FT/MI	SLOPE %	LENGTH MI	LENGTH FT	CN	S	TL TIME LAG
GROSS AREA									
WN	157.83	0.246609	8.836	0.167348	0.275	1452	79	2.658227	1.079688
CN1	107.3	0.167656	14.309	0.271003	0.492	1597.76	79	2.658227	1.351224
CN2	83.1	0.129843	14.807	0.280435	0.466	2460.48	79	2.658227	1.271848
CN3	114.4	0.17875	11.661	0.220852	0.542	2861.76	79	2.658227	1.617303

DESIGN AREAS

WN 0.094 / 0.12 ← MODIFIED AREAS
CN1 0.168 / 0.199 =5YRS AREAS +
CN2 0.13 / 0.168 IMMEDIATE AREAS
CN3 0.179 / 0.21 NEXT TO THE LAKES

MODIFIED TO ACCOUNT FOR ACCELERATED FLOW FROM THE 100 YR STORM AREAS → 1.08 / 0.805 ; 1.35 / 1.09 ; 1.27 / 0.821 ; 1.617 / 1.317 *

TOTAL AREA AS IN EXISITING CONDITIONS / DEVELOPED CONDITION *

APPENDIX B