NEW DOC

FINAL

COLORADO CENTRE RESIDENTIAL

FILING NO. 2

FINAL DRAINAGE STUDY

APRIL 19, 1985

REVISED JULY 8, 1985

Prepared for:

M.D.C. Land Corp.
3600 South Yosemite Suite 750
Denver, Colorado 80237

Prepared by:

JR Developers, Ltd.
2120 Hollowbrook Drive Suite 201
Colorado Springs, Colorado 80918

DRAINAGE REPORT STATEMENT

COLORADO CENTRE RESIDENTIAL, FILING NO. 2

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports. I accept responsibility for any liability caused by the negligent acts, errors or omissions on my part in preparing this report.

Randolph F. Fleming, P.E. #[illegible]
For and on Behalf of JR Developers, Ltd.

Developer's Statement:

The developer has read and will comply with all the requirements specified in this drainage report.

M.D.C. Land Corporation
Business Name

By: _____

Title: Vice President

Address: 3600 South Yosemite
Suite 750
Denver, Co. 80237

County of El Paso:

Filed in accordance with Section 45-1 of the El Paso County Land Development Code, January, 1980.

_____ _____
County Engineer Date

Conditions:

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APPENDIX

TECHNICAL ADDENDUM

FINAL DRAINAGE STUDY

COLORADO CENTRE RESIDENTIAL FILING NO. 2

APRIL 19, 1985

REVISED JULY 8, 1985

General Description

Colorado Centre Residential, Filing No. 2, is located in Sections 3 and 10, Township 15 South, Range 65 West of the Sixth Principal Meridian, in El Paso County, Colorado. The site lies northeast of Marksheffel Road and new Drennan Road, and consists of approximately 27.3813 acres (see Exhibit B).

Single family residential development will take place on this site.

Runoff associated with Filing No. 2 will discharge into an existing box culvert beneath Marksheffel Road and into Jimmy Camp Creek. A master drainage plan for all of Colorado Centre, prepared by Gilbert, Meyer & Sams, Inc. has been previously submitted.

Drainage Characteristics

A. Existing

The site presently consists of gentle slopes with poor grass cover. Four historic outfall points have been identified on the plan. Three of those points consist of culverts beneath old Marksheffel Road which all combine and discharge into a structure under the realigned Marksheffel Road. The forth outfall point is where runoff discharges directly into Jimmy Camp Creek.

A 42" reinforced concrete pipe has been stubbed out, under Drennan Road, but both ends are buried.

The soil type is mostly Ustic Torrifluvents which has hydrologic group B characteristics (see Exhibit C).

B. Proposed

Access to the site will be provided by a 44' collector street extending north from new Drennan Road. This street will have 8" vertical curb and gutter.

Within the subdivision, 36' streets with ramp curb which transition to vertical curb and gutter near catch basins will be installed.

Street grades permit routing of developed runoff towards drainage facilities at three locations. Runoff associated with the eastern portion of the site will be collected in a cluster of inlets at the southeast corner, Filing No. 1. The northwest portion will drain towards a pair of inlets on Bramble Lane and flow into the proposed open channel parallel to Marksheffel Road. The remaining runoff will discharge into a concrete spillway located in the southwest corner, then flow towards the Marksheffel drainage structure.

Offsite runoff to the north will be directed westward into the proposed open channel. Future development of these basins is anticipated and runoff quantities have been included for sizing of the open channel.

Temporary detention facilities, which include a diversion swale, are required to prevent greater than historic runoff. The technical addendum to this report presents the details of the temporary routing of storm runoff.

Hydrologic Calculations

The method used for calculating the anticipated amount of runoff is the SCS Method as outlined in "Areawide Urban Runoff Control Manual" and "Procedures for Determining Peak Flows in Colorado".

Design storms with 5-year and 100-year return frequency and 24-hour duration were used to determine adequate sizing of the storm sewer facilities.

Runoff calculations for individual basins and design points are tabulated in Tables 1 through 5.

Summary

The proposed Colorado Centre Residential, Filing No. 2 Drainage Study is in compliance with the master study, "Colorado Centre".

Approximately 21 lots adjacent to Marksheffel Boulevard lie within a F.E.M.A. floodplain. Due to recent construction of a channel west of Marksheffel, these lots are not longer in the floodplain. Refer to Colorado Centre Residential Phase I F.E.M.A. Floodplain Drainage Study for details.

The runoff quantities associated with the developed site will not adversely affect surrounding developments and will be safely channeled to adequate outfall facilities.

DRAINAGE FEES

1985 Miscellaneous Basin Fee: $2601/Acre x 27.3813 Acres		=	$ 71,218.76

OPINION OF PROBABLE COST FOR PUBLIC DRAINAGE FACILITIES

170	L.F.	24" RCP, Class III @ $26/L.F.	=	$ 4,420.00
37	L.F.	30"x19" Oval RCP, Class III @ $25/L.F.	=	925.00
117	L.F.	27" RCP, Class III @ $30/L.F.	=	3,510.00
1	Ea.	27" RCP-45° Bend @ $400/Ea.	=	400.00
1	Ea.	27" RCP Flared End Section @ $500/Ea.	=	500.00
3	Ea.	12' Type R Inlets @ $3000/Ea.	=	9,000.00
1	Ea.	Sidewalk Chase @ $500/Ea.	=	500.00
108	L.F.	Concrete Spillway @ $10.50/Ea.	=	1,134.00
1200	L.F.	Channel w/Concrete Bottom, Rip-Rap Sides @ $62/L.F.	=	74,400.00
		Sub-Total	=	$ 94,789.00
		10% Engineering & Contingency	=	9,479.00
		Total		$ 104,268.00

OPINION OF PROBABLE COST FOR TEMPORARY DRAINAGE FACILITIES

75	L.F.	42" RCP, Class III @ $75/L.F.	=	$ 5,625.00
132	L.F.	65"x40" Arch CMP, 16 gauge @ $52/L.F.	=	6,864.00
60	L.F.	24" CMP, 16 gauge @ $22/L.F.	=	1,320.00
5800	S.F.	12" Rip-Rap, 18" Thick w/12" Base @ $2/S.F.	=	11,600.00
2150	S.F.	12" Rip-Rap, 24" Thick w/12" Base @ $2.50/S.F.	=	5,375.00
1	Ea.	Concrete Weir Structure	=	3,400.00
		Sub-Total	=	$ 34,184.00
		10% Engineering & Contingency	=	3,418.00
		Total		$ 37,602.00

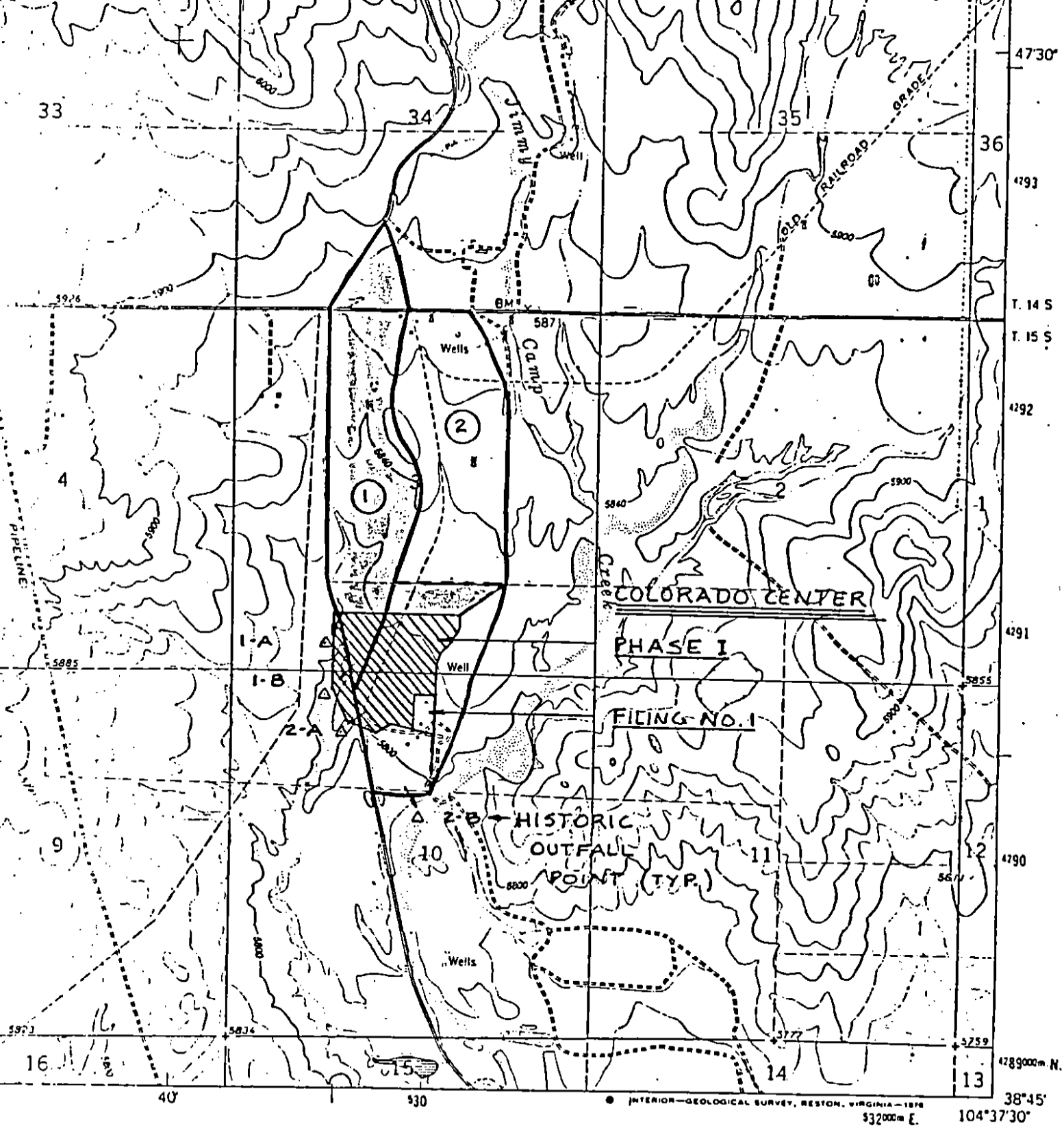
Since JR Developers, Ltd. has no control over the cost of labor, materials, or equipment, or over the contractor's method of determining prices, or over competitive bidding or market conditions, our opinions of probable construction cost provided for herein are made on the basis of our experience and qualifications. These opinions represent our best judgment as a design professional familiar with the construction industry. However, JR Developers, Ltd. cannot and does not quarantee that proposal, bids, or the construction cost will not vary from opinions of probable cost prepared by us. If the owner wishes greater assurance as to the construction cost, he shall employ an independent cost estimator.

Since the cost of public drainage facilities is in excess of the drainage fee, the developer may be eligible for reimbursement pending Department of Transportation and Drainage Board approval.

The developer has been requested by the Department of Transportation to supply a seperate letter of credit for the cost of public drainage improvements, to be held until the drainage fee issue has been resolved.

The cost of temporary drainage facilities will be covered by the overall letter of credit as established in the Estimate of Guaranteed Funds.

APPENDIX

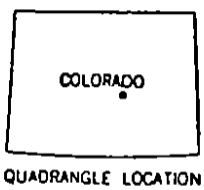


ROAD CLASSIFICATION

Heavy-duty ——— Light-duty ——— · ———

Medium-duty ——— Unimproved dirt - - - - - -

U.S. Route ○ State Route



QUADRANGLE LOCATION

FOUNTAIN NE
5061 II NE

ELSMERE, COLO.

N3845-W10437.5/7 5

1961
PHOTOREVISED 1969 AND 1975
AMS 5061 I SW-SERIES V877

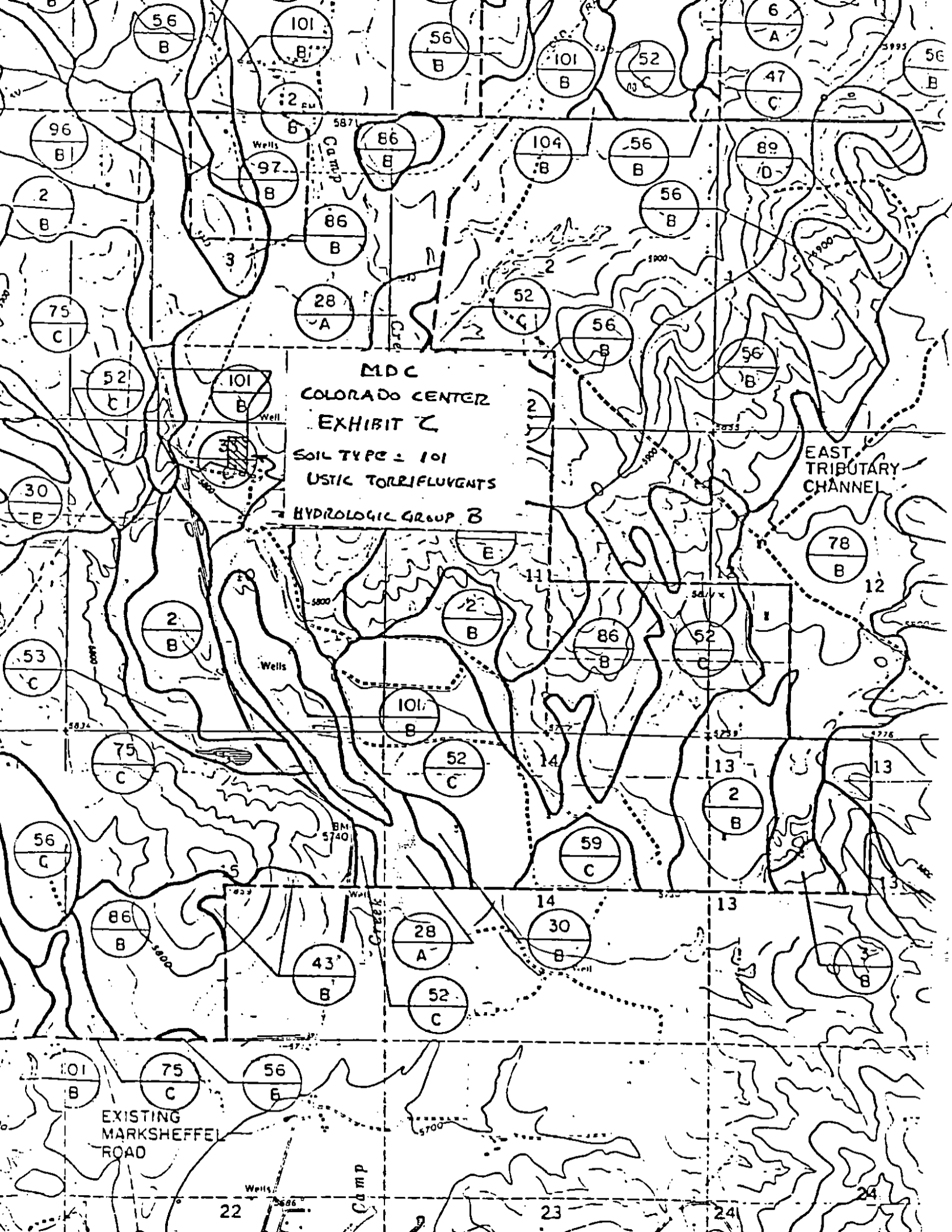
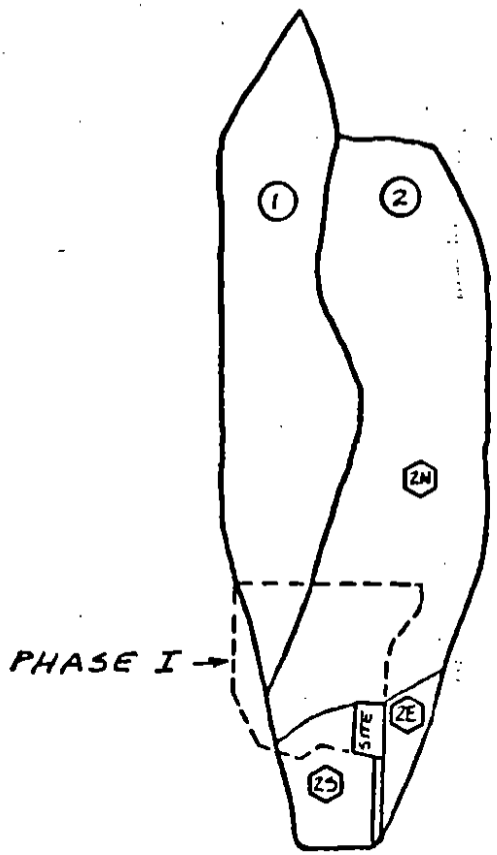

MDC
COLORADO CENTER
EXHIBIT C
SOIL TYPE = 101
USTIC TORRIFLUVENTS
HYDROLOGIC GROUP B
EAST TRIBUTARY CHANNEL
EXISTING MARKSHEFFEL ROAD
Camp Creek
Wells
BM 5740

EXHIBIT "D"



COLORADO CENTRE
FILING NO. 1

OFFSITE BASINS: 2N + 2E + 2S + SITE

OFFSITE = (2)

OFFSITE BASIN SUMMARY

MAJOR BASIN	SUB BASIN	AREA Plonim. Head.	AREA SQ. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR.)	q_p	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR / 100 YR FLOW Q	(CFS) q_5	(CFS) q_{100}
(1)	FROM EXHIBIT "B" & "D"	1.540	0.2210	6900'	1.45% 100'	2.17	225	B	POOR RANGE	79	1.00 / 2.28	49.7	113.
AT 1-A	EXISTING	36" CMP	w/ H_W=3'		CAPACITY = 35 CFS + FLOW-BY TO				1-B			35.0	35.0
AT 1-B	EXISTING	TWIN 24" RCP	w/ H_W =	6',	CAP = 52 CFS							14.7	52.0
	EXISTING	GRATED INLET			, CAP = 56 CFS + OVER TOP OLD ROAD				USED			0	26.0
(2)	FROM EXHIBITS "B" & "D"	2.542	0.3647	7500	1.20% 90'	2.58	200	B	POOR RANGE	79	1.00 / 2.28	72.9	166
AT 2-A	EXISTING	96" CMP	w/ H_W = 1'		CAPACITY = VARIES							35.0	80.0
AT 2-B	FLOW-BY FROM	2-A										37.9	86.0

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ COLORADO CENTRE

By: JWD

Date: 5-85

HISTORIC RUNOFF

1/5

MAJOR BASIN	SUB BASIN	AREA Planim. Head.	AREA SQ. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR)	q_p	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR / 100 YR FLOW Q	Q_5 (CFS)	Q_{100} (CFS)
A	A	9.997	0.0036	1050	2 FPS	0.15	900	B	1/8 AC.	85	1.33 / 2.81	4.5	9.1
	B	41.18	0.0148	1150	2 FPS	0.16	880	B	1/8 AC.	85	1.38 / 2.81	18.0	36.6
	B'	7.87	0.0028	450	2 FPS	0.06	1000	B	1/8 AC.	85	1.33 / 2.81	3.9	7.9
B	TOTAL		0.0176			0.16	880			85		21.4	41.4
	C	4.619	0.0017	650	2FPS	0.09	1000	B	1/3 AC.	85	1.38 / 2.81	2.3	4.1
	C'	26.505	0.0095	1600	2 FPS	0.22	800	B	1/8 AC.	85	1.38 / 2.81	10.5	21.4
C	TOTAL		0.0112				800					12.4	25.2
	D	7.641	0.0027	1200	2 FPS	0.17	865	B	1/8 AC.	85	1.38 / 2.81	3.2	6.6
	D'	2.743	0.0010	200	2 FPS	0.03	1000	B	1/8 AC	85	1.38 / 2.81	1.4	2.8
D	TOTAL		0.0037				865					4.4	9.0
	E	4.976	0.0018	350	2 FPS	0.05	1000	B	1/3 AC	85	1.38 / 2.81	2.5	5.1
	E'	1.689	0.0006	200	2 FPS	0.03	1000	B	1/8 AC.	85	1.38 / 2.81	0.8	1.7
E	TOTAL		0.0024				1000					3.3	6.7

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ COLORADO CENTRE

By: JWD
Date: 5-85

SUBDIVISION (EAST) RUNOFF

2/5

MAJOR BASIN	SUB BASIN	AREA Planim. Head.	AREA sq. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR)	q_p	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR / 100 YR FLOW Q	(CFS) q_5	(CFS) q_{100}
F	F	29.124	0.0104	2400	2 FPS	0.33	680	B	1/8 AC.	85	1.38 / 2.81	9.6	19.9
G	G	22.476	0.0081	1050	2FPS	0.15	900	B	1/8 AC.	85	1.38 / 2.91	10.1	20.5
B	TOTAL		0.0185				680					17.4	35.3
H	H	17.794	0.0064	700	2FPS	0.10	1000	B	1/8 AC.	85	1.38 / 2.81	8.8	18.0
	I	11.144	0.0040	900	2FPS	0.12	960	B	1/8 AC.	85	1.38 / 2.81	5.3	10.8
I	TOTAL		0.0104				960					13.8	28.1
	J	20.382	0.0073	SHEET FLOW		2.10	1000	B	1/8 AC.	85	1.38 / 2.81	10.1	20.5
AT MH	A B C		0.0324			0.17	865				1.39 / 2.81	38.7	78.8
	+												
AT MH	D		0.0361			0.19	840				1.38 / 2.81	41.8	85.2
	+												
AT INLET	E		0.0385			0.19	840				1.38 / 2.81	44.6	90.9
=	S												

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ COLORADO CENTRE

By: JWD

Date: 5-85

SUBDIVISION (WEST) & DRAINAGE FACILITIES

MAJOR BASIN	SUB BASIN	AREA Planim. Head.	AREA SQ. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR.)	q_p	SOIL GROUP	DEV. TYPE	CURVE NO.	5YR/100YR FLOW $Q_{(IN)}$	(CFS) Q_5	(CFS) Q_{100}
	OB-2E	0.279	0.0400	3000'	1.0% 30'	0.75	460	B	POOR RANGE	79	1.00 / 2.28	18.4	42.0
	R-1	3100x40	0.0045	3100'	2 FPS	0.43	610	B	25% - 98 75% - 85	88	1.60 / 3.10	4.3	8.3
1	TOTAL		0.0445				460		COMBINED	79	1.00 / 2.28	20.5	46.7
2	R-2	3.542 + 1000x90	0.0045	1000	2 FPS	0.14	920	B	PAVED + OPEN	88	1.60 / 3.10	6.6	12.8
	R-3	1080x90	0.0035	1080	2 FPS	0.15	900	B		88	1.60 / 3.10	5.0	9.8
3	TOTAL		0.0080	2080	2 FPS	0.29	720			88	1.60 / 3.10	9.2	17.8
	R-4	5.216	0.0019	1020	2 FPS	0.14	920	B		88	1.60 / 3.10	2.8	5.4
4	TOTAL		0.0099	3100	2 FPS	0.43	610			88	1.60 / 3.10	9.7	18.7
	4		0.0099				610			88			
	5		0.0385				850			85			
	OB-2S	0.227	0.0326	1300	2 FPS	0.18	850	B	POOR RANGE	79	1.00 / 2.28	27.7	63.2
6	TOTAL		0.0810				610			83	1.25 / 2.63	61.8	130.

HYDROLOGIC COMPUTATION - BASIC DATA

PROJ COLORADO CENTRE By: JWD Date: 5-85

RUNOFF TO JIMMY CAMP CREEK 4/5

MAJOR BASIN	SUB BASIN	AREA Planim. Head.	AREA sq. MILE	BASIN LENGTH	BASIN HEIGHT	Tc HR.	q_p	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR / 100 YR FLOW Q	(CFS) Q_5	(CFS) Q_{100}
UN-DEVELOPED →	OB-2N	1.643	0.2357	6500	90	2.15	230	B	POOR RANGE	79	1.00 / 2.28	54.2	124
	OB-1N	1.473	0.2113	6500	90	2.15	230	B	POOR RANGE	79	1.00 / 2.28	48.6	111
	TOTAL		0.4470				230					102.	234.
	B → I		0.0362	3800	2FPS	0.53	550	B	1/8 AC.	85	1.38 / 2.81	27.5	55.9
TOTAL @	BOX CULVERT:		0.4832				230		COMBINED	79	1.00 / 2.28	111	253
DEVELOPED →	OB-2N	0.140	0.0201	1700	2FPS	0.24	780	B	1/8 AC.	85	1.38 / 2.81	21.6	44.1
	OB-1N	1.209	0.1735	6000	2FPS	0.83	425	B	1/8 AC.	85	1.38 / 2.81	102.	209
	TOTAL		0.1936				425					113.	231.
	B → I		0.0362				550			85	1.38 / 2.81	SAME AS ABOVE	
TOTAL @	BOX CULVERT:		0.2298				425					134	274

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ COLORADO CENTRE

By: JWD
Date: 5-85

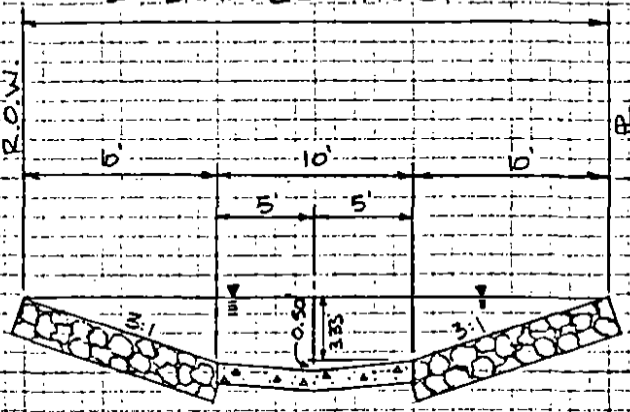
ROUTING OFFSITE BASINS

5/5

JR DEVELOPERS, LTD
2120 HOLLOWBROOK DR.
COLORADO SPRINGS, COLORADO 80918
303-528-8833

LAND DEVELOPMENT CONSULTANTS

35' DRAINAGE TRACT



MANNING'S EQUATION

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

WHERE n (COMPOSITE ROUGHNESS) = 0.034

$A = 69\ FT^2$

$$R = \frac{\text{AREA}}{\text{WETTED PERIMETER}} = \frac{69}{(2)(10.5) + (2)(5)} = 2.23$$

S VARIES - SEE BELOW

CAPACITY AT S = 1.01%

$S = 0.0101\ FT/FT$

$$\therefore Q = \frac{1.486}{0.034} (69)(2.23)^{2/3} (0.0101)^{1/2}$$

$Q = 517\ CFS$

CAPACITY AT S = 0.50%

$S = 0.0050\ FT/FT$

$$\therefore Q = \frac{1.486}{0.034} (69)(2.23)^{2/3} (0.0050)^{1/2}$$

$Q = 364\ CFS$

$Q_{DESIGN} = 231\ CFS$

$Q_{CAPACITY} \geq 364\ CFS$

$\therefore Q_{DESIGN} < Q_{CAPACITY}$

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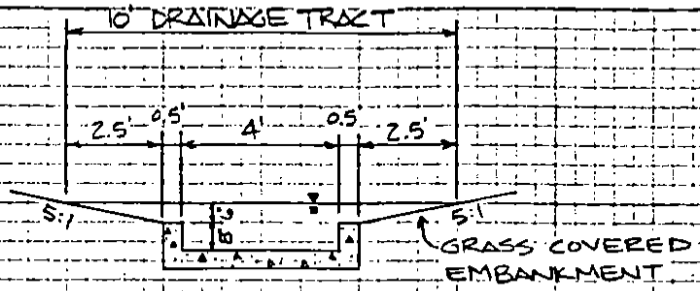
LAND DEVELOPMENT CONSULTANTS



MANNINGS EQUATION

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

WHERE n (COMPOSITE ROUGHNESS) $= 0.021$

$A = 6.4\ FT^2$

$R = \frac{\text{AREA}}{\text{WETTED PERIMETER}} = \frac{6.4}{11.4} = 0.56$

$S = 0.0100\ FT/FT$

$$\therefore Q = \frac{1.486}{0.021}(6.4)(0.56)^{2/3}(0.0100)^{1/2}$$

$$Q_{CAPACITY} = 30.8\ CFS$$

$Q_5 = 13.8$ CFS AND $Q_{100} = 28.1$ CFS

$\therefore Q_{DESIGN} < Q_{CAPACITY}$

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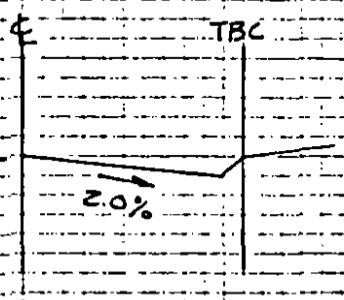
303-528-8833

LAND DEVELOPMENT CONSULTANTS

CURB CAPACITY
COLORADO CENTRE 5-85



$A = 5.0\ FT^2$, $P = 21'$, $R = 0.2381$

6" RAMP CURB

SLOPE = 1%

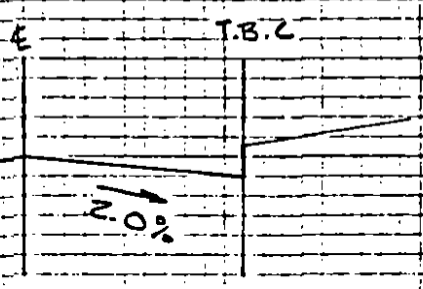
$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$= \frac{1.486}{0.015} (5)(0.2381)^{0.67}(0.01)^{0.5}$$

$= 19$ CFS (0.80 REDUCTION)

$= 15$ CFS

$V_{ELOCITY} = 3.0$ FPS



$A = 10\ FT^2$, $P = 21'$, $R = 0.4762$

8" VERTICAL CURB

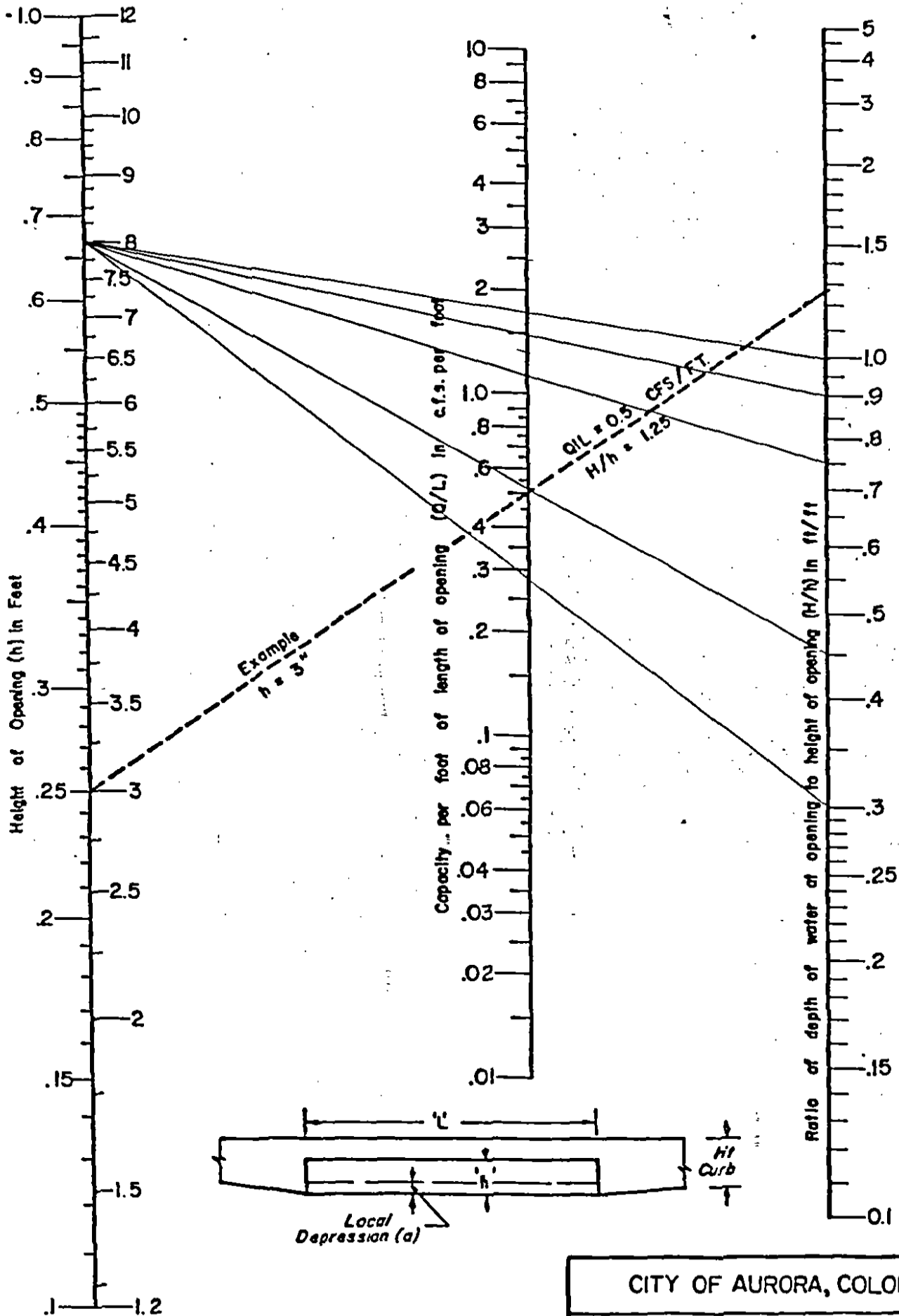
SLOPE = 1%

$$Q = \frac{1.486}{0.015} (10)(0.4762)^{0.67}(0.01)^{0.5}$$

$= 60$ CFS (0.80 REDUCTION)

$= 48$ CFS

$V_{ELOCITY} = 4.8$ FPS



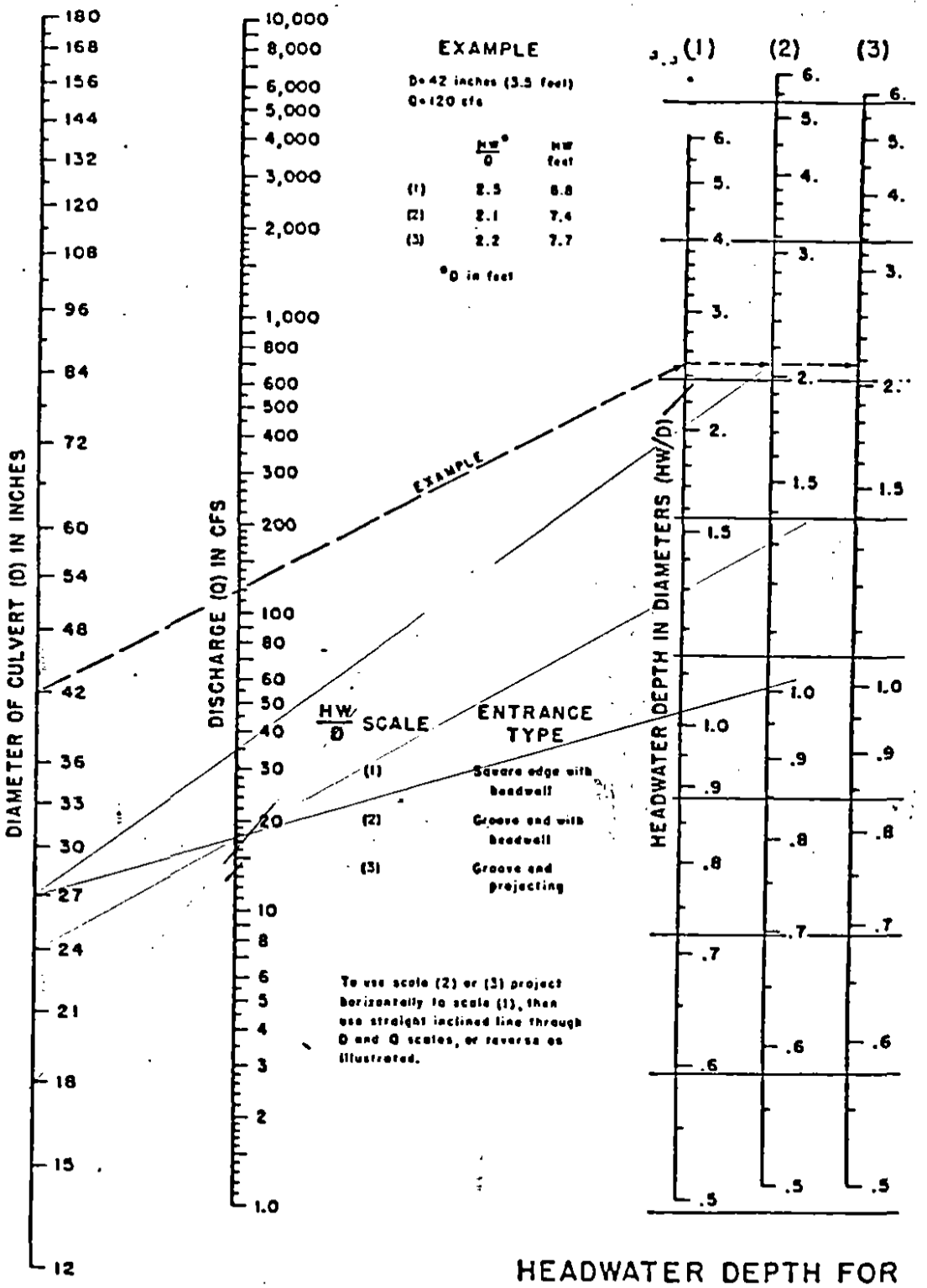
CITY OF AURORA, COLORADO

NOMOGRAPH FOR CAPACITY OF CURB OPENING INLETS AT SUMP

3/7

F.W.	6-14-76	COLORADO CENTRE
JWD	5-85	

CHART 2



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

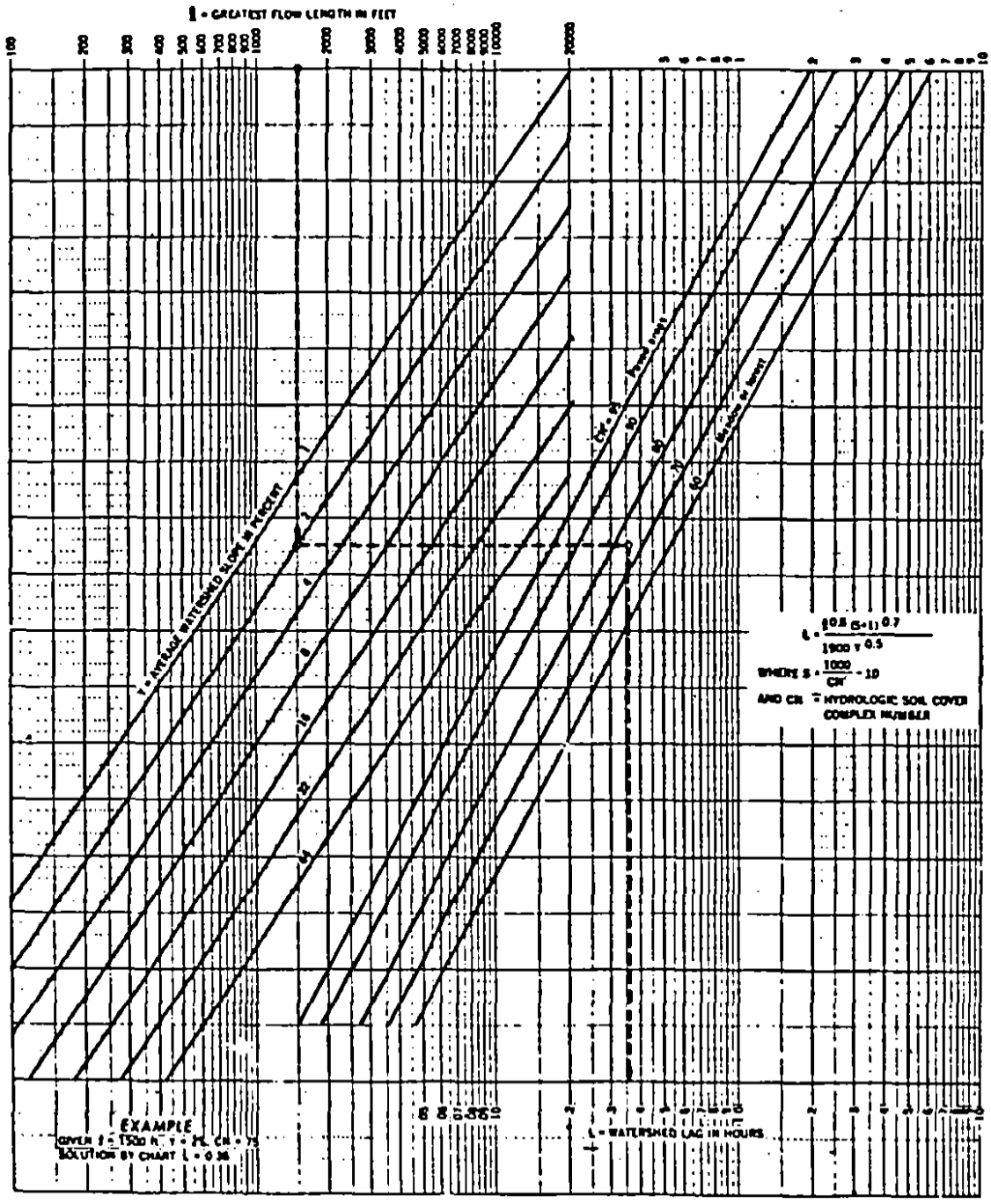


Figure 3-3.--Curve number method for estimating lag (L) for homogeneous watersheds under natural conditions up to 2,000 acres.

$$T_c = \frac{LAG}{0.6}$$

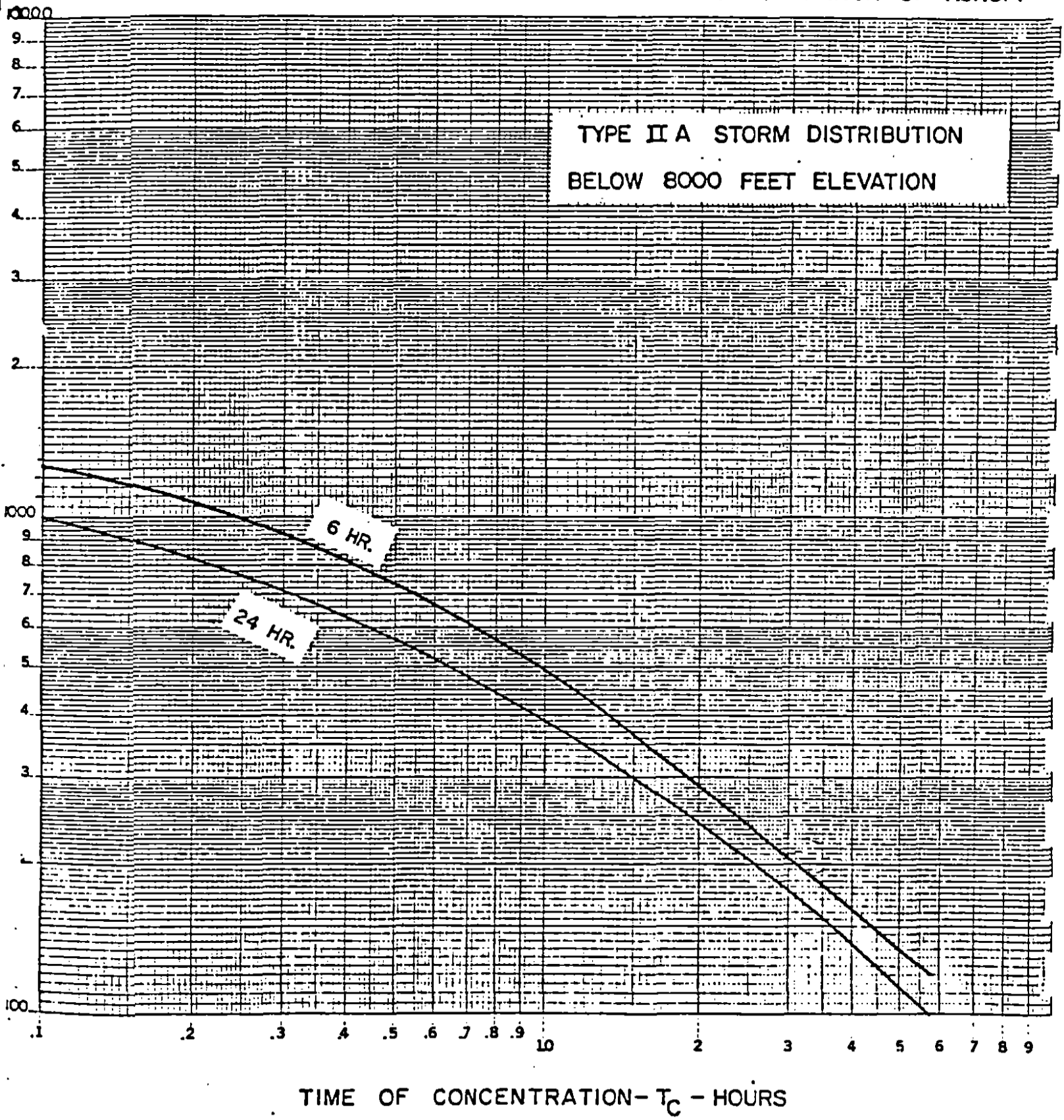


FIGURE III-4

6/7

CURVE
79

RUNOFF FOR INCHES OF RAINFALL

Inches \ Tenths	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0							0.00	0.01	0.02	0.04
1	0.07	0.10	0.13	0.17	0.21	0.26	0.31	0.36	0.41	0.46
2	0.52	0.58	0.64	0.71	0.77	0.84	0.90	0.97	1.04	1.12
3	1.19	1.26	1.34	1.41	1.49	1.57	1.64	1.72	1.80	1.88
4	1.96	2.04	2.13	2.21	2.29	2.38	2.46	2.54	2.63	2.71
5	2.80	2.89	2.97	3.06	3.15	3.24	3.32	3.41	3.50	3.59
6	3.68	3.77	3.86	3.95	4.04	4.13	4.22	4.31	4.40	4.49
7	4.58	4.67	4.77	4.86	4.95	5.04	5.14	5.23	5.32	5.41
8	5.51	5.60	5.69	5.79	5.88	5.97	6.07	6.16	6.26	6.35
9	6.44	6.54	6.63	6.73	6.82	6.92	7.01	7.11	7.20	7.30
10	7.39	7.49	7.58	7.68	7.77	7.87	7.96	8.06	8.16	8.25
11	8.35	8.44	8.54	8.63	8.73	8.83	8.92	9.02	9.12	9.21
12	9.31	9.41	9.50	9.60	9.70	9.79	9.89	9.99	10.08	10.18
13	10.28	10.37	10.47	10.57	10.66	10.76	10.86	10.96	11.05	11.15
14	11.25	11.34	11.44	11.54	11.64	11.73	11.83	11.93	12.03	12.12
15	12.22	12.32	12.42	12.51	12.61	12.71	12.81	12.90	13.00	13.10
16	13.20	13.30	13.39	13.49	13.59	13.69	13.79	13.88	13.98	14.08
17	14.18	14.28	14.37	14.47	14.57	14.67	14.77	14.86	14.96	15.06
18	15.16	15.26	15.36	15.45	15.55	15.65	15.75	15.85	15.95	16.04
19	16.14	16.24	16.34	16.44	16.54	16.64	16.73	16.83	16.93	17.03
20	17.13	17.23	17.32	17.42	17.52	17.62	17.72	17.82	17.92	18.02

NOTE: Runoff value determined by equation $Q = \frac{(P-0.2S)^2}{P+0.8S}$

REFERENCE: National Engineering Handbook, Section 4, HYDROLOGY

7/7

TECHNICAL ADDENDUM

TO

FINAL DRAINAGE STUDY OF

COLORADO CENTRE RESIDENTIAL FILING NO. 2

JULY 5, 1985

INTRODUCTION

THIS ADDENDUM ADDRESSES THE METHODOLOGY AND CALCULATIONS USED IN RESTRICTING THE STORM WATER RELEASE FROM THE SUBJECT SITE TO THE 100 YEAR HISTORIC.

DISCUSSION

A 2.93 ACRE FOOT DETENTION POND IS PROPOSED TO BE CONSTRUCTED NEAR THE INTERSECTION OF HORIZONVIEW DRIVE AND NEW DRENNAN ROAD. THE FLOW FROM THIS PROPOSED POND WILL DISCHARGE INTO AN EXISTING 42" R.C.P. LOCATED IN NEW DRENNAN ROAD AND THEN CONTINUE OVERLAND IN A CHANNEL TO JIMMY CAMP CREEK.

THE RELEASE FROM THE DETENTION FACILITY WILL BE CONTROLLED BY A 42" R.C.P. ANALYSIS OF THE 42" R.C.P. UNDER NEW DRENNAN ROAD SHOWED THAT THE HEAD WATER ON THE NORTH SIDE OF THE ROAD WILL CREATE A TAIL WATER CONDITION THAT WILL CONTROL THE RELEASE OF THE DETENTION POND. USING A BUREAU OF PUBLIC ROAD NOMOGRAPH CHART 9 THE MAXIMUM RELEASE WAS FOUND TO BE 75 CFS. THE 75 CFS WAS USED AS THE MAXIMUM RELEASE RATE FROM THE DETENTION POND TO ARRIVE AT THE REQUIRED VOLUME OF 119,138 CUBIC FEET. MAXIMUM INFLOW INTO THE DETENTION POND WAS CALCULATED AT 214.5 CFS.

IN ORDER TO INSURE THAT FLOWS FROM BASINS G,H,I AND J ARE CONVEYED TO THE DETENTION POND A TRIANGULAR CHANNEL IS DESIGNED

TO CARRY 80 CFS AT A DEPTH OF 2.57 FEET. THIS CORRESPONDS WITH THE DEPTH IN THE MARKSHEFFEL CHANNEL. THIS WILL INSURE THAT LOW FLOWS WILL BE DIVERTED INTO THE TRIANGULAR CHANNEL SINCE UP TO A DEPTH OF 1.0 FEET IT WILL ACT AS A DAM. AT HIGHER FLOWS IT WILL ASSIST IN DIVERTING FLOW, AND AT THE MAXIMUM DEPTH OF 1.5' WILL MAINTAIN THE LEVEL UPSTREAM AT APPROXIMATELY 2.57 FEET WHICH IS EQUAL TO THE DESIGN DEPTH OF THE TRIANGULAR CHANNEL. DUE TO THE DIFFERENCES OF TIMES OF CONCENTRATION BETWEEN THE ENTIRE BASIN AND THE PROPOSED DEVELOPMENT, CONTRIBUTIONS TO THE PROPOSED DETENTION POND WILL BE MAINLY FROM THE OFFSITE HISTORIC FLOWS ROUTED THROUGH THE TRIANGULAR CHANNEL DURING THE MAJOR EVENT. AT MAXIMUM FLOW OF THE ABOVE CHANNEL THE RELAESE RATE OF THE DETENTION POND WILL BE EXCEEDED BY APPROXIMATELY 5 CFS. AN OVERFLOW SPILLWAY WILL BE PROVIDED TO CONVEY THE 100 YEAR HISTORIC EVENT TO THE CULVERT UNDER NEW DRENNAN ROAD SHOULD THE POND VOLUME BE EXCEEDED BY EITHER ACCIDENTAL CLOGGING OF THE RELEASE CULVERT OR EXCESSIVE HISTORIC FLOWS. THE 42" R.C.P. IN NEW DRENNAN ROAD HAS A MAXIMUM CAPACITY OF 160 CFS BEFORE THE ROAD WILL BE OVERTOPPED. THEREFORE THIS PROCEDURE SHOULD NOT OVER TAX THE EXISTING CULVERT.

IT SHOULD BE UNDERSTOOD THAT THE ABOVE PROCEURES AND CONCEPTS ARE INTENDED TO BE AN INTERUM SOLUTION UNTIL SUCH TIME AS ADEQUATE DRAINAGE IMPROVEMENTS ARE MADE ON THE WEST SIDE OF MARKSHEFFEL ROAD. AT THAT TIME THE INTENT IS TO REVERT BACK TO THE CONCEPT AS PRESENTED IN THE ORIGINAL DRAINAGE STUDY OF APRIL 19, 1985 AND RECLAIM THE LAND AFFECTED BY THE INTERUM DRAINAGE IMPROVEMENTS FOR DEVELOPMENT.

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100-YR RUNOFF OF ALL DEVELOPED PHASES.

AREA = 52.90 ACRES

TIME OF CONCENTRATION: total L = 2100' S = 1%

OVERLAND FLOW: L = 100' S = 1% (SCS FIG. 3-1) V = .75'/sec

$\frac{100'}{.75'/sec} \cdot \frac{HR}{3600 sec} = 0.04$ HR

SHALLOW GUTTER FLOW: L = 500' S = 1% (SCS FIG. 3-1) V = 2'/sec

$\frac{500'}{2'/sec} \cdot \frac{HR}{3600 sec} = 0.07$ HR

PIPE FLOW: L = 1000', V = 6'/sec, S = 1%

$\frac{1000'}{6'/sec} \cdot \frac{HR}{3600 sec} = 0.046$ HR

CHANNEL FLOW: L = 500', V = 4'/sec, S = 1%

$\frac{500'}{4'/sec} \cdot \frac{HR}{3600 sec} = 0.035$ HR

TOTAL T_c = 0.04 + 0.07 + 0.046 + 0.035 = 0.19 HR

PEAK DISCHARGE (FIG. 1, 24 HR) = 840 CSM/IN

COMPOSITE CURVE NO.

88.00

100-YR RUNOFF = 3.09 IN

RUNOFF

$Q_{100} = 3.09 \frac{52.90}{640} \cdot 840$

= 214.5 cfs

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PEAK FLOWS FOR BASINS 1 & 2

BASIN 1 L = 6900' S = 1.45% ΔH = 100'

TIME OF CONCENTRATION:

OVERLAND FLOW: L = 700' S = 1.45% (FIG 3-1) V = .85'/sec

$\frac{700'}{.85'/sec} \cdot \frac{HR}{3600 SEC} = 0.22$ HR.

CHANNEL FLOW: L = 6200' S = 1.45% ΔH = 90.0

FROM G.M.S. NOMO. t_c = 0.51 HR.

TOTAL T_c = 0.22 + 0.51 = **0.73 HR**

BASIN 2 L = 7500' S = 1.20% ΔH = 90'

OVERLAND FLOW: L = 500' S = 1.20% (FIG. 3-1) V = .75'/sec

$\frac{500'}{.75'/sec} \cdot \frac{HR}{3600 SEC} = 0.19$ HR

CHANNEL FLOW: L = 7000' S = 1.20 ΔH = 84'

FROM G.M.S. NOMO. t_c = .65 HR.

Total T_c = 0.19 + 0.65 = **0.84 HR**

TIME AT SOUTH END OF PROPERTY:

$\frac{3200'}{1.5'/sec} \cdot \frac{HR}{3600 SEC} = 0.21$ HR

0.73 HR + 0.21 HR = **0.94 HR**

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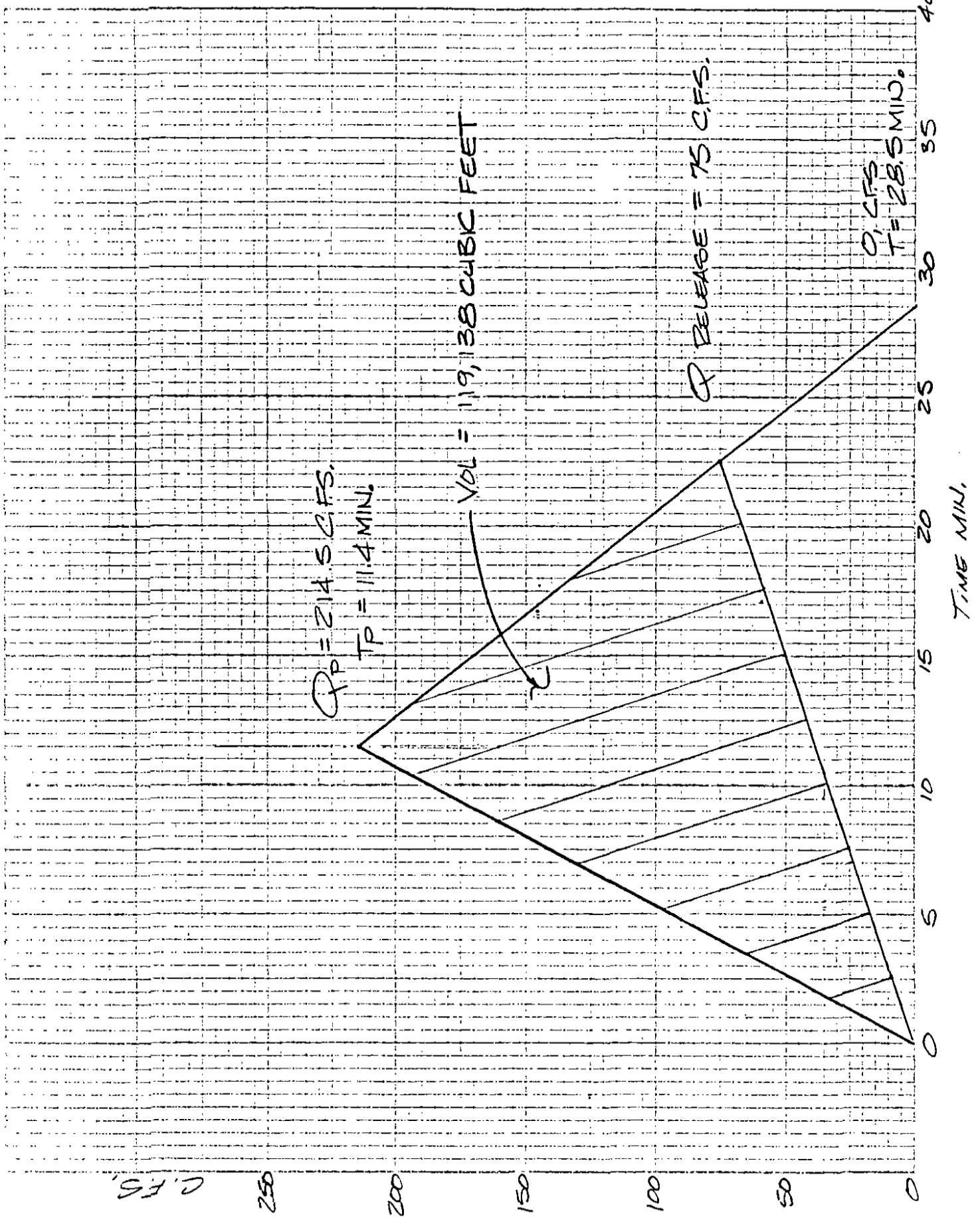

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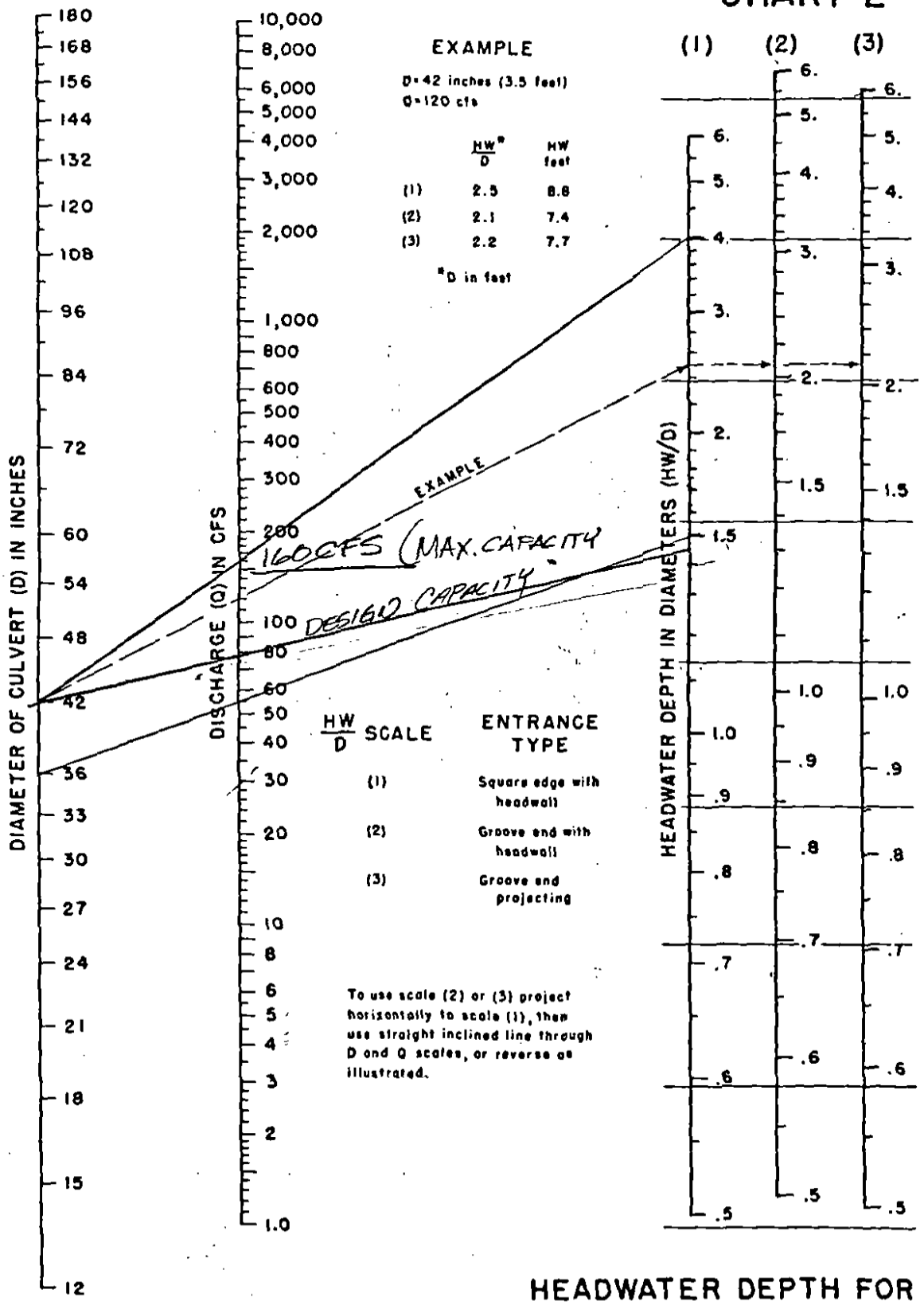
POND VOLUMES

ELEV	PLANIMETER IN^2	AREA FT^2	VOL FT^3	Σ VOL FT^3
5881	0.00	0.00		
5882	1.10, 1.07		1,350	1,350
5884	8.31, 8.23	20,675	23,387.5	24,737.5
5886	21.84, 21.89	54,662.5	75,337.5	100,075.00
5886.5	21.87	54,675.5	27,337.5	127,412.50

AMOUNT OF STORAGE REQUIRED 119,138 CU.FT.
SO VOLUME IS SUFFICIENT.

CULVERT UNDER NEW DRIVEWAY

CHART 2



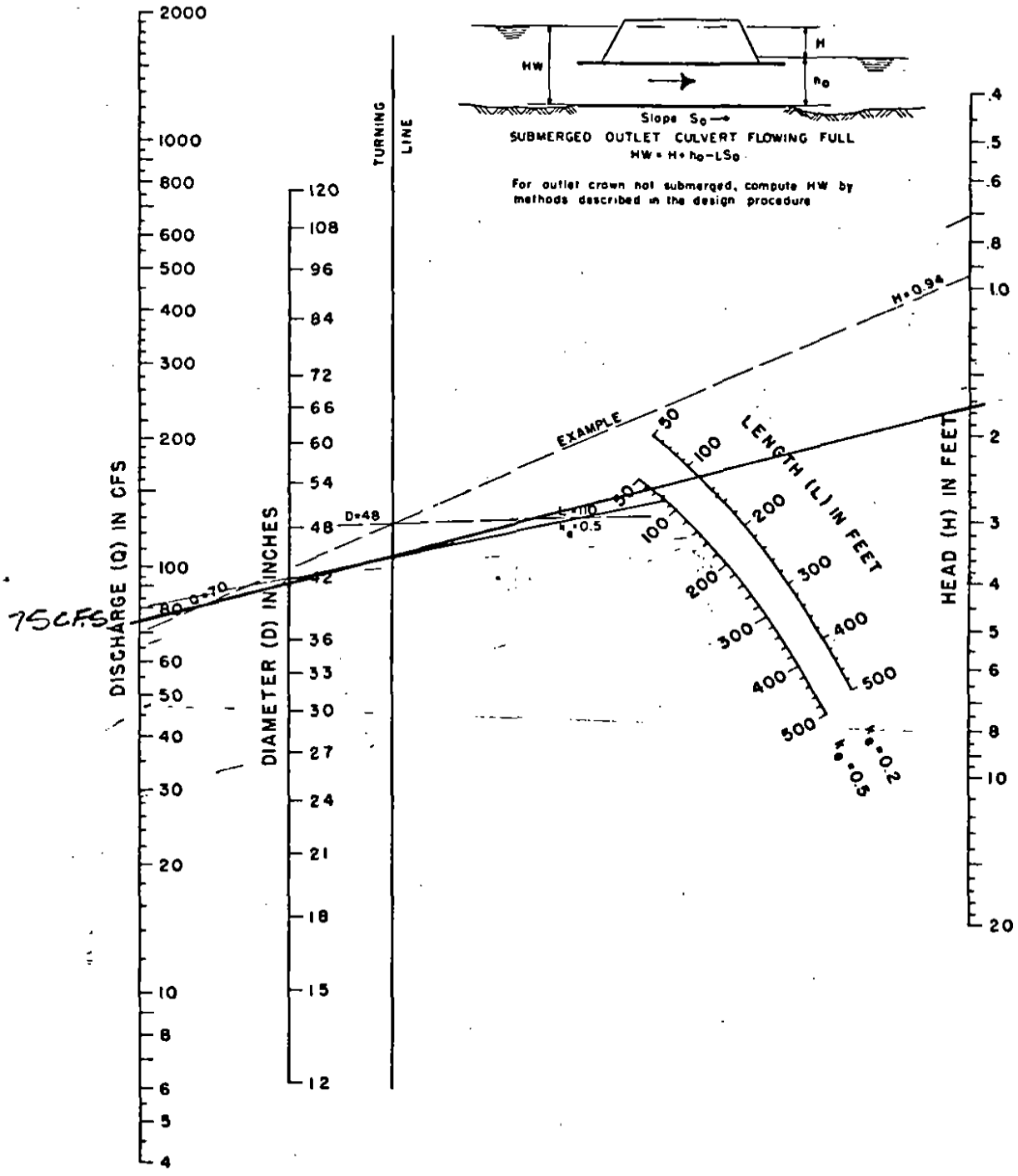
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

Detention Pond Release Culvert

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

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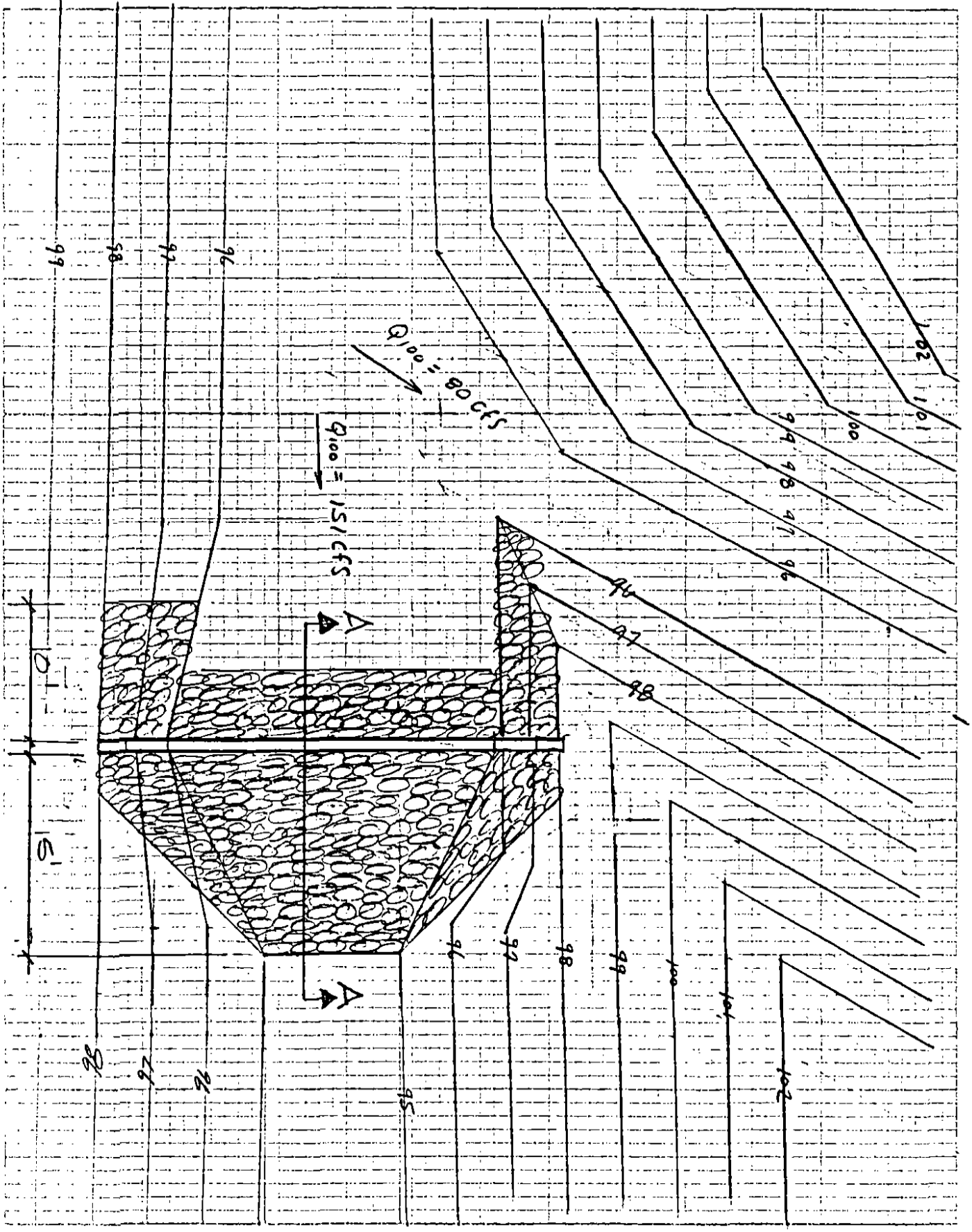

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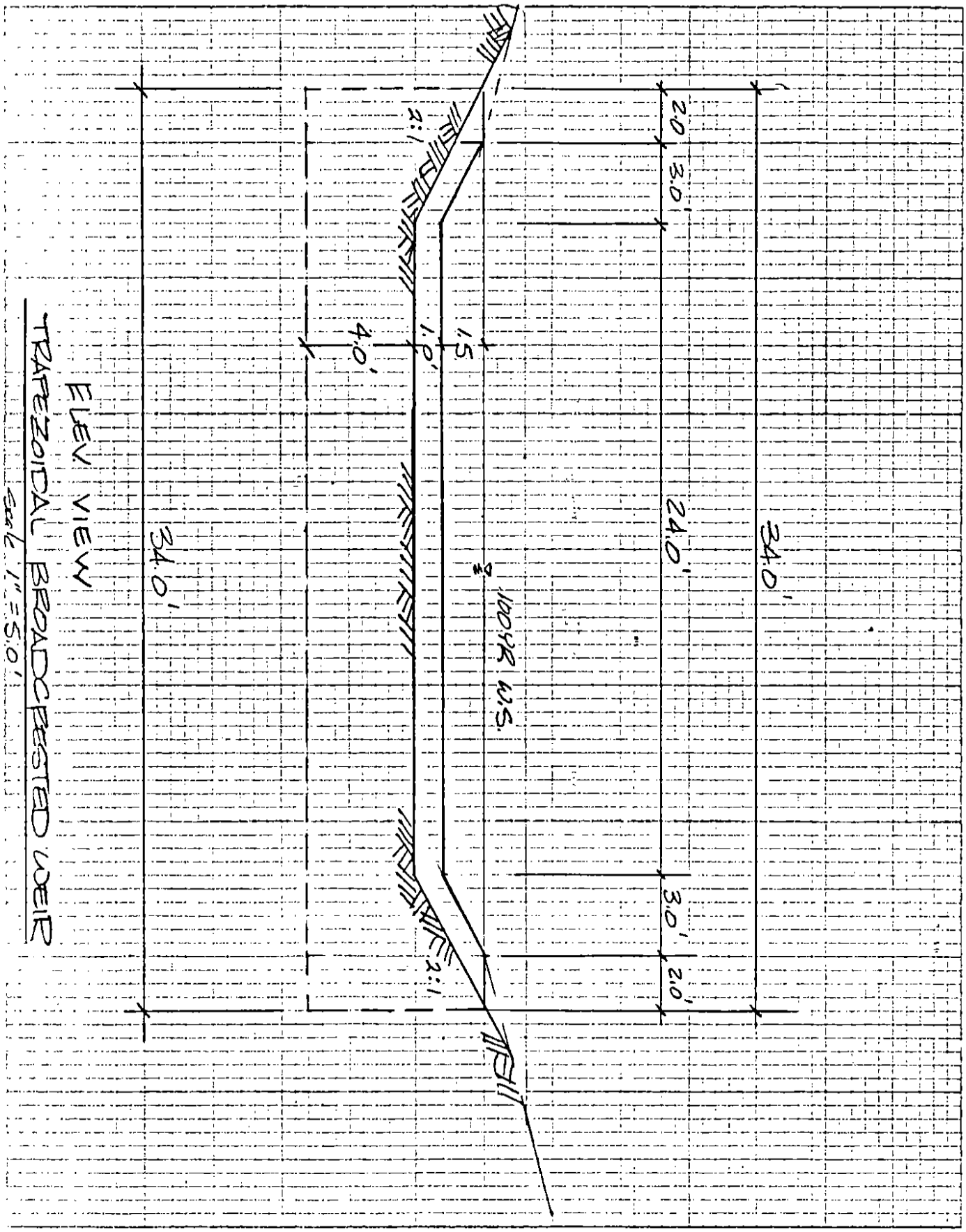

ELEV. VIEW
TRAPEZOIDAL BROADCRESTED WEIR
Scale 1" = 5.0'

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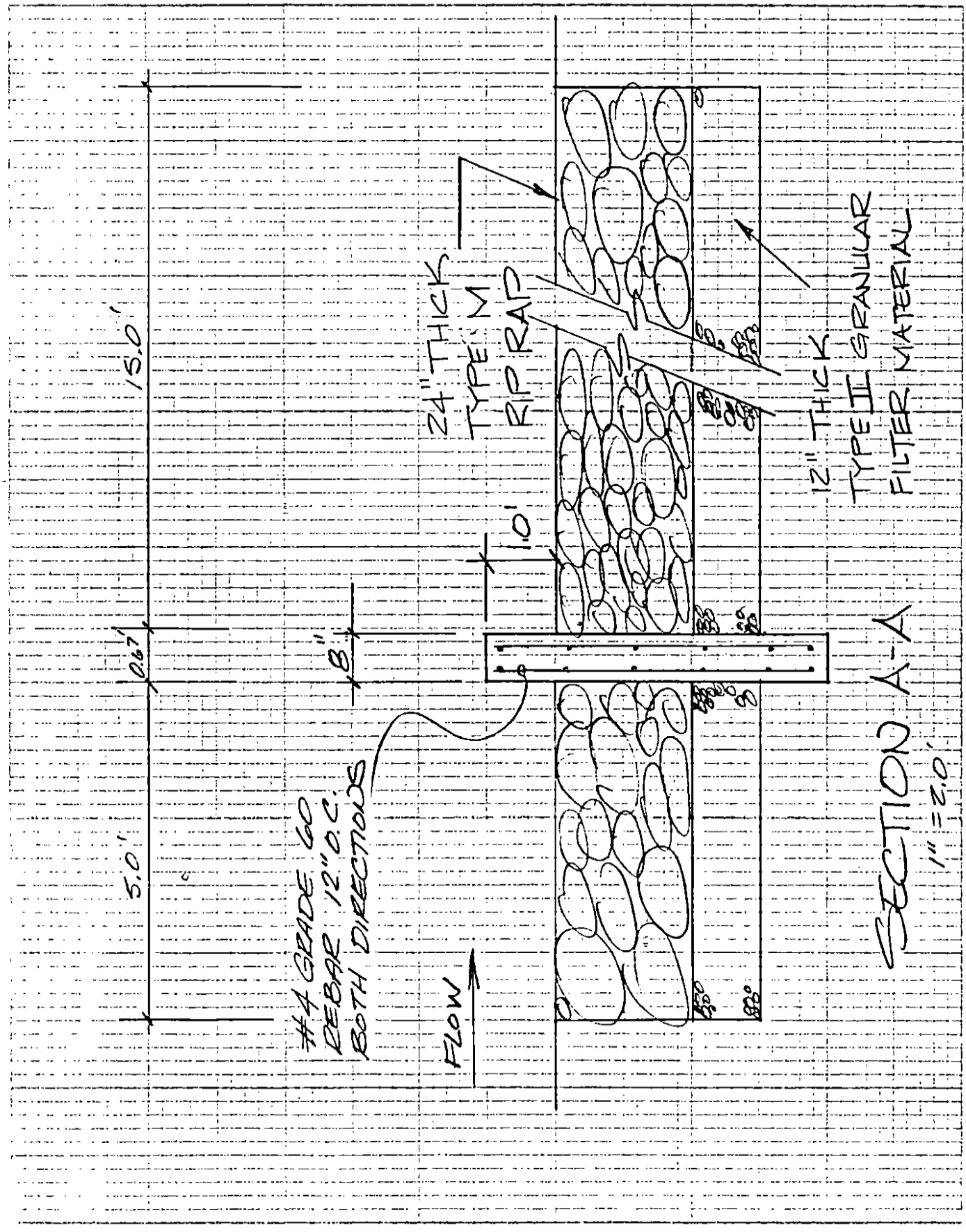

SECTION A-A
1" = 2.0'

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TRAPEZOIDAL BROAD CRESTED WEIR

BOTTOM WIDTH = 24.00 FEET

SIDE ANGLE = 26.57 DEGREES

ELEV. (FT.)	FLOW (CFS)
0.00	0.00
0.10	2.43
0.20	6.90
0.30	12.69
0.40	19.57
0.50	27.39
0.60	36.07
0.70	45.53
0.80	55.71
0.90	66.59
1.00	78.12
1.10	90.27
1.20	103.02
1.30	116.36
1.40	130.25
1.50	144.69
1.60	159.65
1.70	175.14
1.80	191.12
1.90	207.60
2.00	224.57
2.10	242.01
2.20	259.92
2.30	278.29
2.40	297.11
2.50	316.37
2.60	336.08
2.70	356.22
2.80	376.80
2.90	397.79
3.00	419.21

FORMULA USED Q = 4.8*H^1.5*(0.667*W+0.533*HEAD*TAN (A))

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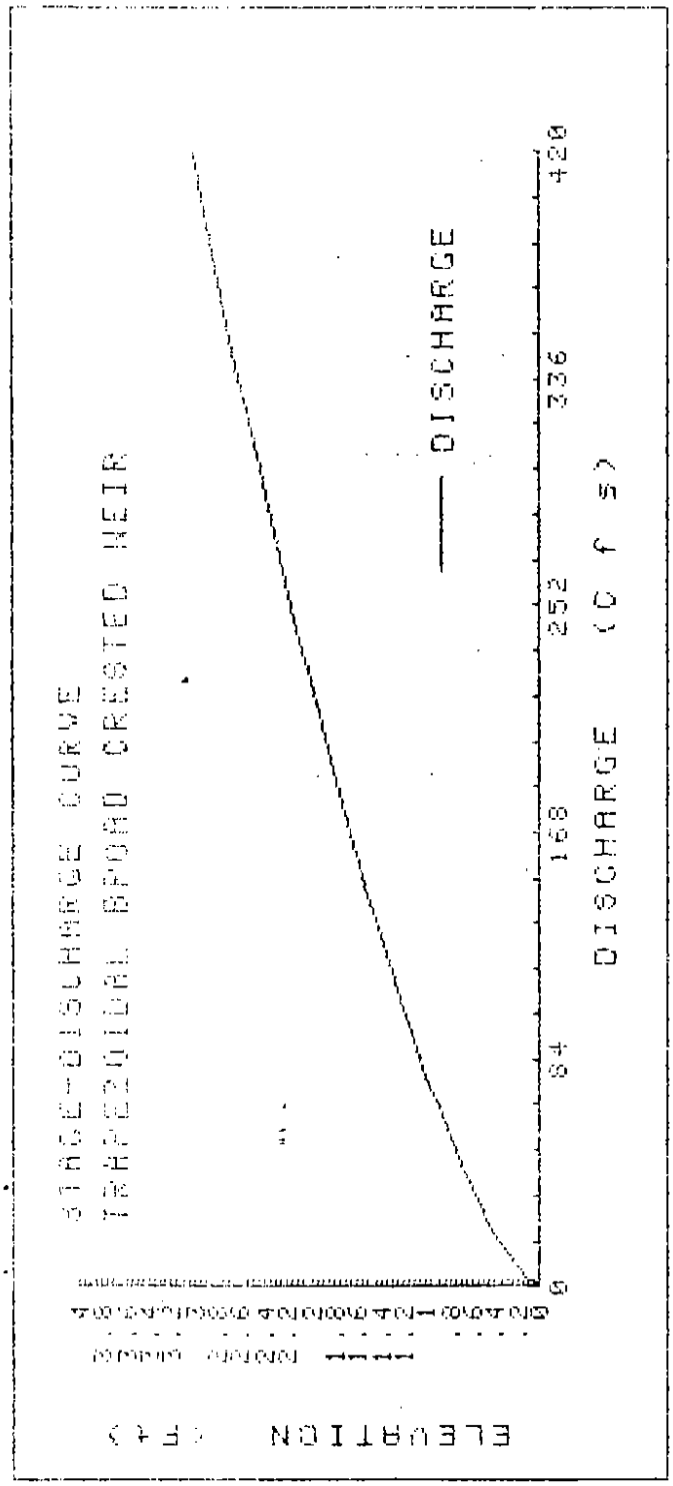

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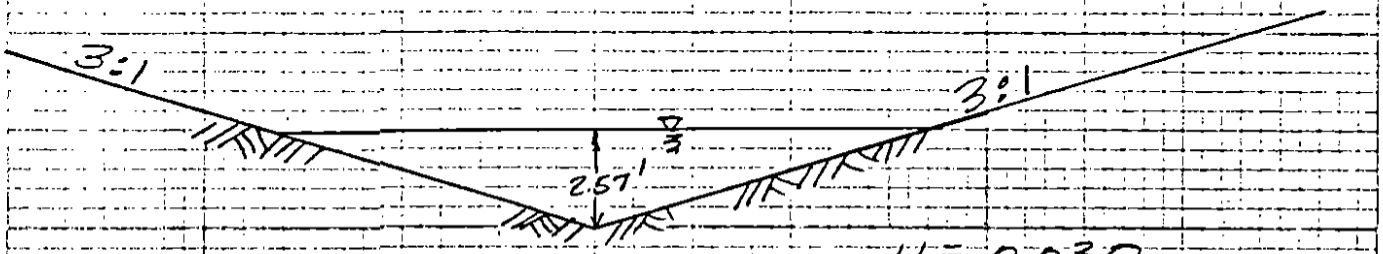
DIVERSION CHANNEL

TRIANGLE SECTION



$n = 0.030$

$S = 0.51\%$

$Q = 80$ C.F.S.

$D = 2.57$

$A = 19.81$

$P = 16.25$

$R = 1.22$

$$Q = \frac{1.486}{0.030} 1.22^{2/3} (0.0051)(19.81)$$

$Q = 30.00$ C.F.S.

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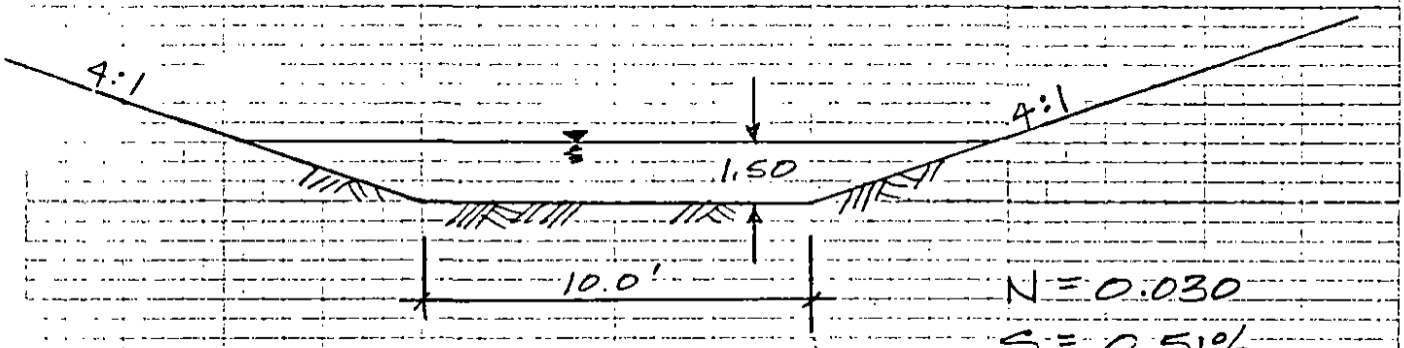
DIVERSION CHANNEL
TRAPEZOID SECTION



$$Q = \frac{1.486}{0.030}(1.07)^{2/3}(0.0051)^{1/2}(24.00)$$

$Q = 88.97$ CFS

$N = 0.030$

$S = 0.51\%$

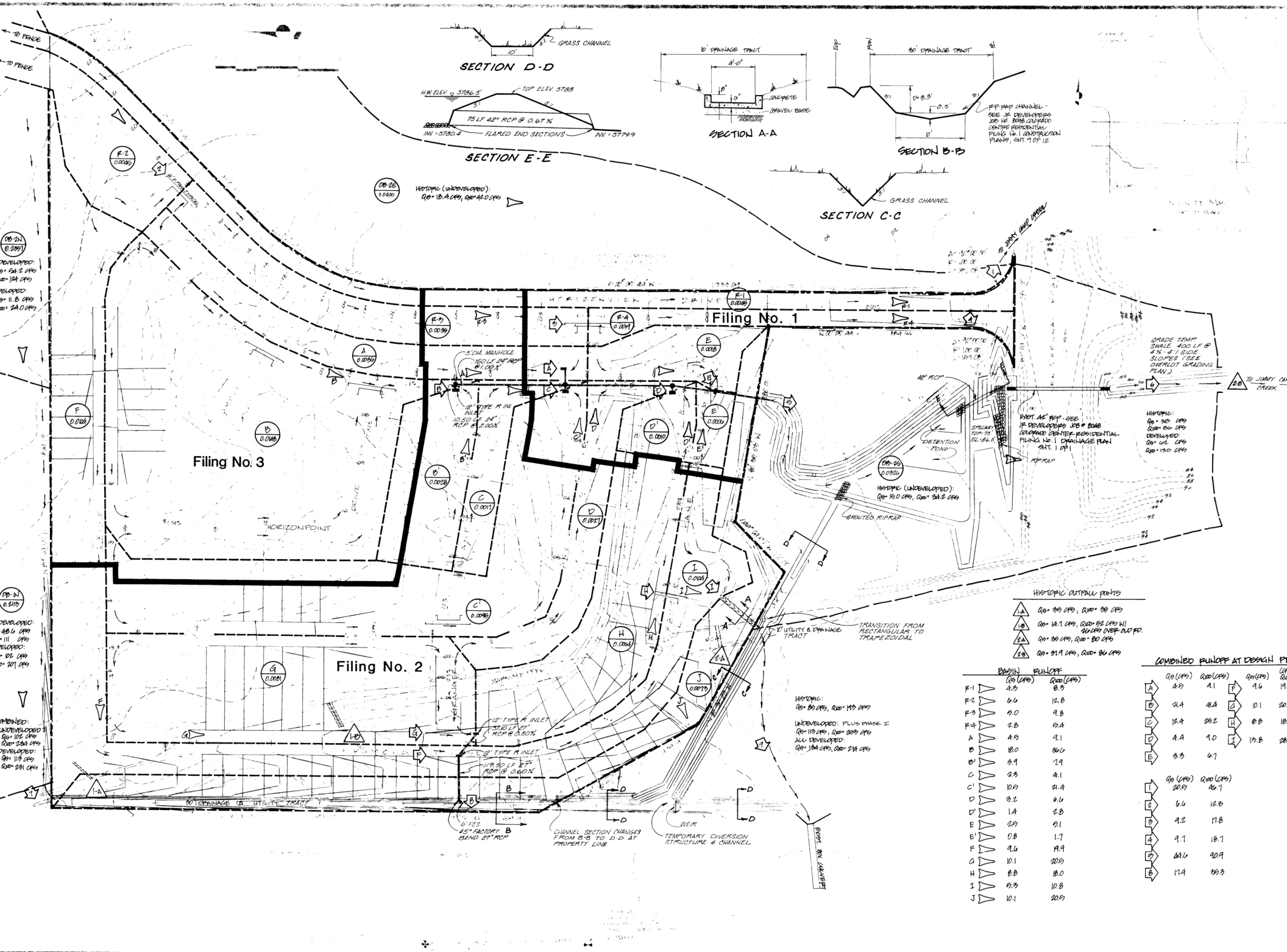
$Q = 89$ C.F.S.

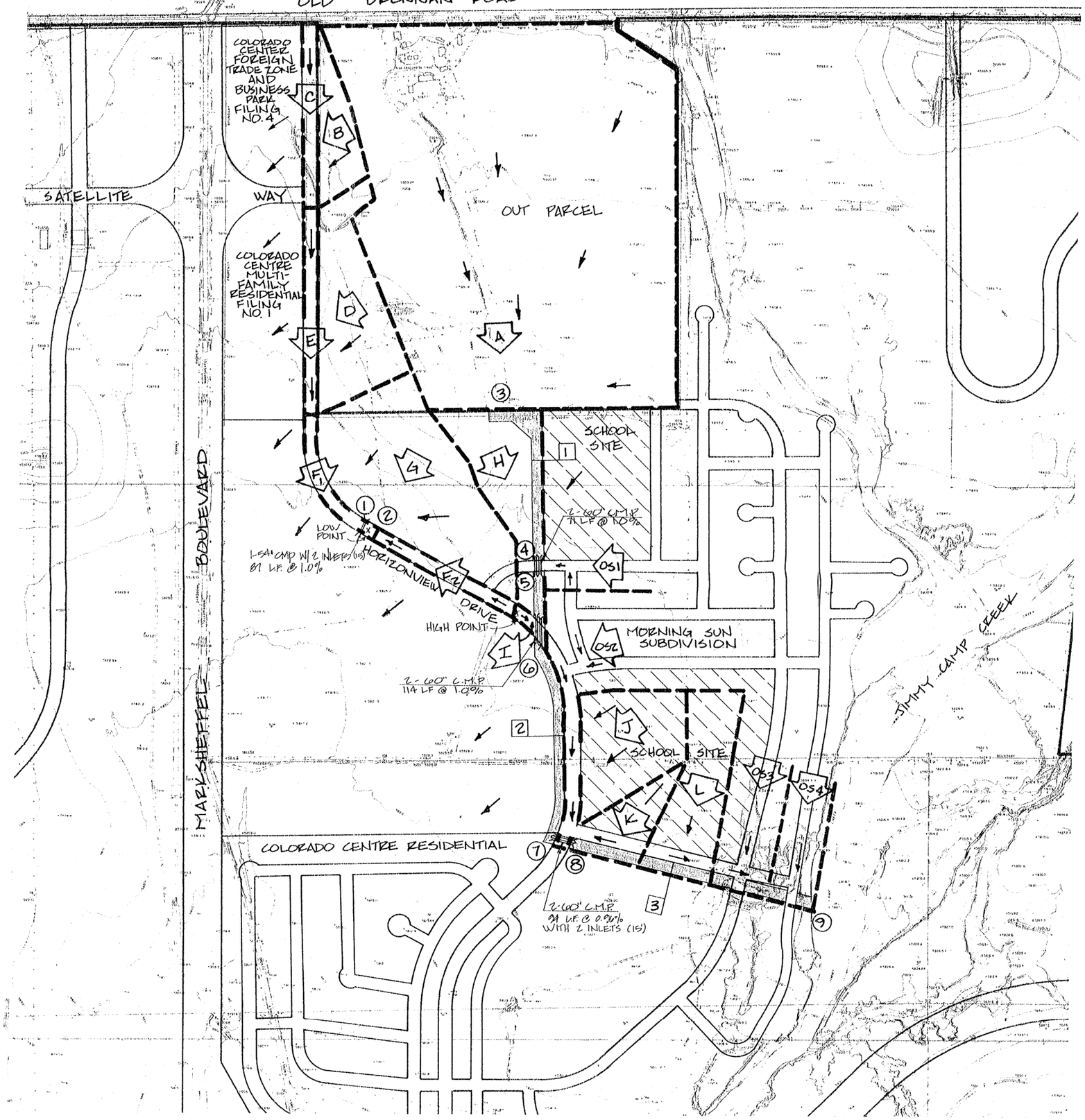
$D = 1.50'$

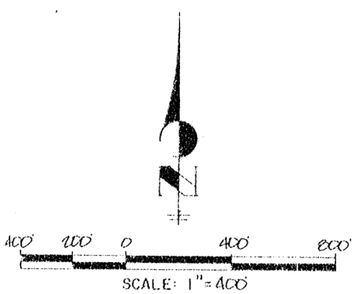
$A = 24.00$

$R = 1.07$

$V = 3.71$ ft/sec


SECTION D-D
SECTION E-E
SECTION A-A
SECTION B-B
SECTION C-C
Filing No. 1
Filing No. 2
Filing No. 3
HORIZON POINT
HORIZON VIEW DRIVE
HISTORIC OUTFALL POINTS
COMBINED RUNOFF AT DESIGN PT
BASIN RUNOFF
Q5 (CFS) Q100 (CFS)
E-1 4.5 8.9
E-2 6.6 12.8
E-3 5.0 9.8
E-4 2.8 5.4
A 4.5 9.1
B 18.0 34.6
B' 3.9 7.9
C 2.3 4.1
C' 10.5 21.4
D 3.2 6.6
D' 1.4 2.8
E 2.5 5.1
E' 0.8 1.7
F 9.6 19.9
G 10.1 20.5
H 8.8 18.0
I 5.3 10.8
J 10.1 20.5





DRAINAGE PLAN

DESIGN POINT	DESCRIPTION	Q10 (CFS)	Q100 (CFS)
1	FOR: INLETS	23	51
2	FOR: CULVERT	48	101
3	FOR: CHANNEL	83	191
4	FOR: CMP'S OPENING	18	36
5	FOR: CULVERTS	109	245
6	FOR: CHANNEL	109	245
7	FOR: INLETS	29	60
8	FOR: CULVERTS	124	270
9	FOR: CHANNEL	150	344

NOTE: THIS DRAINAGE PLAN IS SCHEMATIC ONLY. EXACT LOCATIONS OF PROPERTY LINES, STREET R.O.W.'S, AND BASIN BOUNDARIES HAVE BEEN PLOTTED AT A SCALE OF 1" = 100', WHICH IS TOO LARGE TO INCLUDE IN THIS REPORT.

BASIN	Q10 CFS	Q100 CFS
A	83	191
B	4	9
C	4	9
D	13	30
E	6	11
F	3	6
G	4	8
H	355	71
I	17	34
J	1	2
K	11	24
L	5	12
M	10	22
OS1	18	36
OS2	10	38
OS3	17	34
OS4	15	31

CHANNEL DIMENSIONS

	Q (CFS)	B (FT.)	N	Z	S (%)	Y (FT.)	V (FPS)
1	245	0	0.040	3	1.0	3.90	5.60
2	245	10	0.035	4	0.3%	2.70	4.71
3	344	10	0.035	4	0.2%	3.40	4.37

No.	Revision	By	Date

COLORADO CENTRE METROPOLITAN DISTRICT

HORIZONVIEW DRAINAGE IMPROVEMENTS

Design By J.W.D.	Drawn By K.M.M.
Check By	Scale 1"=400'
Date 3-20-810	Sht. 1 of 1
	Job No. 1017.01

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