

ENGINEER'S OPINION OF COSTS

FOR

**PROPOSED PARKS DRAIN #0471
ALTERNATIVE NO. 3**

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	10110	LF	\$ 8.00	\$ 80,880.00
3	Machine Grading	10110	LF	\$ 4.00	\$ 40,440.00
4	Remove Culvert, Less than 24 inch Diam	8	Each	\$ 200.00	\$ 1,600.00
5	Remove Culvert, 24 inch to 48 inch Diam	2	Each	\$ 600.00	\$ 1,200.00
6	Remove Culvert, Over 48 inch Diam	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 Diam	100	Ft	\$ 10.00	\$ 1,000.00
9	Pavement Removal & Replacement	100	SY	\$ 50.00	\$ 5,000.00
10	Open Drain Excavation, 2 FT Bottom	1770	LF	\$ 5.00	\$ 8,850.00
11	Open Drain Excavation, 4 FT Bottom	5840	LF	\$ 10.00	\$ 58,400.00
12	Restricted Open Drain Excavation, 2 FT Bottom	200	LF	\$ 10.00	\$ 2,000.00
13	Restricted Open Drain Excavation, 4 FT Bottom	2500	LF	\$ 15.00	\$ 37,500.00
14	Detention Basin Excavation	33000	CYD	\$ 4.00	\$ 132,000.00
15	Clearing	7	Acre	\$ 5,000.00	\$ 35,000.00
16	Soil Erosion & Sedimentation Control	1	LS	\$ 10,000.00	\$ 10,000.00
17	Maintenance Gravel	50	Ton	\$ 20.00	\$ 1,000.00
18	12 in. Corrugated Steel Pipe Culvert, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 1	180	LF	\$ 25.00	\$ 4,500.00
19	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
20	28 in. x 20 in. Corrugated Steel Pipe Culvert, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2	50	LF	\$ 40.00	\$ 2,000.00
21	28 in. x 20 in. Corrugated Steel Pipe Storm Sewer, 2-2/3 in. x 1/2 in. Corrugations, Gage 16, Trench Detail 2	40	LF	\$ 45.00	\$ 1,800.00
22	24 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	330	LF	\$ 45.00	\$ 14,850.00
23	30 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	1990	LF	\$ 60.00	\$ 119,400.00
24	36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	1610	LF	\$ 70.00	\$ 112,700.00
25	42 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	1910	LF	\$ 82.00	\$ 156,620.00
26	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	635	LF	\$ 110.00	\$ 69,850.00
27	60 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	110	LF	\$ 125.00	\$ 13,750.00

Parks Drain #0471
Alternative No. 3

ITEM NO.	WORK ITEM	EST. QTY	UNIT	UNIT PRICE	TOTAL AMOUNT
28	36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 2	100	LF	\$ 85.00	\$ 8,500.00
29	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 2	50	LF	\$ 115.00	\$ 5,750.00
30	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-V, Jacked in place under Rail Road Tracks	60	LF	\$ 750.00	\$ 45,000.00
31	Drainage Structure Covers	23	Each	\$ 350.00	\$ 8,050.00
32	4 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	2	Each	\$ 1,500.00	\$ 3,000.00
33	5 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	6	Each	\$ 2,500.00	\$ 15,000.00
34	6 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	14	Each	\$ 3,500.00	\$ 49,000.00
35	7 ft. diam. Drainage Structure, Catch Basin, 0 to 8 Ft.	1	Each	\$ 4,500.00	\$ 4,500.00
36	12 in Steel End Section with Steel Grate	14	Each	\$ 250.00	\$ 3,500.00
37	Steel End Section with Steel Grate for 30" Conc Pipe	3	Each	\$ 1,000.00	\$ 3,000.00
38	Steel End Section with Steel Grate for 60" Conc Pipe	2	Each	\$ 3,000.00	\$ 6,000.00
39	Outlet Weir	2	Each	\$ 2,500.00	\$ 5,000.00
40	Topsoil Surface, 4 inch	30000	SY	\$ 0.75	\$ 22,500.00
41	Chemical Fertilizer Nutrient (240 Lbs/acre)	3000	Lb	\$ 2.00	\$ 6,000.00
42	Class A seeding (200 Lbs/acre)	2500	Lb	\$ 4.00	\$ 10,000.00
43	Mulch (2 tons/acre)	25	Ton	\$ 300.00	\$ 7,500.00
44	Mulch Blanket for Open Drain Bottom	9000	SY	\$ 1.50	\$ 13,500.00
	Estimated Construction Cost				\$ 1,134,540.00
	Design Contingencies				\$ 56,730.00
	Construction Contingencies				\$ 119,130.00
	Preliminary and Design Engineering				\$ 95,910.00
	Construction Engineering & Inspection				\$ 178,690.00
	TOTAL ESTIMATED COST*				\$ 1,585,000.00 *

*Not including the cost of land for the proposed detention basin, or any new drain right-of-way that may be required.

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. 3

Alternative No. 3 Hydraulic Summary

Job Name Parks Drain, Alternative #3

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

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

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

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	DESCRIPTION						
			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	Open Drain	2.08	2.08	0.30	0.62	0.62	60.00	2.00	1.25	N/A	0.30	N/A	N/A	300	2.20	1.00	2.28	11.38	0.00	810.00	809.10	812.00	2.00	3	5.00	5.16	0.97	0.035	Open Drain						
1c	1d	Open Drain	10.44	12.52	0.30	3.13	3.76	150.00	0.96	3.61	N/A	0.30	N/A	N/A	1910	10.71	1.50	2.97	28.99	0.00	809.10	803.37	810.00	2.00	3	9.75	6.74	1.45	0.035	Open Drain						
1d	1e	Open Drain	65.80	78.32	0.30	19.74	23.50	160.71	0.90	21.24	N/A	0.30	N/A	N/A	1760	8.16	2.00	3.59	57.52	0.00	803.37	798.09	804.00	2.00	3	16.00	8.32	1.92	0.035	Open Drain						
10 YEAR DESIGN STORM																																				
2a	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	812.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
2a	2b	PIPE								21.85	30	0.45	29.79	6.07	1080	2.96	N/A	N/A	N/A	N/A	803.06	798.20	804.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
10 & 25 YEAR DESIGN STORM																																				
2b	4a	Open Drain	50.48																																	
1e	4a	Open Drain	43.03	223.64	0.30	12.91	67.09	168.87	0.87	58.08	N/A	0.30	N/A	N/A	1305	6.02	2.00	3.61	72.27	0.00	798.09	794.18	800.00	4.00	3	20.00	10.32	1.94	0.035	Open Drain						
4a	4b	Rd X-ing	20.65	244.29	0.30	6.20	73.29	174.88	0.84	61.52	36	0.75	62.54	8.85	50	0.09	N/A	N/A	N/A	N/A	794.18	793.80	800.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
4b	7b	PIPE		244.29	0.30		73.29	174.98	0.95	69.95	42	0.50	77.03	8.01	1200	2.50	N/A	N/A	N/A	N/A	#REF!	#REF!	796.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
4b	7b	Open Drain					92.56	177.48	0.94	87.26	N/A	0.30	N/A	N/A	350	1.61	2.00	3.62	79.65	0.00	#REF!	780.00	780.00	5.00	3	22.00	11.32	1.94	0.035	Open Drain						
7b	7c	Deten. Basin	66.10	374.64	0.30	19.83	112.39				N/A	0.20	N/A	N/A	300	1.68	2.00	2.97	95.17	0.00	780.00	779.40	780.00	10.00	3	32.00	16.32	1.96	0.035	Detention Basin Allowable						
		Deten. Basin	12.35	386.99	0.30	3.71	116.10			77.40	42	0.51	77.80	8.09																Outflow of 0.20 cfs/acre						
7c	7d	PIPE			0.30		116.10	179.09	0.82	77.40	42	0.51	77.80	8.09	710	1.46	N/A	N/A	N/A	N/A	777.00	773.38	780.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
7d	8a	Rd X-ing	37.72	37.72	0.30	11.32	11.32	180.55	0.82	86.64	48	0.32	87.98	7.01	50	0.12	N/A	N/A	N/A	N/A	773.38	773.22	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
8a	8b	PIPE	3.59	41.31	0.30	1.08	12.39	180.67	0.82	96.74	48	0.40	98.37	7.83	635	1.35	N/A	N/A	N/A	N/A	773.22	770.68	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
10 YEAR DESIGN STORM																																				
3	4c	Rd X-ing	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	Existing 27" Sewer						
4c	5a	Rd X-ing	7.60	53.71	0.30	2.28	16.11	90.09	1.47	23.64	42	0.70	91.14	9.48	54	0.09	N/A	N/A	N/A	N/A	788.90	788.52	798.00	N/A	N/A	N/A	N/A	N/A	N/A	Existing 42" Sewer						
5a	5b	PIPE	17.81	71.52	0.30	5.34	21.46	90.19	1.47	31.45	30	0.51	31.72	6.46	910	2.35	N/A	N/A	N/A	N/A	788.52	783.88	792.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
5b	pond	PIPE	29.12	100.64	0.30	8.74	30.19	92.54	1.44	43.36	36	0.50	51.07	7.23	500	1.15	N/A	N/A	N/A	N/A	783.88	781.38	782.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
pond	6	PIPE	20.00	120.64	0.30	6.00	36.19	93.69	1.42	51.46	36	0.60	55.94	7.92	535	1.13	N/A	N/A	N/A	N/A	781.38	778.17	780.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
6	8b	PIPE	20.00	140.64	0.30	6.00	42.19	94.81	1.41	59.42	36	0.70	60.42	8.55	625	1.22	N/A	N/A	N/A	N/A	778.17	773.80	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	6.42	177.10	181.89	0.92	163.42	60	0.34	164.43	8.38	100	0.20	N/A	N/A	N/A	N/A	770.68	770.34	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer						
8b	9a	Open Drain								145.22	N/A	0.10	N/A	N/A	615	3.39	3.50	3.02	163.92	0.00	770.34	769.72	776.00	5.00	3.00	54.25	16.07	3.38	0.035	Open Drain						
9a	9b	Open Drain	24.43	614.77	0.20	4.89	122.95	182.08	0.92	113.35	N/A	0.10	N/A	N/A	1585	8.74	3.50	3.02	163.92	0.00	769.72	768.14	776.00	5.00	3	54.25	16.07	3.38	0.035	Open Drain						
9b	9c	PIPE	67.90	682.67	0.30	20.37	143.32	190.83	0.88	126.80	48	0.15	60.24	4.80	60	0.31	N/A	N/A	N/A	N/A	768.14	768.05	774.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Rail Road Crossing						
9c	Crapo	Open Drain	0.00	682.67	0.20	0.00	143.32	191.14	0.88	126.61	N/A	0.11	N/A	N/A	1070	5.63	3.50	3.17	171.93	0.00	768.05	766.87	772.00	5.00	3	54.25	16.07	3.38	0.035	Open Drain						
25 YEAR DESIGN STORM																																				
Ex.36 inch at Rail Road Crossing											36	2.89	122.77								771.60	770.00	774.00													
Proposed additional 36" Casing next to existing 36" under Rail Road											48	0.15	60.24								768.14	768.05	774.00													
For information only, 25 year Storm							204.80	190.83	0.88	126.80			183.01																							

KRAFT ENGINEERING AND SURVEYING , INC.

EXHIBIT 9a

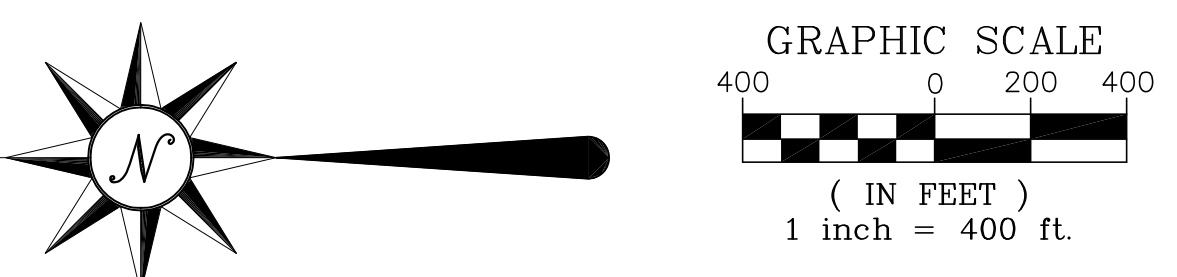
409 W. 7th St.
Flint, MI 48503

RATIONAL METHOD Q=CIA
DETENTION POND VOLUME CALCULATIONS

Area= **386.99**
C= **0.30**
Qout= **77.40**

ALTERNATIVE NO. 3

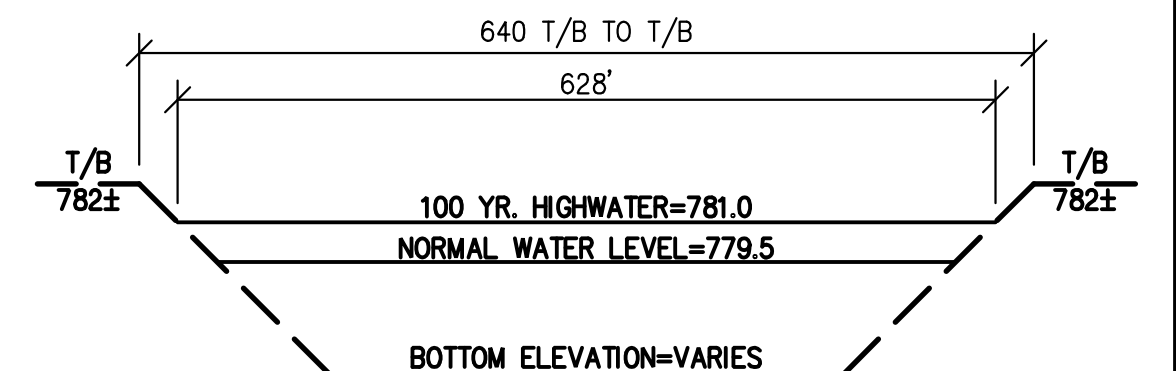
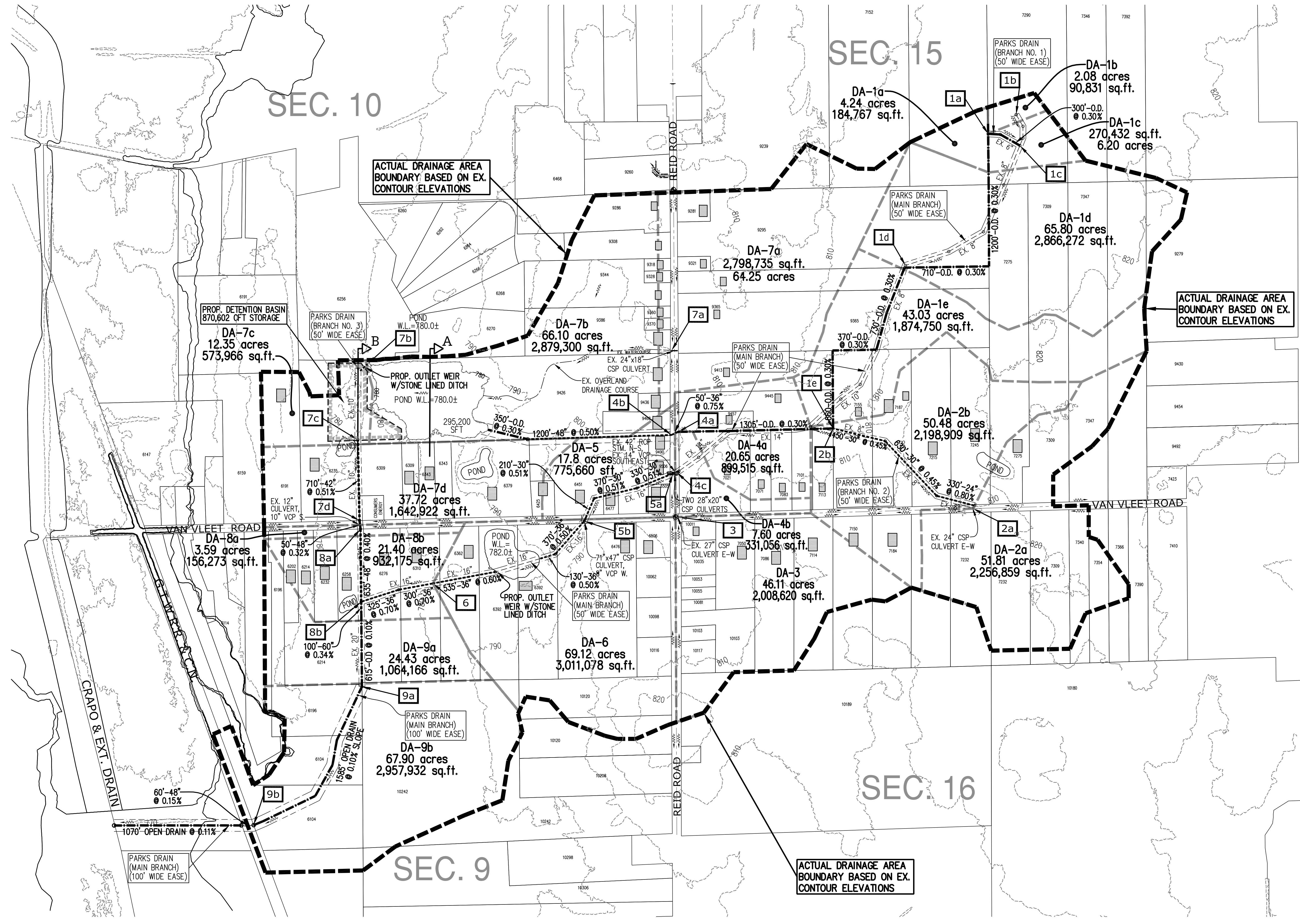
Time conc min	I 100	CwA	Qin	Qout/Qallow	Qin-Qout Ft ³ /s	V=(Qin-Qout)*Tc*60 Ft ³	RETENTION (X2 OF DET)
10	5.77	116.10	669.88	77.40	592.48	355,487.81	710,975.63
20	4.60	116.10	534.05	77.40	456.65	547,975.44	1,095,950.88
30	3.90	116.10	452.78	77.40	375.38	675,680.94	1,351,361.88
40	3.40	116.10	394.73	77.40	317.33	761,591.52	1,523,183.04
50	3.00	116.10	348.29	77.40	270.89	812,673.00	1,625,346.00
60	2.70	116.10	313.46	77.40	236.06	849,822.84	1,699,645.68
70	2.50	116.10	290.24	77.40	212.84	893,938.50	1,787,877.00
80	2.30	116.10	267.02	77.40	189.62	910,190.88	1,820,381.76
90	2.10	116.10	243.80	77.40	166.40	898,579.98	1,797,159.96
100	1.90	116.10	220.58	77.40	143.18	859,105.80	1,718,211.60
110	1.80	116.10	208.97	77.40	131.57	868,392.36	1,736,784.72
120	1.70	116.10	197.36	77.40	119.96	863,747.28	1,727,494.56
130	1.60	116.10	185.76	77.40	108.36	845,170.56	1,690,341.12
140	1.50	116.10	174.15	77.40	96.75	812,662.20	1,625,324.40
150	1.45	116.10	168.34	77.40	90.94	818,465.85	1,636,931.70
160	1.40	116.10	162.54	77.40	85.14	817,303.68	1,634,607.36
170	1.30	116.10	150.93	77.40	73.53	749,966.22	1,499,932.44
180	1.25	116.10	145.12	77.40	67.72	731,389.50	1,462,779.00
190	1.20	116.10	139.32	77.40	61.92	705,846.96	1,411,693.92
200	1.15	116.10	133.51	77.40	56.11	673,338.60	1,346,677.20
210	1.10	116.10	127.71	77.40	50.31	633,864.42	1,267,728.84
220	1.00	116.10	116.10	77.40	38.70	510,800.40	1,021,600.80
230	0.95	116.10	110.29	77.40	32.89	453,911.67	907,823.34
240	0.93	116.10	107.97	77.40	30.57	440,211.02	880,422.05
270	0.83	116.10	96.36	77.40	18.96	307,160.26	614,320.52
300	0.73	116.10	84.75	77.40	7.35	132,314.58	264,629.16
330	0.66	116.10	76.62	77.40	-0.78	-15,364.40	-30,728.81
360	0.62	116.10	71.98	77.40	-5.42	-117,068.98	-234,137.95
390	0.59	116.10	68.50	77.40	-8.90	-208,324.82	-416,649.64
420	0.55	116.10	63.85	77.40	-13.55	-341,375.58	-682,751.16
450	0.53	116.10	61.53	77.40	-15.87	-428,451.93	-856,903.86
480	0.50	116.10	58.05	77.40	-19.35	-557,323.20	-1,114,646.40
510	0.48	116.10	55.73	77.40	-21.67	-663,207.26	-1,326,414.53
540	0.45	116.10	52.24	77.40	-25.16	-815,065.74	-1,630,131.48
570	0.43	116.10	49.92	77.40	-27.48	-939,757.52	-1,879,515.04
600	0.41	116.10	47.60	77.40	-29.80	-1,072,808.28	-2,145,616.56



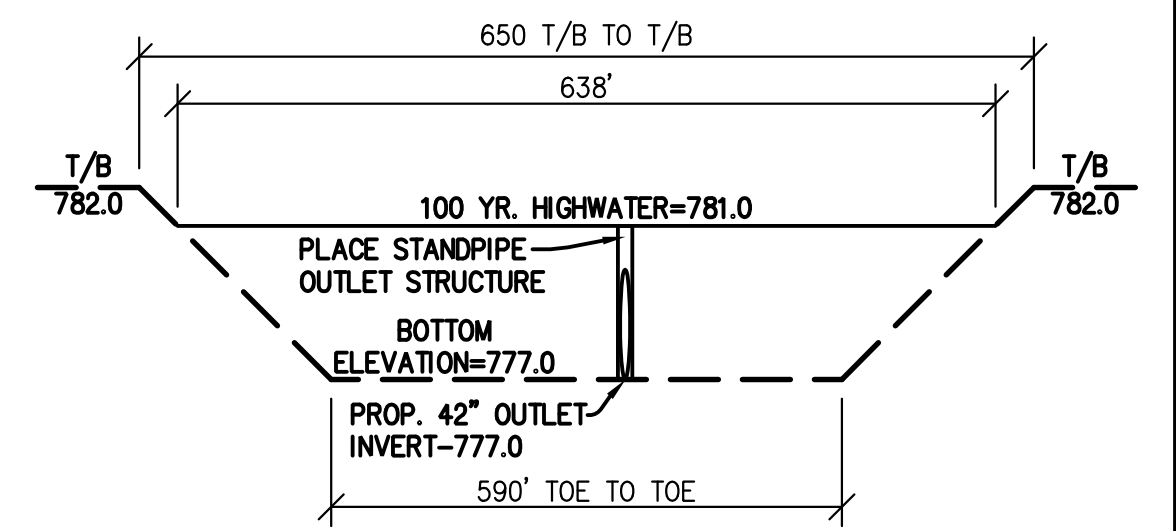
LEGEND

- 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)



EXISTING LAKE/POND CROSS SECTION A-A
442,800 CFT. OF STORAGE



PROPOSED DETENTION BASIN CROSS SECTION B-B
870,600 CFT. OF STORAGE
TOTAL VOLUME REQUIRED:
910,191 CFT.
TOTAL VOLUME PROVIDED:
1,313,400 CFT.

ALTERNATIVE NO. 3:
REPLACE THE EXISTING OPEN DRAIN WITH NEW OPEN DRAIN, AND REPLACE EXISTING PIPE WITH NEW PIPE AND/OR OPEN DRAIN BASED ON THE LOCATION AND PROXIMITY TO EXISTING HOMES AND YARDS, WHILE IMPROVING THE DRAIN ALIGNMENT WHEN PRACTICAL. ALSO RE-ROUTE THE SOUTH SIDE (SOUTH OF REID ROAD) OF THE DRAINAGE AREA TO A PROPOSED DETENTION BASIN TO REDUCE THE SIZE OF THE PIPE SYSTEM.

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. 10
DRAINAGE MAP
ALTERNATIVE NO. 3

REVISIONS	DRN. BY:	RADO	04.11.2013	SHEET NO:
09.27.2013	DSN. BY:	T.L.O.	"	E-14
	CKD. BY:	M.R.P.	"	
	APPR. BY:	M.R.P.	"	