PRELIMINARY

DRAINAGE REPORT

FOR:

LINCOLN POINT
A SUBDIVISION OF INDIAN WOODS P.U.D.

OWNER: JAGOE HOMES AND CONSTRUCTION CO., INC.

ENGINEER: MORLEY AND ASSOCIATES, INC.

JAMES Q. MORLEY
REGISTERED
No. 12629
STATE OF
INDIANA
LAND SURVEYOR

James Q. Morley

MAY 20, 1991

I N D E X

A P P E N D I X

LINCOLN POINT

The site is located in the Indian Woods Planned Unit Development, east of Shoshoni Lane, north of Beaver Trail and south of Crossfield Drive.

The 62 lot development will be improved to allow storm water runoff to flow into existing pipe systems along the subject property's south and west lines. These pipe systems were constructed by CHAL Corporation in their Indian Woods-Phase II development and connect to the large retention lakes in Indian Woods-Phase I. Therefore, the Lincoln Pointe drainage plan is designed to carry a 25 year return period storm under developed conditions without detention or retention facilities except for the large Indian Woods lake which was designed to accept the runoff from this project.

5-16-91

(1)

Lincoln Point
Drainage Calculations

re: HERPIC Page 9

Assumptions: Average structure = (50)(30) = 1500 ft²
Average drive = (20)(35) = 700 ft²
Return Period = 25 years
$C_{25} = (1.1)\,C_{10}$

Sub-basin #1 A_1 = 0.90 Ac. 39204 ft²

structures (2.75)(1500)	4125 ft² =	0.09 Ac (11%)	@ 0.95	⇒	0.105
drives (5)(700) =	3500 ft²	0.08 Ac (9%)	@ 0.95	⇒	0.089
roads (80)(27) + (202)(24) + (252)(15) + 450 =	11,238 ft² =	0.26 Ac (29%)	@ 0.95	⇒	0.27
lawns (total − average roof)	20341 ft² =	.467 A (51%)	@ 0.135	⇒	0.07
					$C_1 = 0.52$

H = 86 − 82 = 4

L = 335

$S = \frac{4}{335} = .0119$

$N_1 = (.51)(.40) + (.49)(.02) = 0.21$ (A% Type Surface, A% Type Surface)

$t_c = .827\left[\frac{.21(335)}{\sqrt{.0119}}\right]^{.467} = 16.96$ ~~17.0 min~~ OK ~~47.74~~ ?

$t_c = .827\left(\frac{NL}{\sqrt{S}}\right)^{.467}$

$= .827\left(\frac{.21 \times 335}{.0119}\right)^{.467}$

$= 47.74$ min

$i_{25} = 4.4$ in/hr ~~2.25 in/hr~~

$Q_1^{25} = (1.1)(.52)(4.4)(.90) = 2.27$ cfs

Sub-basin #2 A_2 = 1.03 Ac. = 44867 ft²

struc. (3.25)(1500) =	4875 ft²	0.11 Ac (11%)	@ 0.95	⇒	0.10
drives (6)(700) =	4200 ft²	0.10 Ac (9%)	@ 0.95	⇒	0.09
roads (339)(10.5) + (252)(15) + 450 =	10,840 ft² =	0.25 Ac (24%)	@ 0.95	⇒	0.23
lawns	24952 ft²	.57 (56%)	@ 0.135	⇒	0.08
					$C_2 = 0.50$

H = 2.3'

L = 364'

$S = \frac{2.3}{364} = .0064$

$N_2 = (.56)(.40) + (.44)(.02) = 0.23$

$t_c = .827\left[\frac{.23(364)}{\sqrt{.0064}}\right]^{.467} = 21.3$ min ~~69.18~~

69 w/o √

$i_{25} = $ ~~1.05~~ 2.0 in/hr

$Q_2^{25} = 1.1(.50)(\ldots)(1.03) = 2.29$ cfs ⇒ ans

Sub-basin #3 — $A_3 = 1.04$ Ac $= 45302$ ft²

str.	(4)(1500) = 6000 ft²	0.14 Ac (13%)	@ 0.95	⇒	0.125
drive	(8)(700) = 5600 ft²	0.13 Ac (12%)	@ 0.95	⇒	0.12
unit.	(75)(27) + (559)(16) = 10,967 ft²	0.25 Ac (24%)	@ 0.95	⇒	0.23
lawn	32785 ft²	(51%)	@ 0.135	⇒	0.07
					$C_3 = 0.55$

$H = 84.3 - 82 = 2.3$

$N_3 = (.51)(.40) + (.49)(.02) = 0.21$

$L = 339 + 18 = 357$

$S = \frac{2.3}{357} = 0.0064$

$t_c = .827 \left[\frac{.21(357)}{\sqrt{.0064}} \right]^{.467} = 20.2$ min ~~65.7~~

$i_{25} = 4.1$ in/hr

$Q_3^{25} = 1.1(0.55)(4.1)(1.04) = 2.58$ cfs

Sub-basin #4 — $A_4 = 1.19$ Ac. 51836

str.	(5)(1500) = 7500 ft²	0.17 Ac (14%)	@ 0.95	⇒	0.14
drive	0				—
pvmt.	0				—
lawn	44336.4 ft² (86%)		@ 0.135	⇒	0.12
					$C_4 = 0.26$

$N_4 = (.86)(.40) + (.14)(.02) = 0.35$

$H = 87.8 - 84.5 = 3.3$

$L = 322$

$S = \frac{3.3}{322} = 0.0102$

$t_c = .827 \left[\frac{.35(322)}{\sqrt{.0102}} \right]^{.467} = 21.9$ min ~~63.9~~

$i_{25} = 3.9$ in/hr

$Q_4^{25} = 1.1(.26)(3.9)(1.19) = 1.33$ cfs

Sub-basin #5 A_5 = 0.75 Ac. = 32670

str.	(3)(1500) = 4500 ft² =	0.10 Ac (14%)	@ 0.95 ⇒		0.13
drives	(6)(700) = 4200 ft² =	0.10 Ac (13%)	@ 0.95 ⇒		0.12
pavement	(327)(12) + 1350 = 6255 ft² =	0.14 Ac (19%)	@ 0.95 ⇒		0.18
lawns	17317	0.3975 (58%)	@ 0.135 ⇒		0.07
					C_5 = 0.50

N = (.54)(.4) + (.46)(.02) = 0.23

H = 86.5 − 82 = 4.5

L = 350

S = $\frac{4.5}{350}$ = 0.0129

$t_c = .827\left[\frac{.23(350)}{\sqrt{.0129}}\right]^{.467}$ = 17.7 min ~~48.46~~

i_{25} = 4.3 in/hr

Q_5^{25} = 1.1 (.50)(4.3)(.75) = 1.77 cfs

Sub-basin #6 A_6 = 0.70 Ac. = 30,492

str.	(2.5)(1500) = 3750 ft² =	0.09 Ac (12%)	@ 0.95 ⇒		0.12
drives	(5)(700) = 3500 ft² =	0.08 Ac (11%)	@ 0.95 ⇒		0.11
pavement	(327)(15) = 4905 ft² =	0.11 Ac (16%)	@ 0.95 ⇒		0.15
lawns	18337	(61%)	@ 0.135 ⇒		0.08
					C_6 = 0.46

N = (.61)(.4) + (.39)(.02) = 0.25

H = 4.5

L = 350

S = 0.0129

$t_c = .827\left[\frac{.25(350)}{\sqrt{.0129}}\right]^{.467}$ = 18.1 min 50.9

i_{25} = 4.25 in/hr

Q_6^{25} = 1.1 (.46)(4.25)(.70) = 1.51 cfs

Sub-basin # 7 $A_7 = 1.04$ Ac. = 45302 ft^2

str.	(4)(1500) = 6000 ft^2	0.14 Ac (13%)	@	0.95	⇒	0.13
drive	(8)(700) = 5600 ft^2 =	0.13 Ac (12%)	@	0.95	⇒	0.12
parkd.	(80)(27) + (511)(21.5) = 13,722 ft^2	0.32 Ac (30%)	@	0.95	⇒	0.29
lawn	19980	(45%)	@	0.135	⇒	0.06

$C_7 = 0.60$

$N_7 = (.45)(.1) + (.55)(.02) = 0.15$

H = 85.7 - 82 = 3.7

L = 340 + 50 = 390

$S = \frac{3.7}{390} = .0095$

$t_c = .827 \left[\frac{.15(390)}{\sqrt{.0095}}\right]^{.467} = 18.3$ min ~~54.34~~

$i_{25} = 4.25$ in/hr

$Q_7^{25} = 1.1(.60)(4.25)(1.04) = 2.92$ cfs

Sub-basin # 8 $A_8 = 0.83$ Ac. = 36154

str.	(3)(1500) = 4500 ft^2	0.10 Ac (12%)	@	0.95	⇒	0.12
drive	(5)(700) = 3500 ft^2 =	0.08 Ac (10%)	@	0.95	⇒	0.09
parkd.	(450)(15) = 6750 ft^2 =	0.15 Ac (19%)	@	0.95	⇒	0.18
lawn	21404	(57%)	@	0.135	⇒	0.08

$C_8 = 0.47$

$N_8 = (.59)(.10) + (.41)(.02) = 0.24$

H = 88.4 - 85 = 3.4

L = 250

$S = \frac{3.4}{250} = 0.0136$

$t_c = .827 \left[\frac{.24(250)}{\sqrt{.0136}}\right]^{.467} = 15.3$ min ~~29.17~~

$i_{25} = 4.55$ in/hr

$Q_8^{25} = 1.1(.47)(4.55)(.83) = 1.95$ cfs

Sub-basin # 9 — $A_9 = 1.87$ Ac $= 81457$

str.	(7)(1500) = 10,500 ft² =	0.24 Ac. (13%)	@ 0.95	⇒	0.12
drive	(7)(700) = 4900 ft² =	0.11 Ac (6%)	@ 0.95	⇒	0.06
pmt.	(450)(15) + (135)(15) + 375 = 9150 ft² =	0.21 Ac (11%)	@ 0.95	⇒	0.11
lawn	56907	(70%)	@ 0.135	⇒	0.09
					$C_9 = 0.38$

$$N_9 = (.70)(.40) + (.30)(.02) = 0.29$$

$H = 88.1 - 85 = 3.1$

$L = 150 + 190 = 340$

$S = \frac{3.1}{340} = 0.0091$

$$t_c = .827\left[\frac{.29(340)}{\sqrt{.0091}}\right]^{.467} = 21.1 \text{ min}$$

~~63.35~~

$i_{25} = 4.05$ in/hr

$$Q_9^{25} = 1.1(.38)(4.05)(1.87) = 3.16 \text{ cfs}$$

Sub-basin # 10 — $A_{10} = 1.63$ Ac $= 71002.8$

str.	(6.5)(1500) = 9750 ft² =	0.22 Ac. (14%)	@ 0.95	⇒	0.13
drive	0				—
pmt.	0				—
lawn	61253	(86%)	@ 0.135	⇒	0.12
					$C_{10} = 0.25$

$$N_{10} = (.86)(.40) + (.14)(.02) = 0.35$$

$H = 86.7 - 84.6 = 2.1$

$L = 165 + 190 + 205 + 30 = 590$

$S = \frac{2.1}{590} = 0.0036$

$$t_c = .827\left[\frac{.35(590)}{\sqrt{.0036}}\right]^{.467} = 37.2 \text{ min.}$$

~~143.64~~

$i_{25} = 3.00$ in/hr

$$Q_{10}^{25} = 1.1(.25)(3.00)(1.63) = 1.34 \text{ cfs}$$

Sub-basin # 11 $A_{11} = 0.90$ Ac. = 39264

str.	(2.5)(1500) = 3750 ft² = 0.09 Ac (10%)	@ 0.95 ⇒		0.09
drive	(5)(700) = 3500 ft² 0.08 Ac. (9%)	@ 0.95 ⇒		0.08
pavmt.	(298)(19.5) + (260)(19.5) = 10,881 ft² 0.25 Ac (28%)	@ 0.95 ⇒		0.26
lawn	21673 (53%)	@ 0.135 ⇒		0.07
			C_{11} =	0.50

$N_{11} = (.53)(.40) + (.47)(.02) = 0.22$

H = 86.3 − 82.2 = 4.1

L = 70+185 = 255

$S = \frac{4.1}{255}$ 0.0161

$t_c = .827\left[\frac{.22(255)}{\sqrt{.0161}}\right]^{.467} = 14.2$ min ~~37.5~~

$i_{25} = 4.7$ in/hr

$Q_{11}^{25} = 1.1\,(.50)(4.7)(0.90) = 2.33$ cfs

Sub-basin # 12 $A_{12} = 1.29$ Ac 256192

str.	(5.5)(1500) = 8250 ft² = 0.19 Ac (15%)	@ 0.95 ⇒		0.14
drive	(11)(700) = 7700 ft² = 0.18 Ac (14%)	@ 0.95 ⇒		0.13
pvmt	(100)(24, +(30)(10)+420)(15) + 1125 = 11,535 ft² 0.26 Ac (21%)	@ 0.95 ⇒		0.20
lawn	28707 (50%)	@ 0.135 ⇒		0.07
			C_{12} =	0.54

$N_{12} = (.50)(.40) + (.50)(.02) = 0.21$

H = 84.7 − 82.2 = 2.50

L = 320

$S = \frac{2.5}{320} = 0.0078$

$t_c = .827\left[\frac{.21(320)}{\sqrt{.0078}}\right]^{.467} = 18.3$ min. ~~56.42~~

$i_{25} = 4.25$ in/hr

$Q_{12}^{25} = 1.1(.54)(4.25)(1.29) = 3.26$ cfs

Sub-basin # 13 A_{13} = 2.29 Ac. = 99752

str.	(8)(1500) = 12,000 ft²	0.27 Ac (12%)	@ 0.95 ⇒		0.11
drive	(8)(700) = 5600 ft²	0.13 Ac (6%)	@ 0.95 ⇒		0.05
pvmt	(135)(15) + 375 + (260)(19.0) + (320)(..) + 1125 = 13,265 ft²	0.30 Ac (13%)	@ 0.95 ⇒		0.13
lawn	68887	(69%)	@ 0.135 ⇒		0.09

C_{13} = 0.38

N_{13} = (.69)(.40) + (.31)(.02) = 0.28

H = 89.5 - 82.2 = 7.3

L = 410

$S = \frac{7.3}{410}$ = .0178

$t_c = .827\left[\frac{.28(410)}{\sqrt{.0178}}\right]^{.467}$ = 19.4 min

49.72

i_{25} = 4.1 in/hr.

Q_{13}^{25} = 1.1 (.38)(4.1)(2.29) = 3.92 cfs

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sub-basin # 14 A_{14} = 0.90 Ac. = 39264

str.	(3.5)(1500) = 5250 ft²	0.12 Ac (13%)	@ 0.95 ⇒		0.13
drive	0				—
pvmt.	0				—
lawn.	33198 ft²	(87%)	@ 0.135 ⇒		0.12

C_{14} = 0.25

N_{14} = (.87)(.40) + (.13)(.02) = 0.35

H = 82 - 75 = 7

L = 50 + 290' = 340

$S = \frac{7}{340'}$ = 0.0206

$t_c = .827\left[\frac{.35(340)}{\sqrt{.0206}}\right]^{.467}$ = 19.1 min

47.23

i_{25} = 4.1 in/hr

Q_{14}^{25} = 1.1 (.25)(4.1)(.90) = 1.01 cfs

Sub-basin # 15 $A_{15} = 0.39$ Ac. = 16988.4

str.	$(1.5)(1500) = 2250$ ft² =	0.05 Ac (13%)	@ 0.95	⇒	0.13
drive	0				
pmt.	0				
lawn	14738.4	87%	@ 0.135	⇒	0.12
					$C_{15} = 0.25$

$N_{15} = (.87)(.40) + (.13)(.02) = 0.35$

H = 84 − 78.3 = 5.7

L = 60 + 270 = 330

$S = \frac{5.7}{330} = 0.0173$

$t_c = .827 \left[\frac{.35(330)}{\sqrt{.0173}}\right]^{.467} = 19.6$ min

56.53

$i_{25} = 4.15$ in/hr

$Q_{15}^{25} = 1.1(.25)(4.15)(.39) = 0.45$ cfs

Sub-basin # 16 $A_{16} = 0.74$ Ac. = 32234

str.	$(2)(1500) = 3000$ ft² =	0.07 Ac (9%)	@ 0.95	⇒	0.09
drive	0				
pmt.	$(240)(27) = 6480$ ft² =	0.15 Ac (20%)	@ 0.95	⇒	0.19
lawn	22754	71%	@ 0.135	⇒	0.10
					$C_{16} = 0.38$

$N_{16} = (.71)(.40) + (.29)(.02) = 0.29$

H = 86 − 83.2 = 2.8

L = 125 + 170 = 295

$S = \frac{2.8}{295} = 0.0095$

$t_c = .827 \left[\frac{.29(295)}{\sqrt{.0095}}\right]^{.467} = 19.6$ min

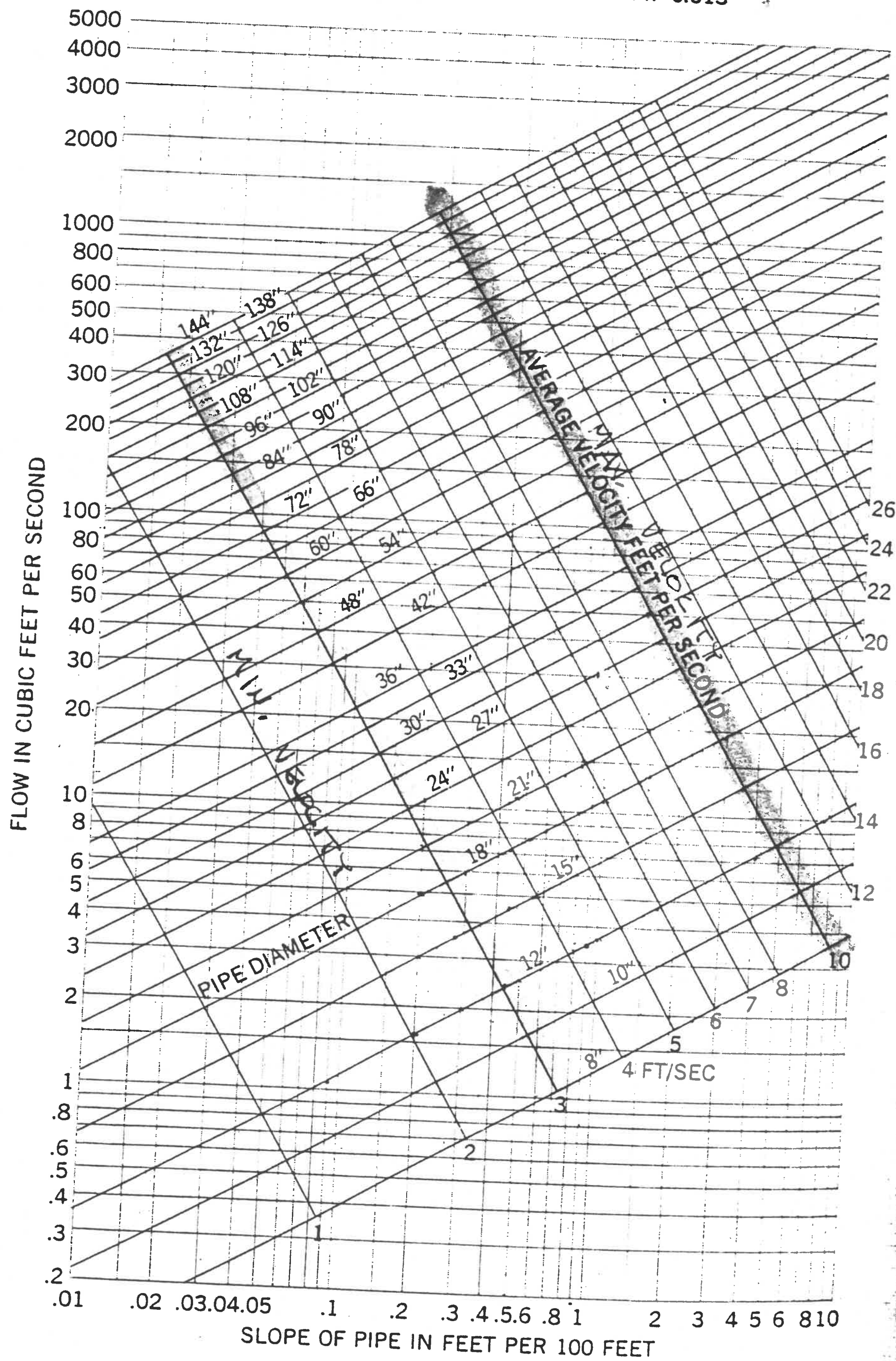
58.11

$i_{25} = 4.15$ in/hr

$Q_{16}^{25} = 1.1(.38)(4.15)(.74) = 1.28$ cfs

FIGURE 5

FLOW FOR CIRCULAR PIPE FLOWING FULL
BASED ON MANNING'S EQUATION n=0.013



STORM SEWER DESIGN SHEET – RATIONAL METHOD

PROJECT LINCOLN POINT – EAST RUN DATE 5-17-91 SHEET 10 OF 10

MORLEY & ASSOCIATES, INC

ENGINEER K. POFF DESIGN STORM 25 MANNINGS n 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣA_jC_j	t_j (min)	t_{cum} (min)	I [inches/hr]	Q (CFS)	Pipe Diameter (inches)	Pipe Slope (%)	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10	1110	1111	29	0.52	.83	0.43	0.43	15.2	15.2	4.55	1.96	12"	0.30	1.95	2.33	0.2						
11	1111	1113	335	0.42	1.37	0.73	1.21	21.1	21.1	4.05	4.90	15"	0.65	4.9	4.49	1.2			[illegible]	78.30		
13	1113	1116	124	—	—	—	1.65	—	37.2	3.05	5.03	15	0.57	5.1	4.60	0.4			[illegible]	[illegible]		
16	1116	1117	213	0.42	2.29	0.96	3.37	19.4	37.6	3.00	11.61	21"	0.49	11.65	5.23	0.7			77.69	76.65		
17	1117	1118	173	—	—	—	3.37	—	37.6	3.00	11.61	21"	0.49	11.65	5.23	0.55			76.65	75.30		
18	1113	945	52	0.27	0.90	0.24	4.11	19.1	38.2	2.95	12.12	21"	0.58	12.1	5.69	0.2			75.30	75.50		
12	1112	1113	160	0.27	1.63	0.44	0.44	37.2	37.2	3.05	1.32	12"	0.20	1.60	2.31	1.1						
14	1114	1116	65	0.55	0.90	0.50	0.50	14.2	14.2	4.7	2.35	12"	0.40	2.35	3.24	0.3						
15	1115	1116	52	0.59	1.29	0.76	0.76	18.3	18.3	4.25	3.23	15"	0.24	3.25	2.99	0.3						

Figure 7.1 Storm Sewer Design Sheet – Rational Method

7-5

STORM SEWER DESIGN SHEET – RATIONAL METHOD

PROJECT LINCOLN POINT – WEST RUN DATE 5-17-91 SHEET 9 OF 10

MORLEY & ASSOCIATES, INC

ENGINEER K. POFF DESIGN STORM 25 YRS. MANNINGS n 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣA_jC_j	t_j (min)	t_{cum} (min)	I [inches/hr]	Q (CFS)	Pipe Diameter (inches)	Pipe Slope (%)	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1101	1103	60	0.57	.90	0.51	0.51	17.0	17.0	4.4	2.26	12"	0.37	2.3	3.22	0.3			80.46	80.22 79.33		
2	1103	1105	200	0.59	1.04	0.62	1.70	20.2	21.6	3.95	6.72	18"	0.37	6.7	4.20	0.3			79.33	79.09		
5	1105	1103	140	—	—	—	2.05	—	22.4	3.9	8.50	18"	0.52	8.0	5.00	0.5			79.09	78.16		
8	1103	1109	133	—	—	—	2.32	—	22.9	3.85	10.86	21"	0.42	10.9	4.89	0.4			78.16	77.61		
9	1109	912	31	0.66	1.04	0.69	3.51	18.3	23.3	3.8	13.34	21"	0.70	13.3	6.27	0.1			77.61	377.39		
3	1102	1103	54	0.55	1.03	0.57	0.57	21.3	21.3	4.05	2.31	12"	0.40	2.35	3.25	0.3						
4	1104	1105	115	0.29	1.19	0.35	0.35	21.9	21.9	3.9	1.36	12"	0.60	2.8	3.53	0.5						
6	1106	1107	29	0.55	0.75	0.41	0.41	17.7	17.7	4.3	1.76	12"	0.40	2.35	3.11	0.2						
7	1107	1103	80	0.51	0.70	0.36	0.77	18.4	18.4	4.25	2.27	12"	0.90	3.45	4.90	0.3						

79.33
-1.50
-0.3
81.54
TO #105

Figure 7.1 Storm Sewer Design Sheet - Rational Method

STORM SEWER DESIGN SHEET – RATIONAL METHOD

PROJECT: LINCOLN POINT- WEST RUN   DATE: 5-17-91   SHEET: 9 OF 10

ENGINEER: MORLEY & ASSOCIATES, INC / K. POFF   DESIGN STORM: 25 YRS.   MANNINGS n: 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣA_jC_j	t_j (min)	t_{cum} (min)	i [inches/hr]	Q (CFS)	Pipe Diameter (inches)	Pipe Slope (%) < 10%	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1101	1103	60	0.57	.90	0.51	0.51	17.0	17.0	4.4	2.26	12"	0.37	2.3	3.22	0.3			80.46	80.22 79.83		
2	1103	1105	200	0.50	1.04	0.62	1.70	20.2	21.6	3.95	6.72	18"	0.37	6.7	4.20	0.3			79.83	79.09		
5	1105	1103	140	—	—	—	2.05	—	22.4	3.9	8.00	18"	0.52	8.0	5.00	0.5			79.09	78.16		
8	1108	1109	133	—	—	—	2.82	—	22.9	3.85	10.86	21"	0.42	10.9	4.89	0.4			78.16	77.61		
9	1109	912	31	0.66	1.04	0.69	3.51	18.3	23.3	3.8	13.34	21"	0.70	13.3	6.27	0.1			77.61	377.39		
3	1102	1103	54	0.55	1.03	0.57	0.57	21.3	21.3	4.05	2.31	12"	0.40	2.35	3.25	0.3						
4	1104	1105	115	0.29	1.19	0.35	0.35	21.9	21.9	3.9	1.36	12"	0.60	2.8	3.53	0.5						
6	1106	1107	29	0.55	0.75	0.41	0.41	17.7	17.7	4.3	1.76	12"	0.40	2.35	3.11	0.2						
7	1107	1103	80	0.51	0.70	0.36	0.77	18.4	18.4	4.25	2.27	12"	0.90	3.45	4.90	0.3						

79.83
+ 1.50
81.33
+ 0.21
81.54
TC # 1105

Figure 7.1 Storm Sewer Design Sheet – Rational Method

STORM SEWER DESIGN SHEET – RATIONAL METHOD

PROJECT: LINCOLN POINT – EAST RUN DATE: 5-17-91 SHEET: 10 OF 10

MORLEY & ASSOCIATES, INC

ENGINEER: K. POFF DESIGN STORM: 25 MANNINGS n: 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣA_jC_j	t_j (min)	t_{cum} (min)	I [inches/hr]	Q (CFS)	Pipe Diameter (inches)	Pipe Slope (%) < 10%	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10	1110	1111	29	0.52	.83	0.43	0.43	15.3	15.3	4.55	1.96	12"	0.30	1.95	2.33	0.2						
11	1111	1113	335	0.42	1.37	0.73	1.21	21.1	21.1	4.05	4.90	15"	0.55 (6)	4.9	4.49	1.2			80.44	78.30		
13	1113	1116	124	—	—	—	1.65	—	37.2	3.05	5.03	15	0.57	5.1	4.60	0.4			78.30	77.99 / 77.69		
16	1116	1117	213	0.42	2.29	0.96	3.37	19.4	37.6	3.00	11.61	21"	0.49	11.65	5.23	0.7			77.69	76.65		
17	1117	1118	173	—	—	—	3.37	—	37.6	3.00	11.61	21"	0.49	11.65	5.23	0.55			76.65	75.30		
18	1113	945	52	0.27	0.90	0.24	4.11	19.1	38.2	2.95	12.12	21"	0.53	12.1	5.69	0.2			75.30	75.50		
12	1112	1113	160	0.27	1.63	0.44	0.44	37.2	37.2	3.05	1.32	12"	0.20	1.60	2.31	1.1						
14	1114	1116	65	0.55	0.90	0.50	0.50	14.2	14.2	4.7	2.35	12"	0.40	2.35	3.34	0.3						
15	1115	1116	52	0.59	1.29	0.76	0.76	18.3	18.3	4.25	3.23	15"	0.24	3.25	2.99	0.3						

Figure 7.1 Storm Sewer Design Sheet – Rational Method