

ENGINEER'S OPINION OF COSTS

FOR

**PROPOSED PARKS DRAIN #0471
ALTERNATIVE NO. 1**

ITEM NO.	WORK ITEM	EST. QTY	UNIT	UNIT PRICE	TOTAL AMOUNT
1	Traffic Maintenance & Control	1	LS	\$ 2,000.00	\$ 2,000.00
2	Clearing & Grubbing	2655	LF	\$ 8.00	\$ 21,240.00
3	Machine Grading	2655	LF	\$ 4.00	\$ 10,620.00
4	Remove Culvert, Less than 24 inch Dia	5	Each	\$ 200.00	\$ 1,000.00
5	Remove Culvert, 24 inch to 48 inch Dia	1	Each	\$ 600.00	\$ 600.00
6	Remove Culvert, Over 48 inch Dia	1	Each	\$ 1,200.00	\$ 1,200.00
7	Remove Drainage Structure	4	Each	\$ 250.00	\$ 1,000.00
8	Remove Sewer, Less than 24 inch Dia	100	LF	\$ 10.00	\$ 1,000.00
9	Pavement Removal & Replacement	125	SY	\$ 50.00	\$ 6,250.00
10	Open Drain Excavation, 4 ft. Bottom	3955	LF	\$ 10.00	\$ 39,550.00
11	Soil Erosion & Sedimentation Control Measures	1	LS	\$ 10,000.00	\$ 10,000.00
12	Maintenance Gravel	50	Ton	\$ 20.00	\$ 1,000.00
13	12 in. Corrugated Steel Pipe Culvert, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2	180	LF	\$ 25.00	\$ 4,500.00
14	12 in. Corrugated Steel Pipe Storm Sewer, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2	140	LF	\$ 30.00	\$ 4,200.00
15	12 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-IV, Trench Detail 1	570	LF	\$ 30.00	\$ 17,100.00
16	18 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	1390	LF	\$ 40.00	\$ 55,600.00
17	24 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	330	LF	\$ 45.00	\$ 14,850.00
18	27 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	680	LF	\$ 55.00	\$ 37,400.00
19	30 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	4285	LF	\$ 60.00	\$ 257,100.00
20	36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	690	LF	\$ 70.00	\$ 48,300.00
21	42 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	570	LF	\$ 82.00	\$ 46,740.00
22	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	1410	LF	\$ 95.00	\$ 133,950.00
23	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-V, Jacked in place under Railroad Tracks	60	LF	\$ 750.00	\$ 45,000.00
24	54 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	1160	LF	\$ 110.00	\$ 127,600.00
25	60 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	715	LF	\$ 125.00	\$ 89,375.00
26	36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 2	50	LF	\$ 85.00	\$ 4,250.00
27	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 2	50	LF	\$ 115.00	\$ 5,750.00

Parks Drain #0471
Alternative No. 1

ITEM NO.	WORK ITEM	EST. QTY	UNIT	UNIT PRICE	TOTAL AMOUNT
28	Drainage Structure Covers	37	Each	\$ 350.00	\$ 12,950.00
29	4 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	6	Each	\$ 1,500.00	\$ 9,000.00
30	5 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	18	Each	\$ 2,500.00	\$ 45,000.00
31	6 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	9	Each	\$ 3,500.00	\$ 31,500.00
32	7 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	4	Each	\$ 4,500.00	\$ 18,000.00
33	12 in. Steel End Section with Steel Grate	14	Each	\$ 250.00	\$ 3,500.00
34	Steel End Section with Steel Grate for 12 inch Concrete Pipe	3	Each	\$ 500.00	\$ 1,500.00
35	Steel End Section with Steel Grate for 30 inch Concrete Pipe	1	Each	\$ 1,000.00	\$ 1,000.00
36	Steel End Section with Steel Grate for 48 inch Concrete Pipe	1	Each	\$ 2,000.00	\$ 2,000.00
37	Steel End Section with Steel Grate for 54 inch Concrete Pipe	1	Each	\$ 2,500.00	\$ 2,500.00
38	Steel End Section with Steel Grate for 60 inch Concrete Pipe	1	Each	\$ 3,000.00	\$ 3,000.00
39	Outlet Weir	1	Each	\$ 2,500.00	2,500.00
40	Topsoil Surface, 4 inch	29500	SY	\$ 0.75	\$ 22,125.00
41	Chemical Fertilizer Nutrient (240 Lbs/acre)	2750	Lb	\$ 2.00	\$ 5,500.00
42	Class A seeding (200 Lbs/acre)	2300	Lb	\$ 4.00	\$ 9,200.00
43	Mulch (2 tons/acre)	23	Ton	\$ 300.00	\$ 6,900.00
44	Mulch Blanket for Open Drain Bottom	2360	SY	\$ 1.50	\$ 3,540.00
				Estimated Construction Cost	\$ 1,166,890.00
				Design Contingencies	\$ 58,345.00
				Construction Contingencies	\$ 122,524.00
				Preliminary and Design Engineering	\$ 98,456.00
				Construction Engineering & Inspection	\$ 183,785.00
				TOTAL ESTIMATED COST*	\$ 1,630,000.00*

*Not including the cost of any new drain right-of-way that may be required.

*Cost of 1300 lf of new pond bank berm included in quantity/price for line item 10 Open Drain Excavation.

Prepared by:



KRAFT ENGINEERING AND SURVEYING, INC.
 409 West Seventh Street, Flint, MI 48503-3781
 Phone: (810) 234-2694 • Fax: (810) 234-2696
 E-mail: mail@kraftengineering.com

PARKS DRAIN STORM SEWER SYSTEM DESIGN, ALTERNATIVE No. 1

Alternative No. 1, Hydraulic Summary

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = CIA \quad i(10) = \frac{166.37}{T + 23.31}$$

$$Q = CIA \quad i(25) = \frac{191.76}{T + 25.93}$$

Job Name Parks Drain, Alternative #1

By TLO
Date 8/30/12

Channel Parameters:

Bottom 2 FT MIN.
Side Slopes 3 FT/FT

INVERT ELEV.

UPSTREAM STRUCT.	DOWNSTREAM STRUCT.	CONVEYANCE	INCREMENT AREA AI	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA CAI	TOTAL EQUIV. AREA TOTAL CAI	TIME T	RAINFALL INTENSITY	DESIGN FLOW Q = I TOTAL CAI	DIAMETER OF PIPE / OR EQUIVALENT	SLOPE OF PIPE / DITCH	PIPE CAPACITY FLOWING FULL	VELOCITY PIPE FLOWING FULL	DISTANCE BETWEEN STRUCTURES	TIME OF FLOW	NORMAL DEPTH REQD. FOR DITCH	OPEN CHAN. VELOCITY AT NORMAL DEPTH	CHECK CAPACITY AT NORMAL DEPTH	DROP AT STRUCTURE	UPPER END	LOWER END	GROUND / RIM	BW	m	A	P	R	n	DISCRIPTION									
			AC.	AC.				MIN.	IN/HR	C.F.S.	IN.	%	C.F.S.	FT/SEC	FT.	MIN.	FT.	FPS	C.F.S.	FT.	ELEV	ELEV	ELEV																
10 YEAR DESIGN STORM																																							
1a	1c	PIPE	4.24	4.24	0.30	1.27	1.27	40.00	2.63	3.34	12	0.75	3.34	4.26	290	1.14	N/A	N/A	N/A	N/A	811.00	808.83	812.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer								
1b	1c	PIPE	2.08	2.08	0.30	0.62	0.62	30.00	3.12	1.95	12	0.60	2.99	3.81	280	1.23	N/A	N/A	N/A	N/A	810.50	808.82	812.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer								
1c	1d	PIPE	6.20	12.52	0.30	1.86	3.76	100.00	1.35	5.07	18	0.20	5.09	2.88	785	4.54	N/A	N/A	N/A	N/A	808.82	807.25	811.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
1c	1d	PIPE									30	0.24	21.76	4.43	720	2.71	N/A	N/A	N/A	N/A	807.25	805.52	812.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
1d	1e-2b	PIPE	65.80	78.32	0.30	19.74	23.50	160.00	0.91	21.32	30	0.55	32.94	6.71	1625	4.03	N/A	N/A	N/A	N/A	805.52	796.58	810.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
2a	1e-2b	PIPE	51.81	51.81	0.30	15.54	15.54	95.00	1.41	21.85	24	0.80	21.91	6.98	330	0.79	N/A	N/A	N/A	N/A	805.70	803.06	806.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer								
											30	0.50	31.40	6.40	1275		N/A	N/A	N/A	N/A	803.06	796.69	810.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
1e-2b	4	PIPE	50.48	180.61	0.30	15.14																																	
1e-2b	4	PIPE	43.03	223.64	0.30	12.91	67.09	164.03	0.89	59.58	36	0.68	59.55	8.43	690	1.36	N/A	N/A	N/A	N/A	796.58	791.89	804.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
1e-2b	4	PIPE						165.40	0.88	59.40	42	0.30	59.67	6.20	570	1.53	N/A	N/A	N/A	N/A	791.89	790.18	804.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
3	4	Reid Rd Ditch	46.11	46.11	0.30	13.83	13.83	90.00	1.47	20.31	27	0.84	30.73	7.73	44	0.09	1.50	4.98	48.51	0.00	N/A	N/A	798.00	2.00	3	9.75	6.74	1.45	0.035	Ex 27" Culv under Vanvleet									
10 YEAR DESIGN STORM																																							
4	5a	Ex PIPE	28.25	298.00	0.30	8.48	89.40	166.93	0.87	78.18	42	0.70	91.14	9.48	54	0.09	N/A	N/A	N/A	N/A	789.66	789.28	796.00	N/A	N/A	N/A	N/A	N/A	N/A	Ex 42" stm under Reid									
25 YEAR DESIGN STORM																																							
5a	5b	PIPE		298.00	0.30		89.40	167.02	0.99	88.85	48	0.60	120.48	9.59	930	1.62	N/A	N/A	N/A	N/A	789.28	781.04	796.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
5b	pond	PIPE	17.81	315.81	0.30	5.34	94.74	168.64	0.99	93.37	48	0.60	120.48	9.59	500	0.87	N/A	N/A	N/A	N/A	781.04	778.04	790.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
pond	6	PIPE	49.12	364.93	0.30	14.74	109.48	169.51	0.98	107.42	54	0.40	134.67	8.47	535	1.05	N/A	N/A	N/A	N/A	778.04	775.90	782.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
6	8b	PIPE	20.00	384.93	0.30	6.00	115.48	170.56	0.98	112.70	54	0.40	134.67	8.47	625	1.23	N/A	N/A	N/A	N/A	775.90	773.40	780.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
7b	7c	Deten. Basin	130.35	130.35	0.30	39.11	39.11				N/A	0.20	N/A	N/A																	ion Basin Allowable Based on 18"								
		Deten. Basin	12.35	142.70	0.30	3.71	42.81			6.73	18	0.35	6.73	3.81																	Outflow Based on 18" Outlet								
7b	7c	PIPE	12.35	130.35	0.30	3.71	3.71	150.00	0.96	6.73	18	0.35	6.73	3.81	605	2.65	N/A	N/A	N/A	N/A	779.00	776.88	779.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer- Instead of a Structure: Use and 18" End Section									
7c	7d	PIPE	12.35	142.70	0.30	3.71	7.41	153.81	0.94	13.69	27	0.25	16.77	4.22	680	2.69	N/A	N/A	N/A	N/A	776.88	775.18	779.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
7d	8a	PIPE	37.72	180.42	0.30	11.32	18.73	158.03	0.92	17.18	30	0.25	22.21	4.53	70	0.26	N/A	N/A	N/A	N/A	775.18	775.01	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Van Vleet Rd X-ing									
8a	8b	PIPE	3.59	184.01	0.30	1.08	19.80	156.50	0.93	18.32	30	0.25	22.21	4.53	615	2.26	N/A	N/A	N/A	N/A	775.18	773.65	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
25 YEAR DESIGN STORM																																							
8b	9a	PIPE	21.40	590.34	0.30		177.10	170.56	0.98	172.84	60	0.40	178.35	9.09	715	1.31	N/A	N/A	N/A	N/A	773.65	770.54	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Combine Drains									
9a	9b	Open Drain	24.43	614.77	0.30	7.33	184.43	171.79	0.97	178.87	N/A	0.10	N/A	N/A	1585	8.02	4.00	3.29	210.86	0.00	770.54	768.95	776.00	4.00	3	64.00	16.65	3.84	0.035	Open Drain									
9b	9c	Pipe at RR X	67.90	682.67	0.30	20.37	204.80	179.81	0.93	190.89	48	0.20	69.56	N/A	60	0.21	4.00	4.66	298.20	0.00	768.95	768.83	774.00	4.00	3	64.00	16.65	3.84	0.035	Proposed RR X-ing									
9c	Crapo	Open Drain	0.00	682.67	0.30	0.00	184.43	179.81	0.93	171.90	N/A	0.10	N/A	N/A	1070	5.60	3.80	3.18	186.38	0.00	768.83	767.76	772.00	4.00	3	58.52	16.02	3.65	0.035	Open Drain									
25 YEAR DESIGN STORM																																							
											36	2.89	122.77												771.60	770.00	774.00						Existing 36" Culvert						
											48	0.20	69.56												768.95	768.83	774.00						Proposed 48" Culvert						
for info only, 25 year storm calc at Railroad Crossing							204.80	179.81	0.93	190.88												192.33																	Combine Culvert Capacities

KRAFT ENGINEERING AND SURVEYING, INC.

EXHIBIT 3a

409 W. 7th St.
Flint, MI 48503

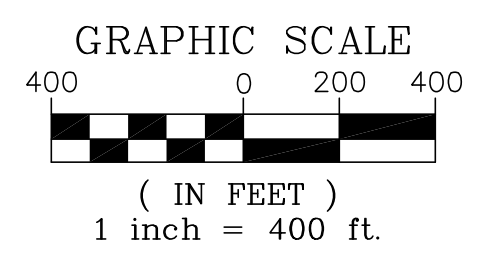
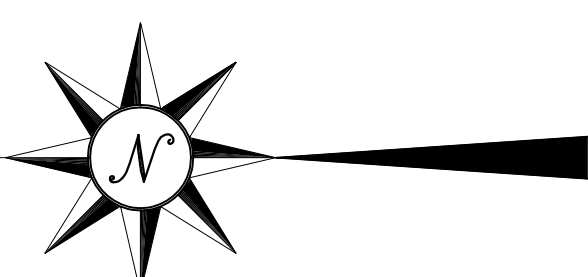
RATIONAL METHOD Q=CIA
DETENTION POND VOLUME CALCULATIONS

Area= **130.35**
C= **0.30**
Qout= **6.73**

18" @.35%

ALTERNATIVE NO. 1 - Existing Pond Storage

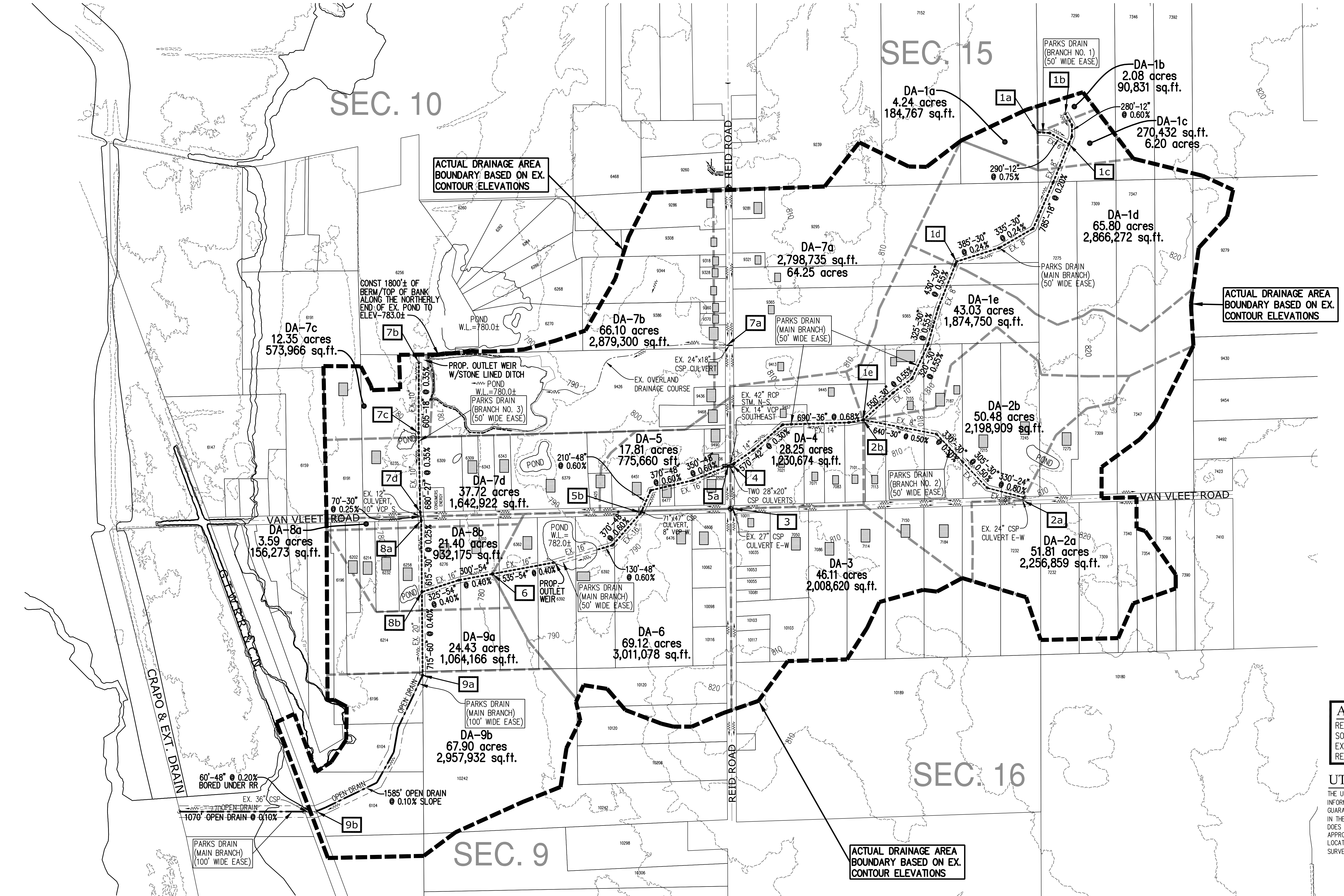
Time conc min	I 100	CwA	Qin	Qout/Qallow	Qin-Qout Ft ³ /s	V=(Qin-Qout)*Tc*60 Ft ³	RETENTION (X2 OF DET)
10	5.77	39.11	225.64	6.73	218.91	131,343.51	262,687.02
20	4.60	39.11	179.88	6.73	173.15	207,783.60	415,567.20
30	3.90	39.11	152.51	6.73	145.78	262,403.10	524,806.20
40	3.40	39.11	132.96	6.73	126.23	302,944.80	605,889.60
50	3.00	39.11	117.32	6.73	110.59	331,755.00	663,510.00
60	2.70	39.11	105.58	6.73	98.85	355,872.60	711,745.20
70	2.50	39.11	97.76	6.73	91.03	382,336.50	764,673.00
80	2.30	39.11	89.94	6.73	83.21	399,415.20	798,830.40
90	2.10	39.11	82.12	6.73	75.39	407,108.70	814,217.40
100	1.90	39.11	74.30	6.73	67.57	405,417.00	810,834.00
110	1.80	39.11	70.39	6.73	63.66	420,149.40	840,298.80
120	1.70	39.11	66.48	6.73	59.75	430,189.20	860,378.40
130	1.60	39.11	62.57	6.73	55.84	435,536.40	871,072.80
140	1.50	39.11	58.66	6.73	51.93	436,191.00	872,382.00
150	1.45	39.11	56.70	6.73	49.97	449,750.25	899,500.50
160	1.40	39.11	54.75	6.73	48.02	460,963.20	921,926.40
170	1.30	39.11	50.84	6.73	44.11	449,886.30	899,772.60
180	1.25	39.11	48.88	6.73	42.15	455,233.50	910,467.00
190	1.20	39.11	46.93	6.73	40.20	458,234.40	916,468.80
200	1.15	39.11	44.97	6.73	38.24	458,889.00	917,778.00
210	1.10	39.11	43.02	6.73	36.29	457,197.30	914,394.60
220	1.00	39.11	39.11	6.73	32.38	427,350.00	854,700.00
230	0.95	39.11	37.15	6.73	30.42	419,792.55	839,585.10
240	0.93	39.11	36.37	6.73	29.64	426,782.16	853,564.32
270	0.83	39.11	32.46	6.73	25.73	416,779.83	833,559.66
300	0.73	39.11	28.55	6.73	21.82	392,699.70	785,399.40
330	0.66	39.11	25.81	6.73	19.08	377,770.14	755,540.28
360	0.62	39.11	24.25	6.73	17.52	378,326.16	756,652.32
390	0.59	39.11	23.07	6.73	16.34	382,401.63	764,803.26
420	0.55	39.11	21.51	6.73	14.78	372,399.30	744,798.60
450	0.53	39.11	20.73	6.73	14.00	377,882.55	755,765.10
480	0.50	39.11	19.55	6.73	12.82	369,288.00	738,576.00
510	0.48	39.11	18.77	6.73	12.04	368,436.24	736,872.48
540	0.45	39.11	17.60	6.73	10.87	352,098.90	704,197.80
570	0.43	39.11	16.82	6.73	10.09	344,912.13	689,824.26
600	0.41	39.11	16.03	6.73	9.30	334,909.80	669,819.60



LEGEND

- - - - - 810 - EX. SURFACE CONTOUR LINE
- - - - - EX. 14" EX. STORM SEWER
- - - - - EX. OPEN DRAIN
- EX. DRAINAGE FLOW ARROW
- 8326 EX. BUILDING/HOUSE W/ADDRESS
- PROP. STORM SEWER
- PROP. OPEN DRAIN (O.D.)
- SUB DRAINAGE AREA BOUNDARY
- DRAINAGE AREA BOUNDARY BASED ON EX. CONTOUR ELEVATIONS
- 1d DRAINAGE POINT LOCATION

NOTE:
THE EXISTING 8" TO 12" STORM SEWER IS A CLAY PIPE (VCP) AND THE EXISTING 14" TO 20" STORM SEWER PIPE IS A CONCRETE PIPE (RCP)



ALTERNATIVE NO. 1:
REPLACE THE EXISTING DRAINAGE SYSTEM IN KIND AND AT SOME LOCATIONS AS THE EXISTING DRAIN. - I.E. REPLACE EXISTING OPEN DRAIN WITH NEW OPEN DRAIN, AND REPLACE EXISTING PIPE WITH NEW PIPE.

UTILITY STATEMENT
THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR/ENGINEER MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR/ENGINEER FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE APPROXIMATE LOCATION AS INDICATED, ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR/ENGINEER HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES.

PRELIMINARY NOT FOR CONSTRUCTION PURPOSES

KES JOB NO. 2012-07

SCALE: 1" = 400'

GENESEE COUNTY DRAIN COMMISSIONER

PREPARED FOR:
GENESEE COUNTY DRAIN COMMISSIONER
DIVISION OF SURFACE WATER MNGT.
G-4608 BEECHER ROAD, FLINT, MI 48532-2617
PHONE: (810) 732-1590 FAX (810) 732-1474
WEBSITE: GDCDWS.COM/SWM

Three full working days before you dig, call the MISS DIG System at 1-800-482-7171

PREPARED BY:
KRAFT ENGINEERING & SURVEYING, INC.
engineers - surveyors - planners
409 WEST SEVENTH STREET FLINT, MICHIGAN 48503
PHONE: 810.234.2694 or 810.234.2695 FAX: 810.234.2696
E-MAIL: MAIL@KRAFTENGINEERING.COM

PARKS DRAIN #0471
PART OF SECTIONS 9, 10, 15 & 16
T6N-R5E, GAINES TWP,
GENESEE COUNTY, MICHIGAN

EXHIBIT NO. 4
DRAINAGE MAP
ALTERNATIVE NO. 1

REVISIONS	DRN. BY:	RADO	04.11.2013	SHEET NO:
09.27.2013	DSN. BY:	T.L.O./J.M.	"	E-5
	CKD. BY:	M.R.P.	"	
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