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OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES

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Prepared For

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

Boyle
Engineering
Corporation
consulting engineers / architects
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Phoenix, Arizona 85020
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PH-M04-110-11

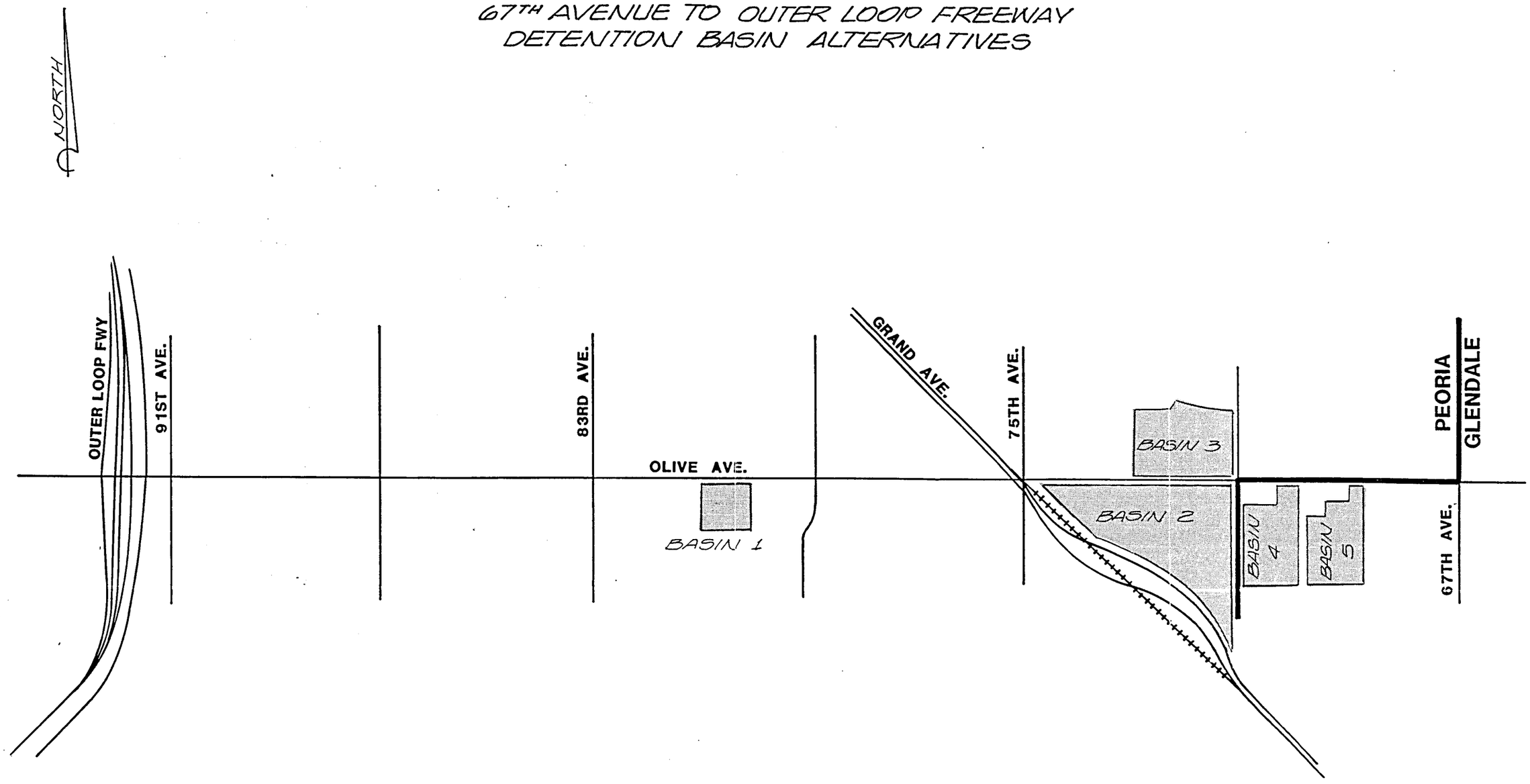
July 1988

Registered Professional Engineer (Civil)
CERTIFICATE NO.
7642
RICHARD R. JEFFRIES
Date Signed 1/14/
ARIZONA, U.S.A.

INTRODUCTION

In the design of a storm drain down Olive Avenue, from 67th Avenue west to the Outer Loop Freeway, it became obvious that detention basin location could have a major impact on the cost of the project; not only in the cost of land but in the size pipes needed to carry the flood flows. The Flood Control District of Maricopa County requested that Boyle Engineering Corporation analyze various detention basin combinations (basin location shown on Figure 1) and report on the results of that analysis. This document is that report.

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



LOCATION OF POTENTIAL
DETENTION BASINS

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988 FIGURE 1

SUMMARY

There is no clear-cut combination of basins and pipe sizes that is hydraulically or economically superior to all other engineering solutions.

Option C, that of utilizing Basin 1 at 5 acres and Basin 2 at 19 acres, is the only option that is relatively expensive compared to all other options.

Option E, utilization of Basin 1 at 5 acres, Basin 3 at 11 acres and Basin 4 at 12.5 acres, appears to be an attractive option to consider further. This arrangement would provide two basins in the City of Peoria totalling 16 acres and one basin in the City of Glendale at 12.5 acres.

OPTION EVALUATION

Under terms of the contract, Boyle was requested to evaluate seven options of basin combinations. In completing the assignment, ten alternatives were considered. Table 1 shows the various detention basin alternatives evaluated.

Table 1

Detention Basin Options Evaluated

Option	Basin Combination
1A	Basin #1 @ 5 Ac. + Basin #4 @ 20 Ac.
2A	Basin #1 @ 5 Ac. + Basin #4 @ 20 Ac. Different Pipe Sizes
3A	Basin #1 @ 5 Ac. + Basin #4 @ 20 Ac. Different Pipe Sizes
2B	Basin #1 @ 10 Ac. + Basin #4 @ 12.5 Ac.
C	Basin #1 @ 5 Ac. + Basin #2 @ 19 Ac.
D	Basin #1 @ 5 Ac. + Basin #3 @ 19 Ac.
E	Basin #1 @ 5 Ac. + Basin #3 @ 11 Ac. + Basin #4 @ 12.5 Ac.
1F	Basin #1 @ 5 Ac. + Basin #5 @ 19.9 Ac.
3F	Basin #1 @ 5 Ac. + Basin #5 @ 23 Ac.
G	Basin #1 @ 5 Ac. + Basin #3 @ 11 Ac. + Basin #5 @ 12.5 Ac.

The detailed results of analysis for each option are shown in the Appendix.

STORM DRAINS

Three sources were utilized for the storm drain hydrologic input; all using the SWMM Model.

1. CDM Report.

2. Boyle (from CDM Report) to account for the following:

   *Existing 48-inch RCP in 75th Avenue that is smaller than that shown in the CDM Master Plan. Using construction drawings and profiles for the 48-inch pipe, a peak outflow from the nearest upstream detention basin (not yet built) was estimated at 80 cfs, based on available head in the basin. Since there is a considerable area upstream of the basin, it was assumed that 80 cfs would flow out of the 48-inch pipe for more than 6 hours (the length of the Boyle SWMM analysis).

   *In order to simplify the Boyle SWMM runs, the flows of pipes immediately connecting to the Olive Avenue Storm Drain were tabulated and input as hydrographs rather than repeating all the calculations for the upstream pipes and subcatchment basins for each iteration.

   Because of the assumptions inherent in using the "surcharge" feature for modelling detention basins, the results obtained will not be precise reflections of the real world. SWMM models flow in pipes using "normal depth." That is, the energy slope is the same as the slope input into the model as pipe slope. To "fool" SWMM into modelling a true surcharged condition, a trial and error procedure is performed where the slope is adjusted to give the desired discharge with the pipe flowing 82 - 100 percent full. This simulates the full-flow condition with an energy grade line greater than the actual pipe slope. The actual behavior of the system would be much more dynamic, with the energy grade line changing constantly (See Figure 2 for location of various pipe elements).

   When the SWMM analysis was performed, certain pipes in Option 1A and 2A showed a hydraulic grade line either above the ground level or within a foot of the ground surface. for this reason, these options were dropped from further analysis.

   In Option B, the hydraulic analysis showed Basin 1 tending to fill indefinitey and then overflow. This option was then discarded.

OLIVE AVENUE STORM DRAIN
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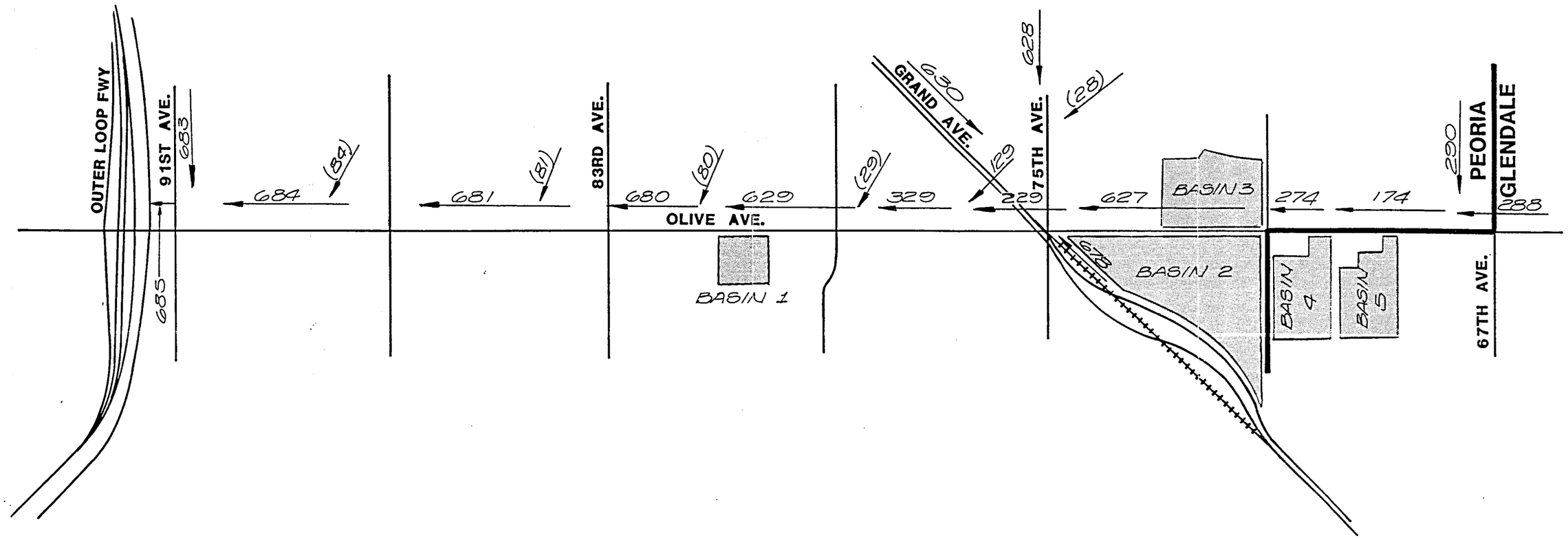
DETENTION BASIN ALTERNATIVES



DUE TO LIMITIONS OF BOYLE'S PC SWMM MODEL PIPE, ELEMENT NUMBERS CANNOT EXCEED 399 - THUS PIPE ELEMENTS IN MODEL ARE MODIFIED. FOR EXAMPLE 629 BECOMES 29 IN MODEL.

XX = PIPE ELEMENT (YY) = CONTRIBUTING SUBCATCHMENT

STORM DRAIN
PIPE NUMBER SYSTEM

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988 FIGURE 2

The remaining seven options were investigated further with pipe costs taken from Figure 3. Costs were indexed upwards when the total length of any particular size pipe on the job was under 2,000 feet. In the case of 102-inch diameter pipe, $20,000 for a mold was distributed among the total linear feet of that pipe on the job. To our knowledge, 102-inch diameter pipe is not presently manufactured in the Phoenix area.

The pipe sizes and cost for each option along with the SWMM analysis summary is shown in the Appendix.

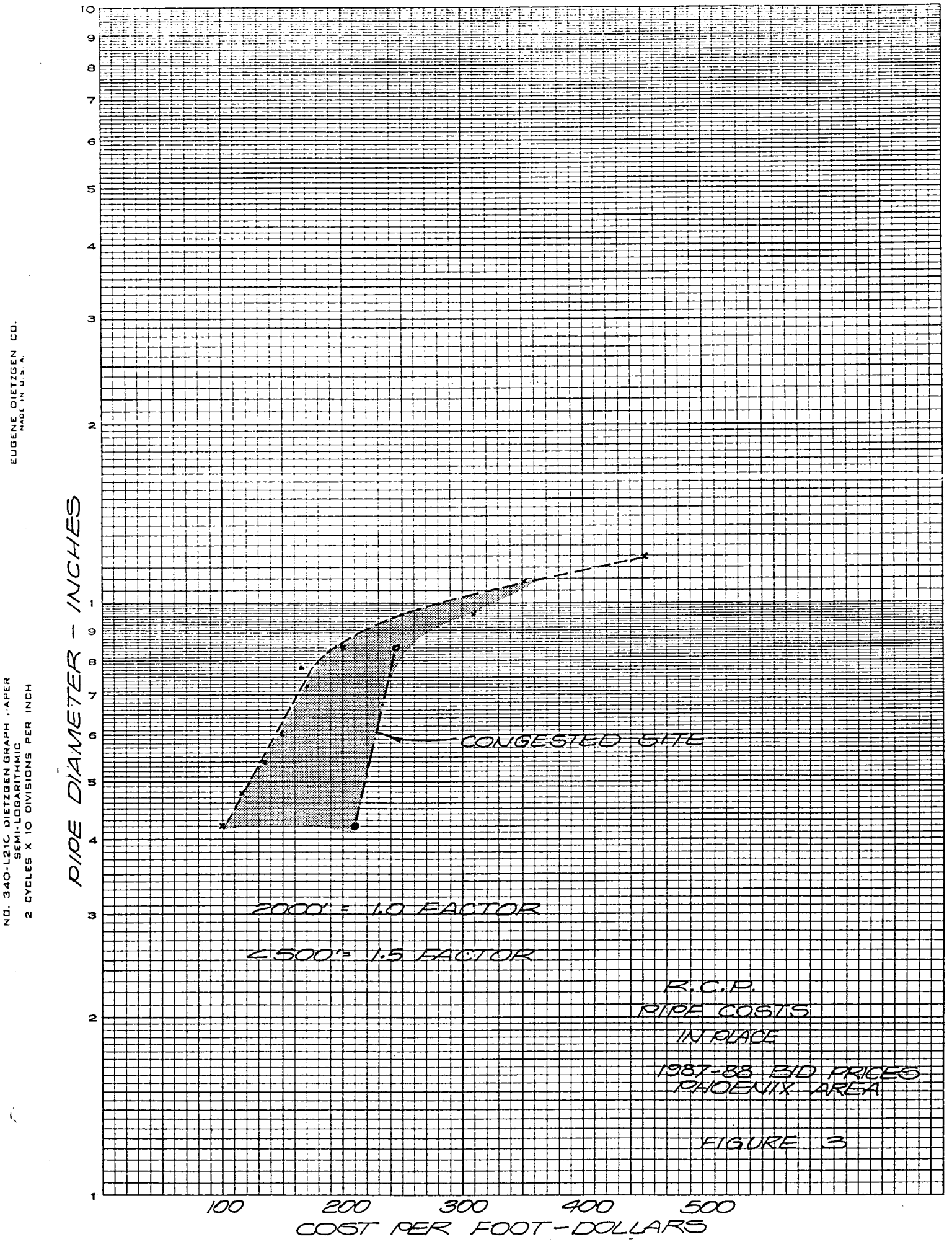

PIPE DIAMETER - INCHES
COST PER FOOT-DOLLARS
100
200
300
400
500
CONGESTED SITE
2000' = 1.0 FACTOR
<500' = 1.5 FACTOR
R.C.P.
PIPE COSTS
IN PLACE
1987-88 BID PRICES
PHOENIX AREA
EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340-L21C DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

FIGURE 3

DETENTION BASIN ALTERNATIVES

Figure 4 depicts the five detention basin alternatives and the land values utilized in the economic evaluation. The land quantities shown under the various options are gross acreages. It was assumed on a 5 acre site that 2/3 of the land would be utilized as a detention basin. On parcels 10 acres or larger, 3/4 of the land was considered to be available for water detention. Thus, 12.5 acres for Basin 4 in Option E really is 12.5 x 3/4 = 9.4 acres actually under water.

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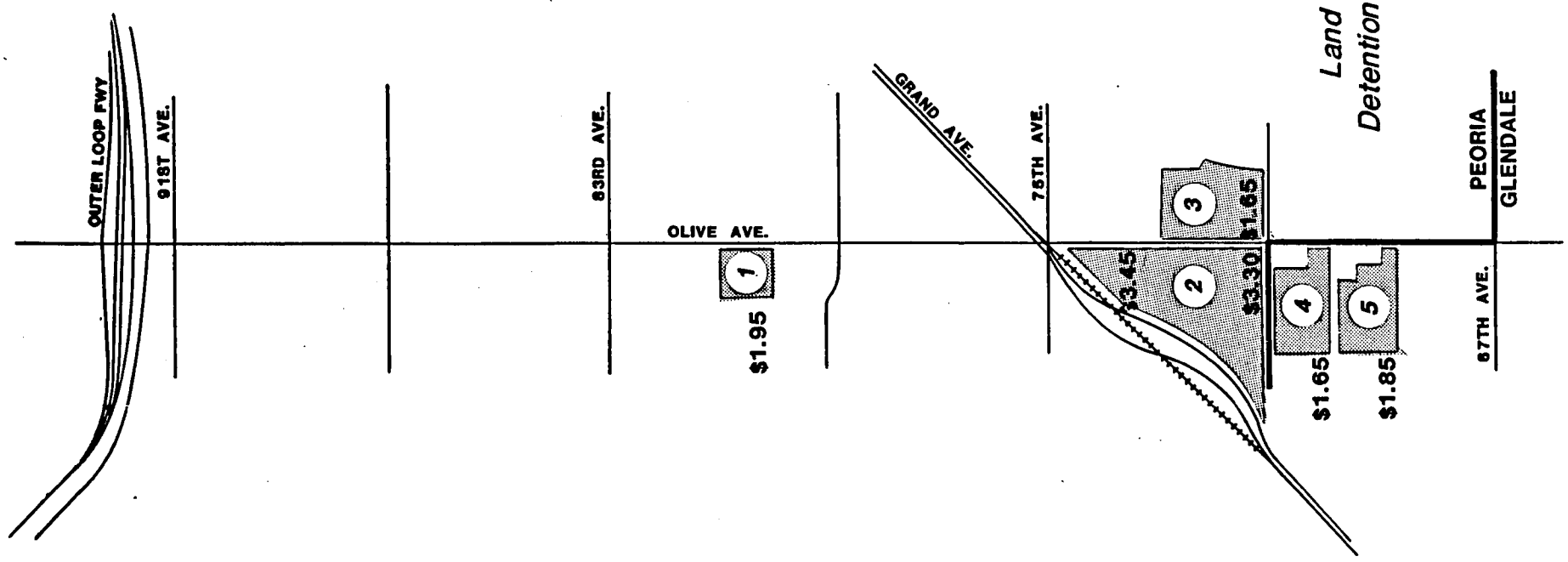


Land Values Utilized
Detention Basin Alternatives
$/ft2

Figure 4

Boyle Engineering Corporation
consulting engineers / architects

ECONOMIC EVALUATION OF ALTERNATIVES

The results of the economic analysis of the various options is shown on Table 2.

Table 2

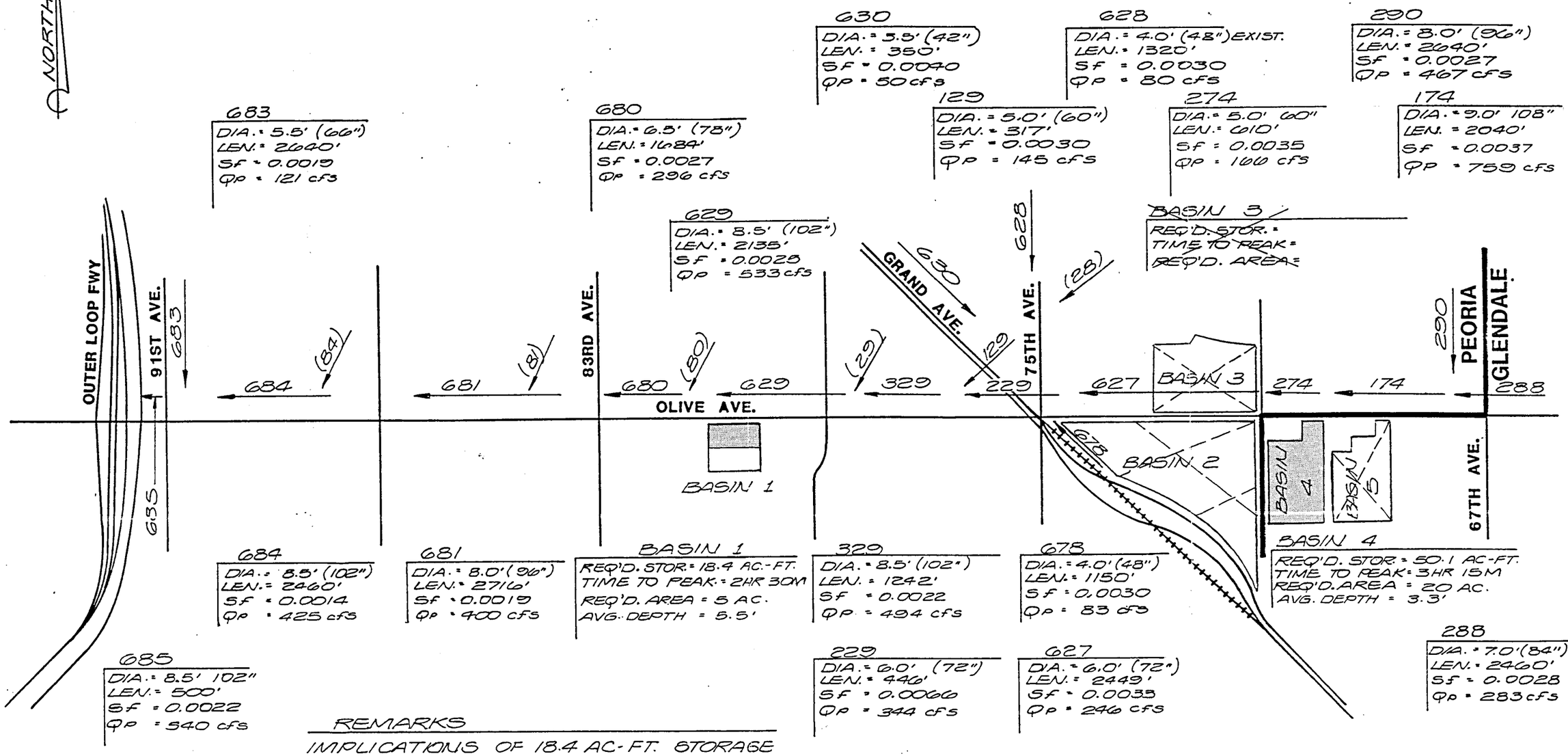
Economic Evaluation of Alternatives

Option	Land Cost $	Pipe Cost $	Total Costs $	% Different From Option D
3A	1,862,190	4,005,660	5,867,850	1.8
C	3,280,068	4,158,645	7,438,813	29.1
D	1,790,316	3,972,415	5,762,731	-
E	2,113,749	3,746,225	5,859,974	1.7
1F	2,028,371	4,112,860	6,141,231	6.6
3F	2,055,174	4,084,860	6,140,034	6.5
G	2,222,649	4,025,240	6,247,889	8.4

While "D" is the least cost option under this analysis, all options except "C" are within the accuracy of the analysis.

APPENDIX

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

IMPLICATIONS OF 18.4 AC-FT. STORAGE IN BASIN 1 AND 8.5' DIA. FOR PIPES 629 & 329 ARE AS FOLLOWS:

1.) EXCESSIVE (5.5') DEPTH IN BASIN 1

2.) HGL SLOPES REQ'D. FOR PASSING 344 cfs UNDER 75TH AVE. (PIPE 229) AND 494 cfs AND 533 cfs IN 8.5' DIA. PIPES (329 & 629 RESP.) EXCEEDS GROUND LEVEL EAST OF 75TH AVE.

FN = "OLVSWM 1A"
ALTERNATIVE "A"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/26/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	2040.	.0037	.0	.0	.013	9.00	0
274	27	0	2	PIPE	5.0	610.	.0035	.0	.0	.013	5.00	0
27	229	0	2	PIPE	6.0	2449.	.0033	.0	.0	.013	6.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0030	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0066	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.5	1242.	.0022	.0	.0	.013	8.50	0
29	80	0	2	PIPE	8.5	2135.	.0025	.0	.0	.013	8.50	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0019	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	9.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES. 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/26/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

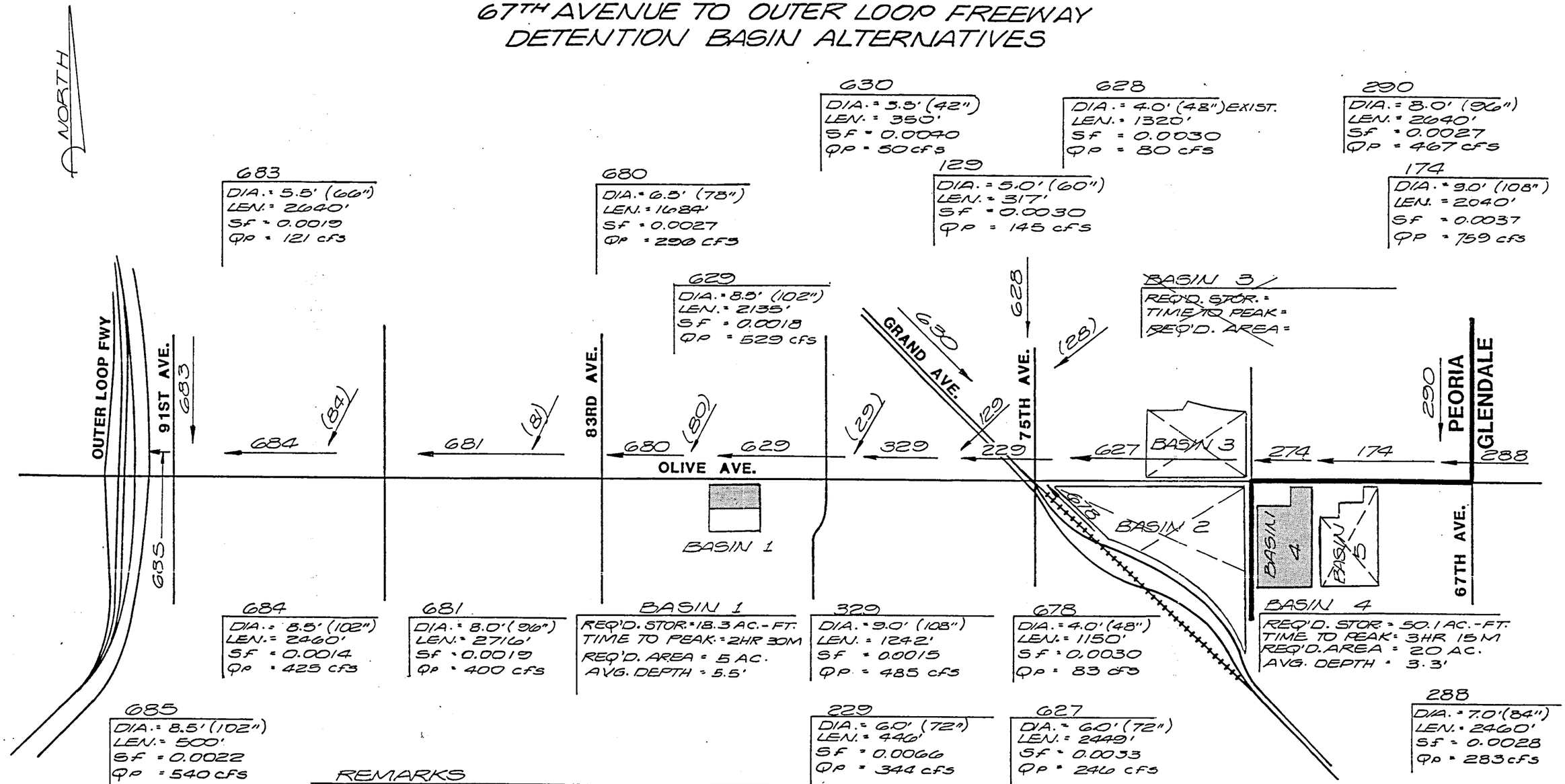
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	759.	7.4		0 30.
274	166.	5.0	50.1	3 15.
78	83.	3.5		0 23.
27	246.	5.0		0 23.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	344.	4.9		0 23.
129	145.	4.2		0 23.
329	494.	6.8		0 23.
29	533.	6.9		0 30.
80	296.	6.5	18.4	2 30.
81	400.	6.6		0 38.
83	121.	3.8		0 30.
84	425.	8.3		0 45.
85	540.	7.8		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLVSWM1A
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	540	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	400	2716	.0019	.1	1112.2	1117.4	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.5	1122.1	1126.9
629	15625	8.5	533	2135	.0025	.2	1122.3	1127.6	1129.9
329	16867	8.5	494	1242	.0022	.2	1127.8	1130.5	1134.2
229	17313	6.0	344	446	.0066	.9	1131.4	1134.3	1134.5
627	19762	6.0	246	2449	.0033	.9	1135.2	1143.3	1144.9
274	20372	5.0	166	610	.0035	.0	1143.3	1145.5	1147.2
174	22412	9.0	756	2040	.0037	1.6	1147.1	1154.7	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

PIPES 629 & 329 WERE INCREASED TO 9.0' DIA. FROM LAST RUN (OLVSWM 1A) TO LOWER HGL BELOW GROUND LEVEL EAST OF 75TH AVE., THOUGH IT IS STILL "TO CLOSE FOR COMFORT!" 18.3 AC-FT. STORAGE AND THE RELATED HIGH PEAK FLOWS THROUGH PIPES 629, 329 AND 229 ARE THE CAUSE OF THIS AND CONTINUING PROBLEM WITH EXCESSIVE DEPTH IN BASIN 1.

FN = "OLVSWM 2A"
ALTERNATIVE "A"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM2A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/29/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
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		TIME IN HRS VS INFLOW IN CFS										
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		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
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27	229	0	2	PIPE	6.0	2449.	.0033	.0	.0	.013	6.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
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229	329	0	2	PIPE	6.0	446.	.0066	.0	.0	.013	6.00	0
329	29	0	2	PIPE	9.0	1242.	.0015	.0	.0	.013	9.00	0
29	80	0	2	PIPE	9.0	2135.	.0018	.0	.0	.013	9.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0019	.0	.0	.013	8.00	0
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		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES. 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM2A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/29/88

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28	82.	3.5		0 23.
229	344.	4.9		0 23.
129	145.	4.2		0 23.
329	485.	7.4		0 23.
29	529.	7.4		0 30.
80	296.	6.5	18.3	2 30.
81	400.	6.6		0 38.
83	121.	3.8		0 30.
84	425.	8.2		0 53.
85	540.	7.8		0 38.

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STARTING HGL= 1107.2

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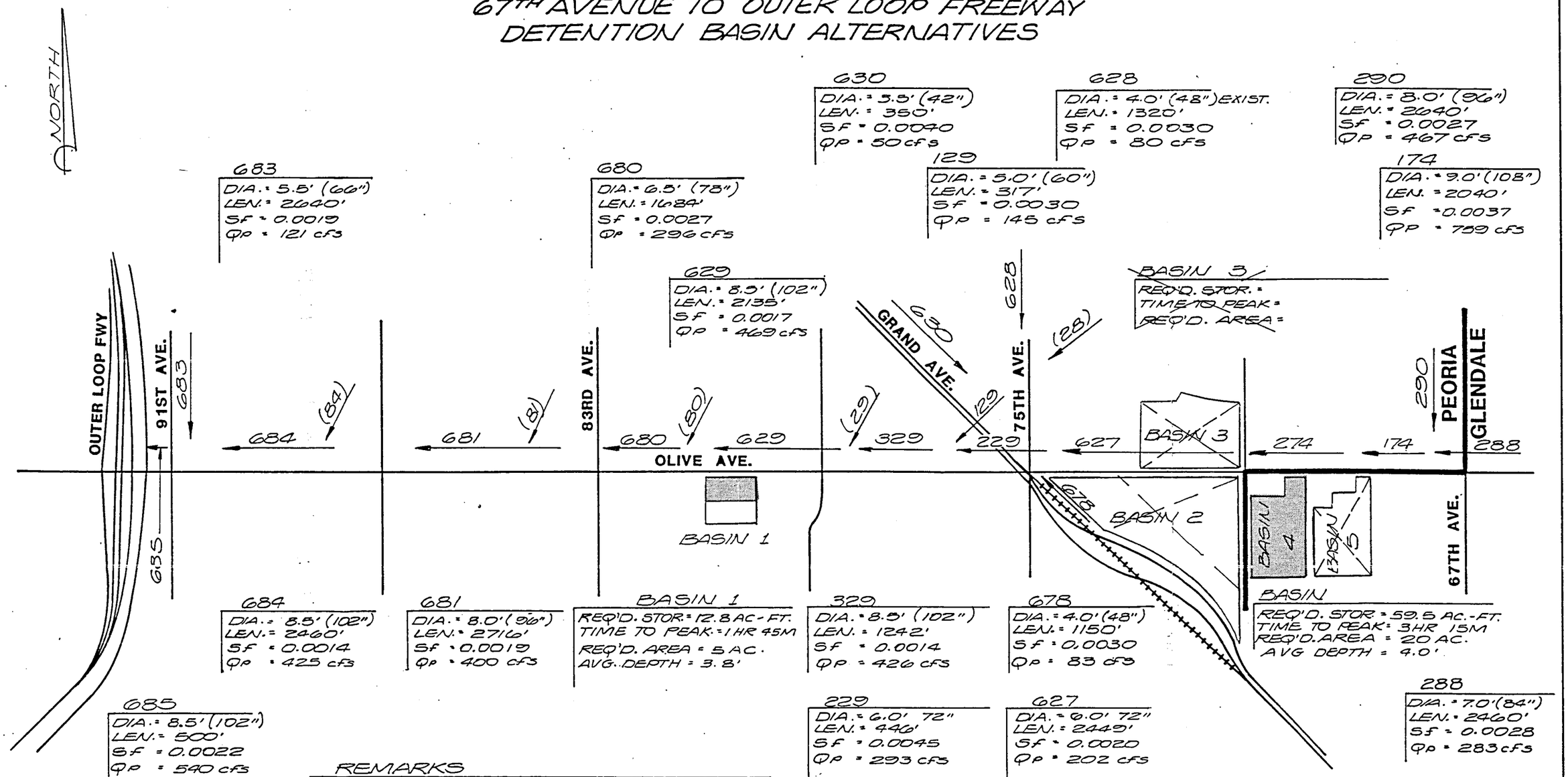
685	6630	8.5	540	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	400	2716	.0019	.1	1112.2	1117.4	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.5	1122.1	1126.9
629	15625	9.0	529	2135	.0018	.2	1122.3	1126.1	1129.9
329	16867	9.0	485	1242	.0015	.1	1126.3	1128.1	1134.2
229	17313	6.0	344	446	.0066	1.1	1129.3	1132.2	1134.5
627	19762	6.0	246	2449	.0033	.9	1133.1	1141.2	1144.9
274	20372	5.0	166	610	.0035	.0	1141.2	1143.4	1147.2
174	22412	9.0	756	2040	.0037	1.6	1145.0	1152.5	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

STORING MORE @ BASIN 4 (59.5 AC-FT. VS. 50.1 AC-FT
LESS AT BASIN 1 (12.8 AC.-FT VS. 18.4 AC-FT.) HAS THE
FOLLOWING APPLICATIONS:

1.) REDUCE PEAK FLOWS IN PIPE 629, 329, 229, 627 AND 274 ALLOWS DOWNSIZING OF PIPES 629 AND 329 (8.5' VS. 9.0') AND A MORE SATISFACTORY HGL FOR ALL THESE PIPES.
2.) BASIN 1 HAS DEPTH CLOSER TO RECOMMENDED 3' MAX. PER C.D.M. STUDY.
3.) APPEARS TO BE A GOOD ALTERNATIVE DESIGN.

FN = "OLVSWM 3A"
ALTERNATIVE "A"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM3A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/29/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	2040.	.0037	.0	.0	.013	9.00	0
274	27	0	2	PIPE	4.5	610.	.0037	.0	.0	.013	4.50	0
27	229	0	2	PIPE	6.0	2449.	.0020	.0	.0	.013	6.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0030	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0045	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.5	1242.	.0014	.0	.0	.013	8.50	0
29	80	0	2	PIPE	8.5	2135.	.0017	.0	.0	.013	8.50	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0019	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES. 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM3A"
CATCHMENT BASIN ALTERNATIVE "A"--1(5AC-79TH),4(20AC-S71ST)6/29/88

‡‡‡ PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ‡‡‡

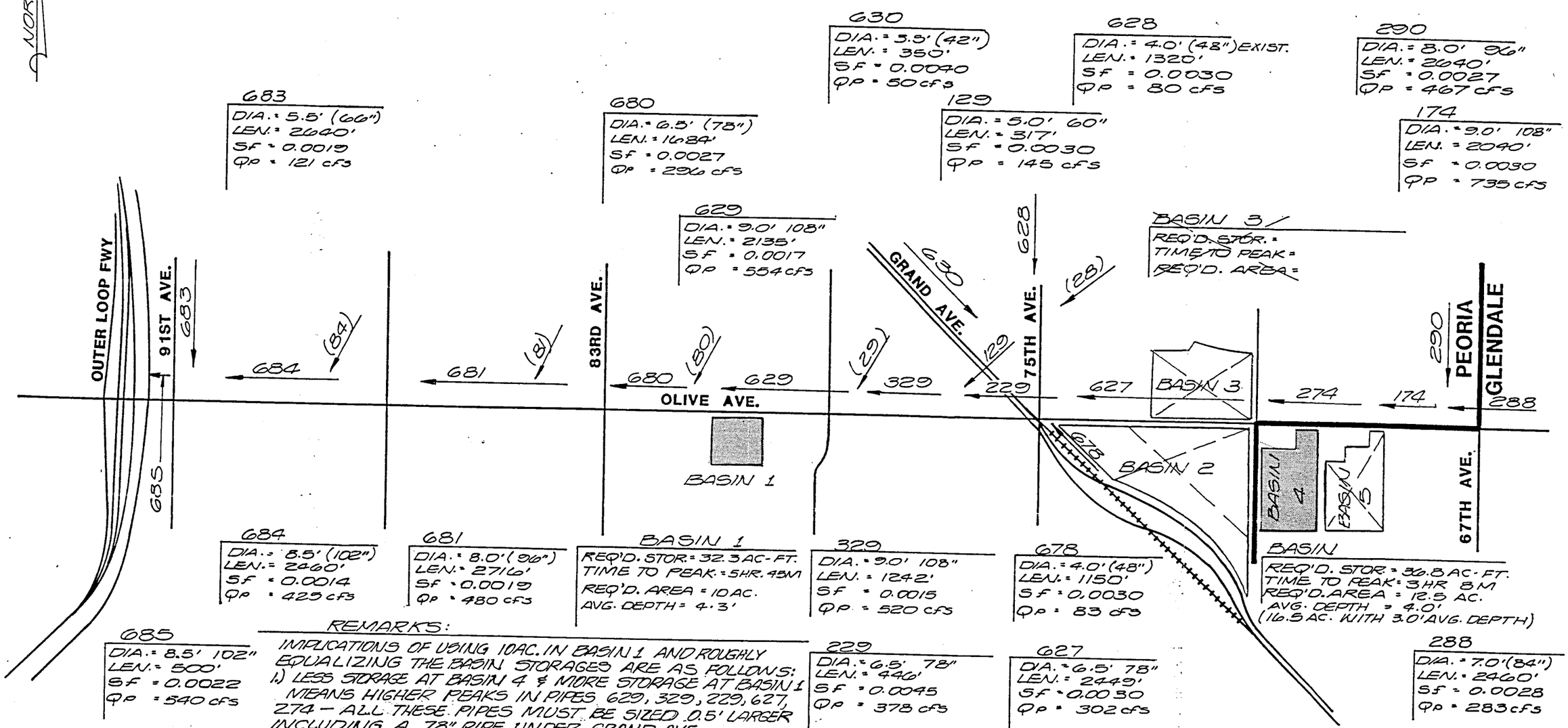
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	759.	7.4		0 30.
274	129.	4.5	59.5	3 15.
78	83.	3.5		0 23.
27	202.	5.4		0 30.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	293.	5.1		0 23.
129	145.	4.2		0 23.
329	426.	7.6		0 30.
29	469.	7.6		0 30.
80	296.	6.5	12.8	1 45.
81	400.	6.6		0 38.
83	121.	3.8		0 30.
84	425.	8.3		0 45.
85	540.	7.8		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLVSWM3A
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	SD ELEV
685	6630	8.5	540	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	400	2716	.0019	.1	1112.2	1117.4	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.5	1122.1	1126.9
629	15625	8.5	469	2135	.0017	.3	1122.3	1126.0	1129.9
329	16867	8.5	426	1242	.0014	.1	1126.1	1127.8	1134.2
229	17313	6.0	293	446	.0045	.6	1128.5	1130.5	1134.5
627	19762	6.0	202	2449	.002	.7	1131.2	1136.1	1144.9
274	20372	4.5	129	610	.0037	.1	1136.2	1138.5	1147.2
174	22412	9.0	756	2040	.0037	1.8	1140.2	1147.8	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS:

IMPLICATIONS OF USING 10AC. IN BASIN 1 AND ROUGHLY EQUALIZING THE BASIN STORAGES ARE AS FOLLOWS:

1.) LESS STORAGE AT BASIN 4 & MORE STORAGE AT BASIN 1 MEANS HIGHER PEAKS IN PIPES 629, 329, 229, 627, 274 — ALL THESE PIPES MUST BE SIZED 0.5' LARGER INCLUDING A 78" PIPE UNDER GRAND AVE..

2.) LATE TIME OF PEAK FOR BASIN 1 MEANS THAT RATHER THAN STORING PEAKS IN BOTH BASINS AND THEN RELEASING, YOU ARE ACTUALLY STORING IN BOTH, THEN TRANSFERRING STORAGE FROM BASIN 4 TO BASIN 1 BEFORE RELEASING FROM BASIN 1.— DANGER HERE IS THAT BASIN 1 MIGHT TEND TO KEEP FILLING INDEFINITELY AND OVER FLOW.

CONCLUSION: NOT A GOOD IDEA TO LEAVE LARGE STORAGE IN BASIN 1. KEEP BASIN 1 @ 5AC.

FN = "OLVSWM 2B"
ALTERNATIVE "B"
(NO 1B)

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM2B"
CATCHMENT BASIN ALTERNATIVE "B"--1(10AC-79TH),4(??AC-5715T)6/30/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	2040.	.0030	.0	.0	.013	9.00	0
274	27	0	2	PIPE	5.5	610.	.0037	.0	.0	.013	5.50	0
27	229	0	2	PIPE	6.5	2449.	.0030	.0	.0	.013	6.50	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0030	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.5	446.	.0045	.0	.0	.013	6.50	0
329	29	0	2	PIPE	9.0	1242.	.0015	.0	.0	.013	9.00	0
29	80	0	2	PIPE	9.0	2135.	.0017	.0	.0	.013	9.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0019	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES, 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM2B"
CATCHMENT BASIN ALTERNATIVE "B"--1(10AC-79TH),4(??AC-5715T)6/30/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

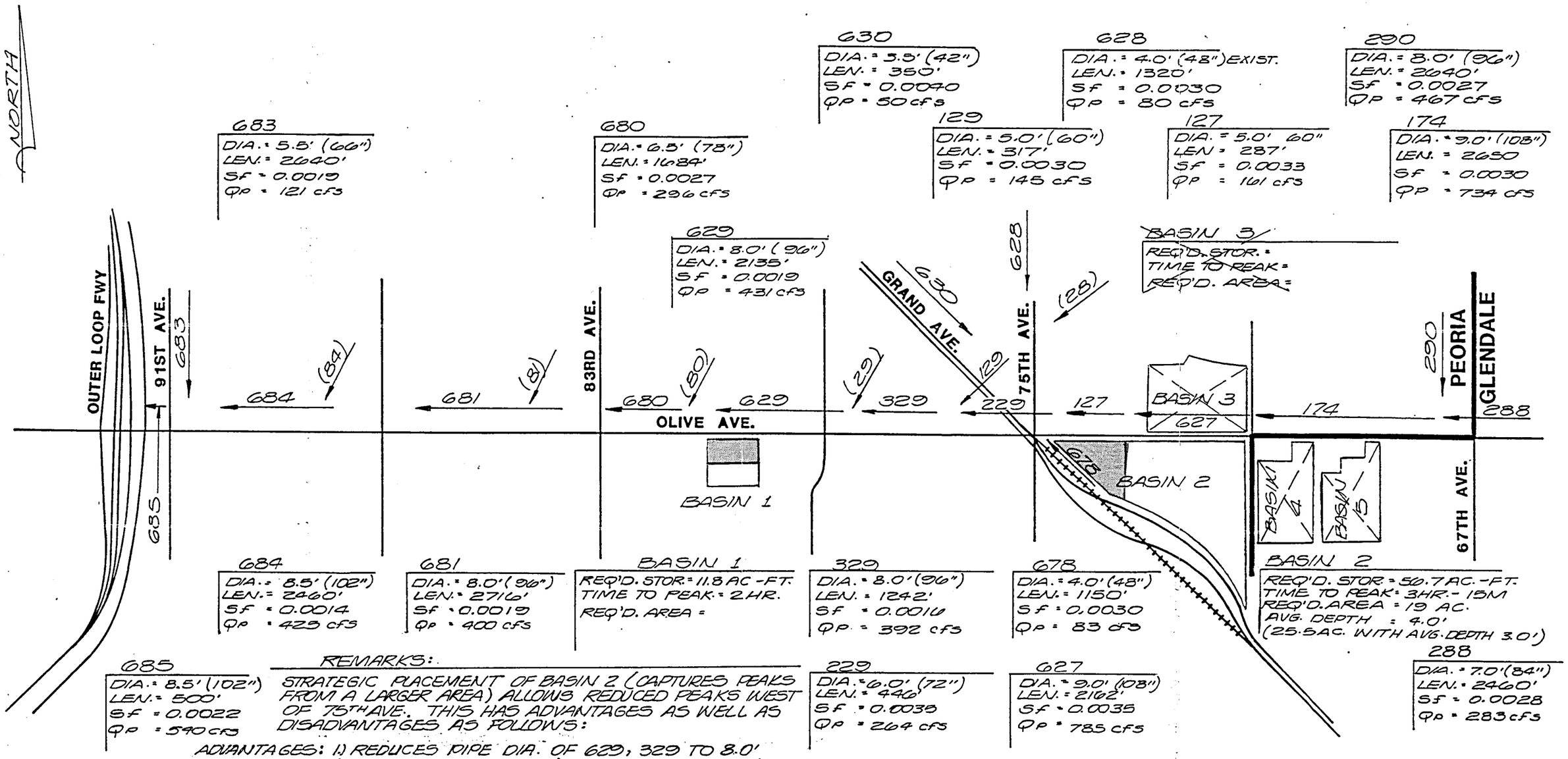
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	735.	8.8		0 30.
274	220.	5.5	36.8	3 8.
78	83.	3.5		0 23.
27	302.	5.7		0 23.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	378.	6.2		0 23.
129	145.	4.2		0 23.
329	520.	8.8		0 30.
29	554.	8.4		0 38.
80	296.	6.5	32.3	5 45.
81	400.	6.6		0 38.
83	121.	3.8		0 30.
84	425.	8.3		0 45.
85	540.	7.8		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLV5WM2B
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	540	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	400	2716	.0019	.1	1112.2	1117.4	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.5	1122.1	1126.9
629	15625	9.0	554	2135	.0017	.1	1122.1	1125.8	1129.9
329	16867	9.0	520	1242	.0015	.1	1125.9	1127.8	1134.2
229	17313	6.5	378	446	.0045	.8	1128.5	1130.5	1134.5
627	19762	6.5	302	2449	.003	.6	1131.1	1138.5	1144.9
274	20372	5.5	220	610	.0037	.0	1138.5	1140.8	1147.2
174	22412	9.0	735	2040	.003	1.1	1141.9	1148.0	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



684	681	BASIN 1	329	678	BASIN 2
DIA. = 8.5' (102")	DIA. = 8.0' (96")	REQ'D. STOR. = 11.8 AC-FT.	DIA. = 8.0' (96")	DIA. = 4.0' (48")	REQ'D. STOR. = 56.7 AC.-FT.
LEN. = 2460'	LEN. = 2716'	TIME TO PEAK = 2 HR.	LEN. = 1242'	LEN. = 1150'	TIME TO PEAK = 3 HR. - 15M
SF = 0.0014	SF = 0.0019	REQ'D. AREA =	SF = 0.0016	SF = 0.0030	REQ'D. AREA = 19 AC.
QP = 423 cfs	QP = 400 cfs		QP = 392 cfs	QP = 83 cfs	AVG. DEPTH = 4.0'
					(25.5 AC. WITH AVG. DEPTH 3.0')

685	229	627	288
DIA. = 8.5' (102")	DIA. = 6.0' (72")	DIA. = 9.0' (108")	DIA. = 7.0' (84")
LEN. = 500'	LEN. = 446'	LEN. = 2162'	LEN. = 2460'
SF = 0.0022	SF = 0.0039	SF = 0.0035	SF = 0.0028
QP = 540 cfs	QP = 264 cfs	QP = 785 cfs	QP = 283 cfs

REMARKS:

STRATEGIC PLACEMENT OF BASIN 2 (CAPTURES PEAKS FROM A LARGER AREA) ALLOWS REDUCED PEAKS WEST OF 75TH AVE. THIS HAS ADVANTAGES AS WELL AS DISADVANTAGES AS FOLLOWS:

ADVANTAGES: 1.) REDUCES PIPE DIA. OF 629, 329 TO 8.0' (3377' TOTAL LENGTH) 287' OF PIPE 627 (ACTUALLY PIPE 127 IN THIS RUN) IS REDUCED TO 5.0' DIA.
2.) STORAGE AND DEPTH IN BASIN 1 IS REDUCED.

DISADVANTAGES: 1.) PIPES 627 AND 174 HAVE TO BE INCREASED TO 9.0' DIA. (4812' TOTAL LENGTH) TO PASS LARGE PEAKS TO BASIN 2 LOCATION.

CONCLUSION: GOOD DESIGN HYDRAULICALLY BUT INCREASED PIPE SIZE (AND COST) VS RELATIVE COSTS FOR REAL ESTATE WILL DECIDE WHETHER THIS IS BEST ALTERNATIVE.

FN = "OLVSWM 1C"
ALTERNATIVE "C"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLV5WM1C"
CATCHMENT BASIN ALTERNATIVE "C"--1(79TH),2(46AC-75TH)7/06/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	27	0	2	PIPE	9.0	2650.	.0030	.0	.0	.013	9.00	0
27	127	0	2	PIPE	9.0	2162.	.0035	.0	.0	.013	9.00	0
127	229	0	2	PIPE	5.0	287.	.0033	.0	.0	.013	5.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0027	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0035	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.0	1242.	.0016	.0	.0	.013	8.00	0
29	80	0	2	PIPE	8.0	2135.	.0019	.0	.0	.013	8.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0019	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES, 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1C"
CATCHMENT BASIN ALTERNATIVE "C"--1(79TH),2(46AC-75TH)7/06/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

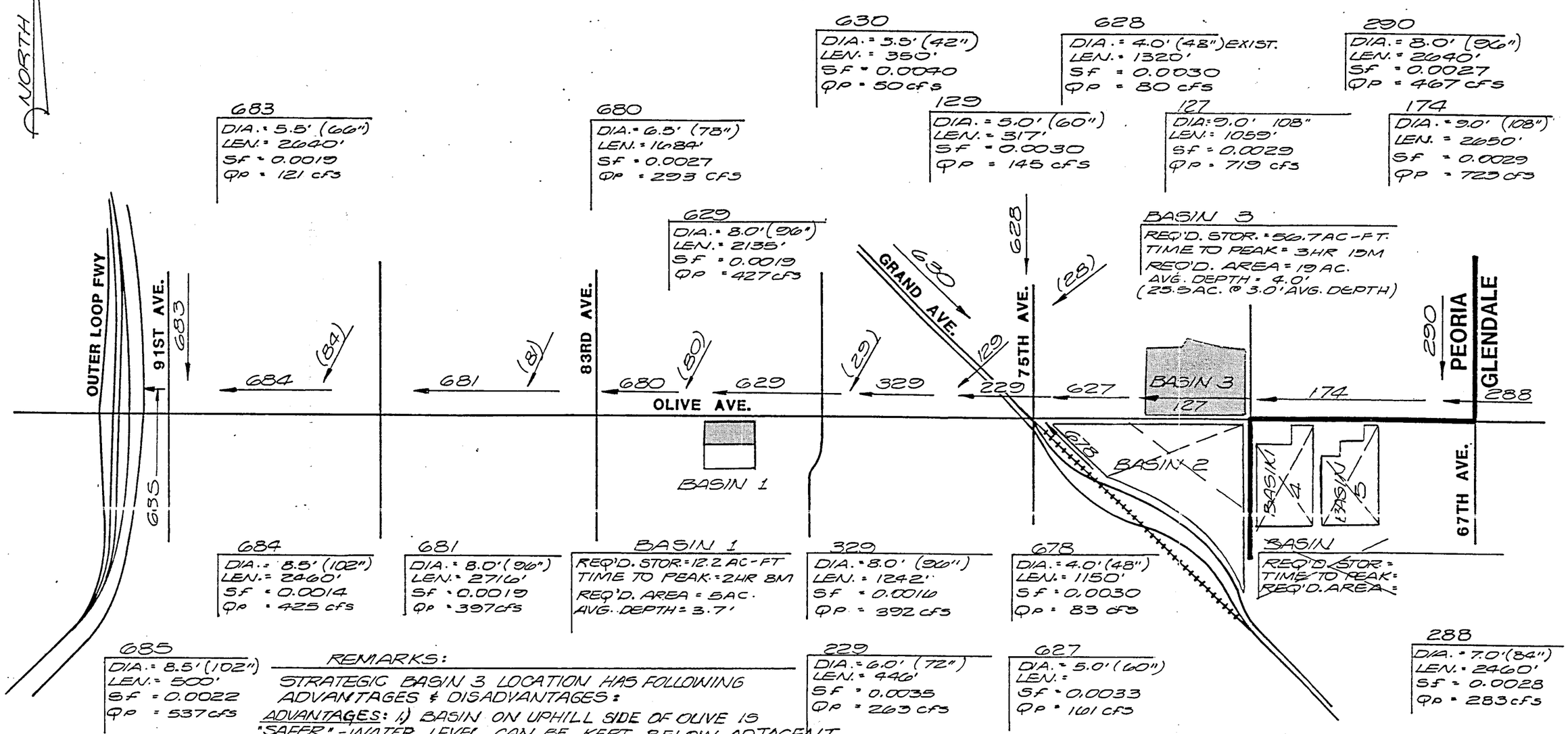
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	734.	8.3		0 30.
27	785.	8.0		0 38.
78	83.	3.5		0 23.
127	161.	5.0	56.7	3 15.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	264.	5.3		0 23.
129	144.	4.5		0 23.
329	392.	7.7		0 23.
29	431.	7.7		0 30.
80	296.	6.5	11.8	2 0.
81	400.	6.6		0 38.
83	121.	3.8		0 30.
84	425.	8.2		0 53.
85	540.	7.8		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLVSWM1C
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	540	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	400	2716	.0019	.1	1112.2	1117.4	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.5	1122.1	1126.9
629	15625	8.0	431	2135	.0019	.1	1122.2	1126.3	1129.9
329	16867	8.0	392	1242	.0016	.2	1126.4	1128.4	1134.2
229	17313	6.0	264	446	.0035	.3	1128.7	1130.3	1134.5
127	17600	5.0	161	287	.0033	.2	1130.5	1131.5	1137.5
627	19762	9.0	785	2162	.0035	1.1	1132.5	1140.1	1144.9
174	22412	9.0	734	2650	.003	.2	1140.4	1148.3	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS:

STRATEGIC BASIN 3 LOCATION HAS FOLLOWING ADVANTAGES & DISADVANTAGES:

ADVANTAGES: 1.) BASIN ON UPHILL SIDE OF OLIVE IS "SAFER" - WATER LEVEL CAN BE KEPT BELOW ADJACENT GROUND - NO EMBANKMENTS.

2.) PIPES 629, 329 REDUCED TO 8.0' DIA. (3377' TOTAL LENGTH)
627 & 15 REDUCED TO 5.0' (1300' TOTAL LENGTH)

DISADVANTAGES: 1.) PIPE 127 MUST BE SIZED @ 9.0' (1059') AS WELL AS 610' - 1400' OF PIPE 174.

CONCLUSION: GOOD DESIGN - MUST WEIGH PIPE COST VS REAL ESTATE COST.

FN = "OLVSWM 1D"
ALTERNATIVE "D"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1D"
CATCHMENT BASIN ALTERNATIVE "D"--1(79TH),3(20AC-N71ST)6/26/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6	252.0
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4	203.0
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	189.0	3.0	181.0	3.3	28.0
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6	350.0
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4	134.0
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0	33.0
		5.0	14.0	6.0 .0								
174	127	0	2	PIPE	9.0	2650.	.0029	.0	.0	.013	9.00	0
127	27	0	2	PIPE	9.0	1059.	.0029	.0	.0	.013	9.00	0
27	229	0	2	PIPE	5.0	1390.	.0033	.0	.0	.013	5.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7	60.0
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4	20.0
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0	1.0
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0027	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0035	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.0	1242.	.0016	.0	.0	.013	8.00	0
29	80	0	2	PIPE	8.0	2135.	.0019	.0	.0	.013	8.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0017	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6	102.0
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4	35.0
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0	2.0
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES. 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWMID"
CATCHMENT BASIN ALTERNATIVE "D"--1(79TH).3(20AC-N71ST)6/26/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

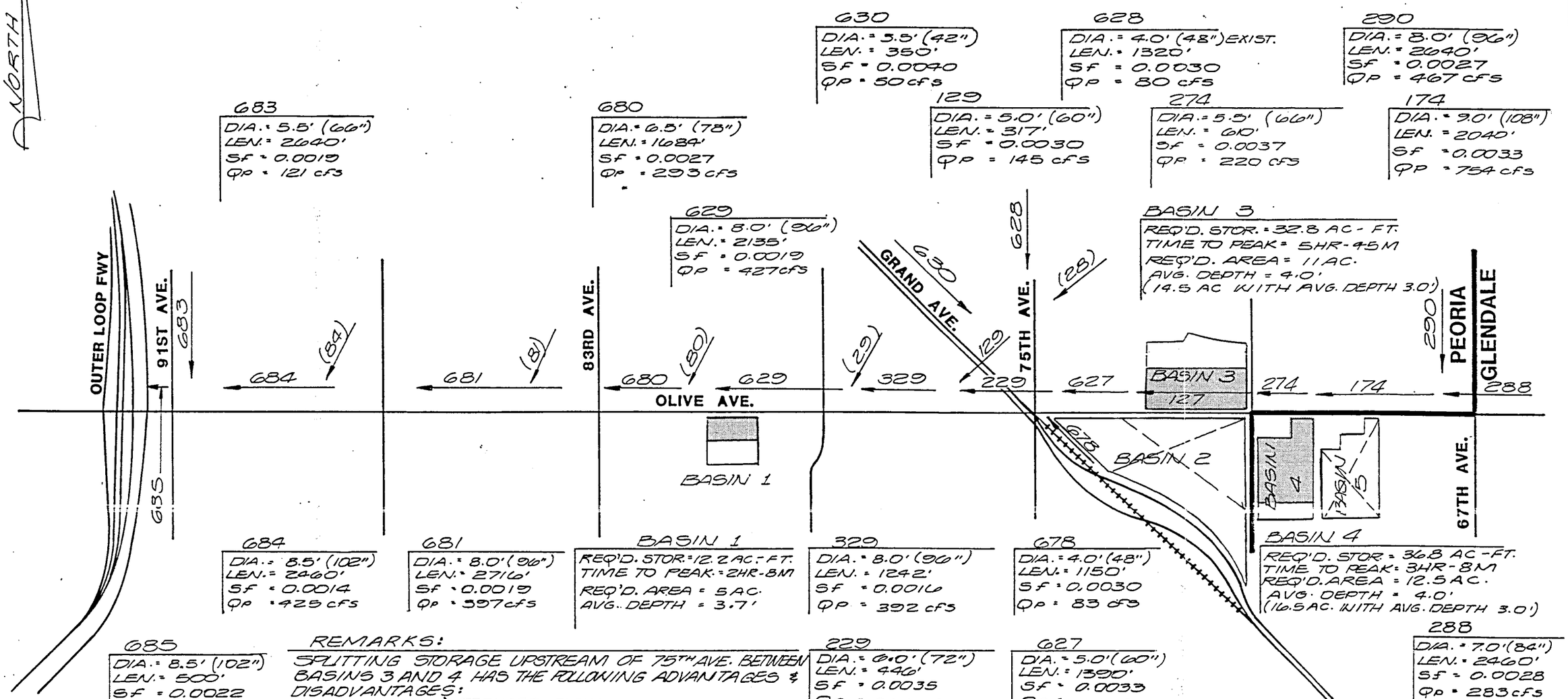
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	723.	8.7		0 30.
127	719.	8.2		0 38.
78	83.	3.5		0 23.
27	161.	5.0	56.7	3 15.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	263.	5.2		0 23.
129	144.	4.5		0 23.
329	392.	7.7		0 23.
29	427.	7.9		0 30.
80	293.	6.5	12.2	2 8.
81	397.	7.0		0 45.
83	121.	3.8		0 30.
84	425.	7.9		0 45.
85	537.	7.7		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= DLVSWM1D
STARTING HGL= 1107.2

PIPE ND	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	537	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	397	2716	.0017	.0	1112.2	1116.8	1123.9
680	13490	6.5	293	1684	.0027	.1	1116.9	1121.5	1126.9
629	15625	8.0	427	2135	.0019	.1	1121.6	1125.7	1129.9
329	16867	8.0	392	1242	.0016	.1	1125.8	1127.8	1134.2
229	17313	6.0	263	446	.0035	.3	1128.1	1129.7	1134.5
627	18703	5.0	161	1390	.0033	.2	1129.9	1134.5	1137.5
127	19762	9.0	719	1059	.0029	.8	1135.3	1138.3	1144.9
174	22412	9.0	723	2650	.0029	.0	1138.4	1146.0	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS:

SPLITTING STORAGE UPSTREAM OF 75TH AVE. BETWEEN BASINS 3 AND 4 HAS THE FOLLOWING ADVANTAGES & DISADVANTAGES:

ADVANTAGES: 1.) REDUCED FLOWS IN PIPES 629, 329 ALLOWS DOWN SIZING TO 8.0' DIA. (3377' TOTAL LENGTH)

2.) REDUCE FLOW IN PIPES 627, 127, 274 ALLOWS DOWN SIZING TO 5.0' (1390' LENGTH), 6.0' (1059' LENGTH), 5.5' (610 LENGTH).

3.) REDUCES SIZES OF INDIVIDUAL BASINS 3 & 4.

DISADVANTAGES: 1.) LATE TIME OF PEAK FOR BASIN 3 (5HR 45MIN.) MEANS BASIN 4 IS EMPTYING INTO BASIN 3 - POSSIBLE TENDENCY FOR BASIN 3 TO CONTINUE FILLING INDEFINITELY AND OVER FLOW.

FN = "OLVSWM 1E"
ALTERNATIVE "E"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1E"
CATCHMENT BASIN ALTERNATIVE "E"--1(79TH),3(N71ST),4(S71ST)7/07/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	2040.	.0033	.0	.0	.013	9.00	0
274	127	0	2	PIPE	5.5	610.	.0037	.0	.0	.013	5.50	0
127	27	0	2	PIPE	6.0	1059.	.0035	.0	.0	.013	6.00	0
27	229	0	2	PIPE	5.0	1390.	.0033	.0	.0	.013	5.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0027	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0035	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.0	1242.	.0016	.0	.0	.013	8.00	0
29	80	0	2	PIPE	8.0	2135.	.0019	.0	.0	.013	8.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0017	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES, 18

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWMIE"
CATCHMENT BASIN ALTERNATIVE "E"--1(79TH),3(N71ST),4(S71ST)7/07/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

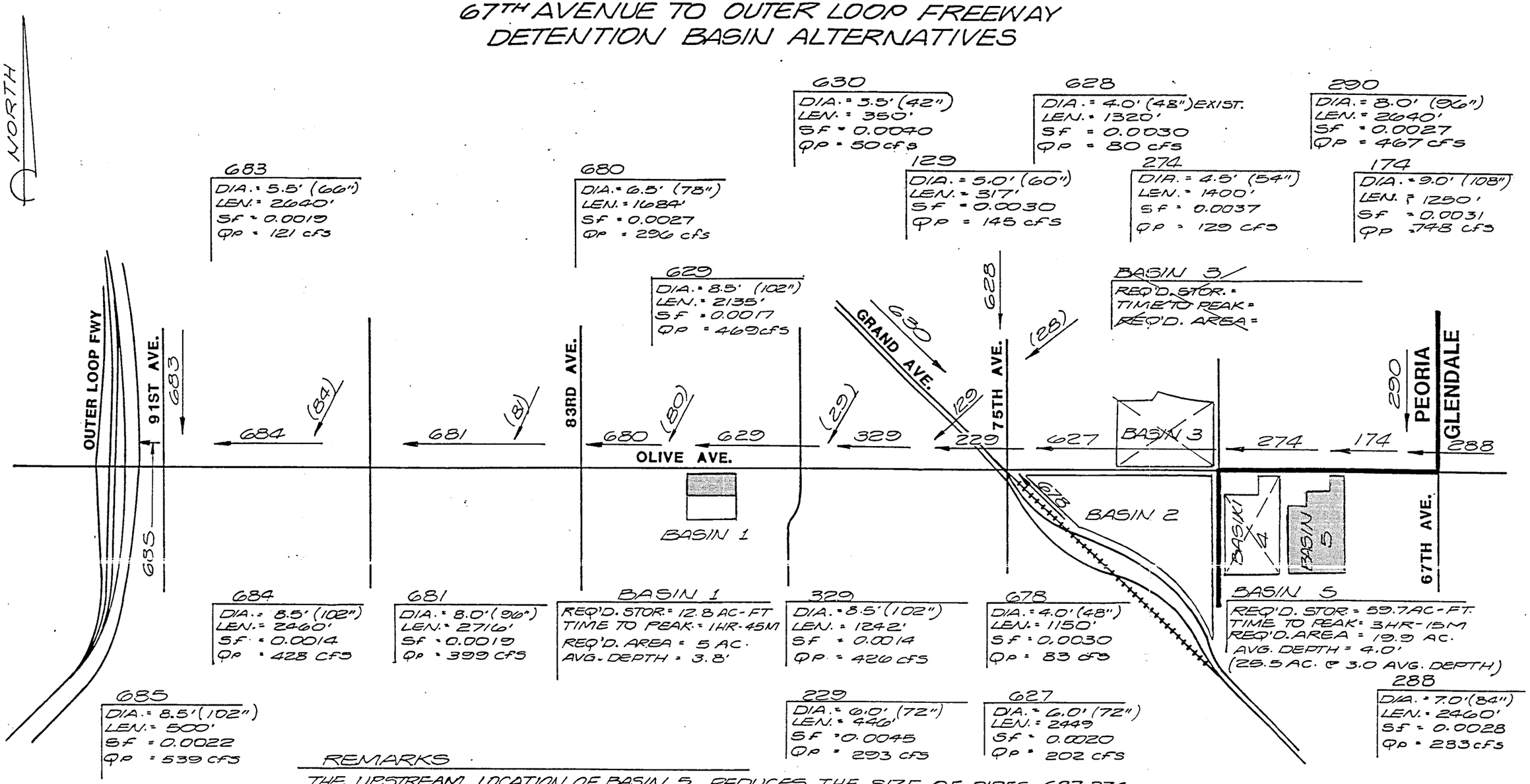
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
289	293.	4.9		0 30.
174	754.	7.9		0 30.
274	220.	5.5	36.8	3 8.
127	252.	4.9		0 23.
78	83.	3.5		0 23.
27	161.	5.0	32.8	5 45.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	264.	5.3		0 23.
129	144.	4.5		0 23.
329	392.	7.7		0 23.
27	427.	7.6		0 38.
80	293.	6.5	12.2	2 8.
81	397.	7.0		0 45.
83	121.	3.8		0 30.
84	425.	7.9		0 45.
85	537.	7.7		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLVSWM1E
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	537	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	397	2716	.0017	.0	1112.2	1116.8	1123.9
680	13490	6.5	293	1684	.0027	.1	1116.9	1121.5	1126.9
629	15625	8.0	427	2135	.0019	.1	1121.6	1125.7	1129.9
329	16867	8.0	392	1242	.0016	.1	1125.8	1127.8	1134.2
229	17313	6.0	263	446	.0035	.3	1128.1	1129.7	1134.5
627	18703	5.0	161	1390	.0033	.2	1129.9	1134.5	1137.5
127	19762	6.0	252	1059	.0035	.2	1134.7	1138.4	1144.9
274	20372	5.5	220	610	.0037	.1	1138.5	1140.7	1147.2
174	22412	9.0	754	2040	.0033	.7	1141.4	1148.1	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

THE UPSTREAM LOCATION OF BASIN 5 REDUCES THE SIZE OF PIPES 627, 274, TO 6.0' (2449 LENGTH) AND 4.5' (1400' LENGTH). IT LEAVES A LOT MORE AREA TO THE WEST BETWEEN 71ST AVE. AND BASIN 1 UNDETAINED. PIPES 629, 329 ARE SUBJECT TO HIGHER PEAK FLOWS, AND THUS ARE LARGER. A SMALLER PIPE 274, WITH RESULTING LARGER STORAGE IN BASIN 5 MIGHT BE ABLE TO REDUCE THOSE PIPES AGAIN.

FN = "OLVSWM IF "
ALTERNATIVE " F "

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1F"
CATCHMENT BASIN ALTERNATIVE "F"--1(79TH),5(67TH<>71ST)6/26/98

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6 252.0	
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0	
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0	
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0	
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0	
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0	
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	1250.	.0031	.0	.0	.013	9.00	0
274	27	0	2	PIPE	4.5	1400.	.0027	.0	.0	.013	4.50	0
27	229	0	2	PIPE	6.0	2449.	.0020	.0	.0	.013	6.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0	
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0	
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0	
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0030	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0045	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.5	1242.	.0014	.0	.0	.013	8.50	0
29	80	0	2	PIPE	8.5	2135.	.0017	.0	.0	.013	8.50	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0017	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0	
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0	
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0	
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES, 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVSWM1F"
CATCHMENT BASIN ALTERNATIVE "F"--1(79TH),5(67TH<>71ST)6/26/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

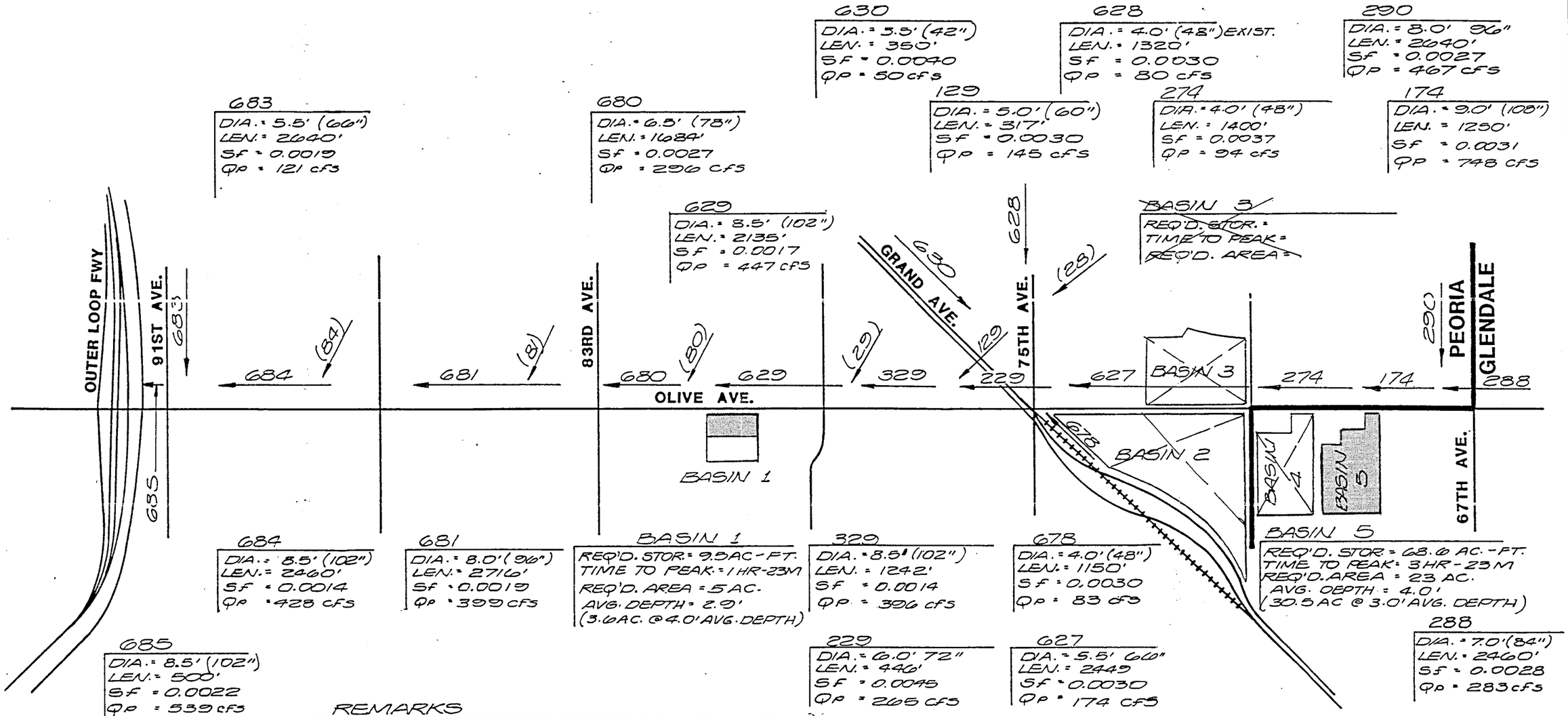
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	748.	8.7		0 30.
274	129.	4.5	59.7	3 15.
78	83.	3.5		0 23.
27	202.	5.4		0 30.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	293.	5.1		0 23.
129	145.	4.2		0 23.
329	426.	7.6		0 30.
29	469.	7.6		0 30.
80	296.	6.5	12.9	1 45.
81	399.	7.1		0 45.
83	121.	3.8		0 30.
84	428.	7.8		0 45.
85	539.	7.8		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= DLVSWM1F
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	BD ELEV
685	6630	8.5	539	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	428	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	399	2716	.0017	.0	1112.2	1116.8	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.0	1121.5	1126.9
629	15625	8.5	469	2135	.0017	.3	1121.8	1125.4	1129.9
329	16867	8.5	426	1242	.0014	.1	1125.5	1127.3	1134.2
229	17313	6.0	293	446	.0045	.6	1127.9	1129.9	1134.5
627	19762	6.0	202	2449	.003	.7	1130.6	1138.0	1144.9
274	21162	4.5	129	1400	.0037	.1	1138.1	1143.3	1147.6
174	22412	9.0	748	1250	.0031	1.7	1145.0	1149.8	1154.8

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

CONSTRICTING THE FLOW PAST BASIN 5 AND PLUS STORING MORE IN THE BASIN ALLOWS REDUCTION OF PIPES 274, 627 TO 4.0' (1400') AND 5.5' (2449'). BASIN 1 STORES A LITTLE LESS WATER ALSO, BUT THE REDUCTION IN THE PEAK IS NOT SUFFICIENT TO REDUCE PIPES 629, 329 OR 229.

FN = "OLVSWM 3F"
ALTERNATIVE "F"

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVGWM3F"
CATCHMENT BASIN ALTERNATIVE "F"--1(79TH).5(67TH<>71ST)7/12/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00
		TIME IN HRS VS INFLOW IN CFS									
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	279.0	.6 252.0
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4 203.0
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3 28.0
		4.0	18.0	6.0 .0							
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00
		TIME IN HRS VS INFLOW IN CFS									
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6 350.0
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4 134.0
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0 33.0
		5.0	14.0	6.0 .0							
174	274	0	2	PIPE	9.0	1250.	.0031	.0	.0	.013	9.00
274	27	0	2	PIPE	4.0	1400.	.0037	.0	.0	.013	4.00
27	229	0	2	PIPE	5.5	2449.	.0030	.0	.0	.013	5.50
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00
		TIME IN HRS VS INFLOW IN CFS									
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7 60.0
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4 20.0
		1.5	19.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0 1.0
		5.0	1.0	6.0 .0							
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00
		TIME IN HRS VS INFLOW IN CFS									
		.0	.0	.1 33.0	.3	80.0	6.0	80.0			
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50
129	329	0	2	PIPE	5.0	317.	.0030	.0	.0	.013	5.00
229	329	0	2	PIPE	6.0	446.	.0045	.0	.0	.013	6.00
329	29	0	2	PIPE	8.5	1242.	.0014	.0	.0	.013	8.50
29	80	0	2	PIPE	8.5	2135.	.0017	.0	.0	.013	8.50
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50
81	84	0	2	PIPE	8.0	2716.	.0017	.0	.0	.013	8.00
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50
		TIME IN HRS VS INFLOW IN CFS									
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6 102.0
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4 35.0
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0 2.0
		5.0	1.0	6.0 .0							
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50

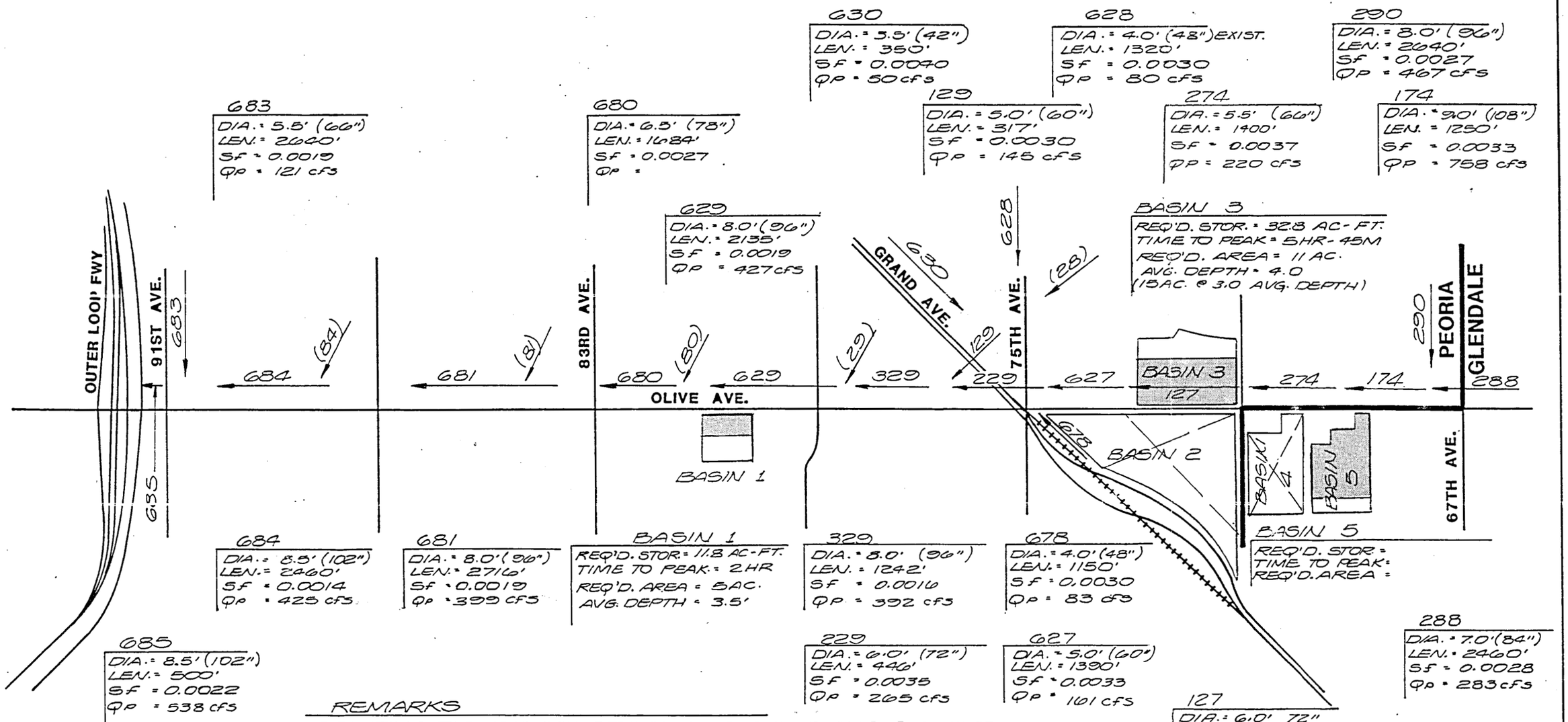
TOTAL NUMBER OF GUTTERS/PIPES. 17

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLVGWMOF"
CATCHMENT BASIN ALTERNATIVE "F"--1(79TH),5(67TH<>71ST)7/12/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	748.	8.7		0 30.
274	94.	4.0	68.6	3 23.
78	83.	3.5		0 23.
27	174.	4.3		0 23.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	265.	4.6		0 23.
129	145.	4.2		0 23.
329	396.	6.9		0 23.
29	447.	7.1		0 30.
80	296.	6.5	9.5	1 23.
81	399.	7.1		0 45.
83	121.	3.8		0 30.
84	428.	7.3		0 45.
85	539.	7.8		0 38.

OLIVE AVENUE STORM DRAIN
67TH AVENUE TO OUTER LOOP FREEWAY
DETENTION BASIN ALTERNATIVES



REMARKS

SPLITTING THE STORAGE BETWEEN BASINS 3 AND 5 REDUCES PEAK FLOWS AND PIPE SIZES, 629, 329 REDUCE TO 8.0' (3277' TOTAL) 627 REDUCES TO 5.0' (1390' LENGTH), 127 REDUCES TO 6.0' (1059' LENGTH), 274 REDUCES TO 5.5' (1400' LENGTH). THE LATE TIME-TO-PEAK OF BASIN 3 MEANS THAT BASIN 5 IS TRANSFERRING STORAGE TO BASIN 3 BEFORE EMPTYING. THIS MAY MEAN BASIN 3 COULD FILL INDEFINITELY AND OVER FLOW.

FN = "OLVSWM G "
ALTERNATIVE " G "

Boyle Engineering Corporation
consulting engineers / architects

JULY 1988

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLV5WM1G"
CATCHMENT BASIN ALTERNATIVE "G"--1(79TH),3(N71ST),5(67TH()71ST)7/11/88

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
288	174	20	2	PIPE	7.0	2460.	.0028	.0	.0	.013	7.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 65.0	.3	209.0	.4	290.0	.5	273.0	.6	252.0
		.8	241.0	.9 229.0	1.0	221.0	1.1	213.0	1.3	208.0	1.4	203.0
		1.5	199.0	1.8 194.0	2.0	191.0	2.5	188.0	3.0	181.0	3.3	28.0
		4.0	18.0	6.0 .0								
290	174	20	2	PIPE	8.0	2640.	.0027	.0	.0	.013	8.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 117.0	.3	418.0	.4	500.0	.5	435.0	.6	350.0
		.8	287.0	.9 240.0	1.0	206.0	1.1	177.0	1.3	154.0	1.4	134.0
		1.5	118.0	1.8 96.0	2.0	84.0	2.5	70.0	3.0	48.0	4.0	33.0
		5.0	14.0	6.0 .0								
174	274	0	2	PIPE	9.0	1250.	.0033	.0	.0	.013	9.00	0
274	127	0	2	PIPE	5.5	1400.	.0037	.0	.0	.013	5.50	0
127	27	0	2	PIPE	6.0	1059.	.0035	.0	.0	.013	6.00	0
27	229	0	2	PIPE	5.0	1390.	.0033	.0	.0	.013	5.00	0
78	229	20	2	PIPE	4.0	1150.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 22.0	.3	77.0	.4	80.0	.5	72.0	.7	60.0
		.8	51.0	.9 42.0	1.0	35.0	1.1	29.0	1.3	24.0	1.4	20.0
		1.5	18.0	1.8 14.0	2.0	11.0	2.5	8.0	3.0	4.0	4.0	1.0
		5.0	1.0	6.0 .0								
28	129	4	2	PIPE	4.0	1320.	.0030	.0	.0	.013	4.00	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 33.0	.3	80.0	6.0	80.0				
30	129	0	2	PIPE	3.5	350.	.0040	.0	.0	.013	3.50	0
129	329	0	2	PIPE	5.0	317.	.0027	.0	.0	.013	5.00	0
229	329	0	2	PIPE	6.0	446.	.0035	.0	.0	.013	6.00	0
329	29	0	2	PIPE	8.0	1242.	.0016	.0	.0	.013	8.00	0
29	80	0	2	PIPE	8.0	2135.	.0019	.0	.0	.013	8.00	0
80	81	0	2	PIPE	6.5	1684.	.0027	.0	.0	.013	6.50	0
81	84	0	2	PIPE	8.0	2716.	.0017	.0	.0	.013	8.00	0
84	85	0	2	PIPE	8.5	2460.	.0014	.0	.0	.013	8.50	0
83	85	20	2	PIPE	5.5	2640.	.0019	.0	.0	.013	5.50	-1
		TIME IN HRS VS INFLOW IN CFS										
		.0	.0	.1 30.0	.3	109.0	.4	128.0	.5	120.0	.6	102.0
		.8	87.0	.9 72.0	1.0	60.0	1.1	50.0	1.3	41.0	1.4	35.0
		1.5	30.0	1.8 24.0	2.0	19.0	2.5	14.0	3.0	7.0	4.0	2.0
		5.0	1.0	6.0 .0								
85	0	0	2	PIPE	8.5	500.	.0022	.0	.0	.013	8.50	0

TOTAL NUMBER OF GUTTERS/PIPES, 18

OLIVE AVE HYDROLOGY (CDM/BEC/GLEN)-67TH AVE TO NEW RIVER"OLV5WM1G"
CATCHMENT BASIN ALTERNATIVE "G"--1(79TH),3(N715T),5(67TH()715T)7/11/88

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
290	467.	6.5		0 30.
288	283.	4.9		0 30.
174	758.	7.9		0 30.
274	220.	5.5	36.9	3 0.
127	253.	5.0		0 23.
78	83.	3.5		0 23.
27	161.	5.0	32.8	5 45.
30	50.	2.3		0 38.
28	82.	3.5		0 23.
229	265.	5.3		0 23.
129	144.	4.5		0 23.
329	392.	7.7		0 23.
29	427.	7.6		0 38.
80	296.	6.5	11.8	2 0.
81	399.	7.1		0 45.
83	121.	3.8		0 30.
84	425.	8.0		0 45.
85	538.	7.7		0 38.

ENDPROGRAM PROGRAM CALLED

OLIVE AVENUE STORM DRAIN--HGL QUICK CHECK
FN= OLVSWM1G
STARTING HGL= 1107.2

PIPE NO	US-STA	DIA	Q	LENGTH	SLOPE	JN-LOSS	DS-HGL	US-HGL	GD ELEV
685	6630	8.5	538	500	.0022		1107.2	1108.3	1110.8
684	9090	8.5	425	2460	.0014	.4	1108.7	1112.2	1117.9
681	11806	8.0	399	2716	.0017	.1	1112.2	1116.8	1123.9
680	13490	6.5	296	1684	.0027	.1	1117.0	1121.5	1126.9
629	15625	8.0	427	2135	.0019	.2	1121.7	1125.7	1129.9
329	16867	8.0	392	1242	.0016	.1	1125.9	1127.9	1134.2
229	17313	6.0	265	446	.0035	.3	1128.2	1129.8	1134.5
627	18703	5.0	161	1390	.0033	.3	1130.0	1134.6	1137.5
127	19762	6.0	253	1059	.0035	.2	1134.8	1138.5	1144.9
274	21162	5.5	220	1400	.0037	.1	1138.5	1143.7	1149.6
174	22412	9.0	758	1250	.0033	.7	1144.4	1148.5	1154.8

BOYLE ENGINEERING CORPORATION

Project
Job No. PH-M04-110-11
RBI Date 7/12/88

Description PIPE COSTS
OLIVE AVE STORM DRAIN
CATCHMENT DESIGN

SHEET 1/4

OPTION 1A

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	–			
274	60			
329	102			
627	72			
629	102			

OPTION 2A

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	–			
274	60	610	175 *	106750 *
329	108	1242	360	447120
627	72	2449	165	404085
629	102	2135	300 **	640500
				1598455

LESS THAN 1000' ON JOB
145 x 1.2 174
USE 175

** 3100 FT ON JOB
295 + 20000 (MOW) / 3100 = 301.45
USE 300

OPTION 3A

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	–			
274	54	610	180 *	109800
329	102	1242	300	372600
627	72	2449	165	404085
629	102	2135	300	640500
				1526985

* ONLY 600 FEET ON JOB
130 x 1.4 = 182
USE 180

BOYLE ENGINEERING CORPORATION

Project
Job No. PH-M04-110-11
RBI Date 7/12/88

Description PIPE COSTS
OLIVE AVE STORM DRAIN
CATCHMENT DESIGN

SHEET 2/4

OPTION B

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127				
274				
329				
627				
629				

OPTION C

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	60	287	200 *	57400
274	—			
329	96	1242	250	310500
627	108	2162	360	778320
629	96	2135	250	533750
				1679970

* 600 FOOT IN JOB
145 × 1.4 = 203
USE 200

OPTION D

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	108	1059	360	381240
274	—			
329	96	1242	250	310500
627	60	1390	175 *	243250
629	96	2135	250	533750
				1468740
				25000
				1,493,740

* 1400 FT IN JOB
145 × 1.2 = 174
USE 175

- MOD'L JUNCT. STRUCTURE

BOYLE ENGINEERING CORPORATION

Project
Job No. PH-M04-110-11
RBI Date 7/12/88

Description PIPE COSTS
OLIVE AVE STORM DRAIN
CATCHMENT DESIGN

SHEET 3/4

OPTION E

PIPE #	DIAMETER	LENGTH	UNIT COST	COST	
127	–				
274	66	610	220 *	134200	* 600 FT ON ENTIRE JOB
329	96	1242	250	310500	155 × 1.4 = 217, USE 220
627	60	1390	190 **	264100	* 900 FT IN ENTIRE JOB
629	96	2135	250	533750	145 × 1.3 = 188.50 - USE 190
				1242550	
				25000	ADD'L JUNCT. STRUCTURE
				1,267,550	

OPTION F

PIPE #	DIAMETER	LENGTH	UNIT COST	COST	
127	–				
274	54	1400	155 *	217000	* 1400 FT ON ENTIRE JOB
329	102	1242	300	372600	130 × 1.2 = 156 - USE 155
627	72	2449	165	404085	
629	102	2135	300	640500	
				1,634,185	

OPTION G

PIPE #	DIAMETER	LENGTH	UNIT COST	COST	
127	72	1059	185 *	195915	* 1500 FT ON WHOLE JOB
274	66	1400	185 **	259000	165 × 1.1 = 181.50 - USE 185
329	96	1242	250	310500	** 1400 WHOLE JOB 155 × 1.2 = 186 - USE 185
627	60	1390	160 ***	222400	*** 1700 ON WHOLE JOB
629	96	2135	250	533750	145 × 1.1 = 159.50 USE 160
				1,521,565	
				25000	ADD'L JUNCT. STRUCTURE
				1,546,565	

BOYLE ENGINEERING CORPORATION

Project No. PH-M04-110-11
RBI Date 7/12/88

Description PIPE COSTS
OLIVE AVE STORM DRAIN
CATCHMENT DESIGN

SHEET /

OPTION 3F

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127	—			
274	48"	1400	135 *	189 000
329	102"	1242	300	372,600
627	66"	2449	165	404 085
629	102"	2135	300	640 500
				1,606,185

120 x 1.1 = 132 - use 135

OPTION ____

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127				
274				
329				
627				
629				

OPTION ____

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
127				
274				
329				
627				
629				

BOYLE ENGINEERING CORPORATION

Project
Job No. PH-M04-110-11
By JEFFRIES Date 7/12/88

Description PIPE COSTS
OLIVE AVE STORM DRAIN
CATCHMENT DESIGN

SHEET 4/4

PIPE COSTS FOR PIPES THAT ARE THE SAME FOR EVERY OPTION

PIPE #	DIAMETER	LENGTH	UNIT COST	COST
129	60	317	175 *	55475
174	108	1250	360	450000
229	72	446	250 *	111500
680	78	1684	175	294700
681	96	2716	250	679000
684	102	2460	300	738000
685	102	500	300	150000
				2,478,675

* FACTORY PRICE

OPTION	STD PIPE COSTS	VARIABLE PIPE COSTS	TOTAL PIPE COST
2A	2,478,675	1,598,455	4,077,130
3A		1,526,985	4,005,660
C		1,679,970	4,158,645
D		1,493,740	3,972,415
E		1,267,550	3,746,225
F		1,634,185	4,112,860
G		1,546,565	4,025,240

Δ - HI/LOW = 412 420
MEAN = 4,014,025 10% VARIATION

3E 1,606,185 4,084860

BOYLE ENGINEERING CORPORATION

Project _____ Description _____ SHEET /

Job No. _____

By _____ Date _____

LAND COSTS

OPTION 2A

BASIN 1	5 AC	1.95	424710
BASIN 4	20 AC	1.65	1437480
			1,862,190

OPTION 3A

BASIN 1			
BASIN 4			
			1862190

OPTION C

BASIN 1	5	1.95	424710
BASIN 2	19	3.45	2855358
			3280068

OPTION D

BASIN 1	5	1.95	424710
BASIN 3	19	1.65	1365606
			1790316

OPTION E

BASIN 1	5	1.95	424710
BASIN 3	11	1.65	790614
BASIN 4	12.5	1.65	898425
			2,113,749

OPTION F

					OPTION 3F
BASIN 1	5	1.95	424710		424710
BASIN 5	19.9	1.25	1603661	923	1630,464
			2,028,371		2,055,174

OPTION G.

BASIN 1	5	1.95	424710
BASIN 3	11	1.65	790614
BASIN 5	12.5	1.25	1007325
			2,222,649