24 PALHVE 0794

FINAL HYDROLOGY REPORT

THE ESTATES AT PALOS VERDES

IN
MARICOPA COUNTY, ARIZONA

PREPARED
FOR

PHOENIX HOLDINGS II, L.L.C.

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Project No. 3111

PREPARED
BY

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July, 1994

Submitted By
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Registered Professional Engineer (Civil)
CERTIFICATE NO. 19408
19408
ROBERT P.
GROW
Date Signed 9-6-94
ARIZONA, U.S.A.

INDEX

SECTION 1 ---- INTRODUCTION AND SUMMARY
SECTION 2 ---- HEC - 1
SECTION 3 ---- HEC - 2
SECTION 4 ---- CHANNELIZATION AND STRUCTURES

INTRODUCTION

The Estates At Palos Verdes is a proposed residential subdivision of 80 acres that will be developed into 75 lots. The zoning for the site is R1-35 RUPD. The site is located easterly of 60th Street, northerly of Dynamite Road in Maricopa County in the alluvial fan area and four washes traverse southwesterly. The vegetation consists of desert brush at about 35 percent coverage and the soil is Group "C".

It is located within a designated flood hazard area and is shown on Federal Emergency Management Map 04013C1230E. The zone is shown as AO which is an area with "flood depths of from 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities are also determined." The depth is shown as 1 foot and the velocity as 3 feet per second.

RUNOFF

Calculations of the run-off volumes were completed by using the Maricopa County Flood Control District hydrology program MCUHP2 and HEC1 for both the 100-year and 50-year events and the results are included in this report. These volumes and computer program HY8 were used to size the drainage structures so that the 50-year storm would pass through the culverts and the 100-year storm would cross the roadways with a maximum depth of one half foot.

The site was separated into three different drainage basins and HEC-2 was used to determine the finished floor elevations within each basin. The finished floors were located fourteen inches above the 100-year flood elevations determined from HEC-2.

RETENTION

The County requires that the property retain the amount of runoff generated for a 100-year 2 hour storm. This will be accomplished by locating separate basins at the low ends of the peninsula like areas. The retention amount to determine the volume retained is calculated using formula 3.4 from the County Hydrology Manual $V = C\left(\frac{P}{12}\right)A$ where V = volume retained, P = rainfall depth in inches(2.7 inches from map Figure 3.3), and A = the drainage area in acres.
V = .44 X (2.7/12) X 80 = 7.9 acre feet or 344,124 cubic feet. This volume will be provided in the basin areas shown on the drainage map.

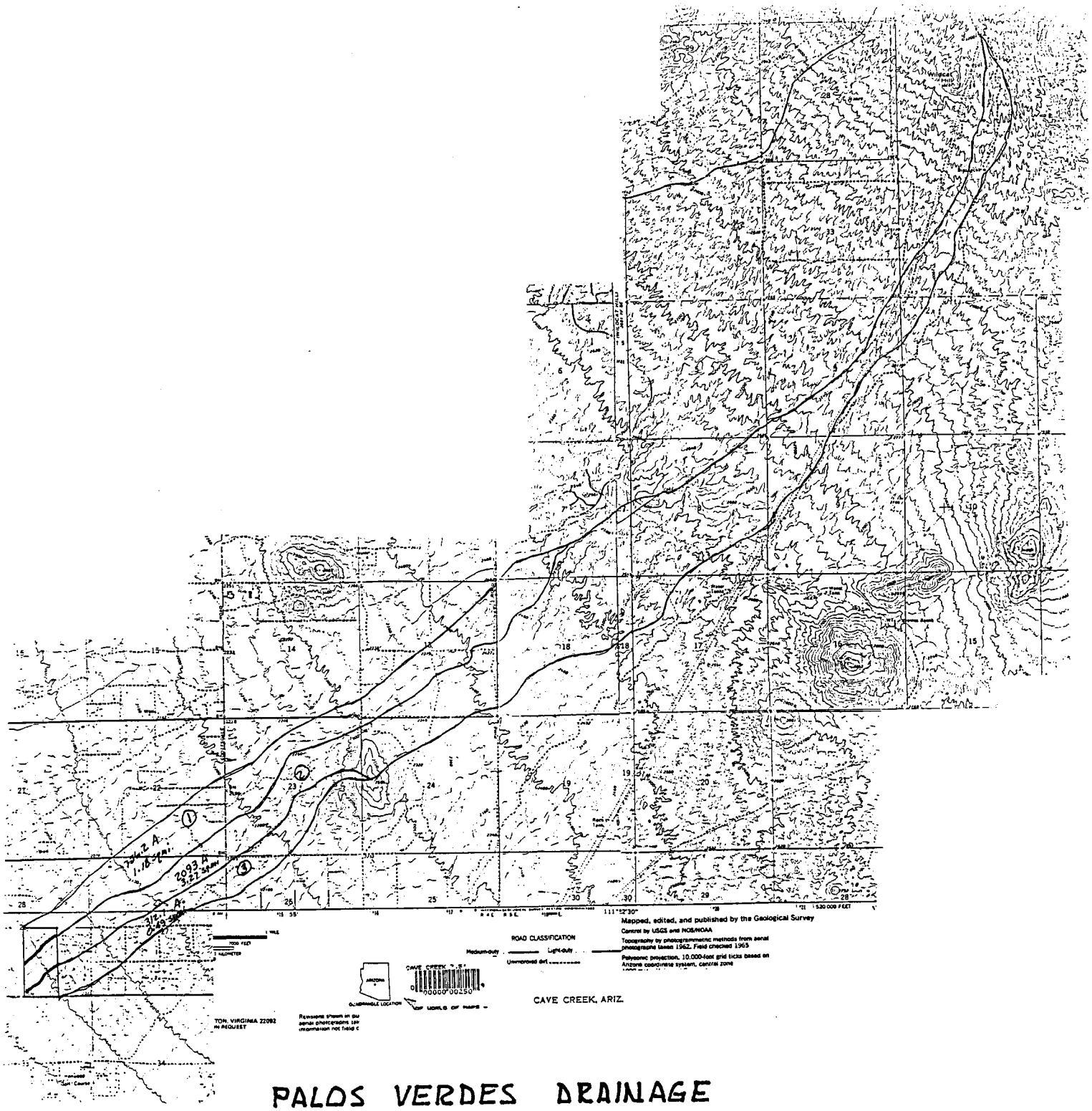
CONSTANTS FOR HEC-1

IA = 0.15 (TABLE 4.1)
XKSAT = 0.35 (TABLE 4.2)
PSIF = 4.00 (TABLE 4.2)
DTHETA = 0.35 (TABLE 4.2)
RTIMP =10 to 30 (ESTIMATED)

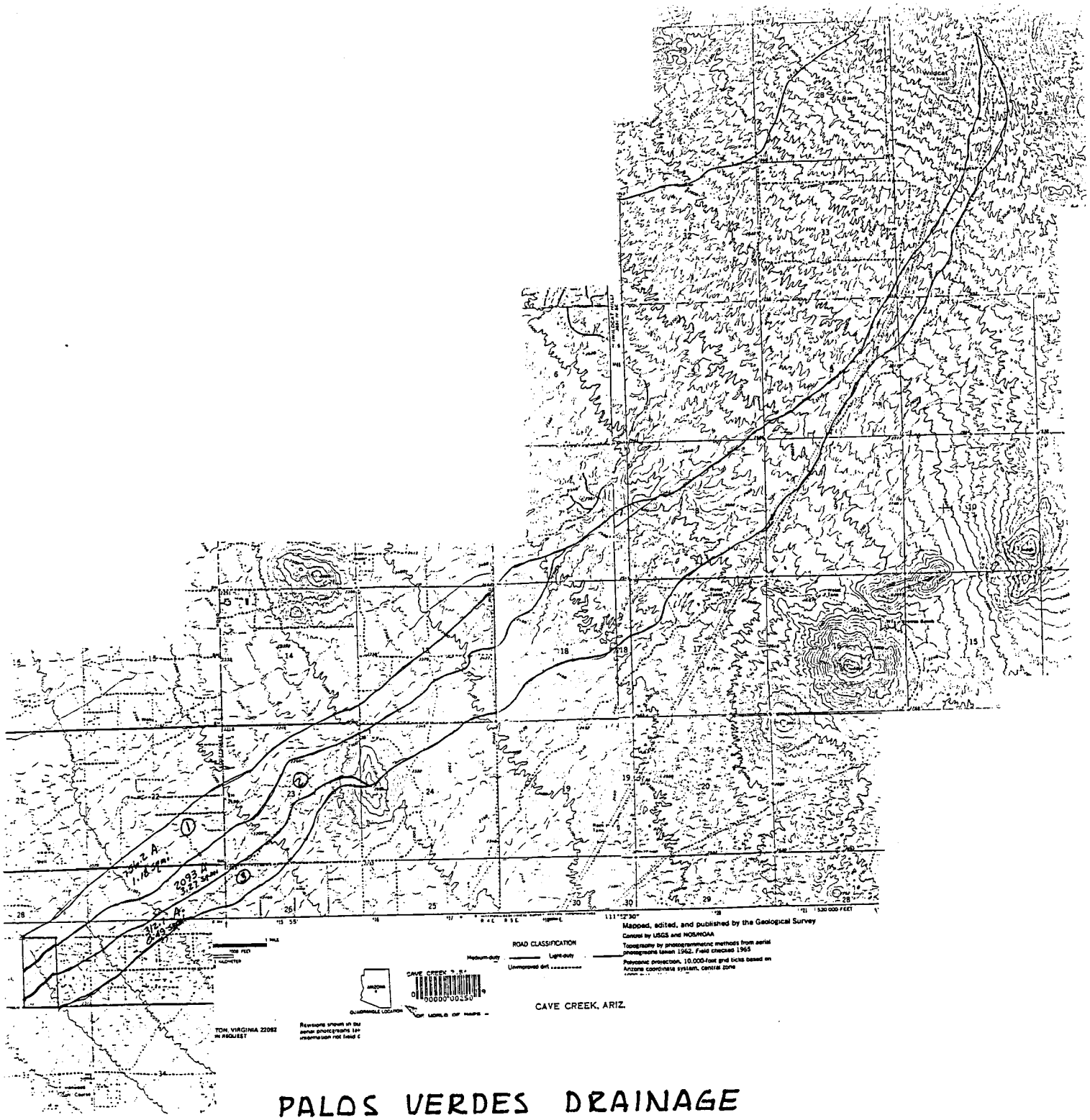
POINT RAINFALL DEPTH

A = 4.94 sq. miles
DEPTH = 0.96 (TABLE 2.2)
100-YEAR 6 HR PRECIPITATION = 3.3 INCHES (FIGURE 2.7 and enclosed IDF Chart)
3.3 X 0.96 = 3.17 INCHES
50-YEAR 6 HR PRECIPITATION = 2.93 INCHES (IDF Chart)
2.93 X 0.96 = 2.81 INCHES

HEC-1



PALOS VERDES DRAINAGE



PALOS VERDES DRAINAGE

Tc for street runoff - Palos Verdes Estates

Basin	L ft	Kb	S ft/mi	i inches/hr	Tc hrs
1	630	0.4	109	8.6	0.09
2	600	0.4	97	8.6	0.09
3	200	0.4	79	8.6	0.03
4	1200	0.4	101	2.5	0.27
5	540	0.4	98	8.6	0.08
6	600	0.4	114	8.6	0.08

Storage Volumes From Street Runoff - Palos Verdes Esta

Basin	Street Area (Ac.)	C	Volume AF	V=.85*(2.9/12)*A CF
1	0.69	0.85	0.14	6174
2	0.79	0.85	0.16	7069
3	0.28	0.85	0.06	2505
4	1.49	0.85	0.31	13332
5	0.50	0.85	0.10	4474
6	1.42	0.85	0.29	12706

PART E

Tabulate the rainfall Depth-Duration-Frequency statistics below

	Rainfall Depth, In Inches						
	Frequency, In Years						
Duration	2	5	10	25	50	100	500
5-min	0.30	0.41	0.49	0.59	0.67	0.75	0.93
10-min	0.46	0.63	0.74	0.90	1.03	1.15	1.43
15-min	0.55	0.78	0.94	1.15	1.31	1.47	1.85
30-min	0.73	1.05	1.26	1.55	1.78	2.00	2.51
1-hour	0.89	1.30	1.57	1.93	2.22	2.50	3.15
2-hour	1.00	1.44	1.74	2.15	2.46	2.77	3.49
3-hour	1.07	1.54	1.86	2.29	2.62	2.95	3.72
6-hour	1.20	1.73	2.08	2.56	2.93	3.30	4.15
12-hour	1.35	1.94	2.33	2.87	3.29	3.70	4.65
24-hour	1.50	2.15	2.58	3.18	3.64	4.10	5.16

RAINFALL INTENSITY-DURATION-FREQUENCY (I-D-F) WORKSHEET

Divide each rainfall depth from the D-D-F Worksheet (Part E) by each corresponding duration, in hours, and tabulate below:

	Rainfall Intensity In Inches/Hour						
	Frequency, In Years						
Duration	2	5	10	25	50	100	500
5-min	3.64	4.96	5.85	7.09	8.05	9.00	11.20
10-min	2.73	3.76	4.45	5.42	6.16	6.90	8.61
15-min	1.85	2.61	3.12	3.83	4.37	4.92	6.17
30-min	1.22	1.75	2.10	2.59	2.96	3.33	4.19
1-hour	0.89	1.30	1.57	1.93	2.22	2.50	3.15
2-hour	0.5	0.72	0.87	1.07	1.23	1.39	1.75
3-hour	0.36	0.51	0.62	0.76	0.87	0.98	1.24
6-hour	0.2	0.29	0.35	0.43	0.49	0.55	0.69
12-hour	0.11	0.16	0.19	0.24	0.27	0.31	0.39
24-hour	0.06	0.09	0.11	0.13	0.15	0.17	0.21

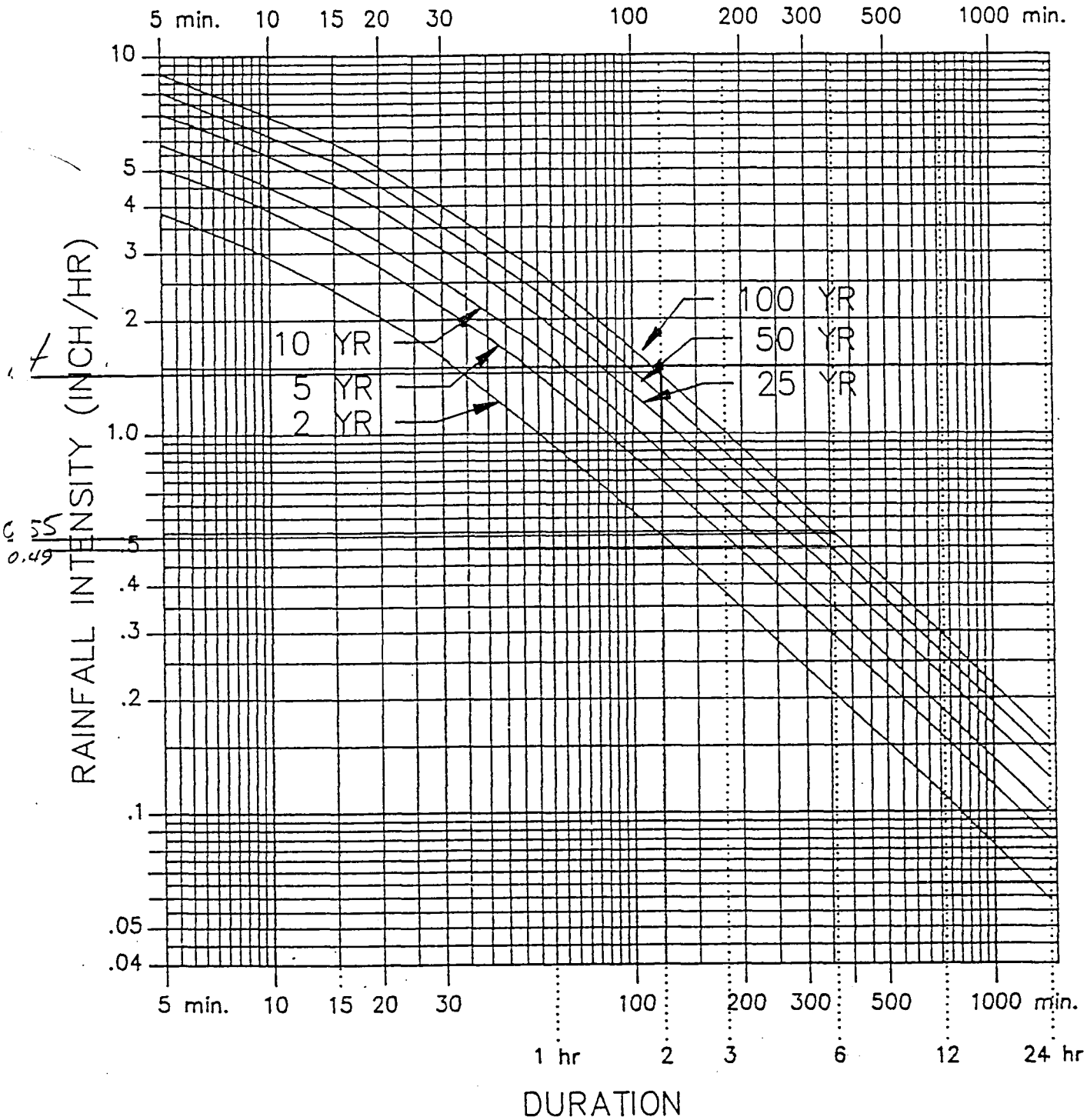


Figure 3.2
Rainfall Intensity-Duration-Frequency Relation
(Phoenix Metro Area)

Table 3.2
C Coefficients for Use with the Rational Method

Land Use	Return Period			
	2-10 Year	25 Year	50 Year	100 Year
Streets and Roads				
Paved Roads	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Gravel Roadways & Shoulders	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Industrial Areas				
Heavy	0.70 – 0.80	0.77 – 0.88	0.84 – 0.95	0.88 – 0.95
Light	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Business Areas				
Downtown	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Neighborhood	0.55 – 0.65	0.61 – 0.72	0.66 – 0.78	0.69 – 0.81
Residential Areas				
Lawns – Flat	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
– Steep	0.25 – 0.40	0.28 – 0.44	0.30 – 0.48	0.31 – 0.50
Suburban	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Single Family	0.45 – 0.55	0.50 – 0.61	0.54 – 0.66	0.56 – 0.69
Multi-Unit	0.50 – 0.60	0.55 – 0.66	0.60 – 0.72	0.63 – 0.75
Apartments	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Parks/Cemetaries	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
Playgrounds	0.40 – 0.50	0.44 – 0.55	0.48 – 0.60	0.50 – 0.63
Agricultural Areas	0.10 – 0.20	0.11 – 0.22	0.12 – 0.24	0.13 – 0.25
Bare Ground	0.20 – 0.30	0.22 – 0.33	0.24 – 0.36	0.25 – 0.38
Undeveloped Desert	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50 — 0.44
Mountain Terrain (Slopes > 10%)	0.60 – 0.80	0.66 – 0.88	0.72 – 0.95	0.75 – 0.95

Note: Values of C for 25, 50 and 100 Year were derived using frequency adjustment factors of 1.10, 1.20, and 1.25, respectively, with an upper limit of 0.95 for C for the 2-10 Year values.

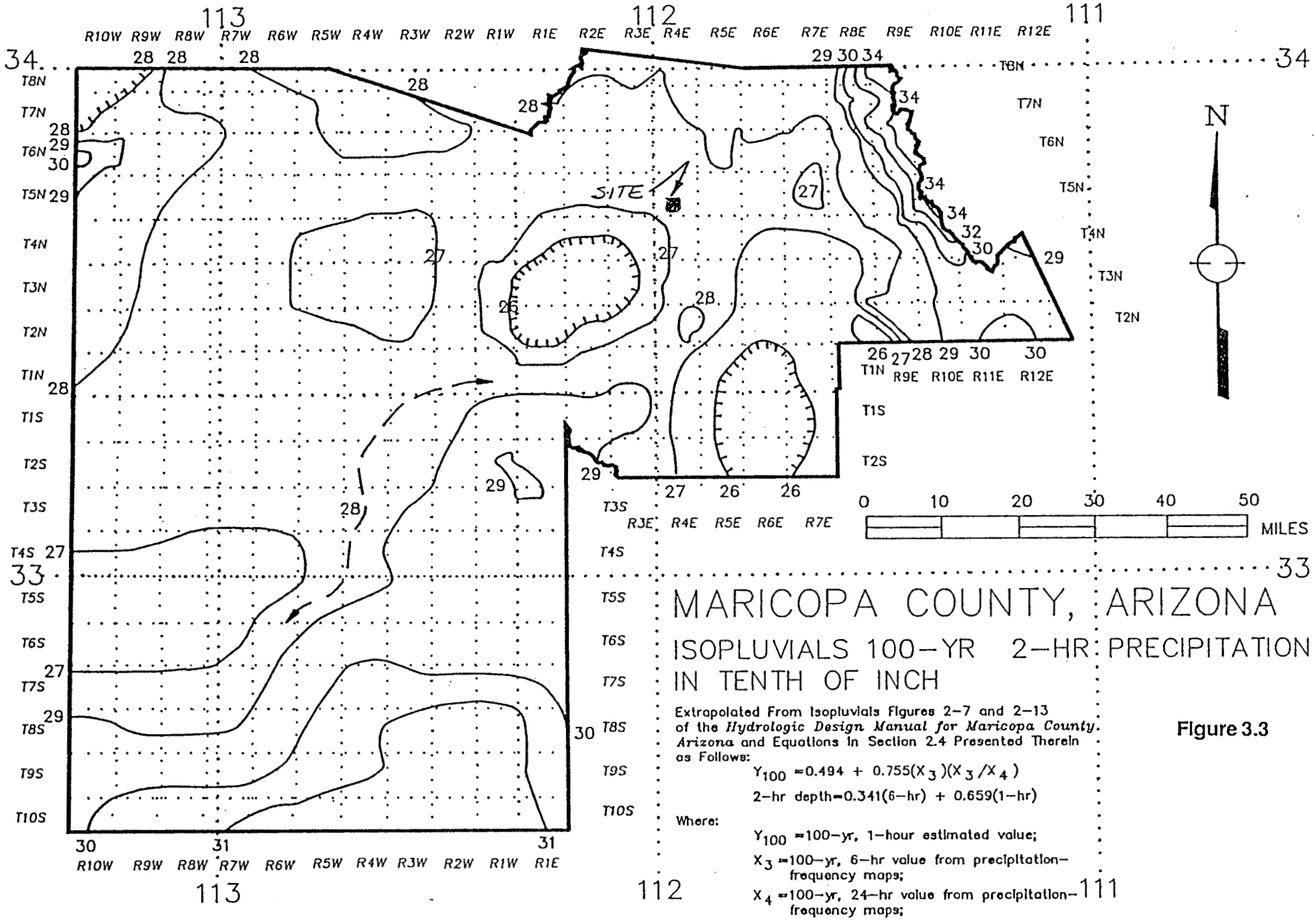

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 2-HR PRECIPITATION
IN TENTH OF INCH
Extrapolated From Isopluvials Figures 2-7 and 2-13 of the Hydrologic Design Manual for Maricopa County, Arizona and Equations in Section 2.4 Presented Therein as Follows:
$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$
2-hr depth = 0.341(6-hr) + 0.659(1-hr)
Where:
Y_{100} = 100-yr, 1-hour estimated value;
X_3 = 100-yr, 6-hr value from precipitation-frequency maps;
X_4 = 100-yr, 24-hr value from precipitation-frequency maps;
6-hr = isopluvial values from figure 2.7;
1-hr = Y_{100} value as computed above.
SITE
N
0 10 20 30 40 50
MILES
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113 112 111
34 33

Figure 3.3

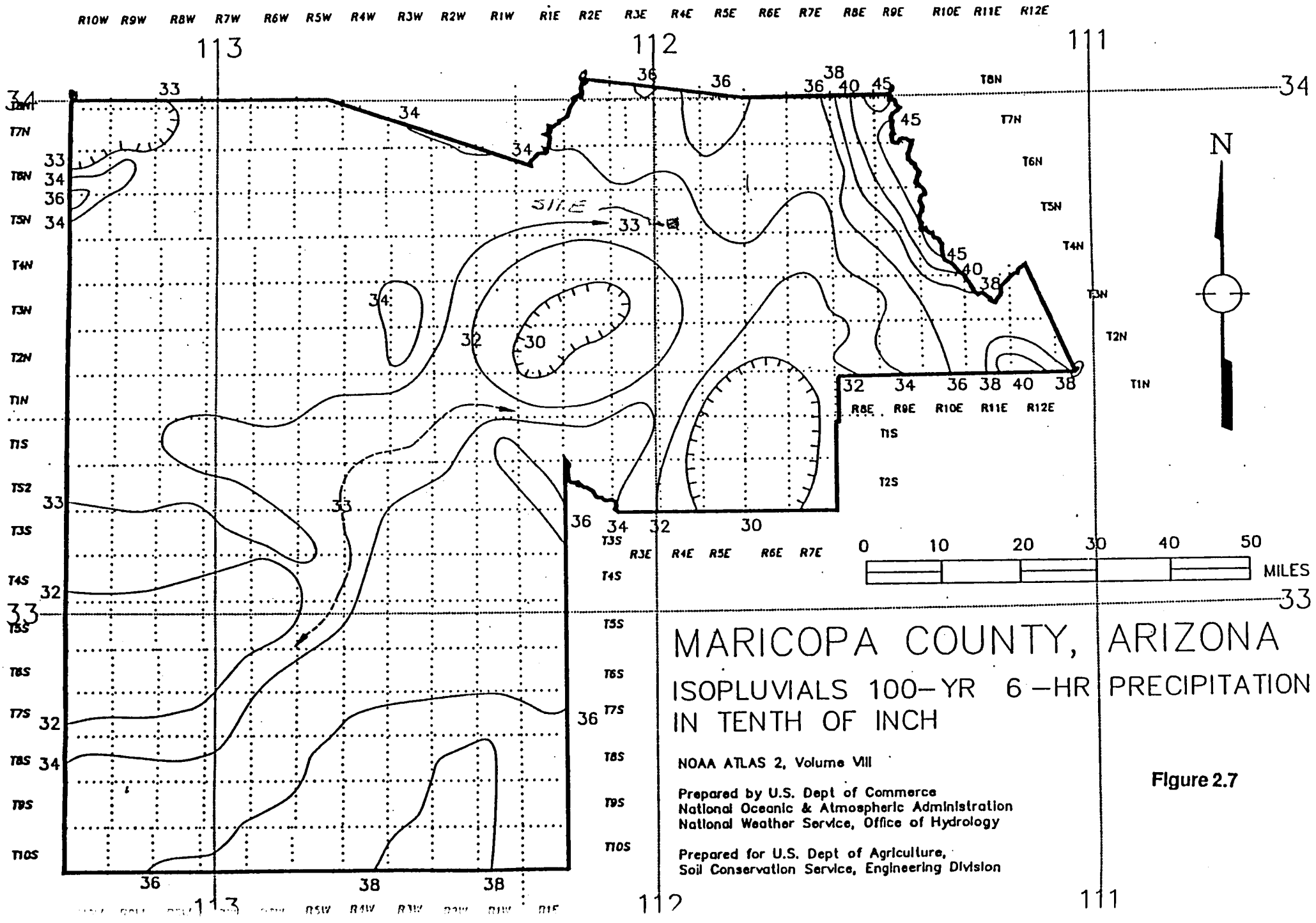

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
SITE
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113
112
111
34
33

Figure 2.7

The three infiltration parameters are functions of soil characteristics, ground surface characteristics, and land management practices. The soil characteristics of interest are particle size distribution (soil texture), organic matter, and bulk density. The primary soil surface characteristics are vegetation canopy cover, ground cover, and soil crusting. The land management practices are identified as various tillages as they result in changes to soil porosity.

Values of Green and Ampt equation parameters as a function of soil characteristics alone (bare ground condition) have been obtained from published reports (Rawls and others, 1983; Rawls and Brakensiek, 1983), and average values of XKSAT and PSIF for each of the soil texture classes are shown in Columns (2) and (3) of Table 4.2. The values of XKSAT and PSIF from Table 4.2 or Figure 4.3 should be used if general soil texture classification of the drainage area is available. References used to create Table 4.2 can be found in the Documentation Manual.

In Table 4.2, loamy sand and sand are combined. The parameter values that are shown in the table are for loamy sand. The hydraulic conductivity (XKSAT) for sand is often used as 4.6 inches/hour, and the capillary suction (PSIF) is often used as 1.9 inches. Using those parameter values for drainage areas can result in the generation of no rainfall excess—which may or may not be correct. Incorrect results could cause serious consequences for flood control planning and design. Therefore, it is recommended that—for watersheds consisting of relatively small subareas of sand—the Green and Ampt parameter values for loamy sand be used for the sand portion of the watershed. If the area contains a large portion of sand, then either the Green and

Table 4.2
Green and Ampt Loss Rate Parameter Values for Bare Ground

Soil Texture Classification (1)	XKSAT inches/hour (2)	PSIF inches (3)	DTHETA[1]		
			Dry (4)	Normal (5)	Saturated (6)
loamy sand & sand	1.2	2.4	0.35	0.30	0
sandy loam	0.40	4.3	0.35	0.25	0
loam	0.25	3.5	0.35	0.25	0
silty loam	0.15	6.6	0.40	0.25	0
silt	0.10	7.5	0.35	0.15	0
sandy clay loam	0.06	8.6	0.25	0.15	0
clay loam	0.04	8.2	0.25	0.15	0
silty clay loam	0.04	10.8	0.30	0.15	0
sandy clay	0.02	9.4	0.20	0.10	0
silty clay	0.02	11.5	0.20	0.10	0
clay	0.01	12.4	0.15	0.05	0

[1] Selection of DTHETA:
Dry = Nonirrigated lands, such as desert and rangeland;
Normal = Irrigated lawn, turf, and permanent pasture;
Saturated = Irrigated agricultural land.

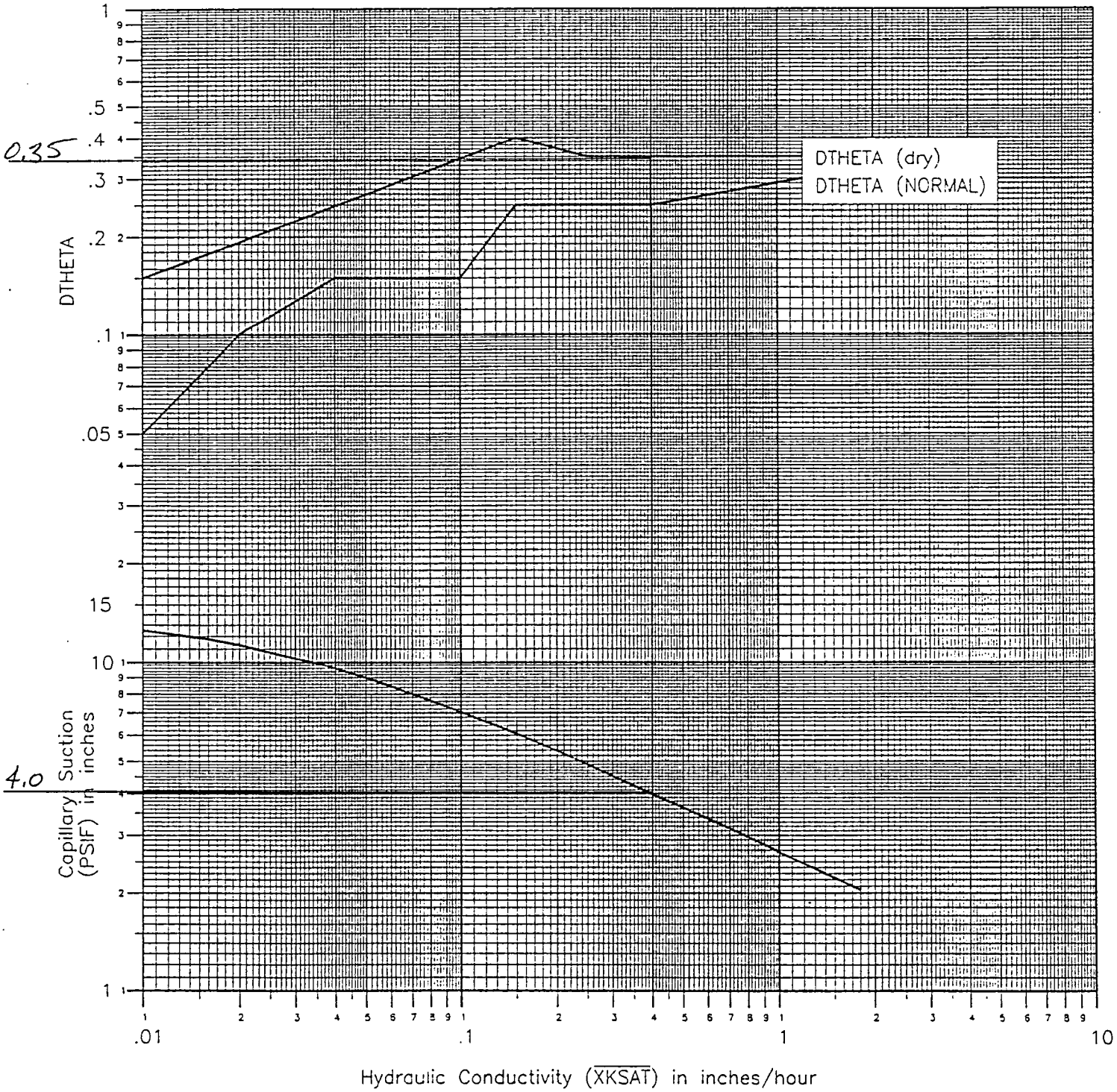


Figure 4.3
Composite Values of PSIF and DTHETA as a function of XKSAT
(To be used for area-weighted averaging of Green and Ampt parameters.)

4.2 Surface Retention Loss

Surface retention loss, as used herein, is the summation of all rainfall losses other than infiltration. The major component of surface retention loss is depression storage; relatively minor components of surface retention loss are due to interception and evaporation, as previously discussed. Depression storage is considered to occur in two forms. First, in-place depression storage occurs at, and in the near vicinity of, the raindrop impact. The mechanism for this depression storage is the microrelief of the soil and soil cover. The second form of depression storage is the retention of surface runoff that occurs away from the point of raindrop impact in surface depressions such as puddles, roadway gutters and swales, roofs, irrigation bordered fields and lawns, and so forth.

A relatively minor contribution by interception is also considered as a part of the total surface retention loss. Estimates of surface retention loss are difficult to obtain and are a function of the physiography and land-use of the area.

The surface retention loss on impervious surfaces has been estimated to be in the range 0.0625 inch to 0.125 inch by Tholin and Keefer (1960), 0.11 inch for 1 percent slope to 0.06 inch for 2.5 percent slopes by Viessman (1967), and 0.04 inch based on rainfall-runoff data for an urban watershed in Albuquerque by Sabol (1983). Hicks (1944) provides estimates of surface retention losses during intense storms as 0.20 inch for sand, 0.15 inch for loam, and 0.10 inch for clay. Tholin and Keefer (1960) estimated the surface retention loss for turf to be between 0.25 to 0.50 inch. Based on rainfall simulator studies on undeveloped alluvial plains in the Albuquerque area, the surface retention loss was estimated as 0.1 to 0.2 inch (Sabol and others, 1982a). Rainfall simulator studies in New Mexico result in estimates of 0.39 inch for eastern plains rangelands and 0.09 inch for pinon-juniper hillslopes (Sabol and others, 1982b). Surface retention losses for various land-uses and surface cover conditions in Maricopa County have been extrapolated from these reported estimates and these are shown in Table 4.1.

Table 4.1
Surface Retention Loss for Various Land Surfaces in Maricopa County

Land-use and/or Surface Cover (1)	Surface Retention Loss IA, Inches (2)
Natural	
Desert and rangeland, flat slope	0.35
Hillslopes, Sonoran Desert	0.15
Mountain, with vegetated surface	0.25
Developed (Residential and Commercial)	
Lawn and turf	0.20
Desert landscape	0.10
Pavement	0.05
Agricultural	
Tilled fields and irrigated pasture	0.50

Table 2.2
Depth-Area Reduction Factors
for 6-Hour Duration Rainfall

Area, Square Miles	Ratio to Point of Rainfall
0	1.0
1	0.987
5	0.96
10	0.94
20	0.91
30	0.89
40	0.87
50	0.86
100	0.80
200	0.72
300	0.66
400	0.61
500	0.57

Use the depth-area reduction values from Figure 2.14 or Table 2.2 to correct the 6-hour point rainfall depth from the isopluvial maps (Figures 2.2 through 2.7) for all flood studies in which the 6-hour local storm is the design rainfall criteria (see Table 2.1).

If the flood study is for the design of a retention/detention facility for a small drainage area and the design rainfall criteria is the 100-year, 2-hour storm, then the point rainfall depths from Figure 2.1 are not to be reduced for area. This is because local retention/detention basins will be provided only for very small drainage areas and the point rainfall from Figure 2.1 is representative of the equivalent uniform depth of rainfall over the entire contributing area.

If a general storm is the accepted design rainfall criteria (as opposed to the 6-hour local storm as defined in this manual), then the appropriate depth-area reduction curve will need to be defined to correspond with the rainfall duration and the temporal distribution of the general storm. This will need to be performed on a case-by-case basis depending on the purpose of the study, location of the watershed, and other meteorological and hydrological factors.

2.3.1 Procedure for Depth-Area Adjustment

The following procedure is to be used with the 6-hour local storm rainfall depths (Figures 2.2 through 2.7):

1. Determine the size of the drainage area.

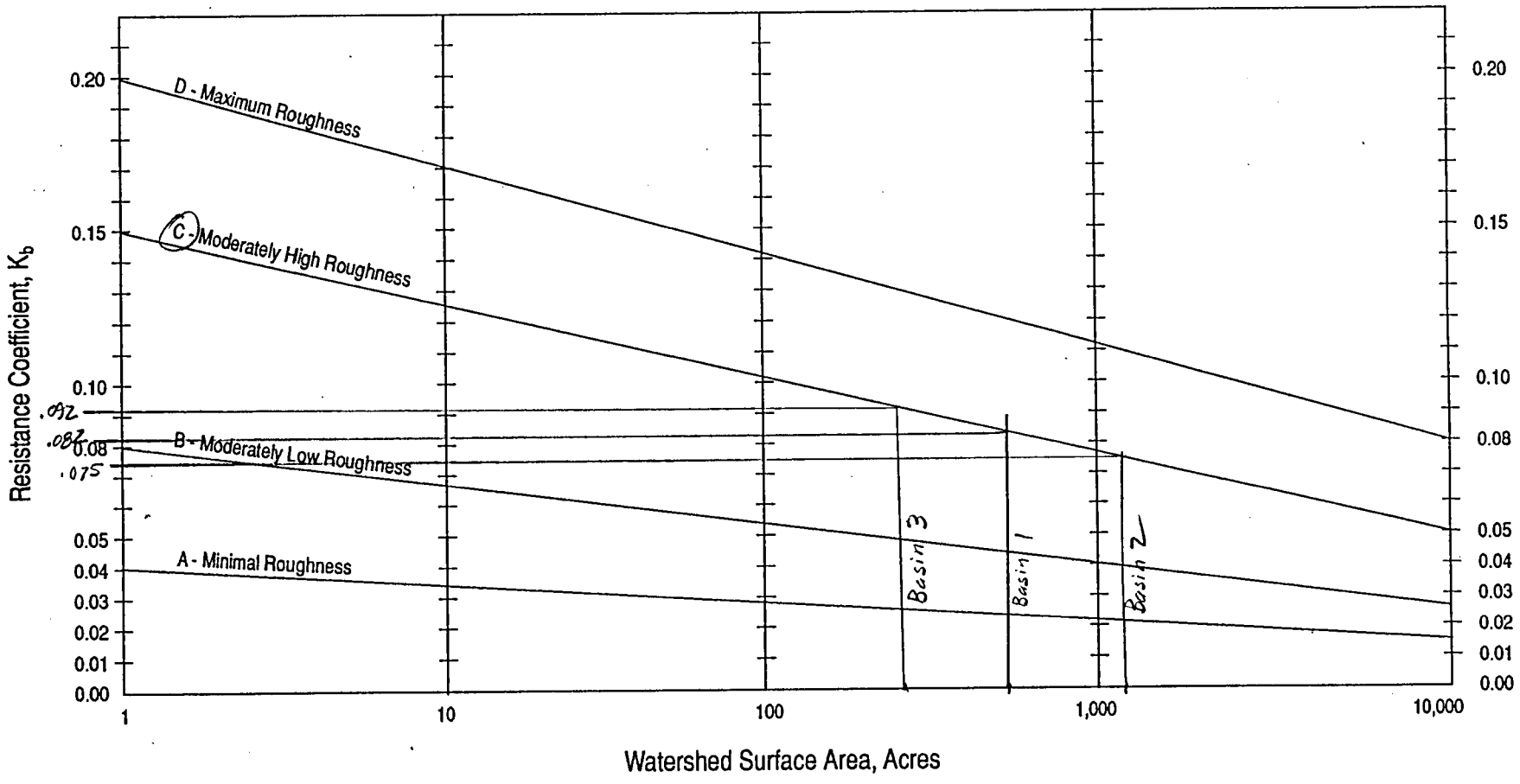


Figure 5.5

Resistance Coefficient "K_b" as a Function of Watershed Size and Surface Roughness Characteristics

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*           VERSION 4.0              *
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*  HYDROLOGIC ENGINEERING CENTER     *
*        609 SECOND STREET           *
*      DAVIS, CALIFORNIA 95616       *
*        (916) 756-1104              *
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID   PALOS VERDES ESTATES FINAL HYDROLOGY, RPG, 6/08/94
  2         ID
  3         IT     20                    300
  4         IO      5

  5         KK
  6         KM   BASIN BASIN1
  7         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  8         KM    L=      4.6  Lca=      2.3   S=  110.0  Kn= .050  LAG=  72.6
  9         KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 10         BA    1.18
 11         IN      15
 12         KM   RAINFALL DEPTH OF 3.30 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 13         KM   AN AREAL REDUCTION COEFFICIENT OF .961 WAS USED
 14         PB    3.17
 15         KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.33
 16         PC    .000    .011    .017    .027    .039    .049    .059    .069    .079    .090
 17         PC    .103    .117    .138    .182    .269    .458    .686    .824    .890    .930
 18         PC    .949    .962    .974    .988   1.000
 19         LG     .15     .35    4.00     .35   10.00
 20         UI     72.    271.    467.    462.    291.    217.    147.    110.     73.     53.
 21         UI     38.     27.     17.     10.     10.     10.      0.      0.      0.      0.
 22         UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 23         KK
 24         KM   BASIN BASIN2
 25         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 26         KM    L=      9.9  Lca=      4.9   S=  120.0  Kn= .050  LAG= 127.2
 27         KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 28         BA    3.27
 29         LG     .15     .35    4.00     .35   10.00
 30         UI     87.    176.    409.    586.    742.    936.    586.    487.    419.    352.
 31         UI    287.    221.    197.    161.    122.    103.     91.     66.     61.     42.
 32         UI     42.     36.     17.     17.     17.     17.     17.     17.     17.      0.
 33         UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 34         UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 35         KK
 36         KM   BASIN BASIN3
 37         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 38         KM    L=      2.5  Lca=      1.2   S=  260.0  Kn= .050  LAG=  38.4
 39         KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 40         BA     .49
 41         LG     .15     .35    4.00     .35   30.00
 42         UI    126.    371.    216.    116.     59.     30.     15.      8.      0.      0.
 43         UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 44         ZZ
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*           VERSION 4.0             *
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*   U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET         *
*       DAVIS, CALIFORNIA 95616     *
*          (916) 756-1104           *
*                                   *
*************************************
```

PALOS VERDES ESTATES FINAL HYDROLOGY, RPG, 6/08/94

```
4 IO        OUTPUT CONTROL VARIABLES
                 IPRNT          5  PRINT CONTROL
                 IPLOT          0  PLOT CONTROL
                 QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT        HYDROGRAPH TIME DATA
                  NMIN         20  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     5    0  ENDING DATE
                NDTIME       0340  ENDING TIME
                 ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .33 HOURS
                 TOTAL TIME BASE   99.67 HOURS

      ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
          FLOW                   CUBIC FEET PER SECOND
          STORAGE VOLUME         ACRE-FEET
          SURFACE AREA           ACRES
          TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT		536.	5.00	166.	42.	14.	1.18		
HYDROGRAPH AT		1038.	5.67	439.	118.	39.	3.27		
HYDROGRAPH AT		395.	4.33	90.	23.	8.	.49		

*** NORMAL END OF HEC-1 ***

```
*****************************************
*                                       *
   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
          SEPTEMBER 1990                *
*          VERSION 4.0                  *
                                        *
  RUN DATE  07/01/1994  TIME  10:20:10  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104               *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X               X
XXXXXXX  XXXX    X       XXXXX   X
X     X  X       X               X
X     X  X       X     X         X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   PALOS VERDES 50 YEAR STORM,RPG,MAY 7 1994
  2           ID
  3           IT     20                    300
  4           IO      5

  5           KK
  6           KM   BASIN BASIN 1
  7           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  8           KM    L=      4.6  Lca=      2.3   S=  110.0  Kn= .050  LAG=  72.6
  9           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 10           BA    1.18
 11           IN      15
 12           KM   RAINFALL DEPTH OF 2.93 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 13           KM   AN AREAL REDUCTION COEFFICIENT OF .961 WAS USED
 14           PB    2.81
 15           KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.33
 16           PC    .000    .011    .017    .027    .039    .049    .059    .069    .079    .090
 17           PC    .103    .117    .138    .182    .269    .458    .686    .824    .890    .930
 18           PC    .949    .962    .974    .988   1.000
 19           LG     .15     .35    4.00     .35   10.00
 20           UI     72.    271.    467.    462.    291.    217.    147.    110.     73.     53.
 21           UI     38.     27.     17.     10.     10.     10.      0.      0.      0.      0.
 22           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 23           KK
 24           KM   BASIN BASIN2
 25           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 26           KM    L=      9.9  Lca=      4.9   S=  120.0  Kn= .050  LAG= 127.2
 27           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 28           BA    3.27
 29           LG     .15     .35    4.00     .35   10.00
 30           UI     87.    176.    409.    586.    742.    936.    586.    487.    419.    352.
 31           UI    287.    221.    197.    161.    122.    103.     91.     66.     61.     42.
 32           UI     42.     36.     17.     17.     17.     17.     17.     17.     17.      0.
 33           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 34           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 35           KK
 36           KM   BASIN BASIN3
 37           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 38           KM    L=      2.5  Lca=      1.2   S=  260.0  Kn= .050  LAG=  38.4
 39           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 40           BA     .49
 41           LG     .15     .35    4.00     .35   30.00
 42           UI    126.    371.    216.    116.     59.     30.     15.      8.      0.      0.
 43           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 44           ZZ
```

```
****************************************
*                                      *
   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          SEPTEMBER 1990              *
*           VERSION 4.0                *
                                       *
  RUN DATE  07/01/1994  TIME  10:20:10 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

PALOS VERDES 50 YEAR STORM,RPG,MAY 7 1994

```
4 IO        OUTPUT CONTROL VARIABLES
                 IPRNT          5  PRINT CONTROL
                 IPLOT          0  PLOT CONTROL
                 QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT        HYDROGRAPH TIME DATA
                  NMIN         20  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     5    0  ENDING DATE
                NDTIME       0340  ENDING TIME
                 ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .33 HOURS
                 TOTAL TIME BASE   99.67 HOURS

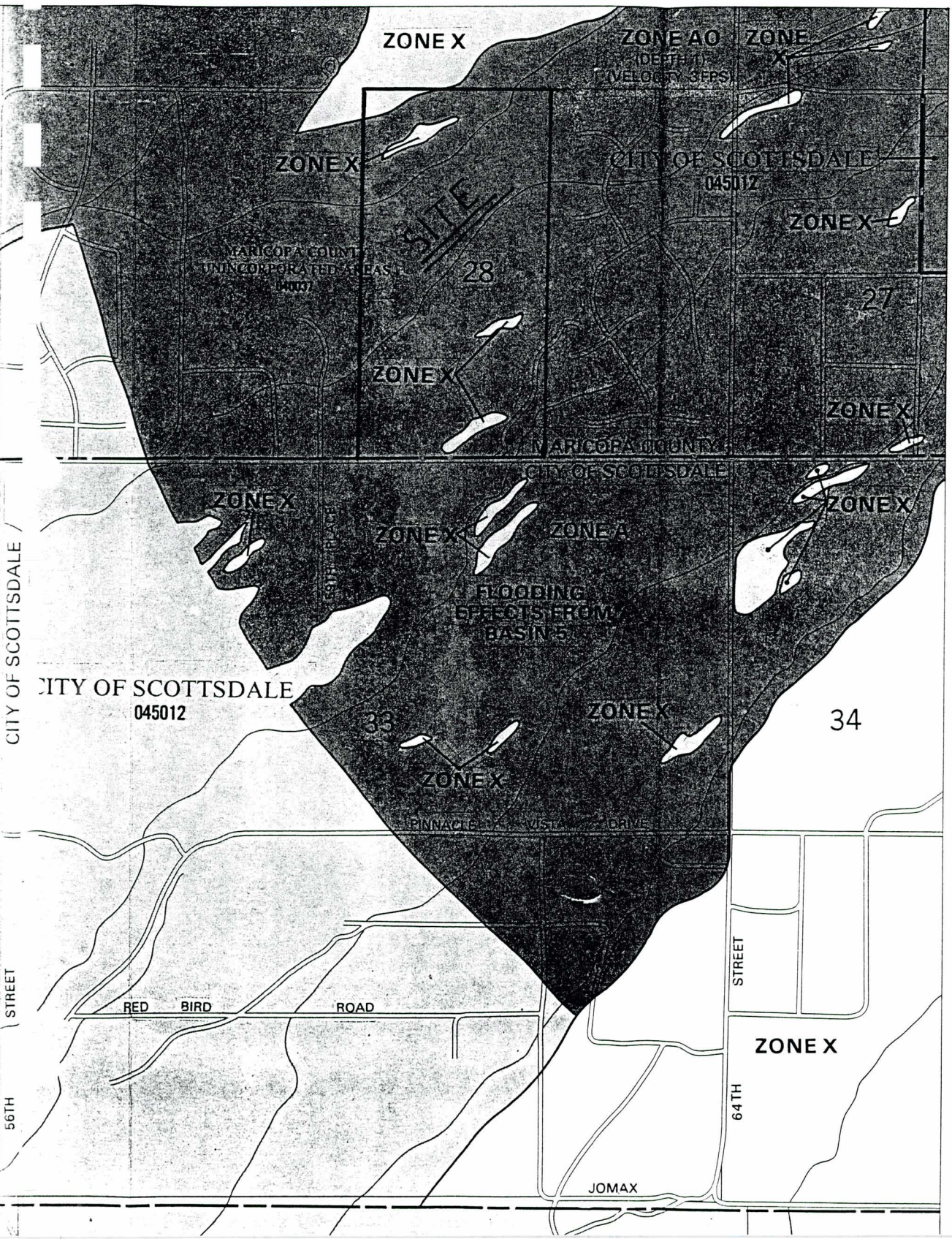
      ENGLISH UNITS
           DRAINAGE AREA        SQUARE MILES
           PRECIPITATION DEPTH  INCHES
           LENGTH, ELEVATION    FEET
           FLOW                 CUBIC FEET PER SECOND
           STORAGE VOLUME       ACRE-FEET
           SURFACE AREA         ACRES
           TEMPERATURE          DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

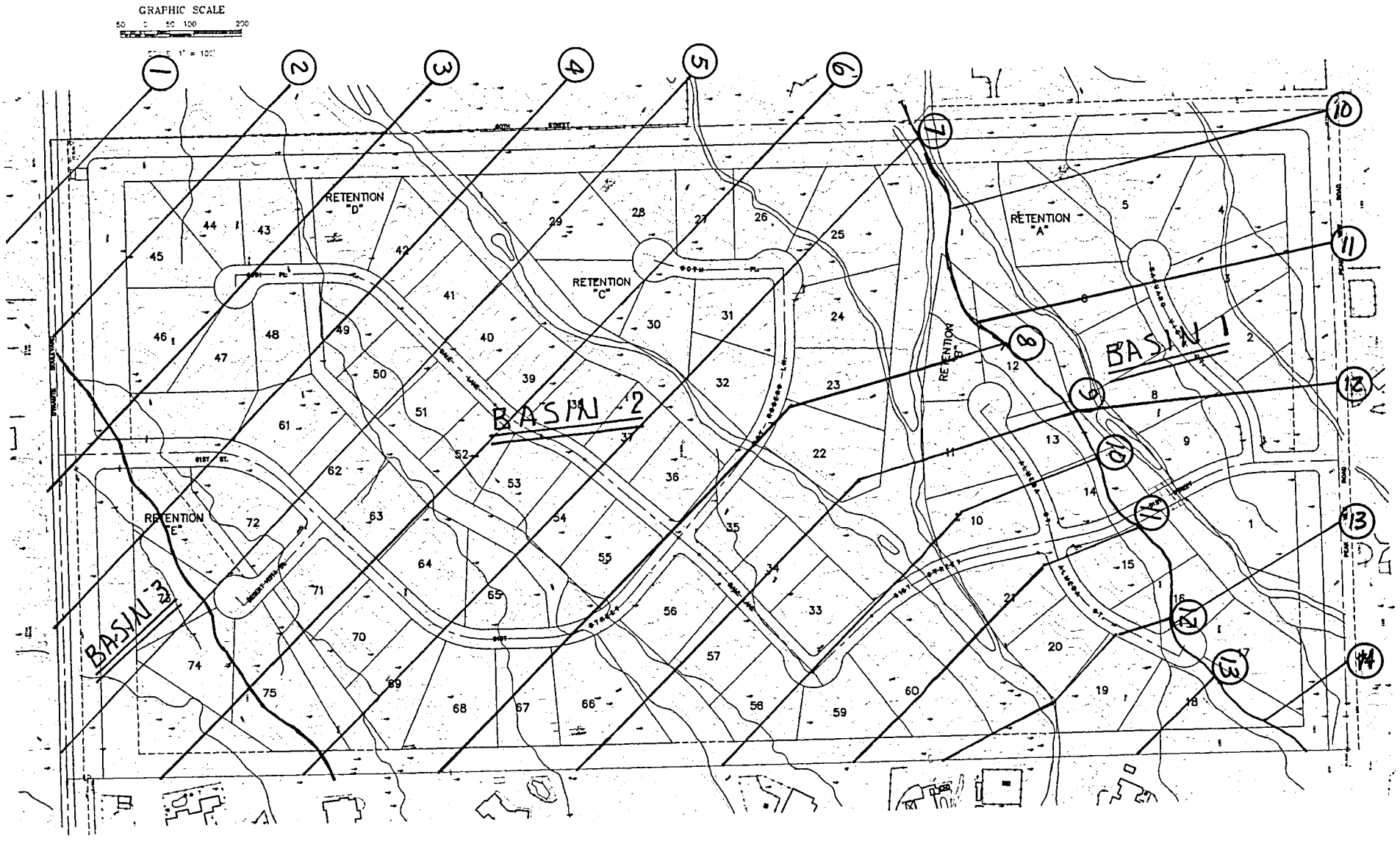
OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT		428.	5.00	132.	34.	11.	1.18		
HYDROGRAPH AT		831.	5.67	348.	94.	31.	3.27		
HYDROGRAPH AT		327.	4.33	75.	19.	6.	.49		

* NORMAL END OF HEC-1 ***

E F


ZONE X
ZONE AO
(DEPTH 1)
(VELOCITY 3 FPS)
ZONE X
ZONE X
CITY OF SCOTTSDALE
045012
SITE
ZONE X
MARICOPA COUNTY
UNINCORPORATED AREAS
040037
28
27
ZONE X
ZONE X
MARICOPA COUNTY
CITY OF SCOTTSDALE
ZONE X
ZONE X
ZONE A
ZONE X
FLOODING
EFFECTS FROM
BASIN 5
CITY OF SCOTTSDALE
045012
33
ZONE X
34
ZONE X
PINNACLE WEST DRIVE
STREET
RED BIRD ROAD
ZONE X
64TH
JOMAX
CITY OF SCOTTSDALE
STREET
56TH

HEC-2



HEC-2 SECTION LOCATIONS

HAVILL ENGIN
a division of Tait & Ass
engineering • surveying •

```
*****************************************
* HEC-2 WATER SURFACE PROFILES          *
*                                       *
* Version   4.6.2;  May 1991            *
*                                       *
* RUN DATE    05JUL94    TIME   12:55:33 *
*****************************************
```

```
*************************************
* U.S. ARMY CORPS OF ENGINEERS      *
* HYDROLOGIC ENGINEERING CENTER     *
* 609 SECOND STREET, SUITE D        *
* DAVIS, CALIFORNIA 95616-4687      *
*         (916) 756-1104            *
*************************************
```

```
X     X  XXXXXXX   XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX     X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX   XXXXX           XXXXXXX
```

Basin 1

THIS RUN EXECUTED 05JUL94 12:55:33

```
*    ********************************
 EC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
**********************************


T1 THE ESTATES AT PALOS VERDES - BASIN 1
   BASINS DIVIDED 100 YEAR EVENT

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0      .021       0        0     545.1   1989.5

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0        0        0        0


..  VARIABLE CODES FOR SUMMARY PRINTOUT

    150        0        0        0        0        0        0        0        0

NC     .08      .08      .05
OT       1    545.1
       700        6        0      170
GR  1989.0        0   1988.0      100   1989.0      110   1989.0      120     1989      140
GR  1988.7      170

        1    545.1
X1    800       11       30      140      180      160      100
GR  1990.8        0   1989.3       30   1990.0       80   1990.0       82   1991.3      140
    1990.9      175   1991.3      200   1990.8      240   1992.2      310   1991.0      390
GR  1992.0      410

        1    544.2
X1    900       13      200      500      120      120      120
GR  1993.7        0   1994.2       20   1993.5       90   1993.6      130   1994.2      165
    1992.7      300   1992.1      330   1992.7      410   1994.2      500   1993.7      540
    1994.3      590   1993.3      630   1994.0      660

OT       1    542.7
       1000       16      560      730      110      110      110
GR  1995.9        0   1997.2       40   1994.9      100   1996.3      150   1994.7      190
GR  1996.8      240   1995.6      350   1996.1      360   1994.7      500   1996.3      560
    1993.5      615   1996.4      730   1996.0      785   1996.3      815   1995.4      840
GR  1996.2      870

        1    540.7
       1100       15      380      545      260      260      260
GR  2003.2        0   2001.0       65   2001.0       82   2001.4      115   2000.5      150
    2001.2      210   2001.0      260   2000.3      330   2002.5      380   1997.5      515
    2001.0      545   2001.3      615   1999.8      655   2001.3      710   2001.3      780
```

T	1	538.9								
J	1200	11	370	595	300	290	280			
(	2008.0	0	2008.5	40	2005.5	160	2006.5	175	2006.2	180
(	2007.2	300	2005.3	370	2007.5	450	2006.7	500	2007.5	550
(	2006.0	595								
OT	1	537.6								
	1300	10	130	450	300	280	250			
GR	2010.0	0	2012.0	60	2012.0	90	2012.8	130	2011.0	320
GR	2011.0	330	2011.9	360	2011.0	390	2011.0	400	2011.6	450
	1	536.6								
X1	1400	4	120	265	250	240	230			
	2017.9	0	2017.1	120	2015.8	165	2017.2	265		

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

ECNO 700.000
3280 CROSS SECTION 700.00 EXTENDED .79 FEET

700.000	1.49	1989.49	.00	1989.50	1989.71	.23	.00	.00	1989.00
545.1	.0	545.1	.0	.0	142.3	.0	.0	.0	1988.70
.00	.00	3.83	.00	.000	.050	.000	.000	1988.00	.00
.021258	0.	0.	0.	0	0	3	.00	170.00	170.00

*SECNO 800.000

3265 DIVIDED FLOW

3230 CROSS SECTION 800.00 EXTENDED .48 FEET

800.000	1.99	1991.29	.00	.00	1991.46	.17	1.75	.00	1989.30
545.1	88.3	434.7	22.1	37.0	121.0	29.7	.4	.6	1991.30
.01	2.39	3.59	.74	.080	.050	.080	.000	1989.30	.00
.012761	180.	100.	160.	3	0	0	.00	284.23	395.67

*SECNO 900.000

3265 DIVIDED FLOW

3222 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .69

900.000	1.29	1993.39	.00	.00	1993.61	.22	2.15	.00	1994.20
544.2	.0	544.1	.1	.0	144.7	.3	.9	1.3	1994.20
.02	.00	3.76	.39	.000	.050	.080	.000	1992.10	237.85
.026888	120.	120.	120.	2	0	0	.00	221.08	633.88

*SECNO 1000.000

3265 DIVIDED FLOW

1000.000	2.04	1995.54	.00	.00	1995.71	.17	2.10	.00	1996.30
542.7	96.2	446.3	.3	79.1	123.8	.7	1.3	2.0	1996.40
.03	1.22	3.60	.38	.080	.050	.080	.000	1993.50	83.21
.014297	110.	110.	110.	2	0	0	.00	327.54	845.39

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


*SECNO 1100.000

3265 DIVIDED FLOW

  1100.000      2.43   1999.93       .00       .00   2000.34       .41      4.63       .00   2002.50
     540.7        .0     540.4        .3        .0     105.7        .6       2.3       3.3   2001.00
       .04       .00      5.11       .47      .000      .050      .080      .000   1997.50    449.17
   .022786      260.      260.      260.         3         0         0       .00     95.46    660.06


*SECNO 1200.000

3265 DIVIDED FLOW

3280 CROSS SECTION   1200.00 EXTENDED       .74 FEET

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3720 CRITICAL DEPTH ASSUMED
  1200.000      1.44   2006.74   2006.74       .00   2006.99       .25      9.83       .00   2005.30
     538.9     312.8     226.1        .0      99.0      45.8        .0       3.1       4.5   2006.00
       .06      3.16      4.94       .00      .080      .050      .000      .000   2005.30    110.50
   .057842      300.      280.      290.        20        14         0       .00    266.03    595.00


*SECNO 1300.000

 265 DIVIDED FLOW

3280 CROSS SECTION   1300.00 EXTENDED      2.14 FEET


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.46

  1300.000      2.14   2012.14       .00       .00   2012.22       .07      5.23       .00   2012.80
     537.6     135.4     402.2        .0      73.5     175.8        .0       4.3       6.4   2011.60
       .10      1.84      2.29       .00      .080      .050      .000      .000   2010.00       .00
   .009540      300.      250.      280.         9         0         0       .00    347.98    450.00


SECNO 1400.000
3280 CROSS SECTION   1400.00 EXTENDED       .03 FEET

.85 MINIMUM SPECIFIC ENERGY
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3720 CRITICAL DEPTH ASSUMED

1400.000	1.43	2017.23	2017.23	.00	2017.61	.38	4.02	.00	2017.10
536.6	.8	535.8	.0	1.3	108.5	.0	5.3	7.8	2017.20
.11	.61	4.94	.00	.080	.050	.000	.000	2015.80	100.04
.040613	250.	230.	240.	4	19	0	.00	164.96	265.00

THIS RUN EXECUTED 05JUL94 12:55:34

****
EC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

MARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	700.000	.00	.00	.00	1988.00	545.10	1989.49	.00	1989.71	212.58	3.83	142.34	37.39
	800.000	100.00	.00	.00	1989.30	545.10	1991.29	.00	1991.46	127.61	3.59	187.72	48.25
	900.000	120.00	.00	.00	1992.10	544.20	1993.39	.00	1993.61	268.88	3.76	145.06	33.19
	1000.000	110.00	.00	.00	1993.50	542.70	1995.54	.00	1995.71	142.97	3.60	203.63	45.39
	1100.000	260.00	.00	.00	1997.50	540.70	1999.93	.00	2000.34	227.86	5.11	106.32	35.82
*	1200.000	280.00	.00	.00	2005.30	538.90	2006.74	2006.74	2006.99	578.42	4.94	144.83	22.41
*	1300.000	250.00	.00	.00	2010.00	537.60	2012.14	.00	2012.22	95.40	2.29	249.33	55.04
*	1400.000	230.00	.00	.00	2015.80	536.60	2017.23	2017.23	2017.61	406.13	4.94	109.87	26.63

..MMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	700.000	545.10	1989.49	.00	.00	-.01	170.00	.00
	800.000	545.10	1991.29	.00	1.80	.00	284.23	100.00
	900.000	544.20	1993.39	.00	2.10	.00	221.08	120.00
	1000.000	542.70	1995.54	.00	2.15	.00	327.54	110.00
	1100.000	540.70	1999.93	.00	4.39	.00	95.46	260.00
*	1200.000	538.90	2006.74	.00	6.80	.00	266.03	280.00
	1300.000	537.60	2012.14	.00	5.41	.00	347.98	250.00
	1400.000	536.60	2017.23	.00	5.09	.00	164.96	230.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
  RNING SECNO=    900.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   1200.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
  UTION SECNO=   1200.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=   1300.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   1400.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   1400.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
```

```
*****************************************
*  HEC-2 WATER SURFACE PROFILES          *
                                         *
*  Version   4.6.2;  May 1991            *
*                                        *
   RUN DATE    11JUL94    TIME   10:42:46 *
*****************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*         (916) 756-1104            *
*************************************
```

```
X     X  XXXXXXX   XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX     X        XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX   XXXXX           XXXXXXX
```

Basin #2

THIS RUN EXECUTED 11JUL94 10:42:46

```
    ********************************
  EC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
***********************************


T1 THE ESTATES AT PALOS VERDES
   BASIN 2 100 YEAR STORM

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0      .014       0        0      1072     1980      0

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0        0        0        0        0        0


.   VARIABLE CODES FOR SUMMARY PRINTOUT

    150        0        0        0        0        0        0        0        0        0
  MANNINGS n = .05 FOR CHANNEL AND .08 FOR OVERBANKS

NC      .08      .08      .05
(         1     1072
X1      100       13      200      350        0        0        0
GR   1977.5        0   1980.0       40   1977.8       50   1977.6      100   1976.0      130
(    1976.6      150   1979.0      200   1976.0      270   1976.7      300   1976.5      330
(    1979.4      350   1978.1      400   1978.1      440

QT        1     1071
X       200       14      200      550      200      200      200
GR   1979.1        0   1977.8       50   1977.6       65   1978.3      100   1979.6      130
GR   1979.0      170   1980.3      198   1979.0      300   1983.1      410   1982.9      550
(    1982.0      565   1982.0      588   1983.6      613   1981.7      650

QT        1     1070
X       300       13        0      218      200      200      200
G    1981.0        0   1981.0      192   1982.7      218   1981.0      350   1984.0      430
GR   1984.6      500   1982.9      577   1986.9      664   1987.3      700   1987.0      770
GP   1986.0      840   1984.0      868   1987.0      940

QT        1     1068
X1      400       23      285      335      200      200      200
G    1983.0        0   1984.4      165   1983.3      200   1985.0      240   1984.0      285
G    1984.0      335   1985.8      382   1984.5      415   1986.0      450   1986.0      645
GR   1985.0      660   1986.5      670   1984.9      720   1989.0      780   1990.9      870
G    1990.0      900   1990.0      910   1991.1      950   1988.0     1020   1987.7     1050
G    1988.5     1080   1987.2     1150   1991.8     1225
```

	1	1065								
[illegible]	500	25	500	665	200	200	200			
[illegible]	1986.2	0	1985.0	10	1985.0	30	1987.0	65	1987.0	100
	1986.0	180	1989.0	260	1988.1	320	1988.6	350	1988.1	450
	1988.0	500	1989.0	580	1988.0	620	1988.0	665	1990.3	850
GR	1991.0	875	1991.0	890	1991.9	895	1990.3	950	1989.0	980
[illegible]	1989.0	995	1987.0	1010	1994.2	1190	1990.0	1320	1996.6	1500
QT	1	1059								
X1	700	26	800	1000	200	200	200			
[illegible]	1996.5	190	1995.6	300	1997.3	410	1994.8	535	1997.3	650
[illegible]	1995.6	730	1996.5	770	1996.3	800	1993.3	860	1993.3	875
GR	1994.6	880	1995.2	900	1997.0	1000	1998.3	1100	1997.0	1150
[illegible]	1997.6	1200	1998.0	1250	1996.3	1300	1999.0	1350	1997.1	1400
[illegible]	1998.3	1440	2002.0	1620	2000.0	1750	2097.0	1775	2097.0	1782
GR	2003.8	1940								
[illegible]	1	1056								
X1	800	14	950	1100	200	200	200			
GR	2000.5	470	1999.0	593	1999.0	625	2000.1	660	1999.0	680
[illegible]	2000.3	755	1999.7	840	2000.3	950	1998.0	1050	1997.8	1060
[illegible]	1998.0	1075	1999.2	1100	2000.0	1180	2002.2	1300		
[illegible]	1	1049								
[illegible]	1000	20	1200	1450	400	400	400			
GR	2006.5	905	2006.0	957	2006.0	967	2007.3	1135	2006.3	1140
[illegible]	2005.5	1310	2006.1	1325	2005.6	1370	2005.8	1450	2006.3	1500
[illegible]	2007.9	1550	2008.5	1620	2006.8	1670	2006.8	1680	2009.5	1780
[illegible]	2008.6	1825	2008.6	1835	2010.2	1895	2007.8	1955	2011.0	2005
[illegible]	1	1045								
[illegible]	1100	21	1000	1300	200	200	200			
GR	2006.0	750	2006.1	800	2006.8	850	2007.8	900	2008.0	950
[illegible]	2007.8	1000	2008.0	1050	2008.8	1100	2006.0	1150	2008.8	1200
[illegible]	2009.0	1250	2009.8	1300	2010.0	1350	2011.0	1400	2012.1	1450
GR	2012.3	1500	2013.5	1550	2013.4	1600	2012.0	1620	2012.3	1650
GR	2012.8	1685								
[illegible]	1	1043								
X1	1200	15	600	1100	200	200	200			
[illegible]	2010.0	600	2010.7	620	2008.5	650	2010.1	700	2011.7	750
[illegible]	2010.8	800	2011.2	850	2013.9	900	2013.0	950	2011.0	970
GR	2012.0	1015	2013.0	1021	2013.3	1100	2014.5	1150	2014.0	1240
[illegible]	1	1041								
X1	1300	12	500	860	200	200	200			
GR	2014.3	500	2014.0	525	2013.0	530	2013.0	545	2014.0	555
[illegible]	2014.0	600	2013.6	650	2017.0	700	2015.5	840	2015.0	850
[illegible]	2015.0	860	2016.0	870						

```
 Γ        1       1038
 1     1400          7        250        400        200        200        200
(     2017.9        250     2018.0        300     2018.1        312     2016.0        320     2018.0        350
^Ϟ    2018.1        400     2020.0        450
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
LOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

SECNO 100.000

3265 DIVIDED FLOW

280 CROSS SECTION 100.00 EXTENDED .71 FEET

100.000	2.21	1978.21	.00	1980.00	1978.43	.23	.00	.00	1979.00
1072.0	332.4	737.5	2.1	136.8	170.6	4.4	.0	.0	1979.40
.00	2.43	4.32	.48	.080	.050	.080	.000	1976.00	.00
.013730	0.	0.	0.	0	0	4	.00	313.88	440.00

*SECNO 200.000

280 CROSS SECTION 200.00 EXTENDED 1.31 FEET

200.000	2.81	1980.41	.00	.00	1980.50	.09	2.07	.00	1980.30
1071.0	844.5	226.5	.0	333.4	103.6	.0	1.7	1.5	1982.90
.02	2.53	2.19	.00	.080	.050	.000	.000	1977.60	.00
.008056	200.	200.	200.	4	0	0	.00	337.72	337.72

SECNO 300.000

265 DIVIDED FLOW

3280 CROSS SECTION 300.00 EXTENDED 1.27 FEET

300.000	1.26	1982.26	.00	.00	1982.46	.19	1.96	.00	1981.00
1070.0	.0	943.9	126.1	.0	255.4	83.6	3.5	3.1	1982.70
.04	.00	3.70	1.51	.000	.050	.080	.000	1981.00	.00
.012114	200.	200.	200.	3	0	0	.00	343.47	383.77

ECNO 400.000

3265 DIVIDED FLOW

80 CROSS SECTION 400.00 EXTENDED 2.05 FEET

400.000	2.05	1985.05	.00	.00	1985.17	.12	2.72	.00	1984.00
1068.0	841.0	198.5	28.6	324.4	52.3	22.1	5.2	4.8	1984.00
.06	2.59	3.79	1.29	.080	.050	.080	.000	1983.00	.00
.015354	200.	200.	200.	3	0	0	.00	396.61	722.14

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 500.000

65 DIVIDED FLOW

3280 CROSS SECTION 500.00 EXTENDED 1.72 FEET

500.000	2.92	1987.92	.00	.00	1988.07	.14	2.89	.00	1988.00
1065.0	1047.1	.0	17.9	344.5	.0	13.8	6.9	6.3	1988.00
.08	3.04	.00	1.29	.080	.000	.080	.000	1985.00	.00
.013639	200.	200.	200.	3	0	0	.00	261.28	1033.08

ECNO 700.000

3265 DIVIDED FLOW

35 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
20 CRITICAL DEPTH ASSUMED

700.000	2.69	1995.99	1995.99	.00	1996.39	.40	3.74	.00	1996.30
1059.0	171.0	888.0	.0	90.0	162.6	.0	8.3	7.7	1997.00
.09	1.90	5.46	.00	.080	.050	.000	.000	1993.30	251.86
027205	200.	200.	200.	20	12	0	.00	362.27	944.11

ECNO 800.000

3265 DIVIDED FLOW

800.000	2.24	2000.04	.00	.00	2000.26	.21	3.87	.00	2000.30
1056.0	240.6	768.9	46.5	156.7	180.8	35.7	9.8	9.8	1999.20
.10	1.54	4.25	1.30	.080	.050	.080	.000	1997.80	507.23
.014421	200.	200.	200.	5	0	0	.00	564.34	1182.51

ECNO 1000.000

3265 DIVIDED FLOW

30 CROSS SECTION 1000.00 EXTENDED .16 FEET

1000.000	1.16	2006.66	.00	.00	2006.84	.18	6.58	.00	2006.30
1049.0	76.9	914.7	57.4	56.1	254.8	32.4	13.1	14.8	2005.80
.14	1.37	3.59	1.77	.080	.050	.080	.000	2005.50	905.00
.018962	400.	400.	400.	6	0	0	.00	520.02	1511.19

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1100.000

55 DIVIDED FLOW

3280 CROSS SECTION 1100.00 EXTENDED 2.58 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.90

1100.000	2.58	2008.58	.00	.00	2008.64	.06	1.80	.00	2007.80
1045.0	714.0	331.0	.0	365.0	163.3	.0	15.1	17.0	2009.80
.17	1.96	2.03	.00	.080	.050	.000	.000	2006.00	750.00
.005233	200.	200.	200.	3	0	0	.00	428.37	1196.07

*SECNO 1200.000

3265 DIVIDED FLOW

3280 CROSS SECTION 1200.00 EXTENDED 1.18 FEET

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

1200.000	2.68	2011.18	2011.18	.00	2011.65	.47	2.25	.00	2010.00
1043.0	.0	1043.0	.0	.0	190.4	.0	16.7	18.5	2013.30
.18	.00	5.48	.00	.000	.050	.000	.000	2008.50	600.00
.039689	200.	200.	200.	20	8	0	.00	212.54	978.15

*SECNO 1300.000

3265 DIVIDED FLOW

3280 CROSS SECTION 1300.00 EXTENDED 1.07 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.83

300.000	2.37	2015.37	.00	.00	2015.62	.24	3.97	.00	2014.30
1041.0	.0	1040.5	.5	.0	263.1	.7	17.8	19.4	2015.00
.19	.00	3.95	.66	.000	.050	.080	.000	2013.00	500.00
.011864	200.	200.	200.	6	0	0	.00	197.30	863.74

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1400.000
3280 CROSS SECTION 1400.00 EXTENDED .98 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .57

1400.000	2.88	2018.88	2018.87	.00	2019.44	.56	3.83	.00	2017.90
1038.0	.0	1023.0	15.0	.0	168.8	8.0	18.8	20.2	2018.10
.20	.00	6.06	1.88	.000	.050	.080	.000	2016.00	250.00
.035930	200.	200.	200.	7	11	0	.00	170.49	420.49

THIS RUN EXECUTED 11JUL94 10:42:47

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EC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

MMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	100.000	.00	.00	.00	1976.00	1072.00	1978.21	.00	1978.43	137.30	4.32	311.86	91.49
	200.000	200.00	.00	.00	1977.60	1071.00	1980.41	.00	1980.50	80.56	2.19	437.07	119.32
	300.000	200.00	.00	.00	1981.00	1070.00	1982.26	.00	1982.46	121.14	3.70	339.05	97.21
	400.000	200.00	.00	.00	1983.00	1068.00	1985.05	.00	1985.17	153.54	3.79	398.72	86.19
	500.000	200.00	.00	.00	1985.00	1065.00	1987.92	.00	1988.07	136.39	.00	358.31	91.19
*	700.000	200.00	.00	.00	1993.30	1059.00	1995.99	1995.99	1996.39	272.05	5.46	252.60	64.21
	800.000	200.00	.00	.00	1997.80	1056.00	2000.04	.00	2000.26	144.21	4.25	373.25	87.94
	1000.000	400.00	.00	.00	2005.50	1049.00	2006.66	.00	2006.84	189.62	3.59	343.26	76.18
*	1100.000	200.00	.00	.00	2006.00	1045.00	2008.58	.00	2008.64	52.33	2.03	528.30	144.45
	1200.000	200.00	.00	.00	2008.50	1043.00	2011.18	2011.18	2011.65	396.89	5.48	190.37	52.35
*	1300.000	200.00	.00	.00	2013.00	1041.00	2015.37	.00	2015.62	118.64	3.95	263.81	95.57
	1400.000	200.00	.00	.00	2016.00	1038.00	2018.88	2018.87	2019.44	359.30	6.06	176.80	54.76

..MMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	100.000	1072.00	1978.21	.00	.00	-1.79	313.88	.00
	200.000	1071.00	1980.41	.00	2.20	.00	337.72	200.00
	300.000	1070.00	1982.26	.00	1.86	.00	343.47	200.00
	400.000	1068.00	1985.05	.00	2.78	.00	396.61	200.00
	500.000	1065.00	1987.92	.00	2.87	.00	261.28	200.00
*	700.000	1059.00	1995.99	.00	8.07	.00	362.27	200.00
	800.000	1056.00	2000.04	.00	4.05	.00	564.34	200.00
	1000.000	1049.00	2006.66	.00	6.62	.00	520.02	400.00
*	1100.000	1045.00	2008.58	.00	1.92	.00	428.37	200.00
*	1200.000	1043.00	2011.18	.00	2.60	.00	212.54	200.00
*	1300.000	1041.00	2015.37	.00	4.19	.00	197.30	200.00
*	1400.000	1038.00	2018.88	.00	3.51	.00	170.49	200.00

JMMARY OF ERRORS AND SPECIAL NOTES

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( JTION SECNO=    700.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    700.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    700.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=   1100.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

( JTION SECNO=   1200.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
( JTION SECNO=   1200.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   1200.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

W NING SECNO=   1300.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   1400.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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****************************************
*  HEC-2 WATER SURFACE PROFILES          *
                                        *
*  Version   4.6.2;  May 1991            *
*                                        *
   RUN DATE    05JUL94    TIME   13:12:30 *
 ****************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*         (916) 756-1104            *
*************************************
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X     X  XXXXXXX   XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX     X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX   XXXXX           XXXXXXX
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Basin 3

THIS RUN EXECUTED 05JUL94 13:12:30

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*****************************
EC-2 WATER SURFACE PROFILES

Version  4.6.2;  May 1991
***********************************

T1 THE ESTATES AT PALOS VERDES - BASIN 3
   100-YEAR EVENT

J1  ICHECK   INQ     NINV    IDIR    STRT    METRIC  HVINS   Q       WSEL    FQ

     0       2       0       0       .022    0       396.4

J2  NPROF    IPLOT   PRFVS   XSECV   XSECH   FN      ALLDC   IBW     CHNIM   ITRACE

    1        0       -1      0       0       0       0

    VARIABLE CODES FOR SUMMARY PRINTOUT

    150

NC      .08      .08      .05
QT        1     396.4
X         5        8     1623     1820
GR   1996.9     1490   1995.3     1540   1997.6     1590   1996.0     1623   1995.0     1715
GR   1993.1     1725   1995.0     1790   1996.0     1820

Q         1     396.0
X1        6        8     1740     1975
GR   2001.2     1740   1999.0     1800   1998.5     1815   1998.5     1835   1999.0     1910
GR   2000.3     1975   1999.6     2010   2000.2     2040

QT        1     395.4
X         7        8     1740     1840
GR   2003.4     1700   2002.4     1710   2003.2     1740   2003.2     1770   2002.4     1815
GR   2003.0     1840   2003.0     1850   2003.5     1880
```

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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    LOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST  .


*PROF 1

  ECNO 5.000
2096 WSEL NOT GIVEN, AVG OF MAX, MIN USED
    5.000      2.18   1995.28       .00       .00   1995.54       .26       .00       .00   1996.00
    396.4        .0     396.4        .0        .0      97.3        .0        .0        .0   1996.00
      .00       .00      4.07       .00      .000      .050      .000      .000   1993.10   1688.99
  .022028        0.        0.        0.         0         0         7       .00    109.49   1798.48


*SECNO 6.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 93 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    6.000       .94   1999.44   1999.44       .00   1999.75       .31       .00       .00   2001.20
    396.0        .0     396.0        .0        .0      88.2        .0        .0        .0   2000.30
      .00       .00      4.49       .00      .000      .050      .000      .000   1998.50   1788.04
  .043877        0.        0.        0.        20        18         0       .00    143.89   1931.93


*SECNO 7.000
3280 CROSS SECTION      7.00 EXTENDED       .09 FEET

3693 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    7.000      1.09   2003.49   2003.49       .00   2003.79       .29       .00       .00   2003.20
    395.4      85.6     284.8      25.0      26.8      60.0      12.3        .0        .0   2003.00
      .00      3.19      4.75      2.03      .080      .050      .080      .000   2002.40   1700.00
  .050448        0.        0.        0.        20        11         0       .00    179.69   1879.69
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THIS RUN EXECUTED 05JUL94 13:12:30

* **********
EC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

: MARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	5.000	.00	.00	.00	1993.10	396.40	1995.28	.00	1995.54	220.28	4.07	97.33	26.71
*	6.000	.00	.00	.00	1998.50	396.00	1999.44	1999.44	1999.75	438.77	4.49	88.18	18.91
*	7.000	.00	.00	.00	2002.40	395.40	2003.49	2003.49	2003.79	504.48	4.75	99.08	17.60

'UMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
5.000	396.40	1995.28	.00	.00	.00	109.49	.00
6.000	396.00	1999.44	.00	4.16	.00	143.89	.00
7.000	395.40	2003.49	.00	4.06	.00	179.69	.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
 AUTION SECNO=     6.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     6.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     6.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

.AUTION SECNO=     7.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     7.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
 AUTION SECNO=     7.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

CHANNELIZATION AND STRUCTURES

EX CULVERTS @ DYNAMYTE

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: dyna1

Comment: culvert cap

Solve For Full Flow Capacity

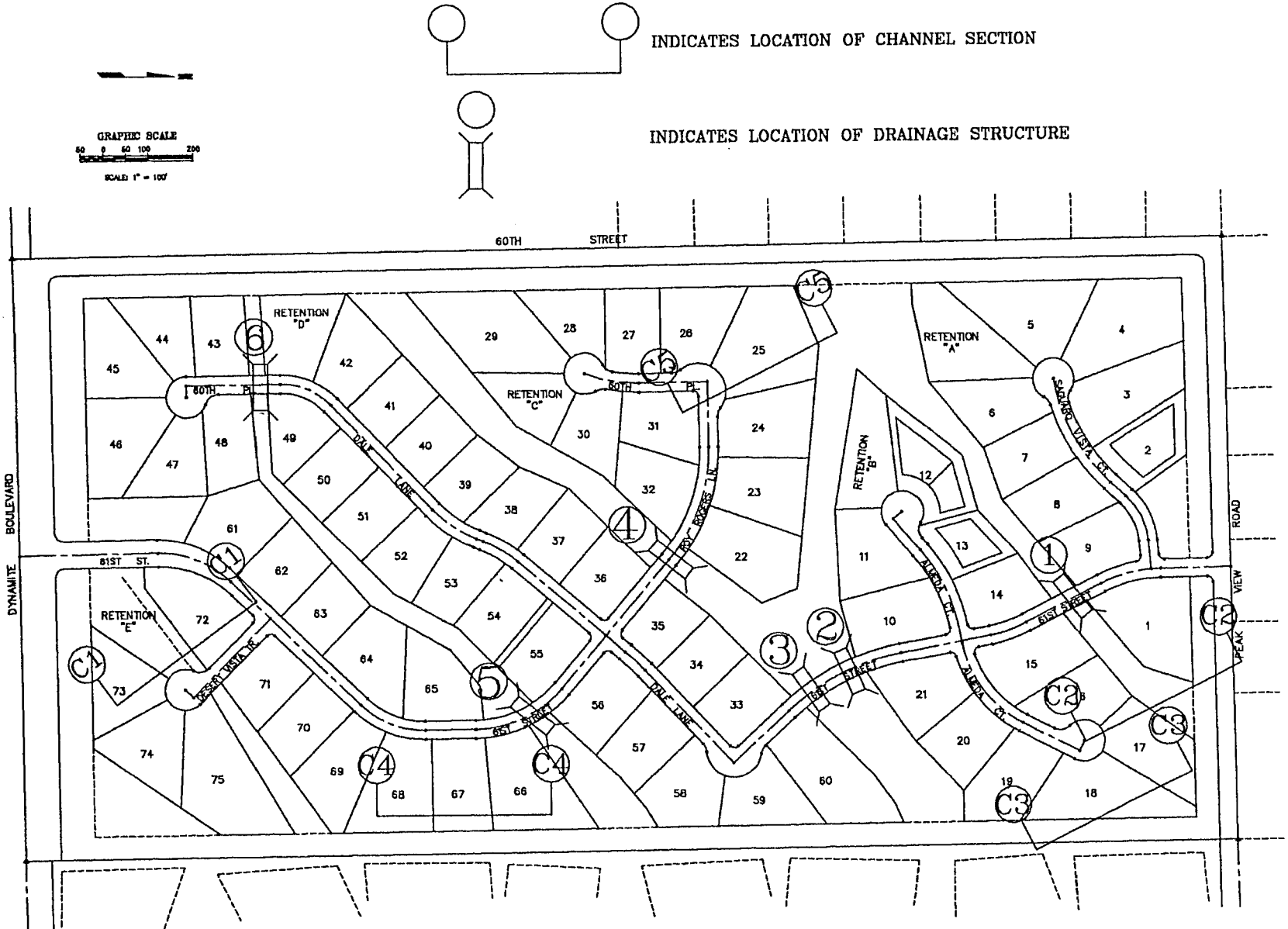
Given Input Data:

Diameter.....	1.50 ft
Slope.....	0.0176 ft/ft
Manning's n.....	0.015
Discharge.....	12.08 cfs X 2 = 24 cfs

Computed Results:

Full Flow Capacity.....	12.08 cfs
Full Flow Depth.....	1.50 ft
Velocity.....	6.83 fps
Flow Area.....	1.77 sf
Critical Depth....	1.32 ft
Critical Slope....	0.0159 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	12.08 cfs
QMAX @.94D.....	12.99 cfs
Froude Number.....	FULL

Open Channel Flow Module, Version 3.3 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708



DRAINAGE STRUCTURE AND CHANNELIZATION
KEY MAP

HAVILL ENGINEERING
a division of Tait & Associates, Inc.
engineering surveying environmental

STRUCTURE 1

FILE: PALOS2 SUMMARY OF CULVERT FLOWS (CFS) DATE: 07-07-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITER
2004.10	0	0	0	0	0	0	0	0	1
2004.93	54	54	0	0	0	0	0	0	1
2005.40	108	108	0	0	0	0	0	0	1
2005.78	161	161	0	0	0	0	0	0	1
2006.08	215	215	0	0	0	0	0	0	1
2006.35	269	269	0	0	0	0	0	0	1
2006.62	323	323	0	0	0	0	0	0	1
2006.91	377	377	0	0	0	0	0	0	1
2007.23	428	428	0	0	0	0	0	0	1
2007.47	484	464	0	0	0	0	0	18	4
2007.66	538	484	0	0	0	0	0	50	4
2007.25	431	431	0	0	0	0	0	0	

PRESS: <P> TO PLOT TOTAL RATING CURVE
<T> TO DISPLAY TABLE FOR EACH CULVERT
<E> TO DISPLAY ERROR TABLE
<R> TO PRINT REPORT
<H> TO RETURN TO HEADWATER TABLE
<ENTER> TO RETURN TO OPTION MENU

-Help 2-Progr 3-Time 4 5-End 6 7 8 9-DOS 10

URRENT DATE: 07-07-1994
CURRENT TIME: 08:54:58

FILE DATE: 07-06-1994
FILE NAME: PALOS2

CROSSING 1

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	2004.10	2003.80	60.00	3 IRCP	15.20	2.53	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS2 DATE: 07-06-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2004.10	0	0	0	0	0	0	0	0	1
2004.93	54	54	0	0	0	0	0	0	1
2005.40	108	108	0	0	0	0	0	0	1
2005.78	161	161	0	0	0	0	0	0	1
2006.08	215	215	0	0	0	0	0	0	1
2006.35	269	269	0	0	0	0	0	0	1
2006.62	323	323	0	0	0	0	0	0	1
2006.91	377	377	0	0	0	0	0	0	1
2007.23	428	428	0	0	0	0	0	0	1
2007.47	484	464	0	0	0	0	0	18	4
2007.66	538	484	0	0	0	0	0	50	4
2007.25	431	431	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS2 DATE: 07-06-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
2004.10	0.00	0	0	0.00
2004.93	0.00	54	0	0.00
2005.40	0.00	108	0	0.00
2005.78	0.00	161	0	0.00
2006.08	0.00	215	0	0.00
2006.35	0.00	269	0	0.00
2006.62	0.00	323	0	0.00
2006.91	0.00	377	0	0.00
2007.23	0.00	428	0	0.00
2007.47	-0.01	484	2	0.51
2007.66	-0.01	538	4	0.72

:1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-07-1994
CURRENT TIME: 08:54:58

CROSSING 1

FILE DATE: 07-06-1994
FILE NAME: PALOS2

PERFORMANCE CURVE FOR CULVERT # 1 - 3 (15.2 BY 2.53) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	2004.10	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
54	2004.93	0.83	0.83	1-S2n	0.31	0.35	3.93	0.31	2.57	0.64
108	2005.40	1.30	1.30	1-S2n	0.50	0.56	4.98	0.50	3.29	0.97
161	2005.78	1.68	1.68	1-S2n	0.65	0.75	5.82	0.65	3.79	1.22
215	2006.08	1.98	1.98	1-S2n	0.80	0.90	6.39	0.80	4.18	1.44
269	2006.35	2.25	2.25	1-S2n	0.94	1.05	6.93	0.94	4.50	1.64
323	2006.62	2.52	2.52	1-S2n	1.08	1.19	7.35	1.08	4.78	1.81
377	2006.91	2.81	2.81	5-S2n	1.21	1.32	7.73	1.21	5.02	1.98
428	2007.23	3.13	3.13	5-S2n	1.35	1.44	8.03	1.35	5.23	2.13
464	2007.47	3.37	3.37	5-S2n	1.45	1.52	8.18	1.46	5.44	2.28
484	2007.62	3.52	3.52	5-S2n	1.51	1.56	8.31	1.51	5.62	2.41

El. inlet face invert 2004.10 ft El. outlet invert 2003.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   2004.10
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  2003.80
     NUMBER OF BARRELS                         3
     SLOPE (V-FT/H-FT)                         0.0050
     CULVERT LENGTH ALONG SLOPE (FT)          60.00

***** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            15.20 FT
     BARREL RISE             2.53 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-07-1994
CURRENT TIME: 08:54:58

FILE DATE: 07-06-1994
FILE NAME: PALOS2

CROSSING 1

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	0.00	0.00	0.00
2	1.00	0.75	0.00
3	2.00	1.32	0.00
4	3.00	1.75	0.00
5	4.00	2.10	0.00
6	5.00	2.35	0.00
7	6.00	2.45	0.00
8	7.00	2.50	0.00
9	7.60	2.53	0.00
10	8.00	2.52	0.00
11	9.00	2.49	0.00
12	10.00	2.30	0.00
13	11.00	2.08	0.00
14	12.00	1.75	0.00
15	13.00	1.35	0.00
16	14.00	0.80	0.00
17	15.00	0.10	0.00
18	15.20	0.00	0.00

CURRENT DATE: 07-07-1994
CURRENT TIME: 08:54:58

FILE DATE: 07-06-1994
FILE NAME: PALOS2

CROSSING 1

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	30.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.015
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	2003.80
CULVERT NO.1 OUTLET INVERT ELEVATION	2003.80 FT

****** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	2003.80	0.000	0.00	0.00	0.00
53.80	2004.44	0.565	0.64	2.57	0.60
107.60	2004.77	0.591	0.97	3.29	0.90
161.40	2005.02	0.604	1.22	3.79	1.14
215.20	2005.24	0.614	1.44	4.18	1.35
269.00	2005.44	0.620	1.64	4.50	1.53
322.80	2005.61	0.625	1.81	4.78	1.70
376.60	2005.78	0.629	1.98	5.02	1.85
428.00	2005.93	0.632	2.13	5.23	1.99
484.20	2006.08	0.635	2.28	5.44	2.13
538.00	2006.21	0.638	2.41	5.62	2.26

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	2007.79
2	5.00	2007.63
3	10.00	2007.46
4	15.00	2007.34
5	20.00	2007.27
6	25.00	2007.25
7	65.00	2007.25
8	70.00	2007.27
9	75.00	2007.34
10	80.00	2007.46
11	85.00	2007.63
12	90.00	2007.79

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:06:12

FILE DATE: 07-15-1994
FILE NAME: PALOS4

STRUCTURE 2

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	2001.63	2001.03	60.00	2 IRCP	15.70	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS4 DATE: 07-15-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2001.63	0	0	0	0	0	0	0	0	1
2002.48	34	34	0	0	0	0	0	0	1
2002.85	68	68	0	0	0	0	0	0	1
2003.23	103	103	0	0	0	0	0	0	1
2003.54	137	137	0	0	0	0	0	0	1
2003.80	171	171	0	0	0	0	0	0	1
2004.04	205	205	0	0	0	0	0	0	1
2004.26	239	239	0	0	0	0	0	0	1
2004.49	274	274	0	0	0	0	0	0	1
2004.49	274	274	0	0	0	0	0	0	1
2004.96	342	342	0	0	0	0	0	0	1
2006.00	460	460	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS4 DATE: 07-15-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
2001.63	0.00	0	0	0.00
2002.48	0.00	34	0	0.00
2002.85	0.00	68	0	0.00
2003.23	0.00	103	0	0.00
2003.54	0.00	137	0	0.00
2003.80	0.00	171	0	0.00
2004.04	0.00	205	0	0.00
2004.26	0.00	239	0	0.00
2004.49	0.00	274	0	0.00
2004.49	0.00	274	0	0.00
2004.96	0.00	342	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1994 FILE DATE: 07-15-1994
CURRENT TIME: 10:06:12 FILE NAME: PALOS4

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (15.7 BY 3) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	2001.63	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.60
34	2002.48	0.85	0.85	1-S2n	0.21	0.33	4.07	0.21	1.82	1.11
68	2002.85	1.22	1.22	1-S2n	0.36	0.53	6.21	0.36	2.35	1.36
103	2003.23	1.60	1.60	1-S2n	0.46	0.69	7.26	0.46	2.72	1.57
137	2003.54	1.91	1.91	1-S2n	0.57	0.85	7.55	0.60	3.01	1.75
171	2003.80	2.17	2.17	1-S2n	0.66	0.98	8.09	0.70	3.26	1.91
205	2004.04	2.41	2.41	1-S2n	0.74	1.11	8.60	0.80	3.47	2.05
239	2004.26	2.63	2.63	1-S2n	0.82	1.23	8.99	0.89	3.65	2.18
274	2004.49	2.86	2.86	1-S2n	0.90	1.35	9.35	0.99	3.82	2.31
274	2004.49	2.86	2.86	1-S2n	0.91	1.35	9.36	0.99	3.82	2.31
342	2004.96	3.33	3.33	5-S2n	1.06	1.56	10.02	1.17	4.12	2.54

El. inlet face invert 2001.63 ft El. outlet invert 2001.03 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   2001.63
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  2001.03
     NUMBER OF BARRELS                         2
     SLOPE (V-FT/H-FT)                         0.0100
     CULVERT LENGTH ALONG SLOPE (FT)          60.00

***** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            15.70 FT
     BARREL RISE             3.00 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:06:12

FILE DATE: 07-15-1994
FILE NAME: PALOS4

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	0.00	0.00	0.00
2	1.00	1.05	0.00
3	2.00	1.60	0.00
4	3.00	2.05	0.00
5	4.00	2.40	0.00
6	5.00	2.70	0.00
7	6.00	2.85	0.00
8	7.00	2.95	0.00
9	7.85	3.00	0.00
10	8.00	3.00	0.00
11	9.00	2.95	0.00
12	10.00	2.80	0.00
13	11.00	2.60	0.00
14	12.00	2.30	0.00
15	13.00	1.93	0.00
16	14.00	1.40	0.00
17	15.00	0.83	0.00
18	15.70	0.00	0.00

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:06:12

FILE DATE: 07-15-1994
FILE NAME: PALOS4

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	35.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	2001.63
CULVERT NO.1 OUTLET INVERT ELEVATION	2001.03 FT

****** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	2001.63	0.000	0.00	0.00	0.00
34.20	2002.14	0.450	0.51	1.82	0.32
68.40	2002.39	0.474	0.76	2.35	0.48
102.60	2002.60	0.487	0.97	2.72	0.61
136.80	2002.78	0.496	1.15	3.01	0.72
171.00	2002.94	0.502	1.31	3.26	0.81
205.20	2003.08	0.507	1.45	3.47	0.91
239.40	2003.21	0.511	1.58	3.65	0.99
273.60	2003.34	0.515	1.71	3.82	1.07
274.00	2003.34	0.515	1.71	3.82	1.07
342.00	2003.57	0.520	1.94	4.12	1.21

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00
CREST LENGTH (FT)	20.00
OVERTOPPING CREST ELEVATION (FT)	2006.00

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:41:27

STRUCTURE 3

FILE DATE: 07-15-1994
FILE NAME: PALOS4

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	2001.63	2001.03	60.00	4 IRCP	15.70	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS4 DATE: 07-15-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2001.63	0	0	0	0	0	0	0	0	1
2002.51	70	70	0	0	0	0	0	0	1
2002.86	139	139	0	0	0	0	0	0	1
2003.24	209	209	0	0	0	0	0	0	1
2003.55	278	278	0	0	0	0	0	0	1
2003.82	348	348	0	0	0	0	0	0	1
2004.06	417	417	0	0	0	0	0	0	1
2004.29	487	487	0	0	0	0	0	0	1
2004.58	556	556	0	0	0	0	0	0	1
2004.58	557	557	0	0	0	0	0	0	1
2005.13	695	695	0	0	0	0	0	0	1
2006.00	901	901	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS4 DATE: 07-15-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
2001.63	0.00	0	0	0.00
2002.51	0.00	70	0	0.00
2002.86	0.00	139	0	0.00
2003.24	0.00	209	0	0.00
2003.55	0.00	278	0	0.00
2003.82	0.00	348	0	0.00
2004.06	0.00	417	0	0.00
2004.29	0.00	487	0	0.00
2004.58	0.00	556	0	0.00
2004.58	0.00	557	0	0.00
2005.13	0.00	695	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:41:27

FILE DATE: 07-15-1994
FILE NAME: PALOS4

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (15.7 BY 3) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	2001.63	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.60
70	2002.51	0.88	0.88	1-S2n	0.21	0.33	4.11	0.21	2.37	1.37
139	2002.86	1.23	1.23	1-S2n	0.36	0.53	5.99	0.38	3.03	1.76
209	2003.24	1.61	1.61	1-S2n	0.47	0.70	7.30	0.47	3.48	2.06
278	2003.55	1.92	1.92	1-S2n	0.58	0.86	7.59	0.60	3.84	2.33
348	2003.82	2.19	2.19	1-S2n	0.66	0.99	8.13	0.71	4.14	2.56
417	2004.06	2.43	2.43	1-S2n	0.75	1.12	8.64	0.81	4.39	2.77
487	2004.29	2.66	2.66	1-S2n	0.83	1.25	9.03	0.90	4.61	2.97
556	2004.58	2.88	2.95	1-S1f	0.91	1.36	4.18	3.00	4.81	3.15
557	2004.58	2.89	2.95	1-S1f	0.92	1.36	4.18	3.00	4.82	3.16
695	2005.13	3.38	3.50	4-FFt	1.07	1.58	5.22	3.00	5.16	3.49

El. inlet face invert 2001.63 ft El. outlet invert 2001.03 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   2001.63
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  2001.03
     NUMBER OF BARRELS                         4
     SLOPE (V-FT/H-FT)                         0.0100
     CULVERT LENGTH ALONG SLOPE (FT)          60.00

***** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            15.70 FT
     BARREL RISE             3.00 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:41:27

FILE DATE: 07-15-1994
FILE NAME: PALOS4

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	0.00	0.00	0.00
2	1.00	1.05	0.00
3	2.00	1.60	0.00
4	3.00	2.05	0.00
5	4.00	2.40	0.00
6	5.00	2.70	0.00
7	6.00	2.85	0.00
8	7.00	2.95	0.00
9	7.85	3.00	0.00
10	8.00	3.00	0.00
11	9.00	2.95	0.00
12	10.00	2.80	0.00
13	11.00	2.60	0.00
14	12.00	2.30	0.00
15	13.00	1.93	0.00
16	14.00	1.40	0.00
17	15.00	0.83	0.00
18	15.70	0.00	0.00

CURRENT DATE: 07-15-1994
CURRENT TIME: 10:41:27

FILE DATE: 07-15-1994
FILE NAME: PALOS4

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	35.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	2001.63
CULVERT NO.1 OUTLET INVERT ELEVATION	2001.03 FT

****** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	2001.63	0.000	0.00	0.00	0.00
69.50	2002.40	0.475	0.77	2.37	0.48
139.00	2002.79	0.496	1.16	3.03	0.72
208.50	2003.09	0.507	1.46	3.48	0.91
278.00	2003.36	0.515	1.73	3.84	1.08
347.50	2003.59	0.521	1.96	4.14	1.22
417.00	2003.80	0.525	2.17	4.39	1.36
486.50	2004.00	0.528	2.37	4.61	1.48
556.00	2004.18	0.531	2.55	4.81	1.59
557.00	2004.19	0.531	2.56	4.82	1.60
695.00	2004.52	0.535	2.89	5.16	1.80

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00
CREST LENGTH (FT)	20.00
OVERTOPPING CREST ELEVATION (FT)	2006.00

CURRENT DATE: 07-26-1994
CURRENT TIME: 10:43:15

FILE DATE: 07-06-1994
FILE NAME: PALOS2

STRUCTURE 4

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1996.17	1995.57	60.00	3 IRCP	15.70	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS2 DATE: 07-06-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1996.17	0	0	0	0	0	0	0	0	1
1997.11	70	70	0	0	0	0	0	0	1
1997.66	139	139	0	0	0	0	0	0	1
1998.09	209	209	0	0	0	0	0	0	1
1998.44	278	278	0	0	0	0	0	0	1
1998.75	348	348	0	0	0	0	0	0	1
1999.05	417	417	0	0	0	0	0	0	1
1999.37	487	487	0	0	0	0	0	0	1
1999.66	556	543	0	0	0	0	0	9	5
1999.66	557	544	0	0	0	0	0	9	2
2000.02	695	607	0	0	0	0	0	91	4
1999.54	519	519	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS2 DATE: 07-06-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1996.17	0.00	0	0	0.00
1997.11	0.00	70	0	0.00
1997.66	0.00	139	0	0.00
1998.09	0.00	209	0	0.00
1998.44	0.00	278	0	0.00
1998.75	0.00	348	0	0.00
1999.05	0.00	417	0	0.00
1999.37	0.00	487	0	0.00
1999.66	-0.01	556	3	0.62
1999.66	1.00	557	4	0.73
2000.02	0.00	695	-3	-0.39

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-26-1994
CURRENT TIME: 10:43:15

FILE DATE: 07-06-1994
FILE NAME: PALOS2

PERFORMANCE CURVE FOR CULVERT # 1 - 3 (15.7 BY 3) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1996.17	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.60
70	1997.11	0.94	0.94	1-S2n	0.28	0.40	5.02	0.28	1.98	1.16
139	1997.66	1.49	1.49	1-S2n	0.43	0.65	7.01	0.43	2.57	1.45
209	1998.09	1.92	1.92	1-S2n	0.58	0.86	7.59	0.60	2.99	1.68
278	1998.44	2.27	2.27	1-S2n	0.69	1.04	8.38	0.74	3.33	1.88
348	1998.75	2.58	2.58	1-S2n	0.80	1.21	8.90	0.87	3.61	2.06
417	1999.05	2.88	2.88	1-S2n	0.91	1.36	9.39	1.00	3.85	2.23
487	1999.37	3.20	3.20	5-S2n	1.02	1.51	9.84	1.13	4.07	2.38
543	1999.66	3.49	3.49	5-S2n	1.10	1.62	10.24	1.21	4.26	2.53
544	1999.66	3.49	3.49	5-S2n	1.10	1.62	10.25	1.21	4.27	2.53
607	2000.01	3.84	3.84	5-S2n	1.20	1.75	10.56	1.33	4.61	2.79

El. inlet face invert 1996.17 ft El. outlet invert 1995.57 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   1996.17
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  1995.57
     NUMBER OF BARRELS                         3
     SLOPE (V-FT/H-FT)                         0.0100
     CULVERT LENGTH ALONG SLOPE (FT)          60.00

**** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            15.70 FT
     BARREL RISE             3.00 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-26-1994
CURRENT TIME: 10:43:15

FILE DATE: 07-06-1994
FILE NAME: PALOS2

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	0.00	0.00	0.00
2	1.00	1.05	0.00
3	2.00	1.60	0.00
4	3.00	2.05	0.00
5	4.00	2.40	0.00
6	5.00	2.70	0.00
7	6.00	2.85	0.00
8	7.00	2.95	0.00
9	7.85	3.00	0.00
10	8.00	3.00	0.00
11	9.00	2.95	0.00
12	10.00	2.80	0.00
13	11.00	2.60	0.00
14	12.00	2.30	0.00
15	13.00	1.93	0.00
16	14.00	1.40	0.00
17	15.00	0.83	0.00
18	15.70	0.00	0.00

CURRENT DATE: 07-26-1994
CURRENT TIME: 10:43:15

FILE DATE: 07-06-1994
FILE NAME: PALOS2

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	60.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	1996.17
CULVERT NO.1 OUTLET INVERT ELEVATION	1995.57 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1996.17	0.000	0.00	0.00	0.00
69.50	1996.73	0.464	0.56	1.98	0.35
139.00	1997.02	0.491	0.85	2.57	0.53
208.50	1997.25	0.507	1.08	2.99	0.68
278.00	1997.45	0.517	1.28	3.33	0.80
347.50	1997.63	0.525	1.46	3.61	0.91
417.00	1997.80	0.532	1.63	3.85	1.02
486.50	1997.95	0.537	1.78	4.07	1.11
556.00	1998.10	0.541	1.93	4.26	1.20
557.00	1998.10	0.541	1.93	4.27	1.20
695.00	1998.36	0.548	2.19	4.61	1.37

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	10.00	2000.58
2	20.00	2000.37
3	30.00	2000.15
4	40.00	1999.91
5	50.00	1999.70
6	60.00	1999.58
7	70.00	1999.54
8	130.00	1999.54
9	140.00	1999.64
10	150.00	1999.93
11	160.00	2000.25
12	170.00	2000.44
13	180.00	2000.51
14	190.00	2000.44

URRENT DATE: 07-15-1994
CURRENT TIME: 14:19:43

FILE DATE: 07-15-1994
FILE NAME: PALOS5

STRUCTURE 5

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1996.13	1995.53	60.00	1 IRCP	15.20	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS5 DATE: 07-15-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1996.13	0	0	0	0	0	0	0	0	1
1997.03	17	17	0	0	0	0	0	0	1
1997.36	34	34	0	0	0	0	0	0	1
1997.74	52	52	0	0	0	0	0	0	1
1998.05	69	69	0	0	0	0	0	0	1
1998.32	86	86	0	0	0	0	0	0	1
1998.56	103	103	0	0	0	0	0	0	1
1998.78	120	120	0	0	0	0	0	0	1
1999.01	138	138	0	0	0	0	0	0	1
1999.02	138	138	0	0	0	0	0	0	1
1999.50	172	172	0	0	0	0	0	0	1
1999.50	172	172	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS5 DATE: 07-15-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1996.13	0.00	0	0	0.00
1997.03	0.00	17	0	0.00
1997.36	0.00	34	0	0.00
1997.74	0.00	52	0	0.00
1998.05	0.00	69	0	0.00
1998.32	0.00	86	0	0.00
1998.56	0.00	103	0	0.00
1998.78	0.00	120	0	0.00
1999.01	0.00	138	0	0.00
1999.02	0.00	138	0	0.00
1999.50	0.00	172	0	0.00

1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1994
CURRENT TIME: 14:19:43

FILE DATE: 07-15-1994
FILE NAME: PALOS5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (15.2 BY 3) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1996.13	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
17	1997.03	0.90	0.90	1-S2n	0.21	0.34	4.16	0.21	1.48	0.37
34	1997.36	1.23	1.23	1-S2n	0.36	0.54	6.04	0.38	1.92	0.56
52	1997.74	1.61	1.61	1-S2n	0.47	0.71	7.38	0.47	2.22	0.71
69	1998.05	1.92	1.92	1-S2n	0.58	0.86	7.65	0.61	2.47	0.84
86	1998.32	2.19	2.19	1-S2n	0.66	1.00	8.18	0.71	2.67	0.95
103	1998.56	2.43	2.43	1-S2n	0.75	1.13	8.68	0.81	2.84	1.06
120	1998.78	2.65	2.65	1-S2n	0.83	1.25	9.09	0.91	3.00	1.16
138	1999.01	2.88	2.88	1-S2n	0.91	1.37	9.44	1.00	3.14	1.25
138	1999.02	2.89	2.89	1-S2n	0.91	1.37	9.45	1.01	3.14	1.25
172	1999.50	3.37	3.37	5-S2n	1.06	1.59	10.15	1.18	3.39	1.42

El. inlet face invert 1996.13 ft El. outlet invert 1995.53 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   1996.13
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  1995.53
     NUMBER OF BARRELS                        1
     SLOPE (V-FT/H-FT)                        0.0100
     CULVERT LENGTH ALONG SLOPE (FT)         60.00

**** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            15.20 FT
     BARREL RISE             3.00 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-15-1994
CURRENT TIME: 14:19:43

FILE DATE: 07-15-1994
FILE NAME: PALOS5

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	0.00	0.00	0.00
2	1.00	1.05	0.00
3	2.00	1.60	0.00
4	3.00	2.05	0.00
5	4.00	2.40	0.00
6	5.00	2.70	0.00
7	6.00	2.85	0.00
8	7.00	2.95	0.00
9	7.85	3.00	0.00
10	8.00	3.00	0.00
11	9.00	2.95	0.00
12	10.00	2.80	0.00
13	11.00	2.60	0.00
14	12.00	2.30	0.00
15	13.00	1.93	0.00
16	14.00	1.40	0.00
17	15.00	0.75	0.00
18	15.20	0.00	0.00

CURRENT DATE: 07-15-1994
CURRENT TIME: 14:19:43

FILE DATE: 07-15-1994
FILE NAME: PALOS5

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	30.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	1995.53
CULVERT NO.1 OUTLET INVERT ELEVATION	1995.53 FT

****** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1995.53	0.000	0.00	0.00	0.00
17.20	1995.90	0.429	0.37	1.48	0.23
34.40	1996.09	0.453	0.56	1.92	0.35
51.60	1996.24	0.466	0.71	2.22	0.44
68.80	1996.37	0.475	0.84	2.47	0.52
86.00	1996.48	0.482	0.95	2.67	0.59
103.20	1996.59	0.487	1.06	2.84	0.66
120.40	1996.69	0.491	1.16	3.00	0.72
137.60	1996.78	0.494	1.25	3.14	0.78
138.00	1996.78	0.495	1.25	3.14	0.78
172.00	1996.95	0.500	1.42	3.39	0.89

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00
CREST LENGTH (FT)	35.00
OVERTOPPING CREST ELEVATION (FT)	1999.50

CURRENT DATE: 07-15-1994
CURRENT TIME: 15:20:27

FILE DATE: 07-15-1994
FILE NAME: PALOS6

STRUCTURE 6

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.1

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1980.13	1979.53	60.00	1 IRCP	17.50	2.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: PALOS6 DATE: 07-15-1994

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1980.13	0	0	0	0	0	0	0	0	1
1980.89	19	19	0	0	0	0	0	0	1
1981.32	38	38	0	0	0	0	0	0	1
1981.69	57	57	0	0	0	0	0	0	1
1981.97	76	76	0	0	0	0	0	0	1
1982.22	95	95	0	0	0	0	0	0	1
1982.46	114	114	0	0	0	0	0	0	1
1982.70	133	133	0	0	0	0	0	0	1
1982.97	152	152	0	0	0	0	0	0	1
1983.17	171	164	0	0	0	0	0	6	4
1983.31	190	173	0	0	0	0	0	16	3
1983.00	154	154 (50)	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PALOS6 DATE: 07-15-1994

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1980.13	0.00	0	0	0.00
1980.89	0.00	19	0	0.00
1981.32	0.00	38	0	0.00
1981.69	0.00	57	0	0.00
1981.97	0.00	76	0	0.00
1982.22	0.00	95	0	0.00
1982.46	0.00	114	0	0.00
1982.70	0.00	133	0	0.00
1982.97	0.00	152	0	0.00
1983.17	-0.00	171	1	0.29
1983.31	-0.01	190	1	0.51

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1994
CURRENT TIME: 15:20:27

FILE DATE: 07-15-1994
FILE NAME: PALOS6

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (17.5 BY 2.5) IRCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1980.13	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
19	1980.89	0.76	0.76	1-S2n	0.23	0.33	4.44	0.23	9.59	0.06
38	1981.32	1.19	1.19	1-S2n	0.36	0.53	5.94	0.38	12.61	0.10
57	1981.69	1.56	1.56	1-S2n	0.48	0.70	7.09	0.48	14.78	0.13
76	1981.97	1.84	1.84	1-S2n	0.57	0.85	7.54	0.60	16.55	0.15
95	1982.22	2.09	2.09	1-S2n	0.66	0.99	8.08	0.71	18.05	0.17
114	1982.46	2.33	2.33	1-S2n	0.76	1.11	8.60	0.80	19.38	0.19
133	1982.70	2.57	2.57	5-S2n	0.84	1.24	8.98	0.91	20.57	0.21
152	1982.97	2.84	2.84	5-S2n	0.92	1.35	9.37	1.00	21.66	0.23
164	1983.16	3.03	3.03	5-S2n	0.98	1.42	9.59	1.06	22.67	0.24
173	1983.31	3.18	3.18	5-S2n	1.02	1.47	9.74	1.11	23.61	0.26

El. inlet face invert 1980.13 ft El. outlet invert 1979.53 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
**** SITE DATA ***** CULVERT INVERT **************
     INLET STATION (FT)                        0.00
     INLET ELEVATION (FT)                   1980.13
     OUTLET STATION (FT)                      60.00
     OUTLET ELEVATION (FT)                  1979.53
     NUMBER OF BARRELS                          1
     SLOPE (V-FT/H-FT)                          0.0100
     CULVERT LENGTH ALONG SLOPE (FT)          60.00

**** CULVERT DATA SUMMARY ************************
     BARREL SHAPE          USER DEFINED
     BARREL SPAN            17.50 FT
     BARREL RISE             2.50 FT
     BARREL MATERIAL       CONCRETE
     BARREL MANNING'S N    0.012 FOR SIDES AND TOP
                           0.012 FOR BOTTOM
     INLET TYPE             CONVENTIONAL
     INLET EDGE AND WALL    HEADWALL
     INLET DEPRESSION       NONE
```

CURRENT DATE: 07-15-1994
CURRENT TIME: 15:20:27

FILE DATE: 07-15-1994
FILE NAME: PALOS6

**** USER DEFINED CULVERT CROSS-SECTION - CULVERT # 1

COORDINATE NUMBER	X (FT)	Y-TOP (FT)	Y-BOTTOM (FT)
1	1.25	0.00	0.00
2	2.00	0.63	0.00
3	3.00	1.19	0.00
4	4.00	1.60	0.00
5	5.00	1.87	0.00
6	6.00	2.10	0.00
7	7.00	2.30	0.00
8	8.00	2.40	0.00
9	9.00	2.48	0.00
10	10.00	2.50	0.00
11	11.00	2.48	0.00
12	12.00	2.40	0.00
13	13.00	2.30	0.00
14	14.00	2.10	0.00
15	15.00	1.87	0.00
16	16.00	1.60	0.00
17	17.00	1.19	0.00
18	18.00	0.63	0.00
19	18.75	0.00	0.00

CURRENT DATE: 07-15-1994
CURRENT TIME: 15:20:27

FILE DATE: 07-15-1994
FILE NAME: PALOS6

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	30.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	4.000
MANNING'S N (.01-0.1)	0.050
CHANNEL INVERT ELEVATION (FT)	1979.53
CULVERT NO.1 OUTLET INVERT ELEVATION	1979.53 FT

****** UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1979.53	0.000	0.00	0.00	0.00
19.00	1979.59	6.604	0.06	9.59	16.34
38.00	1979.63	7.056	0.10	12.61	24.75
57.00	1979.66	7.330	0.13	14.78	31.54
76.00	1979.68	7.527	0.15	16.55	37.46
95.00	1979.70	7.682	0.17	18.05	42.81
114.00	1979.72	7.809	0.19	19.38	47.73
133.00	1979.74	7.918	0.21	20.57	52.33
152.00	1979.76	8.012	0.23	21.66	56.67
171.00	1979.77	8.095	0.24	22.67	60.79
190.00	1979.79	8.169	0.26	23.61	64.73

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00
CREST LENGTH (FT)	30.00
OVERTOPPING CREST ELEVATION (FT)	1983.00

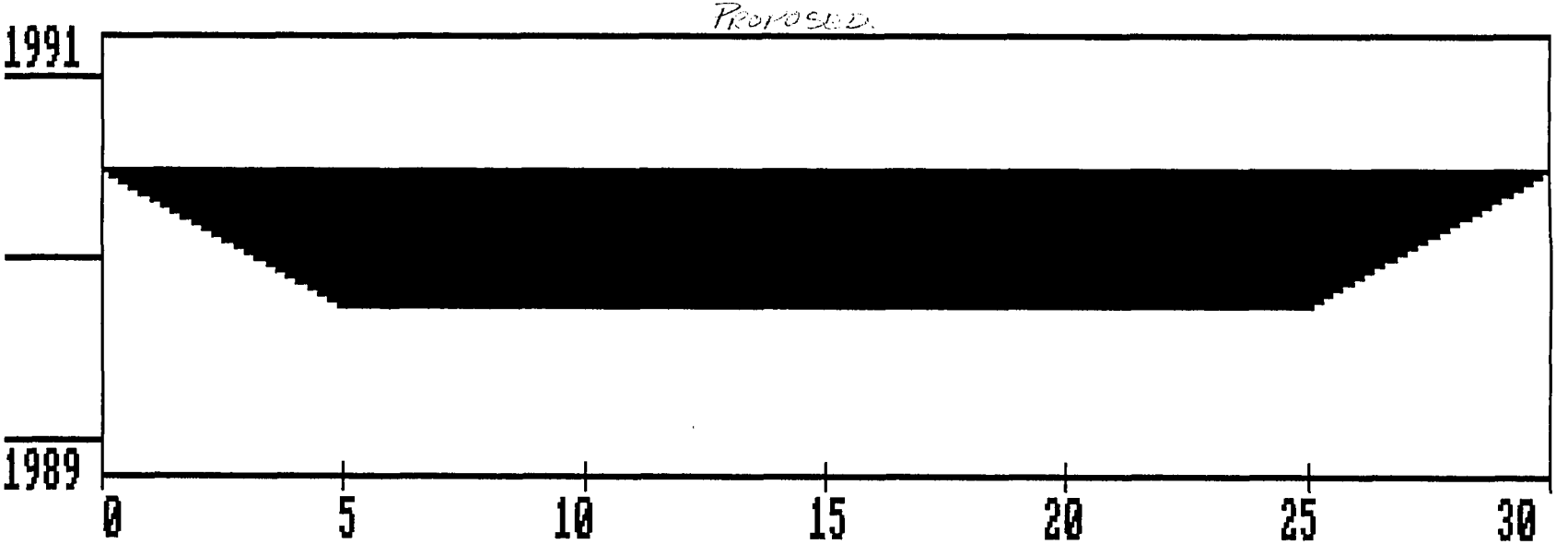
CHANNEL SECTION C-1

lot 72
Channel Slope = 1.818 %
file: lot 18

POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	1990.50	
			0.035
2	5.00	1989.75	
			0.035
3	25.00	1989.75	
			0.035
4	30.00	1990.50	

Water Surface Elevation 1990.5 ft.
Depth of Flow = 0.750 ft.
Channel Slope = 1.818 %
Flow Area = 18.75 sf.

Flow = 81.9 cfs.
Velocity = 4.37 fps.
Froud No.= 0.97
Subcritical Flow



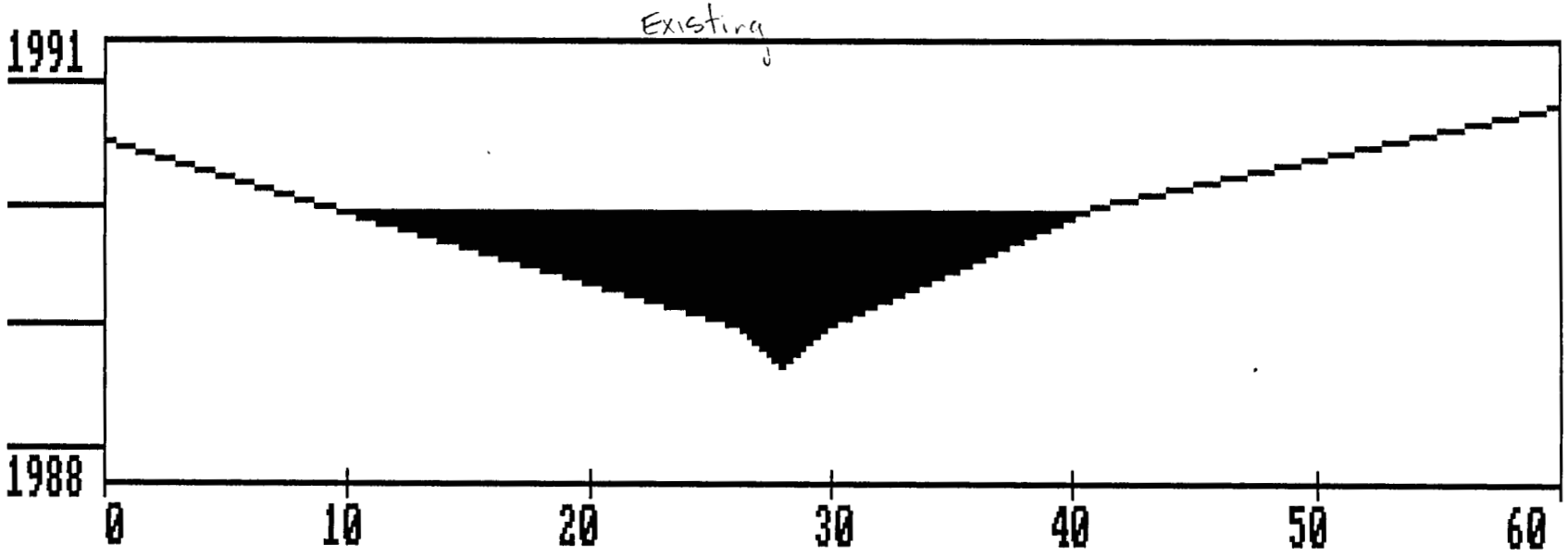
1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 18 lot 72 Slope = 1.818 %

Water Surface Elevation 1989.95 ft.
Depth of Flow = 1.250 ft.
Channel Slope = 1.818 %
Flow Area = 17.03 sf.

Flow = 70.6 cfs.
Velocity = 4.14 fps.
Froud No.= 0.98
Subcritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

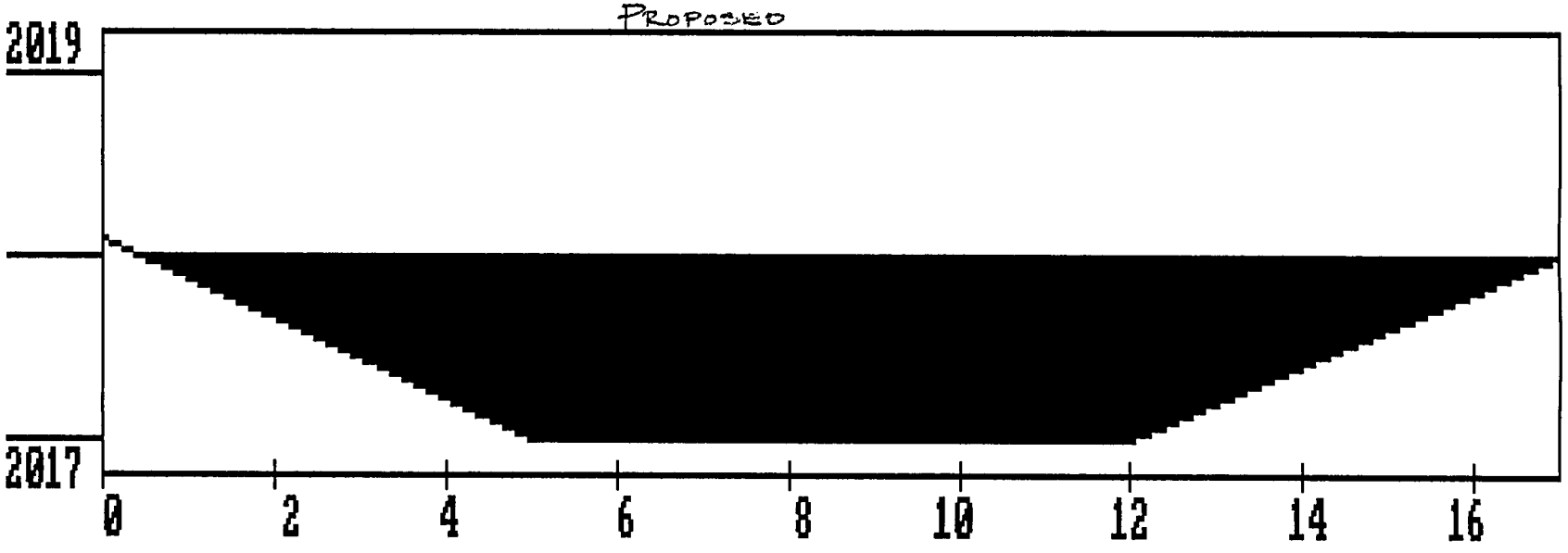
File: lot 18 lot 72 Slope = 1.818 %

lot 72
Channel Slope = 1.818 % Existing
file: lot 18

POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	1990.50	
			0.035
2	9.00	1990.00	
			0.035
3	26.00	1989.00	
			0.035
4	28.00	1988.70	
			0.035
5	30.00	1989.00	
			0.035
6	41.00	1990.00	
			0.035
7	60.00	1990.80	

Water Surface Elevation 2018 ft.
Depth of Flow = 1.000 ft.
Channel Slope = 0.710 %
Flow Area = 11.77 sf.

Flow = 35.6[illegible] cfs.
Velocity = 3.03 fps.
Froud No.= 0.63
Subcritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 17 lot17 Slope = 0.710 %

CHANNEL SECTION C-2

lot17 – PROPOSED
Channel Slope = .71 %
file: lot 17

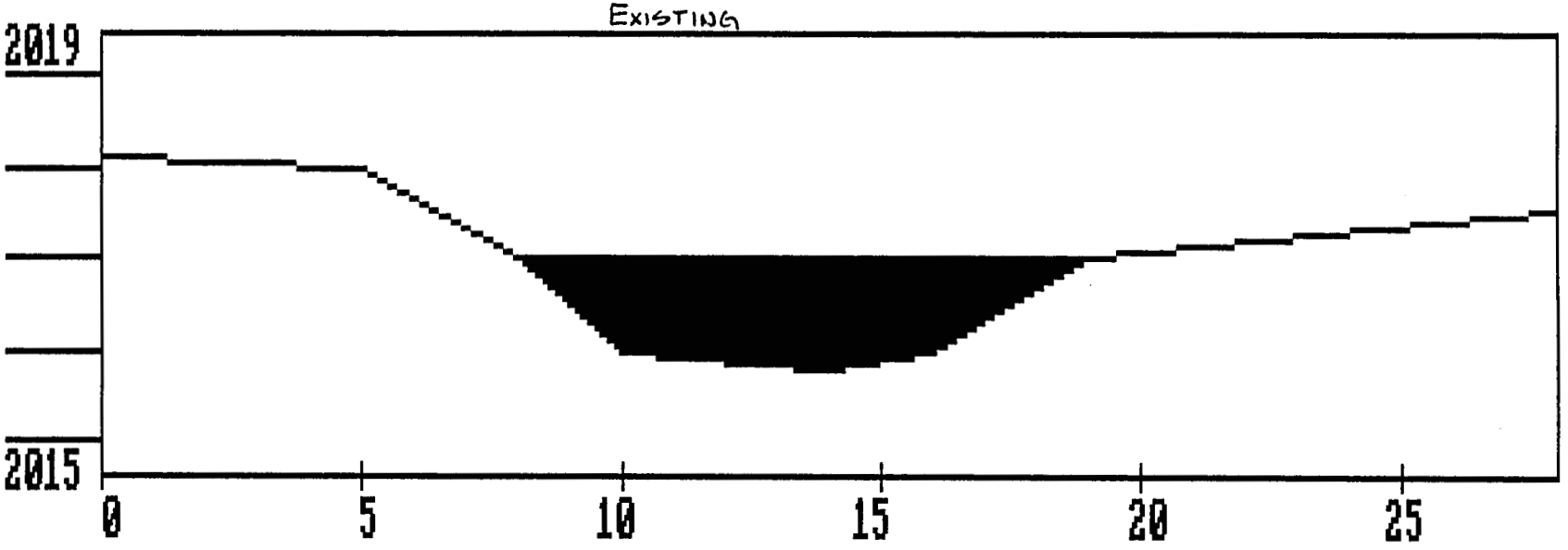
POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	2018.10	
			0.035
2	5.00	2017.00	
			0.035
3	12.00	2017.00	
			0.035
4	17.00	2018.00	

Water Surface Elevation = 2018 ft.
Depth of Flow = 1.000 ft.
Channel Slope = 0.710 %
Flow Area = 11.773 sf.

Flow = 35.65 cfs.
Velocity = 3.03 fps.
Froud No.= 0.63
Subcritical Flow

Water Surface Elevation 2017 ft.
Depth of Flow = 1.200 ft.
Channel Slope = 0.710 %
Flow Area = 9.10 sf.

Flow = 30.4 cfs.
Velocity = 3.35 fps.
Froud No.= 0.65
Subcritical Flow



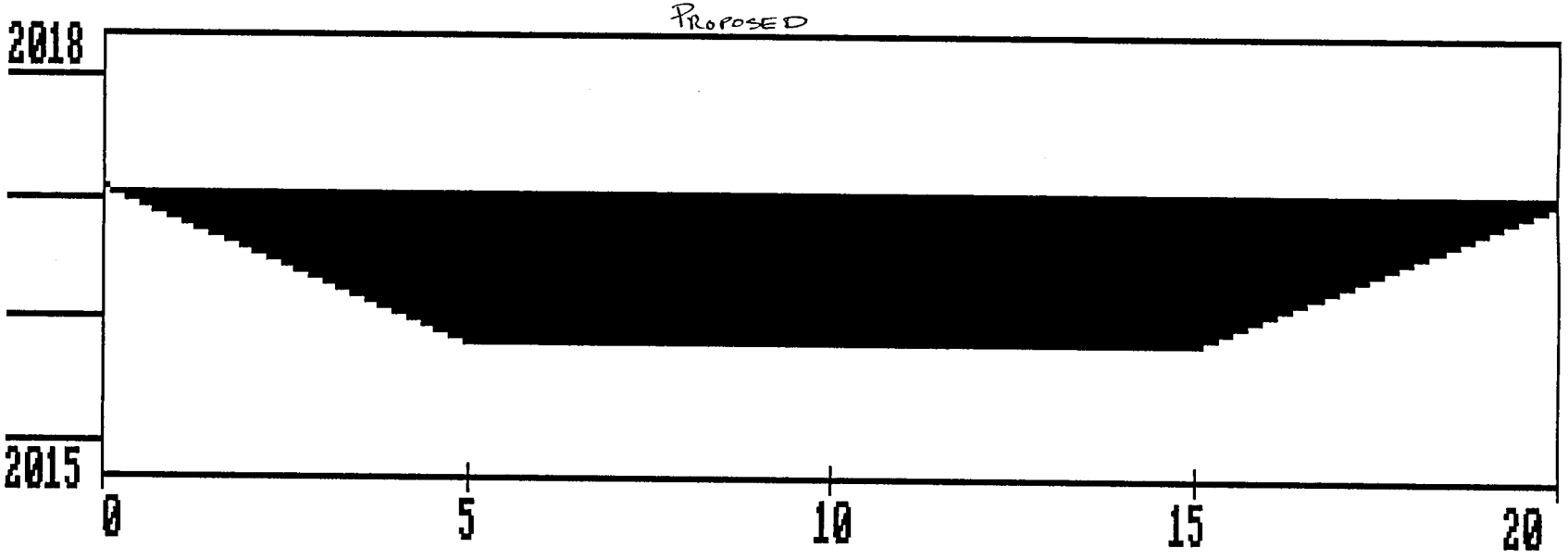
1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 17 lot17 Slope = 0.710 %

Water Surface Elevation 2017.03 ft.
Depth of Flow = 1.230 ft.
Channel Slope = 1.818 %
Flow Area = 18.36 sf.

Flow = 105.6[illegible] cfs.
Velocity = 5.75 fps.
Froud No.= 1.05
Supercritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 18 lot 18 Slope = 1.818 %

CHANNEL SECTION C-3

lot 18
Channel Slope = 1.818 % Proposed.
file: lot 18

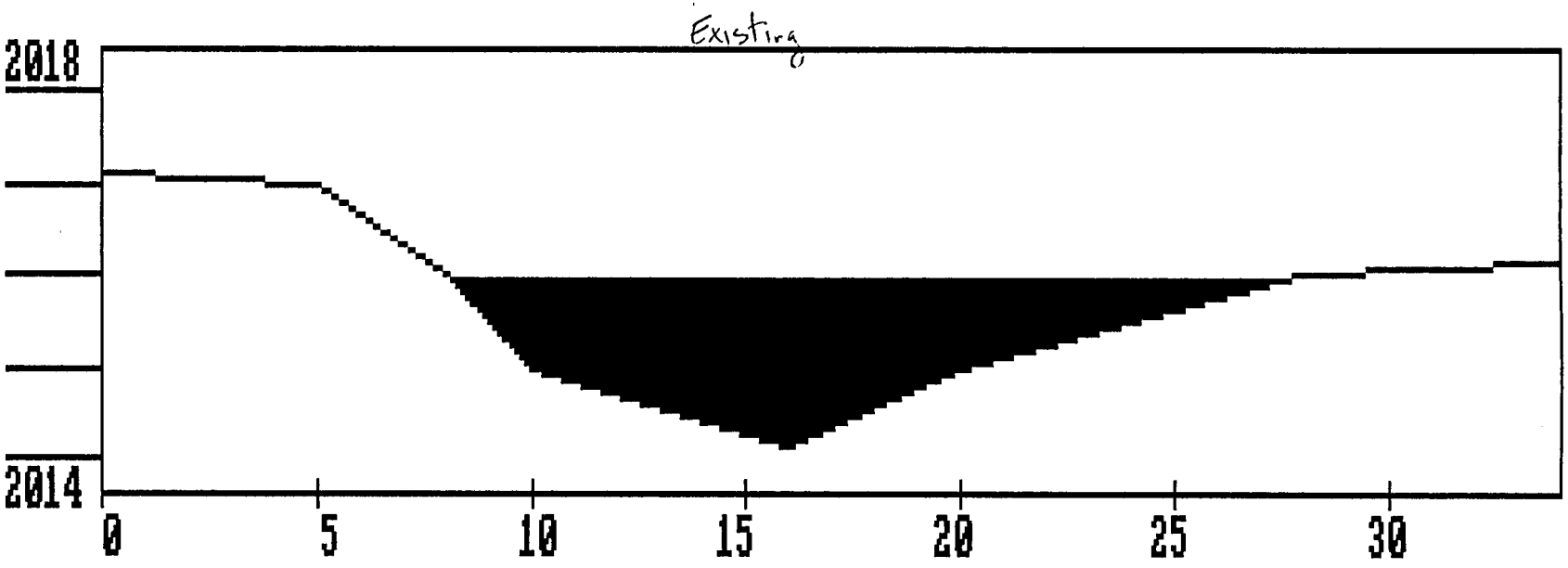
POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	2017.10	
			0.035
2	5.00	2015.80	
			0.035
3	15.00	2015.80	
			0.035
4	20.00	2017.00	

Water Surface Elevation = 2017.03 ft.
Depth of Flow = 1.230 ft.
Channel Slope = 1.818 %
Flow Area = 18.359 sf.

Flow = 105.63 cfs.
Velocity = 5.75 fps.
Froud No.= 1.05
Supercritical Flow

Water Surface Elevation 2015.91 ft.
Depth of Flow = 1.750 ft.
Channel Slope = 1.818 %
Flow Area = 17.44 sf.

Flow = 104.9 cfs.
Velocity = 6.02 fps.
Froud No.= 1.11
Supercritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 18 lot 18 Slope = 1.818 %

lot 18
Channel Slope = 1.818 % Existing
file: lot 18

POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	2017.10	
			0.035
2	5.00	2017.00	
			0.035
3	8.00	2016.00	
			0.035
4	10.00	2015.00	
			0.035
5	16.00	2014.16	
			0.035
6	20.00	2015.00	
			0.035
7	28.00	2016.00	
			0.035
8	34.00	2016.10	

Water Surface Elevation = 2015.91 ft.
Depth of Flow = 1.750 ft.
Channel Slope = 1.818 %
Flow Area = 17.440 sf.

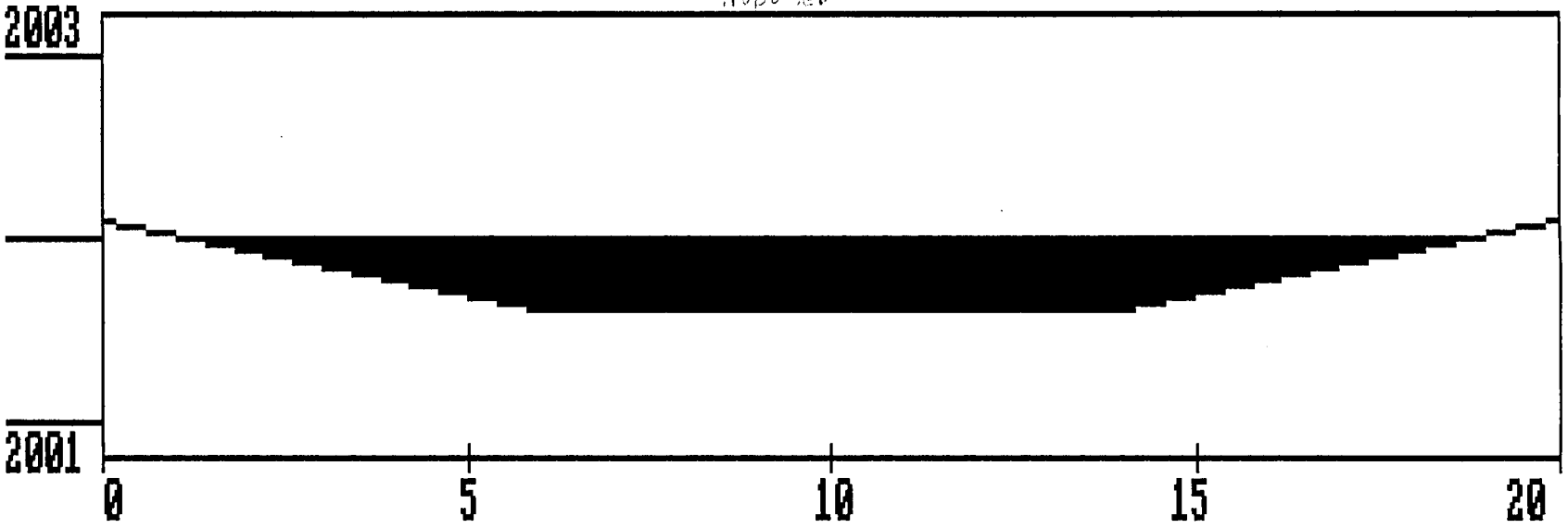
Flow = 104.96 cfs.
Velocity = 6.02 fps.
Froud No.= 1.11
Supercritical Flow

CHANNEL SECTION C-4

Water Surface Elevation 2002.009 ft.
Depth of Flow = 0.409 ft.
Channel Slope = 2.000 %
Flow Area = 5.28 sf.

Flow = 15.0[illegible] cfs.
Velocity = 2.84 fps.
Froud No.= 0.92
Subcritical Flow

Proposed



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 18 lot 67 Slope = 2.000 %

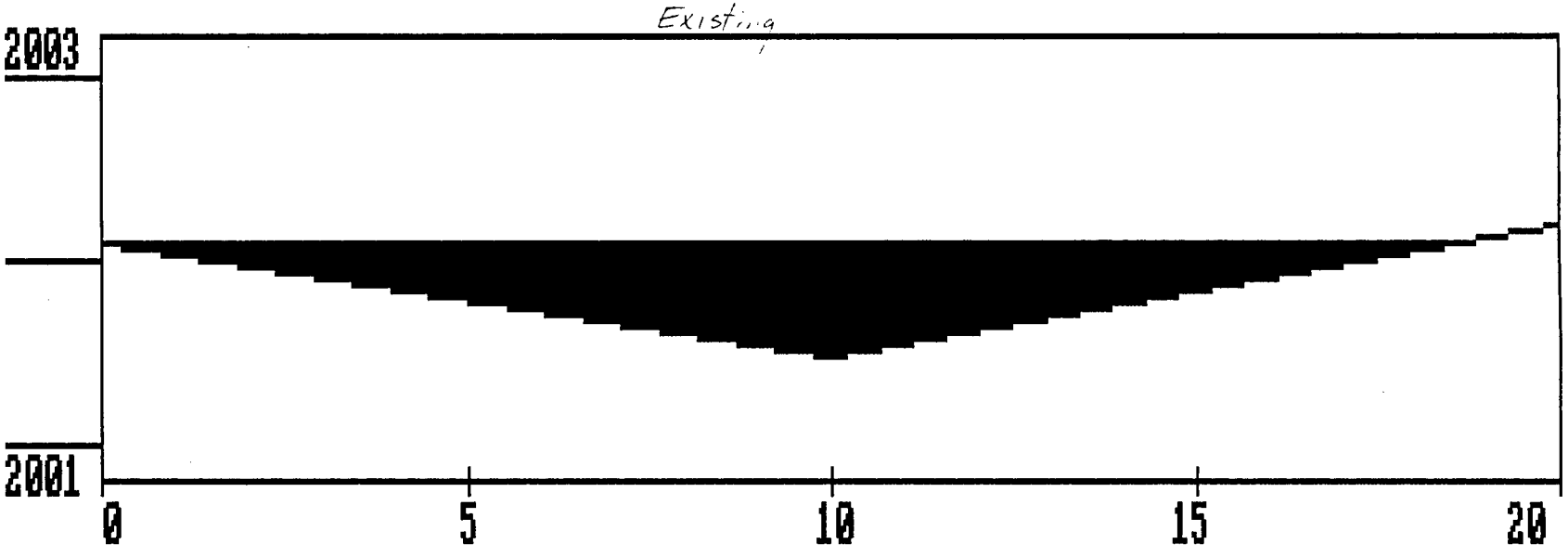
lot 67
Channel Slope = 2 %
file: lot 18

Proposed

POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	2002.10	
			0.035
2	6.00	2001.60	
			0.035
3	14.00	2001.60	
			0.035
4	20.00	2002.10	

Water Surface Elevation 2002.1 ft.
Depth of Flow = 0.600 ft.
Channel Slope = 2.000 %
Flow Area = 5.57 sf.

Flow = 14.9 cfs.
Velocity = 2.69 fps.
Froud No.= 0.86
Subcritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: lot 18 lot 67 Slope = 2.000 %

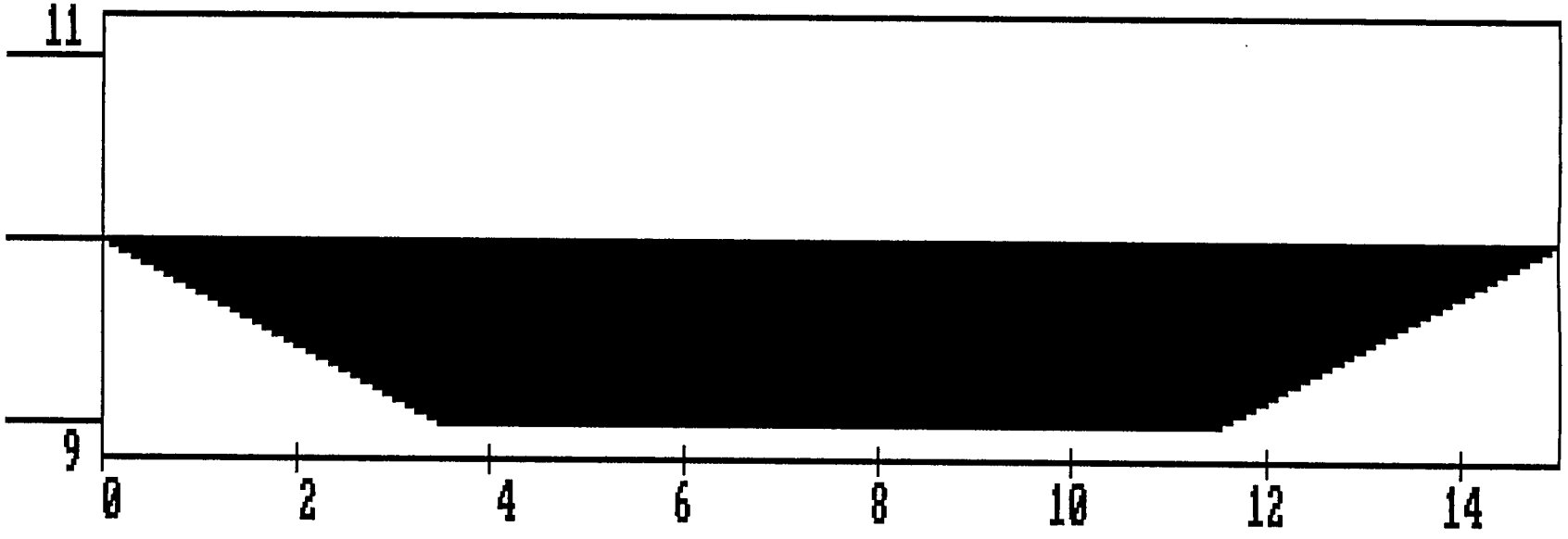
lot 67
Channel Slope = 2 %
file: lot 18

Existing

POINT	OFFSET	ELEVATION	ROUGHNESS
1	0.00	2002.10	
			0.035
2	10.00	2001.50	
			0.035
3	20.00	2002.20	

Water Surface Elevation 10 ft.
Depth of Flow = 1.000 ft.
Channel Slope = 3.330 %
Flow Area = 11.50 sf.

Flow = 137.5 cfs.
Velocity = 11.96 fps.
Froud No.= 2.41
Supercritical Flow



1. Input Flow / Solve for Depth
2. Input Depth / Solve for Flow
3. Input Water Elevation / Solve for Flow
4. Input Flow & Depth / Solve for Slope
5. Stage Discharge
6. Printout
7. Edit Cross-Section Data
8. Load Another Cross-Section
9. Exit Program

YOUR OPTION...?

File: 3111-24 CHANNEL FOR LOTS 24-27 Slope = 3.330 %

CHANNEL SECTION C-5