

**ENGINEER'S OPINION OF COSTS**

FOR

**PROPOSED PARKS DRAIN #0471  
ALTERNATIVE NO. 2**

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	LF	\$ 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	Soil Erosion & Sedimentation Control	1	LS	\$ 10,000.00	\$ 10,000.00
15	Maintenance Gravel	50	Ton	\$ 20.00	\$ 1,000.00
16	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
17	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
18	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
19	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
20	24 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	330	LF	\$ 45.00	\$ 14,850.00
21	30 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	1290	LF	\$ 60.00	\$ 77,400.00
22	36 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-III, Trench Detail 1	635	LF	\$ 70.00	\$ 44,450.00
23	48 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	2530	LF	\$ 95.00	\$ 240,350.00
24	54 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	635	LF	\$ 110.00	\$ 69,850.00
25	60 in. Reinforced Concrete Pipe Storm Sewer, Class C-76-II, Trench Detail 1	100	LF	\$ 125.00	\$ 12,500.00
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	100	LF	\$ 115.00	\$ 11,500.00

Parks Drain #0471  
Alternative No. 2

ITEM NO.	WORK ITEM	EST. QTY	UNIT	UNIT PRICE	TOTAL AMOUNT
28	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
29	Drainage Structure Covers	23	Each	\$ 350.00	\$ 8,050.00
30	4 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	2	Each	\$ 1,500.00	\$ 3,000.00
31	5 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	6	Each	\$ 2,500.00	\$ 15,000.00
32	6 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	14	Each	\$ 3,500.00	\$ 49,000.00
33	7 ft. Diam. Drainage Structure, Catch Basin, 0 to 8 ft.	1	Each	\$ 4,500.00	\$ 4,500.00
34	12 in. Steel End Section with Steel Grate	14	Each	\$ 250.00	\$ 3,500.00
35	Steel End Section with Steel Grate for 30 in Concrete Pipe	3	Each	\$ 1,000.00	\$ 3,000.00
36	Steel End Section with Steel Grate for 60 in Concrete Pipe	1	Each	\$ 3,000.00	\$ 3,000.00
37	Outlet Weir	1	Each	\$ 2,500.00	\$ 2,500.00
38	Topsoil Surface, 4 inch	30000	SY	\$ 0.75	\$ 22,500.00
39	Chemical Fertilizer Nutrient (240 Lbs/acre)	3000	Lb	\$ 2.00	\$ 6,000.00
40	Class A seeding (200 Lbs/acre)	2500	Lb	\$ 4.00	\$ 10,000.00
41	Mulch (2 tons/acre)	25	Ton	\$ 300.00	\$ 7,500.00
42	Mulch Blanket for Open Drain Bottom	8500	SY	\$ 1.50	\$ 12,750.00
				Estimated Construction Cost	\$ 935,020.00
				Design Contingencies	\$ 46,750.00
				Construction Contingencies	\$ 98,180.00
				Preliminary and Design Engineering	\$ 83,785.00
				Construction Engineering & Inspection	\$ 147,265.00
				<b>TOTAL ESTIMATED COST*</b>	<b>\$ 1,311,000.00*</b>

\*Not including the cost of 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. 2

Alternative No. 2 Hydraulic Summary

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

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

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

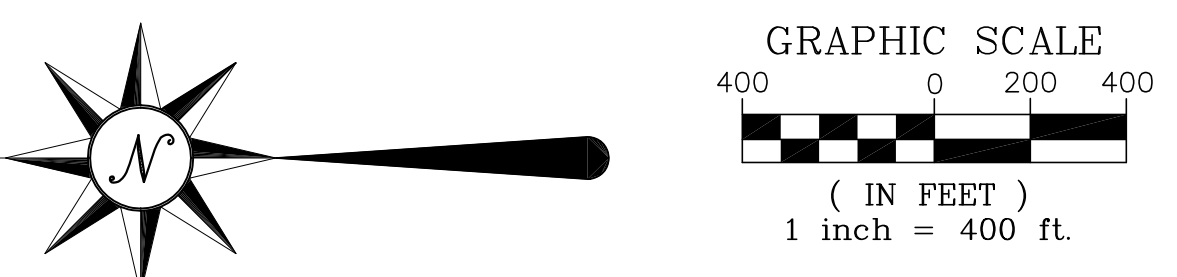
Job Name Parks Drain, Alternative No. 2

By TLO  
Date 8/30/12

Channel Parameters:  
Bottom 2 Ft. Min.  
Side Slopes 3 FT/FT

INVERT ELEV.

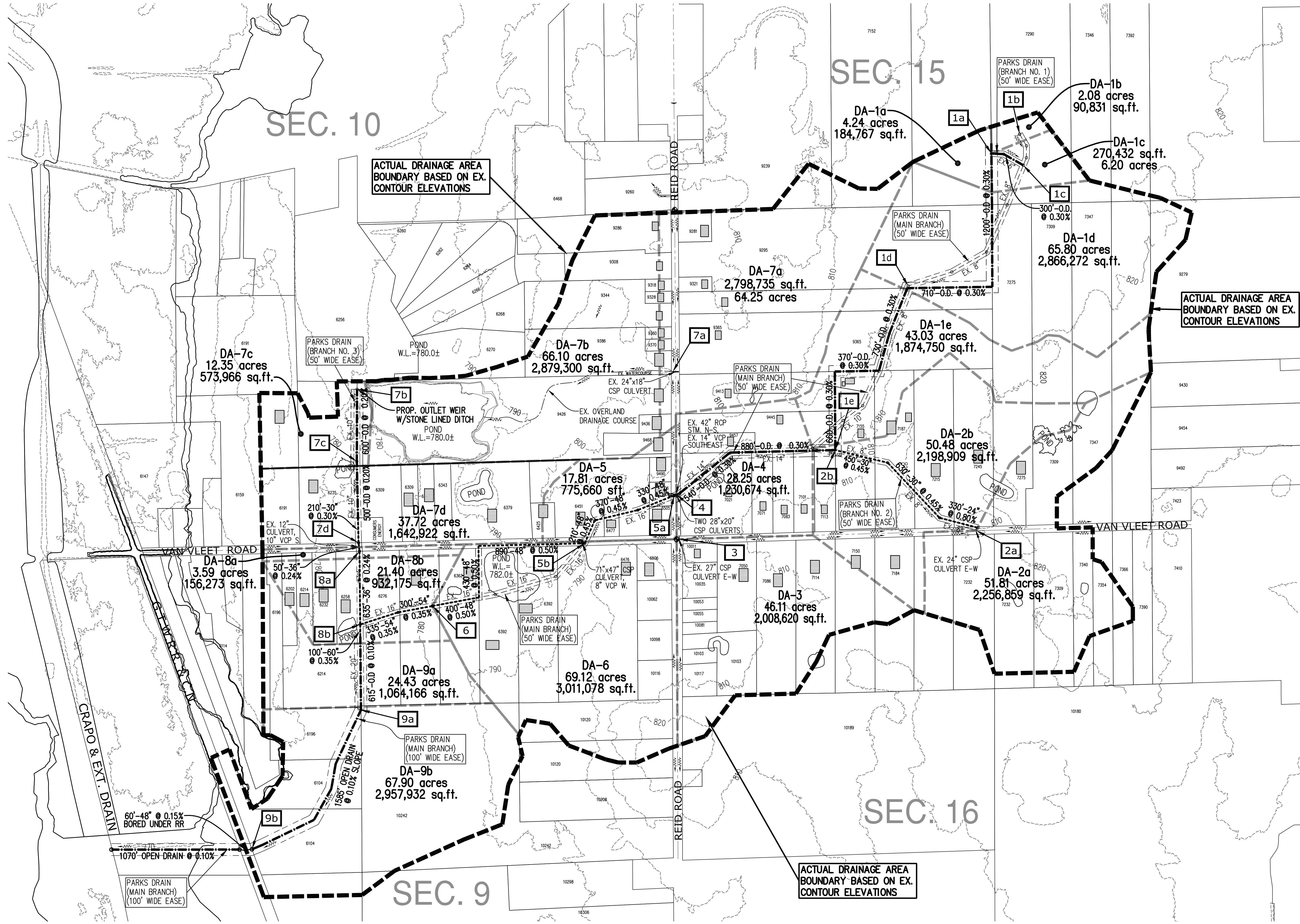
UPSTREAM STRUCT.	DOWNSTREAM STRUCT.	CONVEYANCE	INCREMENT AREA AI	TOTAL AREA A	RUNOFF COEF. C	EQUIVALENT AREA CAI	TOTAL EQUIV. AREA TOTAL CAI	TIME T	RAINFALL INTENSITY	DESIGN FLOW Q = I TOTAL CAI	DIAMETER OF PIPE / OR EQUIVALENT	SLOPE OF PIPE / DITCH	PIPE CAPACITY FLOWING FULL	VELOCITY PIPE FLOWING FULL	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									
10 YEAR DESIGN STORM																																							
1b	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	2.18	1.00	2.29	16.03	0.00	811.00	810.10	812.00	4.00	3	7.00	7.16	0.98	0.035	Open Drain									
1c, 1a	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	10.65	1.50	2.99	38.13	0.00	810.10	804.37	812.00	4.00	3	12.75	8.74	1.46	0.035	Open Drain									
1d	1e, 2b	Open Drain	65.80	78.32	0.30	19.74	23.50	160.65	0.90	21.25	N/A	0.30	N/A	N/A	1760	8.12	2.00	3.61	72.27	0.00	804.37	799.09	810.00	4.00	3	20.00	10.32	1.94	0.035	Open Drain									
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								
2a	1e, 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	810.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
2b	4	Open Drain	50.48																																				
1e	4	Open Drain	43.03	223.64	0.30	67.09	67.09	168.76	0.87	58.11	N/A	0.30	N/A	N/A	1420	6.58	2.00	3.59	57.52	0.00	798.20	793.94	804.00	2.00	3	16.00	8.32	1.92	0.035	Open Drain									
10 YEAR DESIGN STORM																																							
3	4	Ex. 27" Culv	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	797.95	797.58	798.00	2.00	3	9.75	6.74	1.45	0.035	Existing 27" storm sewer									
3	4	Open Drain	0.00	46.11	0.30	13.83	13.83	90.09	1.47	20.29	N/A	0.88	N/A	N/A	350	0.95	2.00	6.16	98.51	0.00	797.58	794.50	797.00	2.00	3	16.00	8.32	1.92	0.035	Existing Roadside Ditch									
10 YEAR DESIGN STORM																																							
4	5a	Ex 42" Pipe	28.25	298.00	0.30	8.48	89.40	175.35	0.84	74.87	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	Existing 42" storm sewer									
25 YEAR DESIGN STORM																																							
5a	5b	PIPE	0.00	298.00	0.30		89.40	175.44	0.95	85.13	48	0.45	104.34	8.31	910	1.83	N/A	N/A	N/A	N/A	789.282	785.187	796	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
5b	6	PIPE	17.81	315.81	0.30	5.34	94.74	177.27	0.94	89.41	48	0.50	109.98	8.76	1720	3.27	N/A	N/A	N/A	N/A	785.187	776.587	790	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
6	8b	PIPE	69.12	384.93	0.30	20.74	115.48	180.54	0.93	107.25	54	0.35	125.97	7.92	635	1.34	N/A	N/A	N/A	N/A	776.587	774.3645	780	N/A	N/A	N/A	N/A	N/A	N/A	Proposed Storm Sewer									
10 YEAR DESIGN STORM																																							
7b	7c		66.10	66.10	0.30	19.83	19.83	150.00	0.96	18.80	N/A	0.20	N/A	N/A	600	4.62	1.25	2.17	20.98	0.00	777.00	775.80	779.00	4.00	3	9.69	7.95	1.22	0.035	Open Drain - Based upon Estimated Flow Required to Hold 0.5' in Pond									
7c	7d	Open Drain	12.35	78.45	0.30	3.71	23.54	154.62	0.94	22.01	N/A	0.20	N/A	N/A	500	3.85	1.25	2.17	20.98	0.00	775.80	774.80	779.00	4.00	3	9.69	7.95	1.22	0.035	Open Drain									
7c	7d	PIPE	0.00	12.35	0.30	0.00	23.54	154.62	0.94	22.01	30	0.30	24.33	4.96	210	0.71	N/A	N/A	N/A	N/A	774.80	774.17	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed 30" Storm Sewer									
10 YEAR DESIGN STORM																																							
7d	8a	PIPE	37.72	50.07	0.30	11.32	34.85	155.32	0.93	32.46	36	0.24	35.38	5.01	50	0.17	N/A	N/A	N/A	N/A	774.17	774.05	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed 36" Storm Sewer									
8a	8b	PIPE	3.59	53.66	0.30	1.08	35.93	155.49	0.93	33.43	36	0.24	35.38	5.01	635	2.11	N/A	N/A	N/A	N/A	774.05	772.53	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed 36" Storm Sewer									
25 YEAR DESIGN STORM																																							
8b	9a	PIPE	21.40	459.99	0.30	6.42	138.00	181.88	0.92	127.34	60	0.35	166.84	8.50	100	0.20	N/A	N/A	N/A	N/A	772.53	772.18	778.00	N/A	N/A	N/A	N/A	N/A	N/A	Proposed 60" Storm Sewer									
9a	9b	Open Drain	24.43	484.42	0.30	7.33	145.33	182.07	0.92	133.98	N/A	0.10	N/A	N/A	615	3.19	4.00	3.22	154.40	0.00	772.18	771.56	777.00	4.00	2	48.00	12.94	3.71	0.035	Open Drain									
9a	9b	Open Drain	0.00	484.42	0.30	0.00	145.33	185.26	0.91	131.96	N/A	0.10	N/A	N/A	1585	8.21	4.00	3.22	154.40	0.00	771.56	769.98	776.00	4.00	2	48.00	12.94	3.71	0.035	Open Drain									
9b	9c	PIPE	67.90	552.32	0.30	20.37	165.70	193.47	0.87	144.82	48	0.15	60.24	4.80	60	0.21	N/A	N/A	N/A	N/A	769.98	769.89	774.00	N/A	N/A	N/A	N/A	N/A	N/A	Ex. 36" & Prop. 48"									
9c	Crapo	Open Drain	0.00	552.32	0.30	0.00	165.70	193.68	0.87	144.68	N/A	0.10	N/A	N/A	1070	5.54	4.00	3.22	154.40	0.00	769.89	768.82	772.00	4.00	2	48.00	12.94	3.71	0.035	Open Drain									
25 YEAR DESIGN STORM																																							
											36	2.89	122.77												771.60	770.00												Existing 36" Culvert	
											48	0.15	60.24												769.976	769.886	774												Proposed 48" Culvert
for info only, 25 year storm calc at Railroad Crossing							204.80	193.47	0.87	179.00												183.01												Combine Culvert Capacities					



**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. 2:**  
 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.

**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'  
 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. 7**  
**DRAINAGE MAP**  
**ALTERNATIVE NO. 2**

REVISIONS	DRN. BY:	RADO	04.11.2013	SHEET NO:
09.27.2013	DSN. BY:	T.L.O.	"	E-9
	CKD. BY:	M.R.P.	"	
	APPR. BY:	M.R.P.	"	