

Continental F.E.M.A. Study

January 3, 1986

Job No. 7016

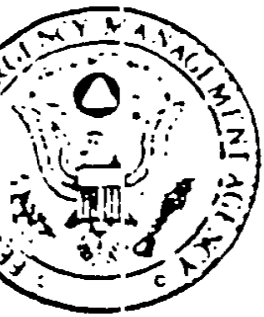
Revised February 14, 1986

Prepared For:

Colorado Centre Metropolitan District
Suite 680, Century Bank Plaza Building
3300 East First Avenue
Denver, Colorado 80206

Prepared By:

JR Developers, Ltd.
2120 Hollowbrook Dr., #201
Colorado Springs, CO 80919



Federal Emergency Management Agency

Region VIII Denver Federal Center P.O. Box 25267
Denver, CO 80225-0267

REQUEST FOR LETTER OF MAP AMENDMENT

This is to request that a determination be made as to whether or not a certain land area or structure is within a Special Flood Hazard Area.

All documents submitted in support of this appeal are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

1/5/86

Date


Signature of Applicant

For and on Behalf of JR Developers, L.P.
Michael B. McCarthy, P.E. #14617



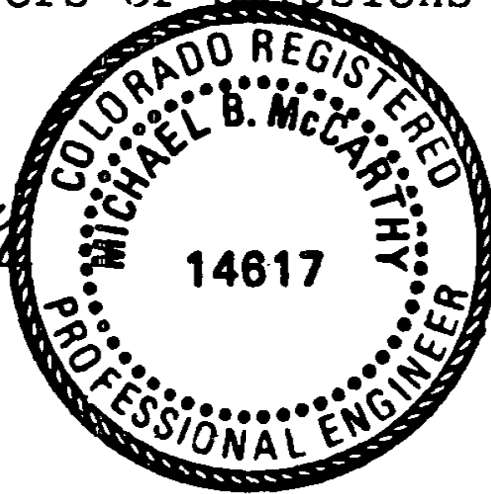
CONTINENTAL F.E.M.A. STUDY

DRAINAGE REPORT STATEMENT

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.

Michael B. McCarthy
Michael B. McCarthy, P.E. #14617



Developer's Statement:

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

Colorado Centre Metropolitan District
Business Name

By: James Torres

Title: District Manager

Address: 1250 Academy Park Loop

Suite #214

Colorado Springs, CO 80910

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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F.E.M.A. Map Effective Date	Exhibit D
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Continental F.E.M.A. Study

January, 1986

Purpose:

The purpose of this study is to present hydrologic and hydraulic analysis which indicate upon construction of the proposed drainage improvements, the proposed Continental site will not lie within a Special Flood Hazard Area (S.F.H.A.). At this time, Colorado Centre Metropolitan District is applying to the Federal Emergency Management Agency (F.E.M.A.) for issuance of a Conditional Letter of Map Amendment (Conditional L.O.M.A.). When the proposed drainage improvements are completed, asbuilt plans will be submitted so that a Letter of Map Amendment (L.O.M.A.) may be issued.

General Description:

Continental at Colorado Centre is located in a portion of the southeast quarter of Section 35, Township 14 South, Range 65 West of the Sixth Principal Meridian, El Paso County, Colorado, (Exhibit "A").

The site contains approximately 65 acres and is bordered by unplatted tracts. Access is provided from Drennan Road to the south. Manufactured homes will be constructed on this site.

The proposed subdivision lies within the Jimmy Camp Creek Drainage Basin. More specifically, the Franceville Tributary which originates to the northeast, flows onto the site near the southeast corner. Flood insurance rate maps from F.E.M.A. show a 100-year floodplain traversing the southern portion, affecting approximately 59 lots (see Exhibit "C").

Drainage Characteristics:

A. Existing

The basin under study contains approximately 3.19 square miles, is 25,000 feet in length, and has an average slope of 2.2 percent. The terrain is steeper in the upper most reach, but most of the area is gentle sloped, (Exhibit "A"). The basin is presently undeveloped poor range land with the exception of a few trailer/houses. Runoff from this area, which flows in a natural channel, makes up the Franceville Tributary to Jimmy Camp Creek.

The Soil Conservation Service (SCS) prepared a study entitled "Flood Hazard Analyses, Portions of Jimmy Camp Creek and Tributaries" in October, 1975. Their study estimates the 100-year runoff in the vicinity of Drennan Road from the Franceville Tributary to be 3,100 CFS. The SCS 100-year floodplain map shows nearly all the runoff discharging to the south through culverts and by overtopping Drennan Road, (Exhibit "E"). The map also shows the ponding required for

runoff to overtop the road causing inundation of the area where the proposed Continental site lies and a small amount of runoff to flow westward (north of Drennan Road) to combine with the Corral Tributary. Examination of the runoff quantities calculated at cross-sections up and downstream along the Corral Tributary indicate less than 100 CFS will enter from the Franceville Tributary, north of Drennan Road.

JR Developers, Ltd., with the use of aerial topography (2 foot contours) and field inspection, has prepared a HEC-2 analysis to verify the existing conditions.

The results of this investigation indicate a somewhat larger (500-1,000 CFS) runoff, flowing north of Drennan Road and entering the Corral Tributary. A probable cause for this discrepancy is that earth berms running north/south along the western edge of the Franceville Tributary, present during the SCS study, have eroded during the past 10 years allowing more discharge to the west.

JR Developers, Ltd. has verified the SCS study to be the accepted reference for floodplains in this area, with F.E.M.A. Therefore, the floodplain shown on the drainage plan was obtained from the SCS report which has considerably more profile and flood elevation information.

JR Developers, Ltd. has also prepared a hydrologic analysis using HEC-1 to verify the quantity of runoff, (see Appendix). This study estimates the anticipated amount of runoff in the Franceville Tributary at Drennan Road to be 2,553 CFS. By adjusting the time of concentration from 1.25 hours to 1.0 hour, the calculated runoff amount is 3,086 CFS which agrees with the 3,100 CFS that SCS estimates. It is reasonable to assume higher velocities from a basin yielding this large of a discharge quantity. Therefore, 3,100 CFS will be used as the design runoff quantity.

B. Proposed

The proposed drainage improvements consists of installing 21 culverts under Drennan Road and an earth berm along the west bank of the tributary; in affect, providing a channelization of the floodplain.

A HEC-2 analysis of the proposed drainage improvements is included to show the revised limits of the 100-year floodplain.

The earth berm along the west bank of the channel provides 3 feet of freeboard (4 feet at the culverts) above the 100-year flood elevations as determined by the HEC-2 analysis. The culverts beneath Drennan Road have been sized to discharge the 100-year storm without overtopping the road.

The construction of the earth berm and channel will be completed within the 338 foot wide tract between the Continental site and the Colorado Centre boundary. Since the land to the south of Drennan Road is not in the Colorado Centre Metropolitan District, the proposed culverts were placed to discharge at the existing ground elevation. This requires Drennan Road to be raised as shown on the construction plans. Concrete cradle/headwalls will be provided in addition to rip-rap protection to stabilize the culvert entrance and outfall. A drainage easement is required to install the rip-rap protection on the south side.

Hydrologic/Hydraulic Calculations:

The method used for calculating the anticipated amount of runoff is the SCS method as outlined in "Peak Flows In Colorado" by the U.S. Department of Agriculture, SCS, March, 1984; and "Areawide Urban Runoff Control Manual" prepared for the Pikes Peak Area Council of Governments, 1980.

Computerized hydrologic and hydraulic analysis were calculated using HEC-1 and HEC-2 software from the U.S. Army Corps of Engineers, revised January, 1985.

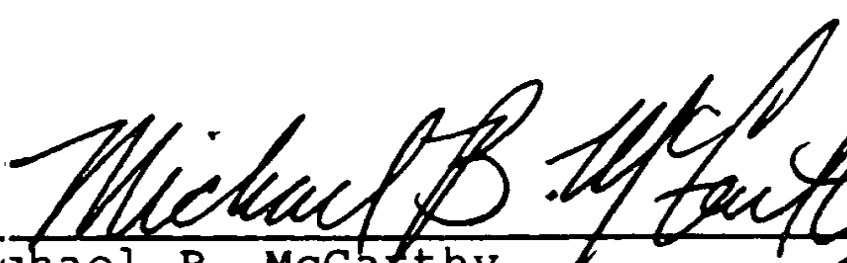
A design storm with 100-year recurrence interval, 24-hour duration, yielding 4.5 inches of precipitation was used in hydrograph generation.

A variety of soil types exist in this area as shown in Exhibit "B". Hydrologic Group B is representative of the soils which indicate moderate to good drainage characteristics.

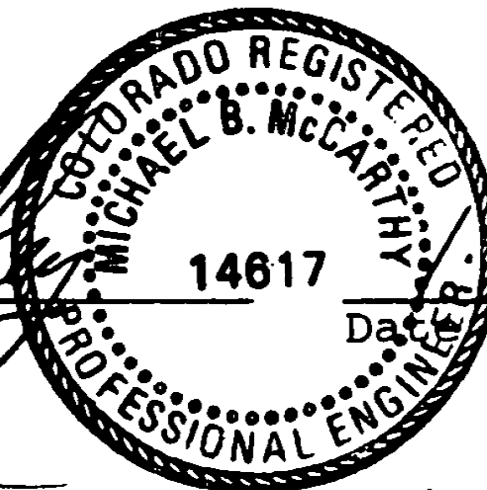
Summary:

The proposed Continental site currently lies within a Special Flood Hazard Area along the Franceville Tributary. Construction of an earth berm and installation of culverts beneath Drennan Road will allow the 100-year runoff to flow southward which is the historic path as determined by SCS. The channelization of runoff will remove the Continental site from the floodplain. Therefore, we are requesting a Conditional Letter of Map Amendment be issued for this area.

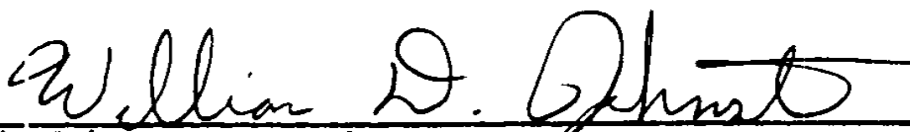
Respectfully Submitted By:



Michael B. McCarthy

 15.86

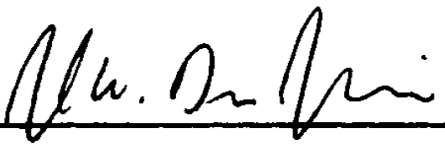
Date



William D. Johnston

1-14-86

Date



Joseph W. DesJardin

1-3-86

Date

For and on Behalf of JR Developers, Ltd.

CONTINENTAL F.E.M.A. STUDY

OPINION OF PROBABLE CONSTRUCTION COST

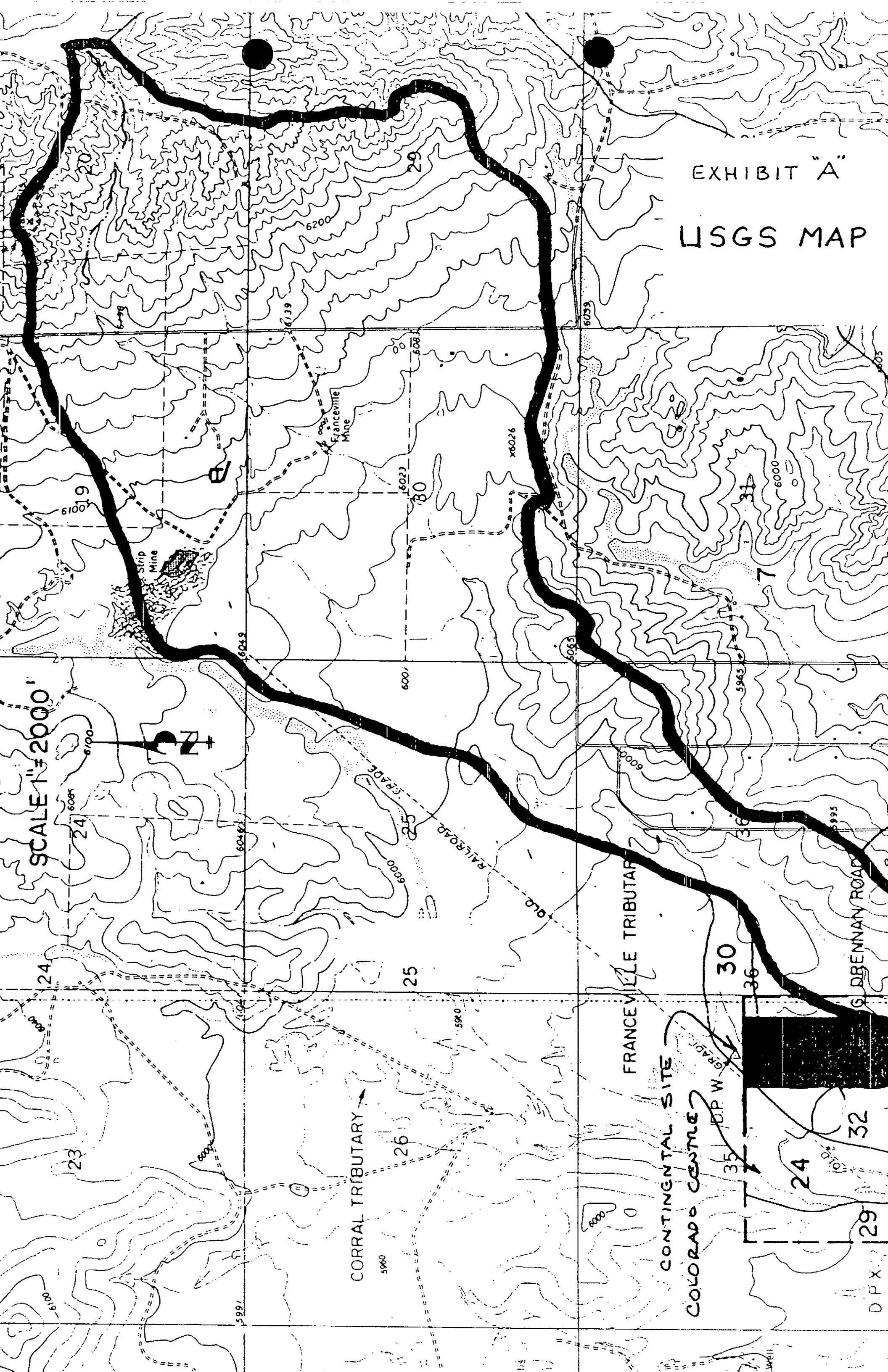
S T O R M S E W E R DESCRIPTION	UNIT	QUANT	UNIT COST	EXTENSION
CULVERTS				
C M P ARCH 77" X 52"	LF	1,260.00	73.98	93,209.76
CULVERT END TREATMENT				
CONC HEADWALL FOR CMP CLVRT	CY	74.00	200.00	14,800.00
OPEN CHANNELS				
IMPORT FILL	CY	20,710.00	4.00	82,840.00
RIP-RAP	CY	1,999.00	30.00	59,970.00
TOTAL				\$250,819.76

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 guarantee 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.

APPENDIX

EXHIBIT "A"
USGS MAP

SCALE 1"=2000'



CORRAL TRIBUTARY

FRANCEVILLE TRIBUTARY

CONTINENTAL SITE

COLORADO CENTRE

DPX 29

G. BRENNAN ROAD

30

36

24

32

29

30

31

19

24

25

23

26

6200

6139

6083

x6026

6023

6049

6007

6065

5965

6100

6049

6000

6000

5995

6000

6000

5997

5940

6000

6070

UP W

WELL

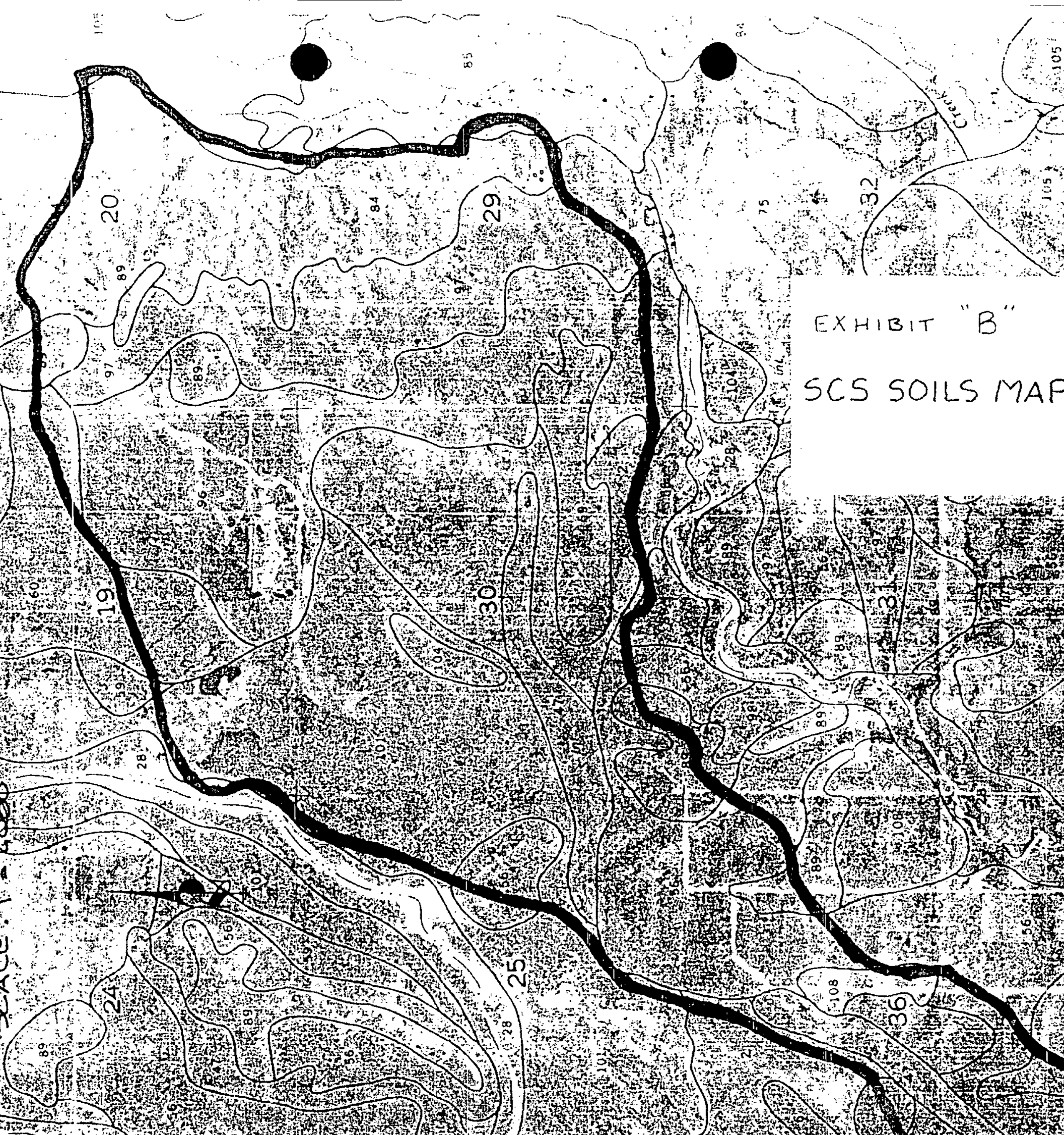
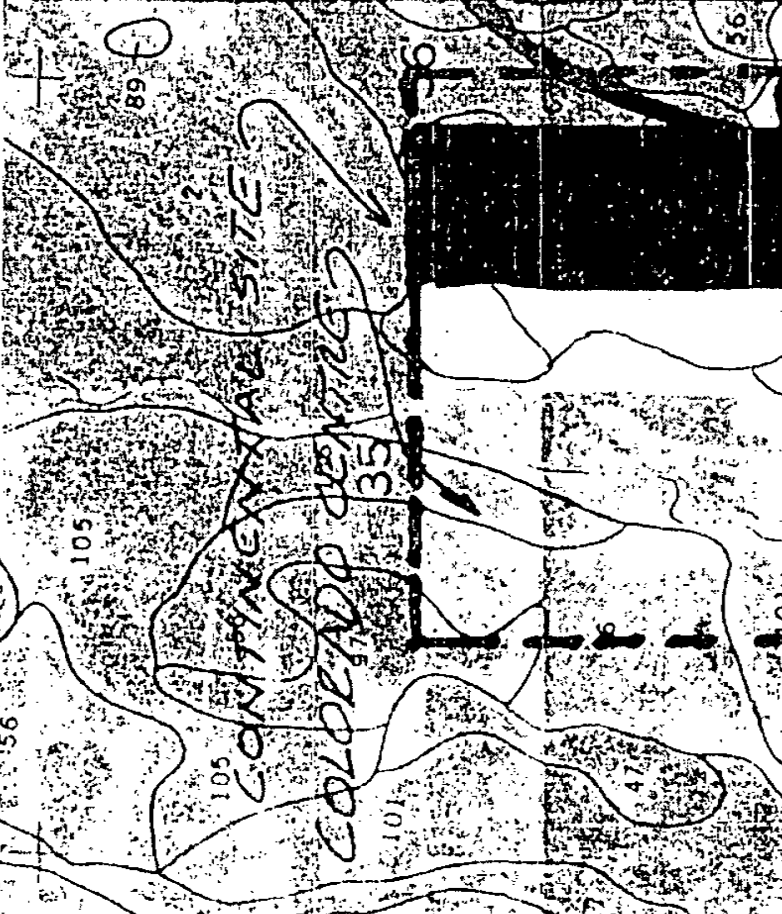


EXHIBIT "B"
SCS SOILS MAP

Index #	Soil Type	Hydrologic Group
2	Ascalon	B
47	Limon	C
54	Midway	D
56	Nelson	B
59	Nunn	C
60	Olney	B
84	Stapleton	B
89	Tassel	D
96, 97	Truckton	B
101	Ustic Torrifuvents	B
104	Vona	B
108	Wiley	B



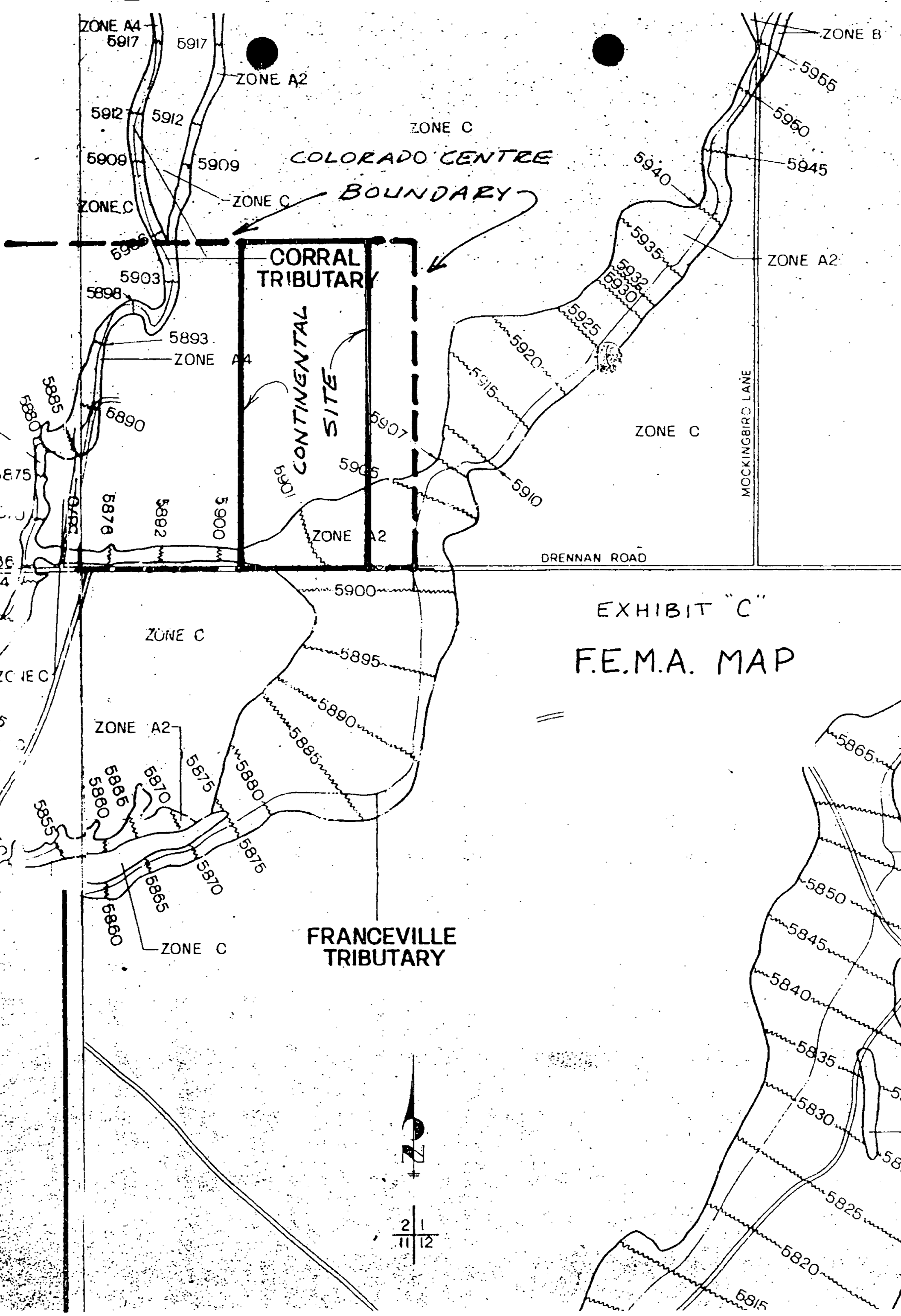
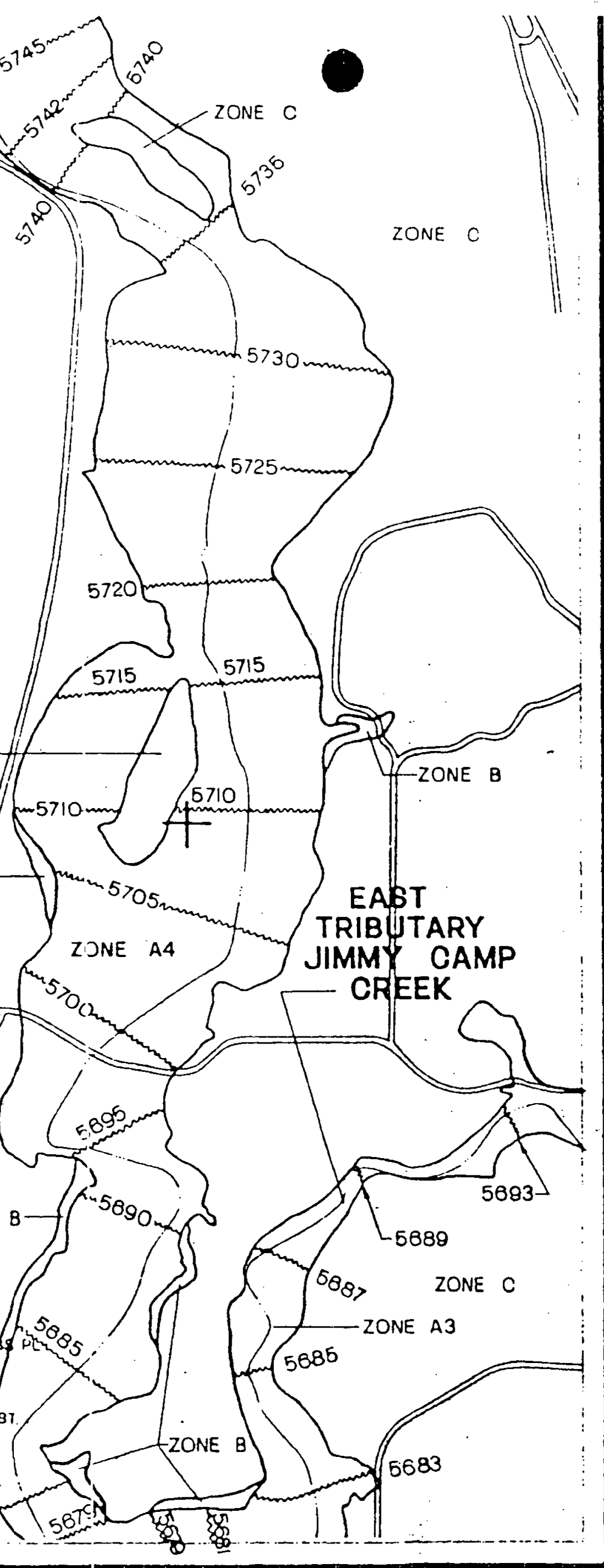
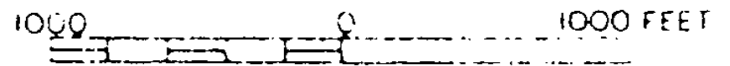


EXHIBIT "C"
F.E.M.A. MAP



APPROXIMATE SCALE



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**EL PASO COUNTY,
COLORADO**
(UNINCORPORATED AREAS)

PANEL 295 OF 625
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**REVISED
PRELIMINARY**

COMMUNITY-PANEL NUMBER
080059 0295

EFFECTIVE DATE:

DEC 21 1984



Federal Emergency Management Agency

EXHIBIT "D"

Franceville Tributary
Hydrologic Analysis
Q100 = 2,553 CFS
Tc = 1.25 Hr

$$T = \left(\frac{11.9 L^3}{H} \right)^{.385}$$

T = T_c in hours

L = Length of longest watercourse in miles

H = Elevation difference in feet

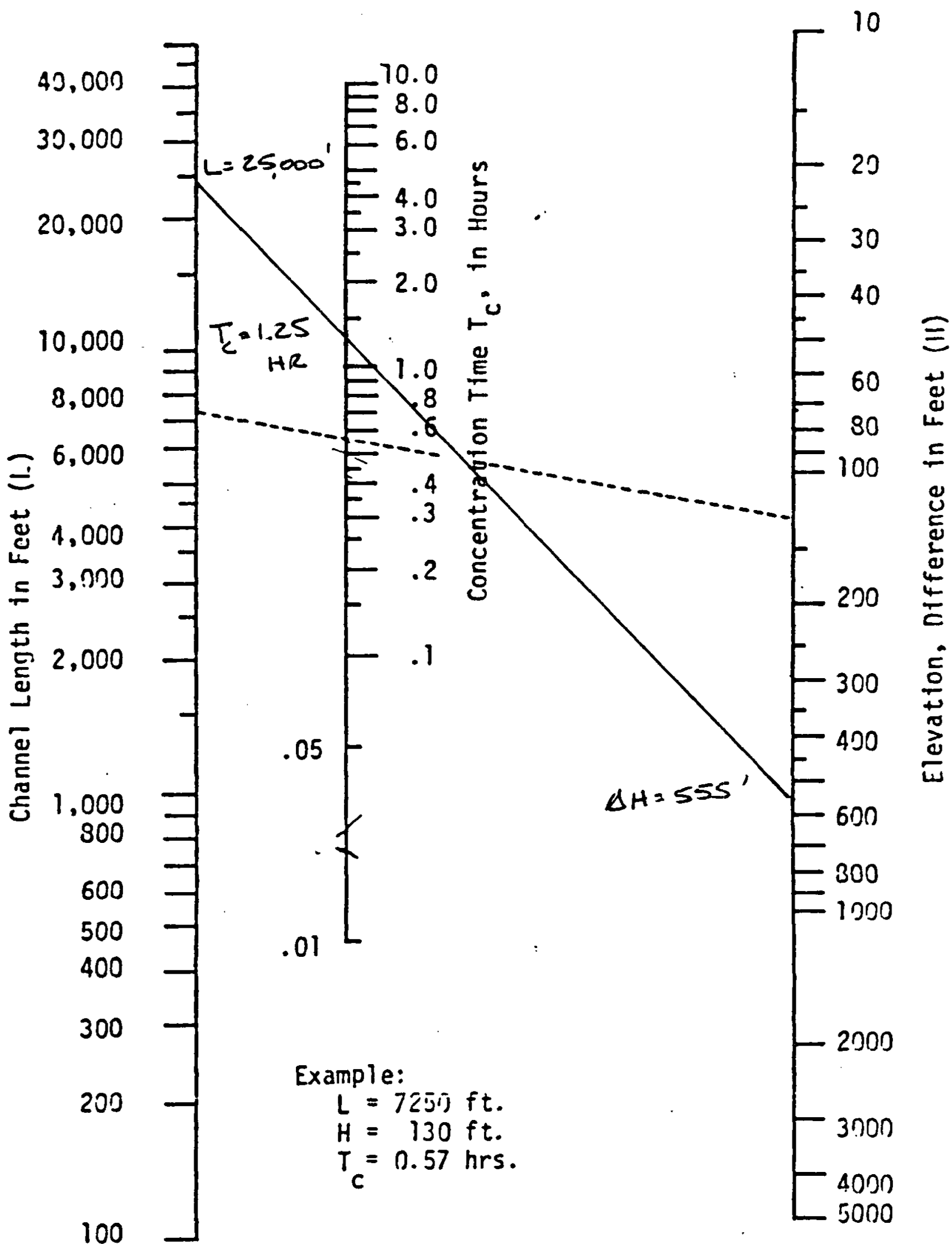


Figure III-6 Estimating T_c from Lengths and Slopes of Natural Channels

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

HEC-1 INPUT

LINE	ID.....	1.....	2.....	3.....	4.....	5.....	6.....	7.....	8.....	9.....	10
1	ID	CONTINENTAL FEMA STUDY									
2	ID	BY JR DEVELOPERS LTD. DECEMBER 1985									
3	IT	10	0	0	200						
4	ID	5	2								
5	PG	2	4.50								
6	PG	1	0								
7	IN	12									
8	PC	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
9	PC	.011	.013	.015	.017	.018	.019	.021	.024	.027	.030
10	PC	.034	.039	.042	.050	.060	.070	.090	.170	.400	.700
11	PC	.720	.740	.755	.767	.780	.790	.798	.808	.814	.820
12	PC	.825	.830	.834	.838	.840	.847	.850	.853	.857	.860
13	PC	.862	.864	.866	.868	.870	.874	.878	.882	.886	.890
14	PC	.893	.896	.899	.902	.905	.907	.909	.911	.913	.915
15	PC	.918	.920	.923	.925	.928	.930	.933	.935	.938	.940
16	PC	.942	.944	.946	.948	.950	.952	.954	.956	.958	.960
17	PC	.962	.964	.966	.968	.970	.972	.974	.976	.978	.980
18	PC	.982	.984	.986	.988	.990	.992	.994	.996	.998	1.000
19	KK	DRN-RD									
20	KM	SCS RUNOFF COMPUTATION									
21	BA	3.19									
22	PR	1									
23	PW	1									
24	PT	2									
25	PW	1									
26	LS		79.57								
27	UD	0.75									
28	ZZ										

CONTINENTAL FEMA STUDY
 BY JR DEVELOPERS LTD. DECEMBER 1985

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

HEC-1 INPUT

LINE	ID.....	1.....	2.....	3.....	4.....	5.....	6.....	7.....	8.....	9.....	10
1	ID	CONTINENTAL FEMA STUDY									
2	ID	BY JR DEVELOPERS LTD. DECEMBER 1985									
3	IT	8	0	0	200						
4	ID	5	2								
5	PG	2	4.50								
6	PG	1	0								
7	IN	12									
8	PC	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
9	PC	.011	.013	.015	.017	.018	.019	.021	.024	.027	.030
10	PC	.034	.039	.042	.050	.060	.070	.090	.170	.400	.700
11	PC	.720	.740	.755	.767	.780	.790	.798	.808	.814	.820
12	PC	.825	.830	.834	.838	.840	.847	.850	.853	.857	.860
13	PC	.862	.864	.866	.868	.870	.874	.878	.882	.886	.890
14	PC	.893	.896	.899	.902	.905	.907	.909	.911	.913	.915
15	PC	.918	.920	.923	.925	.928	.930	.933	.935	.938	.940
16	PC	.942	.944	.946	.948	.950	.952	.954	.956	.958	.960
17	PC	.962	.964	.966	.968	.970	.972	.974	.976	.978	.980
18	PC	.982	.984	.986	.988	.990	.992	.994	.996	.998	1.000
19	KK	DRN-RD									
20	KM	SCS RUNOFF COMPUTATION									
21	BA	3.19									
22	PR	1									
23	PW	1									
24	PT	2									
25	PW	1									
26	LS		79.57								
27	UD	0.60									
28	ZZ										

CONTINENTAL FEMA STUDY
 BY JR DEVELOPERS LTD. DECEMBER 1985

GR	900.000	.000	894.500	1.000	894.500	175.000	902.000	176.000	.000	.000
X1	5.000	4.000	.000	176.000	60.000	60.000	60.000	.000	.000	1.000
X5	1.000	899.900	.000	.000	.000	.000	.000	.000	.000	.000
GR	900.000	.000	895.000	1.000	895.000	175.000	902.000	176.000	.000	.000
X1	6.000	6.000	.000	340.000	205.000	140.000	180.000	.000	.000	1.000
GR	901.000	.000	896.000	20.000	896.000	230.000	898.000	260.000	900.000	280.000
GR	902.000	340.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	7.000	6.000	.000	460.000	200.000	200.000	200.000	.000	.000	1.000
GR	902.000	.000	897.000	20.000	897.000	200.000	898.000	220.000	900.000	370.000
GR	902.000	460.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	8.000	6.000	.000	520.000	230.000	180.000	200.000	.000	.000	1.000
GR	903.000	.000	898.000	20.000	898.000	170.000	900.000	180.000	902.000	460.000
GR	904.000	520.000	.000	.000	.000	.000	.000	.000	.000	.000

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PAGE 2

X1	9.000	8.000	.000	430.000	170.000	170.000	170.000	.000	.000	1.000
GR	905.000	.000	900.000	25.000	900.000	110.000	899.500	130.000	900.000	160.000
GR	902.000	200.000	904.000	340.000	906.000	430.000	.000	.000	.000	.000
X1	10.000	7.000	.000	330.000	70.000	30.000	60.000	.000	.000	1.000
GR	906.000	.000	904.000	40.000	902.000	80.000	900.100	100.000	902.000	170.000
GR	904.000	240.000	906.000	330.000	.000	.000	.000	.000	.000	.000
X1	11.000	9.000	.000	410.000	130.000	80.000	130.000	.000	.000	1.000
GR	908.000	.000	906.000	40.000	904.000	140.000	902.000	200.000	901.500	220.000
GR	902.000	250.000	904.000	280.000	906.000	320.000	908.000	410.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

01/02/86 21:15:12

PAGE 3

SECND	DEPTH	CMSEL	CRISW	WSELK	EG	HV	HL	DLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CDRAR	TOPWID	ENDST

*PROF 1

CCHV= .100 CEHV= .300

*SECND 1.000

3720 CRITICAL DEPTH ASSUMED

1.00	1.54	886.54	886.54	887.00	886.98	.44	.00	.00	888.00
3100.	0.	3100.	0.	0.	584.	0.	0.	0.	890.00
.00	.00	5.31	.00	.030	.030	.030	.000	885.00	394.50
.014133	0.	0.	0.	0	14	0	.00	681.66	1076.17

*SECND 2.000

2.00	2.16	889.66	.00	.00	889.88	.23	2.88	.02	890.00
3100.	0.	3100.	0.	0.	811.	0.	5.	6.	892.00
.02	.00	3.82	.00	.030	.030	.030	.000	887.50	113.01
.005937	330.	330.	330.	5	0	0	.00	809.59	922.60

0

*SECNO 3.000

3.00	2.22	891.72	.00	.00	892.10	.38	2.17	.05	892.00
3100.	0.	3100.	0.	0.	627.	0.	10.	10.	894.00
.04	.00	4.95	.00	.030	.030	.030	.000	889.50	55.12
.009394	200.	290.	310.	3	0	0	.00	613.79	668.91

0

*SECNO 4.000

WATER EL=X5 CARD= 898.000

4.00	3.50	898.00	.00	.00	898.40	.40	.70	.01	900.00
3100.	0.	3100.	0.	0.	611.	0.	13.	12.	902.00
.05	.00	5.07	.00	.030	.030	.030	.000	894.50	.36
.002074	160.	180.	190.	0	0	0	.00	175.10	175.47

0

*SECNO 5.000

WATER EL=X5 CARD= 899.900

5.00	4.90	899.90	.00	.00	900.10	.20	.07	.02	900.00
3100.	0.	3100.	0.	0.	857.	0.	14.	12.	902.00
.05	.00	3.62	.00	.030	.030	.030	.000	895.00	.02
.000286	60.	60.	60.	0	0	0	.00	175.68	175.70

0

1

01/02/86 21:15:12

SECNO	DEPTH	CMSEL	CRIMS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CDRAR	TOPWID	ENDST

*SECNO 6.000

6.00	4.09	900.09	.00	.00	900.23	.15	.12	.01	901.00
3100.	0.	3100.	0.	0.	1006.	0.	17.	13.	902.00
.07	.00	3.08	.00	.030	.030	.030	.000	896.00	3.65
.000702	205.	180.	140.	2	0	0	.00	278.94	282.59

0

*SECNO 7.000

7.00	3.26	900.26	.00	.00	900.46	.20	.21	.02	902.00
3100.	0.	3100.	0.	0.	853.	0.	22.	15.	902.00
.09	.00	3.63	.00	.030	.030	.030	.000	897.00	6.96
.001798	200.	200.	200.	2	0	0	.00	374.69	381.65

0

*SECNO 8.000

3301 HV CHANGED MORE THAN HVINS

8.00	2.55	900.55	.00	.00	901.35	.80	.71	.18	903.00
3100.	0.	3100.	0.	0.	433.	0.	25.	16.	904.00
.09	.00	7.16	.00	.030	.030	.030	.000	898.00	9.78
.009939	230.	200.	180.	2	0	0	.00	247.77	257.55

0

*SECNO 9.000

7185 MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

9.00	2.82	902.32	902.32	.00	903.27	.95	1.75	.05	905.00
3100.	0.	3100.	0.	0.	395.	0.	26.	17.	906.00
.10	.00	7.84	.00	.030	.030	.030	.000	899.50	13.40
.010718	170.	170.	170.	2	8	0	.00	208.98	222.38

0

61100.	.	X	.	.	.	.	.	.	.	.	.
1150.	.	.	X	.	.	.	.	.	.	.	.
1200.	.	.	.	X	.	.	.	.	.	.	.
71250.	.	.	.	.	X	.	.	.	.	.	BANK.

NRD= 0 ELLC= 9999999.00 ELTRD= 9999999.00

EL(I),STA(I)										
888.00	.00	886.00	540.00	885.00	980.00	886.00	1060.00	888.00	1120.00	
890.00	1240.00									

CROSS SECTION 2.00
 STREAM PROPOSED CHANNEL PROFILE
 DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV	887.	888.	889.	890.	891.	892.	893.	894.	895.	896.	897.
STA- FEET											
2 0.	.	.	.	X	.	.	.	.	.	.	BANK.
20.	.	.	.	X.	.	.	.	.	.	.	.
40.	.	.	.	X.	.	.	.	.	.	.	.
60.	.	.	.	XE.	.	.	.	.	.	.	.
80.	.	.	.	XE.	.	.	.	.	.	.	.
100.	.	.	.	X E.	.	.	.	.	.	.	.
120.	.	.	.	XW E.	.	.	.	.	.	.	.
140.	.	.	.	XW E.	.	.	.	.	.	.	.
160.	.	.	.	X W E.	.	.	.	.	.	.	.
180.	.	.	.	X W E.	.	.	.	.	.	.	.
200.	.	.	.	X W E.	.	.	.	.	.	.	.
220.	.	.	.	X W E.	.	.	.	.	.	.	.
240.	.	.	.	X W E.	.	.	.	.	.	.	.
260.	.	.	.	X W E.	.	.	.	.	.	.	.
280.	.	.	.	X W E.	.	.	.	.	.	.	.
300.	.	.	.	X W E.	.	.	.	.	.	.	.
320.	.	.	.	X W E.	.	.	.	.	.	.	.
340.	.	.	.	X W E.	.	.	.	.	.	.	.
360.	.	.	.	X W E.	.	.	.	.	.	.	.
380.	.	.	.	X W E.	.	.	.	.	.	.	.
400.	.	.	.	X W E.	.	.	.	.	.	.	.
420.	.	.	.	X W E.	.	.	.	.	.	.	.
440.	.	.	.	X W E.	.	.	.	.	.	.	.
460.	.	.	.	X W E.	.	.	.	.	.	.	.
480.	.	.	.	X W E.	.	.	.	.	.	.	.
500.	.	.	.	X W E.	.	.	.	.	.	.	.
520.	.	.	.	X W E.	.	.	.	.	.	.	.
540.	.	.	.	X W E.	.	.	.	.	.	.	.
560.	.	.	.	X W E.	.	.	.	.	.	.	.
580.	.	.	.	X W E.	.	.	.	.	.	.	.
600.	.	.	.	X W E.	.	.	.	.	.	.	.
620.	.	.	.	X W E.	.	.	.	.	.	.	.
640.	.	.	.	X W E.	.	.	.	.	.	.	.
3 660.	.	.	.	X W E.	.	.	.	.	.	.	.
680.	.	.	.	X W E.	.	.	.	.	.	.	.
4 700.	.	.	.	X W E.	.	.	.	.	.	.	.
720.	.	.	.	X W E.	.	.	.	.	.	.	.

NRD= 0 ELLC= 9999999.00 ELTRD= 9999999.00

EL(I),STA(I)
 900.00 .00 895.00 1.00 895.00 175.00 902.00 176.00

1
 CROSS SECTION 6.00
 STREAM PROPOSED CHANNEL PROFILE
 DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV	896.	897.	898.	899.	900.	901.	902.	903.	904.	905.	906.
STA-FEET											
2 0.	.	.	.	.	.	X	.	.	.	.	BANK.
10.	.	.	X	.	.WE	.	.	.	.	.	.
3 20.	X	.	.	.	.WE	.	.	.	.	.	.
30.	X	.	.	.	.WE	.	.	.	.	.	.
40.	X	.	.	.	.WE	.	.	.	.	.	.
50.	X	.	.	.	.WE	.	.	.	.	.	.
60.	X	.	.	.	.WE	.	.	.	.	.	.
70.	X	.	.	.	.WE	.	.	.	.	.	.
80.	X	.	.	.	.WE	.	.	.	.	.	.
90.	X	.	.	.	.WE	.	.	.	.	.	.
100.	X	.	.	.	.WE	.	.	.	.	.	.
110.	X	.	.	.	.WE	.	.	.	.	.	.
120.	X	.	.	.	.WE	.	.	.	.	.	.
130.	X	.	.	.	.WE	.	.	.	.	.	.
140.	X	.	.	.	.WE	.	.	.	.	.	.
150.	X	.	.	.	.WE	.	.	.	.	.	.
160.	X	.	.	.	.WE	.	.	.	.	.	.
170.	X	.	.	.	.WE	.	.	.	.	.	.
180.	X	.	.	.	.WE	.	.	.	.	.	.
190.	X	.	.	.	.WE	.	.	.	.	.	.
200.	X	.	.	.	.WE	.	.	.	.	.	.
210.	X	.	.	.	.WE	.	.	.	.	.	.
220.	X	.	.	.	.WE	.	.	.	.	.	.
4 230.	X	.	.	.	.WE	.	.	.	.	.	.
240.	.	X	.	.	.WE	.	.	.	.	.	.
250.	.	.	X	.	.WE	.	.	.	.	.	.
5 260.	.	.	.	X	.WE	.	.	.	.	.	.
270.	.	.	.	.	.WE	.	.	.	.	.	.
6 280.	.	.	.	.	XWE	.	.	.	.	.	.
290.	.	.	.	.	.	X	.	.	.	.	.
300.	.	.	.	.	.	.	X	.	.	.	.
310.	.	.	.	.	.	.	.	X	.	.	.
320.	.	.	.	.	.	.	.	.	X	.	.
330.	.	.	.	.	.	.	.	.	.	X	.
7 340.	.	.	.	.	.	.	.	.	.	.	X

NRD= 0 ELLC= 9999999.00 ELTRD= 9999999.00

EL(I),STA(I)
 901.00 .00 896.00 20.00 896.00 230.00 898.00 260.00 900.00 280.00
 902.00 340.00

1
 CROSS SECTION 7.00

STREAM PROPOSED CHANNEL PROFILE
DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV	897.	898.	899.	900.	901.	902.	903.	904.	905.	906.	907.	
STA- FEET												
2 0.	.	.	.	.	.	X	.	.	.	.	.	BANK.
10.	.	.	X	WE	.	.	.	.	.	.	.	.
3 20.	X	.	.	WE	.	.	.	.	.	.	.	.
30.	X	.	.	WE	.	.	.	.	.	.	.	.
40.	X	.	.	WE	.	.	.	.	.	.	.	.
50.	X	.	.	WE	.	.	.	.	.	.	.	.
60.	X	.	.	WE	.	.	.	.	.	.	.	.
70.	X	.	.	WE	.	.	.	.	.	.	.	.
80.	X	.	.	WE	.	.	.	.	.	.	.	.
90.	X	.	.	WE	.	.	.	.	.	.	.	.
100.	X	.	.	WE	.	.	.	.	.	.	.	.
110.	X	.	.	WE	.	.	.	.	.	.	.	.
120.	X	.	.	WE	.	.	.	.	.	.	.	.
130.	X	.	.	WE	.	.	.	.	.	.	.	.
140.	X	.	.	WE	.	.	.	.	.	.	.	.
150.	X	.	.	WE	.	.	.	.	.	.	.	.
160.	X	.	.	WE	.	.	.	.	.	.	.	.
170.	X	.	.	WE	.	.	.	.	.	.	.	.
180.	X	.	.	WE	.	.	.	.	.	.	.	.
190.	X	.	.	WE	.	.	.	.	.	.	.	.
4 200.	X	.	.	WE	.	.	.	.	.	.	.	.
210.	.	X	.	WE	.	.	.	.	.	.	.	.
5 220.	.	.	X	WE	.	.	.	.	.	.	.	.
230.	.	.	.	WE	.	.	.	.	.	.	.	.
240.	.	.	X	WE	.	.	.	.	.	.	.	.
250.	.	.	X	WE	.	.	.	.	.	.	.	.
260.	.	.	X	WE	.	.	.	.	.	.	.	.
270.	.	.	X	WE	.	.	.	.	.	.	.	.
280.	.	.	X	WE	.	.	.	.	.	.	.	.
290.	.	.	X	WE	.	.	.	.	.	.	.	.
300.	.	.	X	WE	.	.	.	.	.	.	.	.
310.	.	.	X	WE	.	.	.	.	.	.	.	.
320.	.	.	X	WE	.	.	.	.	.	.	.	.
330.	.	.	X	WE	.	.	.	.	.	.	.	.
340.	.	.	X	WE	.	.	.	.	.	.	.	.
350.	.	.	X	WE	.	.	.	.	.	.	.	.
360.	.	.	X	WE	.	.	.	.	.	.	.	.
6 370.	.	.	X	WE	.	.	.	.	.	.	.	.
380.	.	.	X	WE	.	.	.	.	.	.	.	.
390.	.	.	X	WE	.	.	.	.	.	.	.	.
400.	.	.	X	WE	.	.	.	.	.	.	.	.
410.	.	.	X	WE	.	.	.	.	.	.	.	.
420.	.	.	X	WE	.	.	.	.	.	.	.	.
430.	.	.	X	WE	.	.	.	.	.	.	.	.
440.	.	.	X	WE	.	.	.	.	.	.	.	.
450.	.	.	X	WE	.	.	.	.	.	.	.	.
7 460.	.	.	X	WE	.	.	.	.	.	.	.	BANK.

280.	.	.	.	.	X.E	.	.	.	.	.	.
290.	.	.	.	.	.X	.	.	.	.	.	.
300.	.	.	.	.	.	X	.	.	.	.	.
310.	.	.	.	.	.	.	X	.	.	.	.
320.	.	.	.	.	.	.	.	X	.	.	.
B 330.	.	.	.	.	.	.	.	.	X	.	BANK.

NRD= 0 ELLC= 9999999.00 ELTRD= 9999999.00

EL(I),STA(I)											
906.00	.00	904.00	40.00	902.00	80.00	900.10	100.00	902.00	170.00		
904.00	240.00	906.00	330.00								

CROSS SECTION 11.00
 STREAM PROPOSED CHANNEL PROFILE
 DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV	901.	902.	903.	904.	905.	906.	907.	908.	909.	910.	911.
STA- FEET											
2 0.	X	.	.	BANK.
10.	X	.	.	.
20.	X	.	.	.	.
30.	X	.	.	.	.
3 40.	X.E	.	.	.	.	.
50.	X.E	.	.	.	.	.
60.	X.E	.	.	.	.	.
70.	XW.E	.	.	.	.	.
80.	X	W.E	.	.	.	.	.
90.	X	W.E	.	.	.	.	.
100.	X	W.E	.	.	.	.	.
110.	X	W.E	.	.	.	.	.
120.	X	W.E	.	.	.	.	.
130.	.	.	.	X	.	W.E	.	.	.	.	.
4 140.	.	.	.	X	.	W.E	.	.	.	.	.
150.	.	.	.	X	.	W.E	.	.	.	.	.
160.	.	.	X	.	.	W.E	.	.	.	.	.
170.	.	.	X	.	.	W.E	.	.	.	.	.
180.	.	X	.	.	.	W.E	.	.	.	.	.
190.	.	X	.	.	.	W.E	.	.	.	.	.
5 200.	.	X	.	.	.	W.E	.	.	.	.	.
210.	.	X	.	.	.	W.E	.	.	.	.	.
6 220.	X	.	.	.	.	W.E	.	.	.	.	.
230.	X	.	.	.	.	W.E	.	.	.	.	.
240.	X	.	.	.	.	W.E	.	.	.	.	.
7 250.	X	.	.	.	.	W.E	.	.	.	.	.
260.	.	X	.	.	.	W.E	.	.	.	.	.
270.	.	.	X	.	.	W.E	.	.	.	.	.
8 280.	.	.	.	X	.	W.E	.	.	.	.	.
290.	.	.	.	X	.	W.E	.	.	.	.	.
300.	X	W.E	.	.	.	.	.
310.	X.E	.	.	.	.	.
9 320.	X.E	.	.	.	.	.
330.X	.	.	.	.	.
340.X	.	.	.	.	.

THIS RUN EXECUTED 01/02/86 21:17:30

HEC2 RELEASE DATED NOV 76 UPDATED MAY 1984
ERROR CORR - 01,02,03,04,05,06
MODIFICATION - 50,51,52,53,54,55,56
IBM-PC-XT VERSION APRIL 1985

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*****
* WATER SURFACE PROFILES
* VERSION OF NOVEMBER 1976
* UPDATED MAY 1984
* IBM-PC-XT VERSION
* RUN DATE 01/02/86 TIME 20:57:37
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*****
* U.S. ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET, SUITE 100
* DAVIS, CALIFORNIA 95616
* (916) 440-2105 (FTS) 448-2105
*****

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X X XXXXXXX XXXXX
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X X X X X
X X X X X
X X XXXXXXX XXXXX

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01/02/86 20:57:39

PAGE 1

THIS RUN EXECUTED 01/02/86 20:57:40

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HECZ RELEASE DATED NOV 76 UPDATED MAY 1984
ERROR CORR - 01,02,03,04,05,06
MODIFICATION - 50,51,52,53,54,55,56
IBM-PC-XT VERSION APRIL 1985
*****

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T1 WATER SURFACE PROFILES FOR FRANCEVILLE TRIBUTARY
T2 BY JR DEVELOPERS LTD, JANUARY,1986
T3 PROPOSED CHANNEL PROFILES \ SUPERCRITICAL

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J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FB
	0.	2.	0.	1.	-1.000000	.00	.0	3100.	905.500	1.000
NC	.030	.030	.030	.100	.300	.000	.000	.000	.000	.000
X1	11.000	9.000	.000	410.000	130.000	80.000	130.000	.000	.000	1.000
GR	908.000	.000	906.000	40.000	904.000	140.000	902.000	200.000	901.500	220.000
GR	902.000	250.000	904.000	280.000	906.000	320.000	908.000	410.000	.000	.000
X1	10.000	7.000	.000	330.000	70.000	30.000	60.000	.000	.000	1.000
GR	906.000	.000	904.000	40.000	902.000	80.000	900.100	100.000	902.000	170.000
GR	904.000	240.000	906.000	330.000	.000	.000	.000	.000	.000	.000
X1	9.000	8.000	.000	430.000	170.000	170.000	170.000	.000	.000	1.000
GR	905.000	.000	900.000	25.000	900.000	110.000	899.500	130.000	900.000	160.000
GR	902.000	200.000	904.000	340.000	906.000	430.000	.000	.000	.000	.000
X1	8.000	6.000	.000	520.000	230.000	180.000	200.000	.000	.000	1.000
GR	903.000	.000	898.000	20.000	898.000	170.000	900.000	180.000	902.000	460.000

GR	904.000	520.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	7.000	6.000	.000	460.000	200.000	200.000	200.000	.000	.000	1.000
GR	902.000	.000	897.000	20.000	897.000	200.000	898.000	220.000	900.000	370.000
GR	902.000	460.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	6.000	5.000	.000	280.000	205.000	140.000	180.000	.000	.000	1.000
GR	901.000	.000	896.000	20.000	896.000	230.000	898.000	260.000	900.000	280.000
X1	5.000	4.000	.000	176.000	60.000	60.000	60.000	.000	.000	1.000
X5	1.000	899.900	.000	.000	.000	.000	.000	.000	.000	.000
GR	900.000	.000	895.000	1.000	895.000	175.000	902.000	176.000	.000	.000
X1	4.000	4.000	.000	176.000	160.000	190.000	180.000	.000	.000	1.000
X5	1.000	898.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	900.000	.000	894.500	1.000	894.500	175.000	902.000	176.000	.000	.000

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X1	3.000	6.000	.000	750.000	200.000	310.000	290.000	.000	.000	1.000
GR	892.000	.000	890.000	390.000	889.500	425.000	890.000	480.000	892.000	700.000
GR	894.000	750.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	2.000	6.000	.000	980.000	330.000	330.000	330.000	.000	.000	1.000
GR	890.000	.000	888.000	660.000	887.500	710.000	888.000	790.000	890.000	950.000
GR	892.000	980.000	.000	.000	.000	.000	.000	.000	.000	.000
X1	1.000	6.000	.000	1240.000	.000	.000	.000	.000	.000	1.000
GR	888.000	.000	886.000	540.000	885.000	980.000	886.000	1060.000	888.000	1120.000
GR	890.000	1240.000	.000	.000	.000	.000	.000	.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

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SECNO	DEPTH	CWSEL	CRIMS	WSELK	EG	HV	HL	GLOSS	BANK	ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT	
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA	
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CDRAR	TOPWID	ENDST	

*PROF 1

CCHV= .100 CEHV= .300

*SECNO 11.000

3720 CRITICAL DEPTH ASSUMED

11.00	3.60	905.10	905.10	905.50	906.04	.94	.00	.00	908.00
3100.	0.	3100.	0.	0.	399.	0.	0.	0.	908.00
.00	.00	7.77	.00	.030	.030	.030	.000	901.50	84.95
.010930	0.	0.	0.	0	10	0	.00	217.07	302.02

*SECNO 10.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

10.00	3.98	904.08	904.08	.00	905.05	.97	1.41	.98	906.00
3100.	0.	3100.	0.	0.	392.	0.	1.	1.	906.00

.00	.00	7.90	.00	.030	.030	.030	.000	900.10	38.34
.010750	130.	130.	80.	20	8	0	.00	205.40	243.74

*SECNO 9.000

3301 HV CHANGED MORE THAN HVINS

9.00	2.08	901.58	902.32	.00	903.85	2.27	1.08	.13	905.00
3100.	0.	3100.	0.	0.	256.	0.	2.	1.	906.00
.01	.00	12.09	.00	.030	.030	.030	.000	899.50	17.12
.035711	70.	60.	30.	5	19	0	.00	174.41	191.53

*SECNO 8.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

8.00	2.47	900.47	900.47	.00	901.35	.88	3.09	1.24	903.00
3100.	0.	3100.	0.	0.	412.	0.	3.	2.	904.00
.01	.00	7.53	.00	.030	.030	.030	.000	898.00	10.14
.010961	170.	170.	170.	20	8	0	.00	235.08	245.21

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PAGE 4

SECNO	DEPTH	CWSEL	CRWS	WSELK	E6	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 7.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

7.00	2.01	899.01	899.01	.00	899.79	.78	2.25	.98	902.00
3100.	0.	3100.	0.	0.	437.	0.	5.	3.	902.00
.02	.00	7.09	.00	.030	.030	.030	.000	897.00	11.98
.011516	230.	200.	180.	20	15	0	.00	283.47	295.44

*SECNO 6.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED

6.00	1.83	897.83	897.83	.00	898.69	.86	2.27	.94	901.00
3100.	0.	3100.	0.	0.	416.	0.	7.	4.	900.00
.03	.00	7.45	.00	.030	.030	.030	.000	896.00	12.68
.011147	200.	200.	200.	20	11	0	.00	244.79	257.46

*SECNO 5.000

WATER EL=X5 CARD= 899.900
 7185 MINIMUM SPECIFIC ENERGY

5.00	2.12	897.12	897.14	.00	898.21	1.09	1.98	.02	900.00
3100.	0.	3100.	0.	0.	370.	0.	8.	5.	902.00
.03	.00	8.38	.00	.030	.030	.030	.000	895.00	.58
.010827	205.	180.	140.	0	8	0	.00	174.73	175.30

*SECNO 4.000

WATER EL=X5 CARD= 898.000

7185 MINIMUM SPECIFIC ENERGY

4.00	2.12	896.62	896.64	.00	897.71	1.09	.65	.00	900.00
3100.	0.	3100.	0.	0.	369.	0.	9.	5.	902.00
.04	.00	8.39	.00	.030	.030	.030	.000	894.50	.61
.010879	60.	60.	60.	0	5	0	.00	174.67	175.28

*SECNO 3.000

3301 HV CHANGED MORE THAN HVINS

3.00	1.49	890.99	891.58	.00	893.18	2.19	4.42	.11	892.00
3100.	0.	3100.	0.	0.	261.	0.	10.	6.	894.00
.04	.00	11.89	.00	.030	.030	.030	.000	889.50	197.08
.095070	160.	180.	190.	6	5	0	.00	391.74	588.83

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PAGE

SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCK	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 2.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

2.00	1.85	889.35	889.35	.00	889.79	.44	8.73	10.32	890.00
3100.	0.	3100.	0.	0.	582.	0.	13.	10.	892.00
.05	.00	5.33	.00	.030	.030	.030	.000	887.50	214.31
.014334	200.	290.	310.	20	11	0	.00	683.74	898.05

*SECNO 1.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

1.00	1.54	886.54	886.54	.00	886.98	.44	4.71	2.74	888.00
3100.	0.	3100.	0.	0.	583.	0.	17.	15.	890.00
.07	.00	5.32	.00	.030	.030	.030	.000	885.00	394.90
.014201	330.	330.	330.	20	15	0	.00	681.22	1076.12

CROSS SECTION 11.00
 STREAM PROPOSED CHANNEL PROFILE
 DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV	901.	902.	903.	904.	905.	906.	907.	908.	909.	910.	911.
------	------	------	------	------	------	------	------	------	------	------	------

STA- FEET

DISCHARGE= 3100.

PLOTTED POINTS (BY PRIORITY)-B=BOTTOM BRIDGE,T=TOP BRIDGE,X=GROUND,W=WATER SUR,E=ENERGY GRADIENT,C=CRITICAL WSEL

ELEV 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907.

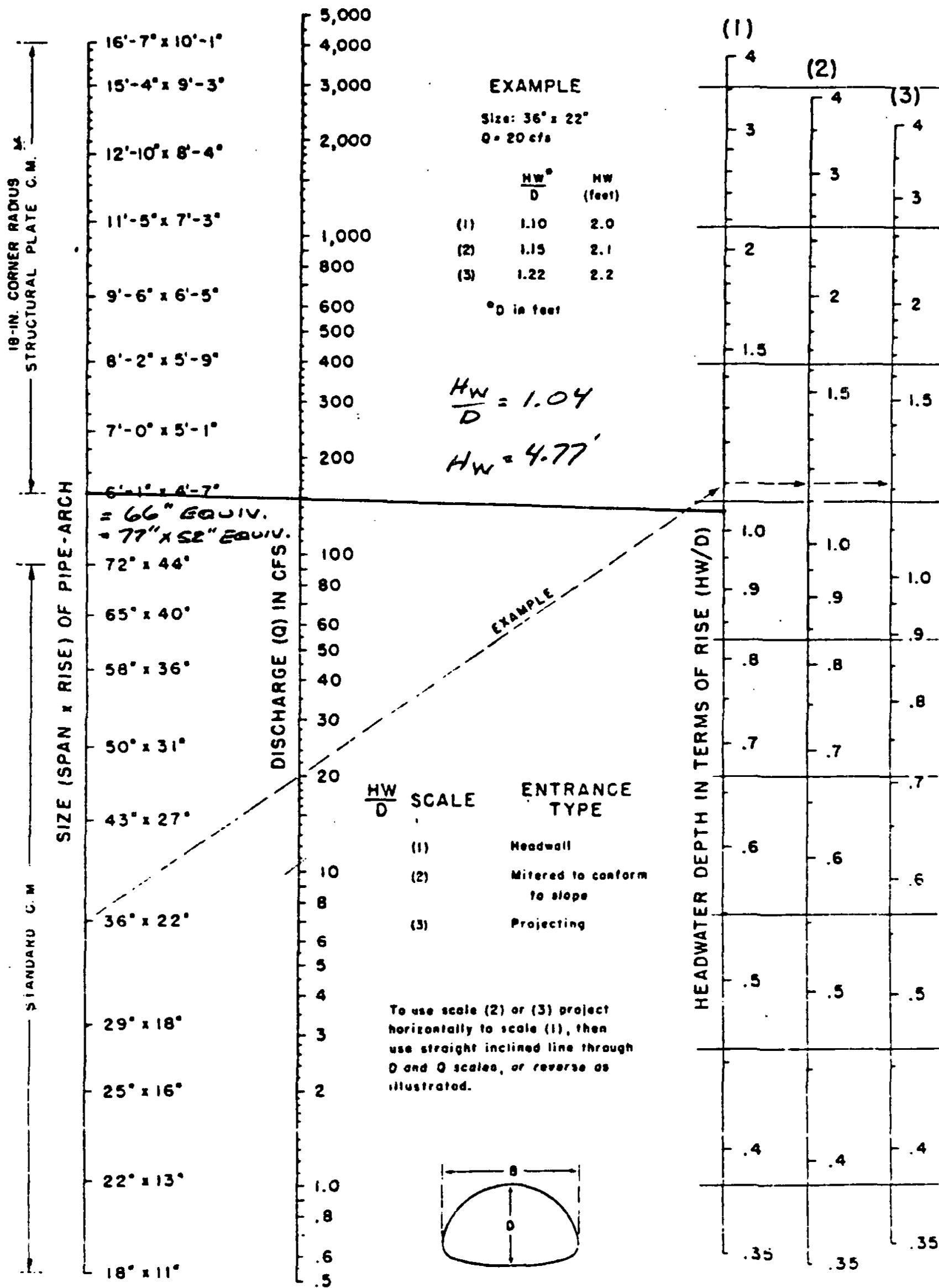
STA- FEET

STA	897.	898.	899.	900.	901.	902.	903.	904.	905.	906.	907.	
2 0.	.	.	.	.	.	X	.	.	.	.	.	BANK.
10.	.	.	.	X E.	.	.	.	.	.	.	.	.
3 20.	X	.	W	E.	.	.	.	.	.	.	.	.
30.	X	.	W	E.	.	.	.	.	.	.	.	.
40.	X	.	W	E.	.	.	.	.	.	.	.	.
50.	X	.	W	E.	.	.	.	.	.	.	.	.
60.	X	.	W	E.	.	.	.	.	.	.	.	.
70.	X	.	W	E.	.	.	.	.	.	.	.	.
80.	X	.	W	E.	.	.	.	.	.	.	.	.
90.	X	.	W	E.	.	.	.	.	.	.	.	.
100.	X	.	W	E.	.	.	.	.	.	.	.	.
110.	X	.	W	E.	.	.	.	.	.	.	.	.
120.	X	.	W	E.	.	.	.	.	.	.	.	.
130.	X	.	W	E.	.	.	.	.	.	.	.	.
140.	X	.	W	E.	.	.	.	.	.	.	.	.
150.	X	.	W	E.	.	.	.	.	.	.	.	.
160.	X	.	W	E.	.	.	.	.	.	.	.	.
170.	X	.	W	E.	.	.	.	.	.	.	.	.
180.	X	.	W	E.	.	.	.	.	.	.	.	.
190.	X	.	W	E.	.	.	.	.	.	.	.	.
4 200.	X	.	W	E.	.	.	.	.	.	.	.	.
210.	.	X	W	E.	.	.	.	.	.	.	.	.
5 220.	.	X	W	E.	.	.	.	.	.	.	.	.
230.	.	.X	W	E.	.	.	.	.	.	.	.	.
240.	.	.X	W	E.	.	.	.	.	.	.	.	.
250.	.	.X	W	E.	.	.	.	.	.	.	.	.
260.	.	.X	W	E.	.	.	.	.	.	.	.	.
270.	.	.X	W	E.	.	.	.	.	.	.	.	.
280.	.	.X	W	E.	.	.	.	.	.	.	.	.
290.	.	.X	W	E.	.	.	.	.	.	.	.	.
300.	.	.X	W	E.	.	.	.	.	.	.	.	.
310.	.	.X	W	E.	.	.	.	.	.	.	.	.
320.	.	.X	W	E.	.	.	.	.	.	.	.	.
330.	.	.X	W	E.	.	.	.	.	.	.	.	.
340.	.	.X	W	E.	.	.	.	.	.	.	.	.
350.	.	.X	W	E.	.	.	.	.	.	.	.	.
360.	.	.X	W	E.	.	.	.	.	.	.	.	.
6 370.	.	.X	W	E.	.	.	.	.	.	.	.	.
380.	.	.X	W	E.	.	.	.	.	.	.	.	.
390.	.	.X	W	E.	.	.	.	.	.	.	.	.
400.	.	.X	W	E.	.	.	.	.	.	.	.	.
410.	.	.X	W	E.	.	.	.	.	.	.	.	.
420.	.	.X	W	E.	.	.	.	.	.	.	.	.
430.	.	.X	W	E.	.	.	.	.	.	.	.	.
440.	.	.X	W	E.	.	.	.	.	.	.	.	.
450.	.	.X	W	E.	.	.	.	.	.	.	.	.
7 460.	.	.X	W	E.	.	.	.	.	.	.	.	BANK.

ALIGNED POINTS (BY PRIORITY)-E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

LEVATION SECNO	885. CUMDIS	890.	895.	900.	905.	910.	915.	920.	925.	930.
11.00	0.	.	.	.	I	W E L	.	.	.	.
	20.	.	.	.	I	W E L	.	.	.	.
	40.	.	.	.	I	W E L	.	.	.	.
	60.	.	.	.	I	W E L	.	.	.	.
	80.	.	.	.	I	W E L	.	.	.	.
	100.	.	.	.	I	W E L	.	.	.	.
	120.	.	.	.	I	W E L	.	.	.	.
10.00	140.	.	.	.	I	W E L	.	.	.	.
	160.	.	.	.	I	W C E L R	.	.	.	.
	180.	.	.	.	I	W C E L R	.	.	.	.
9.00	200.	.	.	.	I	W C E L R	.	.	.	.
	220.	.	.	.	I	W C E L R	.	.	.	.
	240.	.	.	.	I	W C E L R	.	.	.	.
	260.	.	.	.	I	W C E L R	.	.	.	.
	280.	.	.	.	I	W C E L R	.	.	.	.
	300.	.	.	.	I	W E L R	.	.	.	.
	320.	.	.	.	I	W E L R	.	.	.	.
	340.	.	.	.	I	W C E L R	.	.	.	.
8.00	360.	.	.	.	I	W E L R	.	.	.	.
	380.	.	.	.	I	W E L R	.	.	.	.
	400.	.	.	.	I	W E L R	.	.	.	.
	420.	.	.	.	I	W E L R	.	.	.	.
	440.	.	.	.	I	W E L R	.	.	.	.
	460.	.	.	.	I	W E L R	.	.	.	.
	480.	.	.	.	I	W E L R	.	.	.	.
	500.	.	.	.	I	W E L	.	.	.	.
	520.	.	.	.	I	W E L R	.	.	.	.
	540.	.	.	.	I	W E L	.	.	.	.
7.00	560.	.	.	.	I	W E L	.	.	.	.
	580.	.	.	.	I	W E L	.	.	.	.
	600.	.	.	.	I	W E R L	.	.	.	.
	620.	.	.	.	I	W E L	.	.	.	.
	640.	.	.	.	I	W E R L	.	.	.	.
	660.	.	.	.	I	W E R L	.	.	.	.
	680.	.	.	.	I	W E R L	.	.	.	.
	700.	.	.	.	I	W E R L	.	.	.	.
	720.	.	.	.	I	W E R L	.	.	.	.
	740.	.	.	.	I	W E R L	.	.	.	.
6.00	760.	.	.	.	I	W E R L	.	.	.	.
	780.	.	.	.	I	W E R L	.	.	.	.
	800.	.	.	.	I	W E M R L	.	.	.	.
	820.	.	.	.	I	W E M L	.	.	.	.
	840.	.	.	.	I	W E M L R	.	.	.	.
	860.	.	.	.	I	W E M L R	.	.	.	.
	880.	.	.	.	I	W E M L R	.	.	.	.
	900.	.	.	.	I	W E L R	.	.	.	.
	920.	.	.	.	I	W E L R	.	.	.	.
5.00	940.	.	.	.	I	W E L R	.	.	.	.
	960.	.	.	.	I	W E L R	.	.	.	.
	980.	.	.	.	I	W E L R	.	.	.	.
4.00	1000.	.	.	.	I	W E L R	.	.	.	.
	1020.	.	.	.	I	W E L R	.	.	.	.

CHART 6



* ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

