PHASE I

PRELIMINARY DESIGN REPORT

AND

COST ESTIMATE

BURROUGH DRAIN

SUBMITTED TO:

GENESEE COUNTY DRAIN COMMISSION
ANTHONY B. RAGNON, DRAIN COMMISSIONER
932 BEACH STREET
FLINT, MICHIGAN 48502

SUBMITTED BY:

CHMP, INC
2505 LAPEER ROAD
FLINT, MICHIGAN 48503

TELEPHONE: (313) 232-5211

August 26, 1985

I N D E X

SUMMARY

The flows listed below are for existing development conditions with the exception of the Corunna Road corridor. Lots fronting Corunna Road are presently mixed commercial and residential in nature. It is anticipated that ultimately, all lots fronting Corunna Road will be commercial property. Therefore, these flows reflect commercialization along Corunna Road one lot deep on both the North and South side of the road. These conditions are also assumed to represent ultimate development.

ESTIMATED PEAK FLOWS

LOCATION	POINT	DRAINAGE AREA ACRES	DEVELOPED FLOWS AND FREQUENCIES CFS	
			10 YR	25 YR
Southside Corunna Road	50	206	142	160
West Court Street	58	398	289	326
Outlet at Chapman Drain	63	476	308	347

ESTIMATED COSTS

ALTERNATE NO.	DESCRIPTION	ESTIMATED CONSTRUCTION COST
1	Replace Existing Sewer/Clean Channel	$ 957,275
2	Relief Sewer/Clean Channel	$ 745,700

LAND USE

Existing land use consists mostly of residential and commercial developments. South of Corunna Road, development is exclusively single-family residential except for about 12 acres of sloped woodlands and a school in the southwest corner. The Corunna Road Corridor consists of commercial and residential developments. The area between Corunna Road and West Court Street contains single-family residential dwellings, two mobile-home parks and an apartment building complex. Northwest of West Court Street is an argicultural area while northeast of Court Street is another single-family residential area.

SOIL TYPES

The drainage basin is composed of a variety of soils including Conover Loam, Celina Loam, Celina-Owosso Sandy Loam, Augres Loamy Sand, Gilford Sandy Loam and Spinks-Oakvile Loamy Sand. Conover Loam 2-6% predominates in the southwest portion of the basin, but the remainder of the basin is intertwined with all of the above soil types. These soils range from hydrologic soil group A, low runoff potential (Spinks Loamy Sand) to C, moderate runoff potential with slow infiltration (Celina Loam). The predominate soil type is B. The runoff from the basin is not only influenced by the soils but also by the imprevious nature of the mobile-home parks, apartment complexes and the commercial nature of the Corunna Road Corridor.

HYDROLOGY

The Rational Formula (Q=CiA) was used to develop estimates of peak flows. The total drainage basin area is approximately 476 acres. The 300 acres dividing point (the Drain Commission's dividing line for changing storm frequency from 10 years to 25 years) occurs at the west end of Redwing Drive. Since the upstream area is governed by the 10-year storm and downstream area is governed by the 25-year storm, the entire basin was investigated for each storm frequency. The 25-year frequency produced higher flows but the pipe sizes increased only 6-inches. Therefore, as a conservative estimate the 25-year storm was utilized for all proposed facilities.

Runoff coefficients for the drainage basin ranged from 0.30 in the agricultural area Northwest of Court Street to 0.70 in the area of the mobile-home parks and the commercial corridor on Corunna Road.

As a result of the high runoff coefficients, and relatively steep slopes the time of concentration at the upstream end of the basin is relatively short. The short time of concentration is compounded because most of the drainage basin is served by a pipe network which by its nature promotes short travel times.

ALTERNATIVES

Two different alternatives were considered. Each alternative consisted of combinations of pipe and open channel improvements as described below. The same flow, the 25-year frequency storm was utilized for both alternatives. Therefore, the major difference in the alternatives is the alignment and pipe size in the pipe network. Comparative cost estimates for each alternative were also developed. The cost estimates are in May, 1985 dollars. No adjustments have been made for future inflation.

Two other alternatives which were screened out from further consideration were construction of an open channel to replace the existing pipe north of Corunna Road and a pumping station located at Corunna Road with a force main to Court Street. The channel was not considered viable since top widths would be between 40' to 50', requiring permanent abandonment of existing mobile home sites and possibly apartment complexes. Pumping was not considered further due to operating and maintenance costs which would be incurred after construction and during operation of the system.

ALTERNATIVE 1

This alternative includes the following major features:

- Replace the existing 36-inch diameter storm sewer between Corunna Road and West Court Street with Class III reinforced concrete elliptical pipe sized from 63" X 98" to 77" X 121". The new pipe will be installed at the same slope as the replaced pipe.

- The drain from the north side of Court Street will be an open channel with bottom width of 4 feet and channel depth of 6 feet.

The existing pipe slope is 0.10 percent. Elliptical pipe is required at this slope to insure sufficient cover over the pipe. The potential for using circular pipe exists if the slope of the pipeline can be increased. Increasing the slope of the pipeline may also allow a reduction in pipe diameter and hence cost. The largest pipe need only be equivalent to a 96-inch circular pipe, since capacity at 0.10 percent slope is 313 cfs compared to the maximum pipe flow of 325 cfs. Note that the existing slope and surface profile have been evaluated from existing plans. Only after extensive field work will the actual slopes be available. This alternative also includes a cost for temporarily displacing many mobile homes during the construction, since the existing pipe traverses both mobile-home parks. Figure 1 shows the proposed improvements under this alternative. Table 1 gives the estimated construction costs for this alternative.

ALTERNATIVE 2

This alternative includes the following major features:

- Maintain the existing 36-inch storm sewer in its current location.
- Construct a relief storm sewer through a corridor between Corunna Road and West Court Street.
- The drain from the north side of Court Street will be an open channel, with bottom width of 4 feet and channel depth of 6 feet.

The new sewer will carry excess flow not capable of being carried by the existing sewer. An exact path for the relief sewer was not determined. Rather, it was assumed that the relief sewer will be constructed along the least cumbersome path from Corunna Road to Court Street. The relief sewer size and capacity was determined using the same slope as the existing 36-inch sewer. Elliptical pipe was also used in this alternative. As with Alternative 1, the pipe size may be reduced by increasing the slope of the pipe and reducing the slope of the channel. Figure 2 shows one proposed corridor for Alternative 2. Table 2 gives the estimated construction costs for this alternative.

TABLE 1

... DATE ... SUBJECT Replace Existing Storm Drain & Clean Channel - Alternate 1 - Costs SHEET NO. ... OF ...

CHKD. BY ... DATE ... JOB NO. ...

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Clearing & Grubbing (4' Bottom Ditch)	2080	L.F.	5.00	10,400.00
2	Open Drain Excavation (4' Bottom Ditch)	2080	L.F.	5.00	10,400.00
3	Machine Grading (4' Bottom Ditch)	2080	L.F.	5.00	10,400.00
4	63' X 98" RCEP HE III TD2	265	L.F.	230.00	60,950.00
5	68 X 106 RCEP HE III TD2	100	L.F.	250.00	25,000.00
6	72 X 113 RCEP HE III TD2	890	L.F.	330.00	293,700.00
7	77 X 121 RCEP HE III TD2	1115	L.F.	345.00	384,675.00
8	Junction Chambers	10	Each	6500.00	65,000.00
9	Pavement Remove & Replace - Court St.	250	SY	60.00	15,000.00
10	Pavement Remove & Replace - Corunna Rd	170	SY	75.00	12,750.00
11	Remove & Replace Mobile Home Pads And Utilities	30	Each	1500.00	45,000.00
	Remove & Replace Mobile Homes	30	Each	800.00	24,000.00
				TOTAL	957,275.00

TABLE 2

Y. ______ DATE ______ SUBJECT Construct Relief Sewer And Clean Channel - Alternate 2 - Costs SHEET NO. ______ OF ______

CHKD. BY ______ DATE ______ JOB NO. ______

ITEM NO.	DESCRIPTION OF ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Clearing & Grubbing (4' Bottom Drain)	2080	L.F.	5.00	10,400.00
2	Open Drain Excavation (4' Bottom Drain)	2080	L.F.	5.00	10,400.00
3	Machine Grading (4' Bottom Drain)	2080	L.F.	5.00	10,400.00
4	58" X 91" RCEP HE III TD2	265	L.F.	220.00	58,300.00
5	68 X 106 RCEP HE III TD2	990	L.F.	250.00	247,500.00
6	72 X 113 RCEP HE III TD2	865	L.F.	280.00	242,200.00
7	77 X 121 RCEP HE III TD2	250	L.F.	295.00	73,750.00
8	Junction Chambers	10	Each	6500.00	65,000.00
9	Pavement Removal & Replace - Court. St.	250	SY	60.00	15,000.00
10	Pavement Removal & Replace - Corunna Rd	170	SY	75.00	12,750.00
				TOTAL	745,700.00

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BURROUGHS DRAIN

DESIGN FLOOD FREQUENCY : 10 YEARS
INTENSITY CONSTANTS
FOR I = a/(t+d)n
a = 166.37
d = 23.305
n = 1

OUR JOB NUMBER : 27312
THIS RUN AT
DATE: 4 - 19 - 85
TIME: 8 : 46 : 52

FROM POINT	TO POINT	NEW ACRES A	RNFF CFNT C	A * C	SUM A * C	TIME OF CONCEN-TRATION TC(min)	INTEN-SITY in/hr	DISCH. Q(cfs)	LENGTH L(ft)	VELO-CITY fps	TOTAL TIME min	GRADE %	N	DIAMETER	TYPE
1	2	9.1	.40	3.64	3.64	32.00	3.008	10.95	120	8.40	32.24	1.700	.012	18	P
2	3	0.3	.40	0.12	3.76	32.24	2.995	11.26	52	8.40	32.34	1.700	.012	18	P
3	4	0.1	.40	0.04	3.80	32.34	2.990	11.36	183	8.40	32.70	1.700	.012	18	P
4	6	1.6	.40	0.64	4.44	32.70	2.971	13.19	270	10.97	33.11	3.700	.012	15	P
6	7	2.0	.40	0.80	5.24	33.11	2.949	15.45	60	12.39	33.19	3.700	.012	18	P
7	8	0.3	.40	0.12	5.36	33.19	2.945	15.79	270	7.14	33.82	1.000	.012	21	P
8	9	0.7	.40	0.28	5.64	33.82	2.912	16.42	342	3.23	35.58	0.100	.012	36	P
9	10	2.5	.40	1.00	6.64	35.58	2.825	18.76	218	3.23	36.70	0.100	.012	36	P
12	10	1.0	.40	0.40	0.40	23.00	3.593	1.44	415	2.20	26.14	0.200	.012	12	P
10	22	1.0	.40	0.40	7.44	36.70	2.773	20.63	42	7.80	36.79	1.000	.012	24	P
17	19	3.1	.40	1.24	1.24	26.00	3.374	4.18	200	2.88	27.16	0.200	.012	18	P
18	19	11.3.	.30	3.39	3.39	58.00	2.046	6.94	33	3.19	58.17	0.200	.012	21	P
19	21	0.7	.40	0.28	4.91	58.17	2.042	10.03	200	4.27	58.95	0.300	.012	24	P
20	21	15.6	.40	6.24	6.24	31.00	3.064	19.12	35	3.23	31.18	0.100	.012	36	P
21	16	1.9	.40	0.76	11.91	58.95	2.023	24.09	237	4.57	59.81	0.200	.012	36	P
13	14	0.9	.40	0.36	0.36	20.00	3.842	1.38	360	4.66	21.29	0.900	.012	12	P
14	15	1.0	.40	0.40	0.76	21.29	3.731	2.84	165	2.55	22.37	0.200	.012	15	P
15	16	1.0	.40	0.40	1.16	22.37	3.642	4.22	35	2.88	22.57	0.200	.012	18	P
16	22	5.8	.40	2.32	15.39	59.81	2.002	30.81	258	4.57	60.75	0.200	.012	36	P
24	23	1.3	.40	0.52	0.52	28.00	3.243	1.69	37	1.80	28.34	0.100	.012	15	P
23	22	1.0	.40	0.40	0.92	28.34	3.221	2.96	344	2.04	31.15	0.100	.012	18	P
22	30	0.0	.40	0.00	23.75	60.75	1.979	47.00	300	3.92	62.03	0.100	.012	48	P
30	32	30.8	.40	12.32	36.07	62.03	1.950	70.34	50	4.54	62.21	0.100	.012	60	P

TOTAL ACRES= 93.0 TOTAL LENGTH= 4226

C H M P ENGINEERING
2505 LAFEER ROAD
FLINT MICHIGAN 48503
TEL: (313)232-5211

BURROUGHS DRAIN

DESIGN FLOOD FREQUENCY : 10 YEARS
INTENSITY CONSTANTS
FOR I = a/(t+d)n
a = 166.37
d = 23.305
n = 1

OUR JOB NUMBER : 27312
THIS RUN AT
DATE: 4 - 18 - 85
TIME: 13 : 22 : 34

FROM POINT	TO POINT	NEW ACRES A	RNFF CFNT C	A * C	SUM A * C	TIME OF CONCEN-TRATION TC(min)	INTEN-SITY in/hr	DISCH. Q(cfs)	LENGTH L(ft)	VELO-CITY fps	TOTAL TIME min	GRADE %	N	DIAMETER	TYPE
18	19	11.3	.30	3.39	3.39	58.00	2.046	6.94	33	3.19	58.17	0.200	.012	21	P
19	21	3.8	.40	1.52	4.91	58.17	2.042	10.03	200	4.27	58.95	0.300	.012	24	P
21	16	17.5	.40	7.00	11.91	58.95	2.023	24.09	237	4.57	59.81	0.200	.012	36	P
16	22	8.7	.40	3.48	15.39	59.81	2.002	30.81	258	4.57	60.75	0.200	.012	36	P
22	30	21.1	.40	8.44	23.83	60.75	1.979	47.16	300	3.92	62.03	0.100	.012	48	P
30	32	30.8	.40	12.32	36.15	62.03	1.950	70.49	50	4.54	62.21	0.100	.012	60	P
32	40	3.0	.40	1.20	37.35	62.21	1.946	72.68	680	4.54	64.71	0.100	.012	60	P
40	41	30.4	.40	12.16	49.51	64.71	1.890	93.57	350	4.84	65.92	0.100	.012	66	P
41	42	2.0	.40	0.80	50.31	65.92	1.865	93.83	40	4.84	66.06	0.100	.012	66	P
42	43	32.9	.40	13.16	63.47	66.06	1.862	118.18	240	5.13	66.84	0.100	.012	72	P
43	44	9.1	.40	3.64	67.11	66.84	1.846	123.89	640	5.13	68.92	0.100	.012	72	P
44	45	3.0	.40	1.20	68.31	68.92	1.804	123.23	40	5.13	69.05	0.100	.012	72	P
45	46	2.4	.40	0.96	69.27	69.05	1.801	124.76	270	5.13	69.93	0.100	.012	72	P
46	47	3.9	.40	1.56	70.83	69.93	1.784	126.36	240	5.13	70.71	0.100	.012	72	P
47	48	21.9	.40	8.76	79.59	70.71	1.770	140.87	40	5.13	70.84	0.100	.012	72	P
48	49	1.2	.40	0.48	80.07	70.84	1.767	141.48	320	5.13	71.88	0.100	.012	72	P
49	50	1.0	.40	0.40	80.47	71.88	1.748	140.66	170	5.13	72.43	0.100	.012	72	P

TOTAL ACRES= 204.0

TOTAL LENGTH= 4108

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INTENSITY CONSTANTS
FOR $I = a/(t+d)^n$
a = 166.37
d = 23.305
n = 1

OUR JOB NUMBER : 27312
THIS RUN AT
DATE: 5 - 2 - 85
TIME: 10 : 19 : 22

FROM POINT	TO POINT	NEW ACRES A	RNFF CFNT C	A * C	SUM A * C	TIME OF CONCEN-TRATION TC(min)	INTEN-SITY in/hr	DISCH. Q(cfs)	LENGTH L(ft)	VELO-CITY fps	TOTAL TIME min	GRADE %	N				
															DIAMETER		TYPE
50	51	206.0	.40	82.40	82.40	73.00	1.728	142.39	265	5.13	73.86	0.100	.012		72		P
51	52	31.7	.57	18.07	100.47	73.86	1.712	172.00	100	5.41	74.17	0.100	.012		78		P
52	53	23.2	.70	16.24	116.71	74.17	1.707	199.22	275	5.69	74.98	0.100	.012		84		P
53	54	3.0	.70	2.10	118.81	74.98	1.693	201.15	480	5.69	76.39	0.100	.012		84		P
54	55	11.8	.70	8.26	127.07	76.39	1.669	212.08	135	5.69	76.79	0.100	.012		84		P
55	56	58.2	.43	25.03	152.10	76.79	1.662	252.79	205	5.95	77.36	0.100	.012		90		P
56	57	8.3	.70	5.81	157.91	77.36	1.653	261.03	435	5.95	78.58	0.100	.012		90		P
57	58	0.0	.70	0.00	157.91	78.58	1.633	257.87	225	5.95	79.21	0.100	.012		90		P
58	59	55.9	.36	20.12	178.03	79.21	1.623	288.94	250	6.22	79.88	0.100	.012		96		P
														BOTTOM	DEPTH	SLOPE	TYPE
59	60	22.5	.38	8.55	186.58	79.88	1.612	300.77	180	4.45	80.55	0.300	.035	4	4.9	2.0	T
60	61	5.5	.30	1.65	188.23	80.55	1.602	301.54	1100	4.46	84.66	0.300	.035	4	4.9	2.0	T
61	62	23.5	.30	7.05	195.28	84.66	1.541	300.93	500	4.45	86.53	0.300	.035	4	4.9	2.0	T
62	63	26.2	.30	7.86	203.14	86.53	1.515	307.76	300	4.40	87.67	0.300	.035	4	5.0	2.0	T

TOTAL ACRES= 475.8

TOTAL LENGTH= 4450

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DESIGN FLOOD FREQUENCY : 25 YEARS
INTENSITY CONSTANTS
FOR I = a/(t+d)n
a = 191.76
d = 25.93
n = 1

OUR JOB NUMBER : 27312
THIS RUN AT
DATE: 4 - 18 - 85
TIME: 13 : 36 : 42

FROM POINT	TO POINT	NEW ACRES A	RNFF CFNT C	A * C	SUM A * C	TIME OF CONCEN-TRATION TC(min)	INTEN-SITY in/hr	DISCH. Q(cfs)	LENGTH L(ft)	VELO-CITY fps	TOTAL TIME min	GRADE %	N	DIAMETER	TYPE
18	19	11.3	.30	3.39	3.39	58.00	2.285	7.75	33	3.49	58.16	0.200	.012	24	P
19	21	3.8	.40	1.52	4.91	58.16	2.280	11.19	200	4.27	58.94	0.300	.012	24	P
21	16	17.5	.40	7.00	11.91	58.94	2.259	26.90	237	4.57	59.80	0.200	.012	36	P
16	22	8.7	.40	3.48	15.39	59.80	2.237	34.43	259	5.07	60.65	0.200	.012	42	P
22	30	21.1	.40	8.44	23.83	60.65	2.215	52.78	300	4.24	61.83	0.100	.012	54	P
30	32	30.8	.40	12.32	36.15	61.83	2.185	78.99	50	4.54	62.01	0.100	.012	60	P
32	40	3.0	.40	1.20	37.35	62.01	2.181	81.46	650	4.34	64.51	0.100	.012	60	P
40	41	30.4	.40	12.16	49.51	64.51	2.120	104.96	350	4.84	65.72	0.100	.012	66	P
41	42	2.0	.40	0.80	50.31	65.72	2.092	105.25	40	4.84	65.86	0.100	.012	66	P
42	43	32.9	.40	13.16	63.47	65.86	2.089	132.59	240	5.13	66.64	0.100	.012	72	P
43	44	9.1	.40	3.64	67.11	66.64	2.072	139.05	640	5.13	68.72	0.100	.012	72	P
44	45	3.0	.40	1.20	68.31	68.72	2.026	138.40	40	5.13	68.85	0.100	.012	72	P
45	46	2.4	.40	0.96	69.27	68.85	2.023	140.13	270	5.13	69.73	0.100	.012	72	P
46	47	3.9	.40	1.56	70.83	69.73	2.005	142.01	240	5.13	70.51	0.100	.012	72	P
47	48	21.9	.40	8.76	79.59	70.51	1.988	158.22	40	5.41	70.63	0.100	.012	78	P
48	49	1.2	.40	0.48	80.07	70.63	1.986	159.02	320	5.41	71.62	0.100	.012	78	P
49	50	1.0	.40	0.40	80.47	71.62	1.966	158.20	170	5.41	72.14	0.100	.012	78	P

TOTAL ACRES= 204.0
TOTAL LENGTH= 4108

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DESIGN FLOOD FREQUENCY : 25 YEARS
INTENSITY CONSTANTS
FOR $I = a/(t+d)^n$
a = 191.76
d = 25.93
n = 1

OUR JOB NUMBER : 27312
THIS RUN AT
DATE: 5 - 2 - 85
TIME: 10 : 28 : 34

FROM POINT	TO POINT	NEW ACRES A	RNFF CFNT C	A * C	SUM A * C	TIME OF CONCEN-TRATION TC(min)	INTEN-SITY in/hr	DISCH. Q(cfs)	LENGTH L(ft)	VELO-CITY fps	TOTAL TIME min	GRADE %	N	DIAMETER			TYPE	EQ. PIPE
50	51	206.0	.40	82.40	82.40	73.00	1.938	159.69	265	5.41	73.82	0.100	.012	78			P	63x98
51	52	31.7	.57	18.07	100.47	73.82	1.922	193.10	100	5.69	74.11	0.100	.012	84			P	68x106
52	53	23.2	.70	16.24	116.71	74.11	1.917	223.73	275	5.95	74.88	0.100	.012	90			P	72x113
53	54	3.0	.70	2.10	118.81	74.88	1.902	225.98	480	5.95	76.22	0.100	.012	90			P	72x113
54	55	11.8	.70	8.26	127.07	76.22	1.877	238.51	135	5.95	76.60	0.100	.012	90			P	72x113
55	56	58.2	.43	25.03	152.10	76.60	1.870	284.43	205	6.22	77.15	0.100	.012	96			P	77x121
56	57	8.3	.70	5.81	157.91	77.15	1.860	293.71	435	6.22	78.32	0.100	.012	96			P	77x121
57	58	0.0	.70	0.00	157.91	78.32	1.839	290.40	225	6.22	78.92	0.100	.012	96			P	77x121
58	59	55.9	.36	20.12	178.03	78.92	1.829	325.62	250	6.47	79.56	0.100	.012	~~102~~ 96			P	77x121
														BOTTOM	DEPTH	SLOPE	TYPE	
59	60	22.5	.38	8.55	186.58	79.56	1.818	339.20	180	4.38	80.24	0.300	.035	4	5.3	2.0	T	
60	61	5.5	.30	1.65	188.23	80.24	1.806	339.94	1100	4.39	84.42	0.300	.035	4	5.3	2.0	T	
61	62	23.5	.30	7.05	195.28	84.42	1.738	339.40	500	4.39	86.32	0.300	.035	4	5.3	2.0	T	
62	63	26.2	.30	7.86	203.14	86.32	1.708	346.96	300	4.48	87.44	0.300	.035	4	5.3	2.0	T	

TOTAL ACRES= 475.8

TOTAL LENGTH= 4450