UPPER EAST FORK CAVE CREEK

AREA DRAINAGE MASTER STUDY

TECHNICAL SUBMITTALS

PREPARED BY

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UPPER EAST FORK CAVE CREEK AREA DRAINAGE MASTER STUDY

EXECUTIVE SUMMARY

ABSTRACT

CONCLUSIONS

RECOMMENDATIONS

CHAPTER 1

INTRODUCTION

OBJECTIVE

This Report on the Upper East Fork of Cave Creek Area Drainage Master Study has been prepared for the Flood Control District of Maricopa County, the City of Phoenix and the Maricopa County Highway Department to achieve the following objectives:

1. To document the status of existing runoff and flooding conditions in the study area.

2. To identify and evaluate alternatives for providing 100-year flood protection throughout the study area.

3. To identify improvements needed to implement the recommended alternative.

4. To develop cost estimates and preliminary engineering design data for the proposed flood protection plan.

STUDY AREA

The study area is shown on Figure 1.1. It includes approximately 16 square miles, encompassing the watershed of the Upper East Fork of Cave Creek.

The area is bounded on the north by the Granite Reef Aqueduct of the Central Arizona Project. The Paradise Valley Detention Structure prevents runoff from entering the study area from the north.

The east and southeast edge of the study area is the Cave Creek - Indian Bend Wash divide. The study area is bounded by Lookout Mountain to the south and by Cave Creek to the west.

STUDY GUIDELINES

Under the terms of NBS/Lowry's agreement with the Flood Control District of Maricopa County, this study has been completed using the following guidelines:

1. Runoff modeling has been performed using the Soil Conservation Service TR-20 model.
2. Subdrainage area boundaries have been selected to correlate with those boundaries used in the "North Central Area Master Storm Drainage Study (East Half)" completed in 1981 for the City of Phoenix.
3. Calibration and flowpath routing of the TR-20 model has been based on a 100-year flood. Runoff computations for 10-year, 50-year and 500-year floods have been extrapolated using the flowpaths identified for a 100-year flood.

LAND USE

Development within the study area is proceeding very rapidly. The majority of the area is zoned residential. Commercial development is occurring along major thoroughfares such as Bell Road and Cave Creek Road.

ACKNOWLEDGMENTS

The completion of this report was made possible by many individuals whose assistance and cooperation is gratefully acknowledged. We especially wish to thank Ms. Teresa Dominguez, Ms. Sue Mutschler and Mr. Tim Sutko of the Flood Control District of Maricopa County, Mr. Dwayne Williams of the City of Phoenix, Engineering Department and Mr. Gordon Heiniger and Mr. Dick Wallace of the Maricopa County Highway Department.

Ms. Barbara Lewis and Ms. Marty Rozelle of Dames and Moore were responsible for the public involvement coordination associated with this study.

PROJECT STAFF

The individuals that were responsible for the preparation of this report were directed by Mr. Geza E. Kmetty, P.E., R.L.S., who served as principal in charge and project manager. Mr. Kmetty was assisted by Mr. William Booth, P.E., R.L.S., chief engineer. Dr. Gary L. Guymon, PhD, P.E. served as technical advisor for this study and was responsible for developing computerized finite element modeling techniques to simulate overland flow in the study area. Mr. M. Shawn Fleming, Mr. Brian Fry, and Mr. Dennis Phinney served as project staff. Graphics were prepared by Mr. Sam Maccherola.

CHAPTER 2

ENGINEERING AND PLANNING CRITERIA

DRAINAGE AREA CHARACTERISTICS

Subdrainage Areas

The Study area has been divided into 144 subdrainage areas shown on Plate 2.1 (not included in this draft). These subdrainage areas range in size from 0.025 to .35 square miles.

Characteristic data describing each subdrainage area is detailed in Table 2.1.

Land Use and Zoning

Table 2.2 summarizes existing land use in the study area. Future land use is summarized in Table 2.3.

Existing land use patterns used in this study are based on an aerial photograph of the study area taken in November, 1985. Future land use patterns are based on current zoning information obtained from the City of Phoenix and County of Maricopa.

Soils

Soils in the drainage area are classified by the Soil Conservation Service as being Type D in the higher elevations. Type B soils are prominent in the lower alluvial floodplains.

Curve Numbers

The SCS TR-20 hydrologic procedure combines the soil type, land use, and type of cover into a hydrologic soil cover complex or "curve number". In an urban area, the predominant factor in determining runoff is the percentage of impervious surfaces. The impervious area percentage varies with zoning and type of development. Curve numbers have been developed by the City of Phoenix for a number of zoning and soil classifications.

Composite curve numbers for each subdrainage area have been developed for both existing and future conditions using the weighted average method considering the various combinations of land use and soil types therein.

UPPER EAST FORK - CAVE CREEK ADMS

DRAINAGE AREA NO.	AREA [SQ. MI.]	RUNOFF CURVE NO.	TIME OF CONCENT. [HRS.]
1	0.148	95	0.30
2	0.097	95	0.19
3	0.047	77	0.36
4	0.195	95	0.22
5	0.125	77	0.56
6	0.109	81	0.82
7	0.117	77	0.69
8	0.131	78	0.75
9	0.198	77	0.93
10	0.095	77	0.56
11	0.234	77	0.84
12	0.07	77	0.42
13	0.125	82	0.61
14	0.177	83	0.39
15	0.073	82	0.89
16	0.119	86	0.54
17	0.059	95	0.17
18	0.184	78	0.72
19	0.022	95	0.17
20	0.064	95	0.17
21	0.189	83	0.58
22	0.153	83	0.47
23	0.091	95	0.23
24	0.198	81	0.46
25	0.089	83	0.43
26	0.067	85	0.31
27	0.188	80	1.20
28	0.156	79	0.93
29	0.25	78	1.03
30	0.25	79	0.97
31	0.084	77	0.58
32	0.18	77	0.93
33	0.234	77	1.14
34	0.125	84	0.73
35	0.125	83	0.49
36	0.125	83	0.48
37	0.125	83	0.25
38	0.125	79	0.44
39	0.125	85	0.53
40	0.094	82	0.51
41	0.172	84	0.38
42	0.078	83	0.22
43	0.047	86	0.17
44	0.125	83	0.30
45	0.125	86	0.51
46	0.125	82	0.29
47	0.125	82	0.31

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TABLE 2.1

UPPER EAST FORK - CAVE CREEK ADMS

DRAINAGE AREA NO.	AREA [SQ. MI.]	RUNOFF CURVE NO.	TIME OF CONCENT. [HRS.]
48	0.125	79	0.60
49	0.086	95	0.19
50	0.134	77	0.57
51	0.063	83	0.18
52	0.063	79	0.56
53	0.084	84	0.31
54	0.061	79	0.23
55	0.063	83	0.25
56	0.063	82	0.25
57	0.063	82	0.25
58	0.063	84	0.25
59	0.063	82	0.25
60	0.063	81	0.49
61	0.102	83	0.25
62	0.13	79	0.88
63	0.141	84	0.34
64	0.25	82	0.33
65	0.063	77	0.49
66	0.063	83	0.46
67	0.063	88	0.25
68	0.063	85	0.25
69	0.063	81	0.62
70	0.063	86	0.25
71	0.125	85	0.49
72	0.125	83	0.49
73	0.197	80	0.79
74	0.063	90	0.24
75	0.063	95	0.52
76	0.063	86	0.25
77	0.063	77	0.38
78	0.063	86	0.27
79	0.063	88	0.25
80	0.063	83	0.45
81	0.063	77	0.52
82	0.063	84	0.27
83	0.063	81	0.52
84	0.063	78	0.52
85	0.063	80	0.52
86	0.063	86	0.27
87	0.063	83	0.52
88	0.094	87	0.75
89	0.047	84	0.39
90	0.109	85	0.63
91	0.125	86	0.47
92	0.125	86	0.47
93	0.195	84	0.45
94	0.139	84	0.34
95	0.125	86	0.98

TABLE 2.1

UPPER EAST FORK - CAVE CREEK ADMS

DRAINAGE AREA NO.	AREA [SQ. MI.]	RUNOFF CURVE NO.	TIME OF CONCENT. [HRS.]
96	0.125	82	0.51
97	0.188	87	0.53
98	0.094	86	0.37
99	0.094	86	0.49
100	0.078	86	0.39
101	0.047	89	0.52
102	0.063	82	0.63
103	0.081	84	0.26
104	0.069	78	0.67
105	0.063	78	0.63
106	0.063	79	0.56
107	0.059	82	0.42
108	0.025	79	0.28
109	0.063	84	0.29
110	0.073	78	0.56
111	0.07	77	0.56
112	0.061	77	0.46
113	0.053	86	0.52
114	0.128	77	1.19
115	0.094	82	0.45
116	0.094	79	0.77
117	0.313	77	2.38
118	0.231	81	1.59
119	0.231	81	1.05
120	0.231	87	0.30
121	0.25	95	0.17
122	0.355	85	0.29
123	0.213	95	0.25
124	0.219	84	0.25
125	0.117	95	0.17
126	0.158	95	0.28
127	0.159	82	0.21
128	0.036	80	0.17
129	0.108	82	0.17
13	0.031	91	0.17
131	0.119	86	0.27
132	0.145	88	0.27
133	0.08	95	0.17
134	0.197	85	0.31
135	0.042	95	0.17
136	0.066	95	0.17
137	0.078	79	0.49
138	0.203	84	0.24
139	0.188	87	0.43
140	0.125	86	0.44
141	0.188	87	0.53
142	0.25	83	1.39
TOTAL	16.46		

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TABLE 2.1

PRESENT LAND USE

ZONING	TOTAL AREA IN SQ. MILES
C-0	0.024
C-1	0.006
C-2	0.709
C-3	0.049
PSC	0.027
IND PK	0.073
IND-1	0.000
P-1	0.002
PAD 6	0.148
PAD 8	0.322
PAD 10	0.157
PAD 11	0.032
PAD 12	0.020
PAD 13	0.114
PAD 14	0.008
PAD R1-8	0.223
R-2	0.671
R-3	1.230
R-3A	0.132
R-4	0.036
R-4A	0.489
R-5	0.179
R 1-6	1.589
R 1-7	0.296
R 1-8	2.134
R 1-10	0.482
R 1-14	0.241
R 1-18	0.004
R 1-35	0.012
RE-35	0.000
RE-43	1.678
S-1	1.187
UNDEV COM	0.381
UNDEV RES	3.805

TABLE 2.2

FUTURE LAND USE

ZONING	TOTAL AREA IN SQ. MILES
C-0	0.024
C-1	0.006
C-2	0.709
C-3	0.049
PSC	0.027
IND PK	0.073
IND-1	0.023
P-1	0.002
PAD 6	0.148
PAD 8	0.322
PAD 10	0.165
PAD 11	0.032
PAD 12	0.020
PAD 13	0.114
PAD 14	0.008
PAD R1-8	0.223
R-2	0.782
R-3	1.551
R-3A	0.150
R-4	0.164
R-4A	0.634
R-5	0.368
R 1-6	1.882
R 1-7	0.426
R 1-8	3.673
R 1-10	0.716
R 1-14	0.446
R 1-18	0.418
R 1-35	0.012
RE-35	0.070
RE-43	1.678
S-1	1.187
UNDEV COM	0.381

TABLE 2.3

Table 2.4 shows the curve numbers for each zoning and soil type used to develop weighted average curve numbers for each subdrainage area.

A minimum curve number of 95 was used in areas having slopes in excess of 10%.

On-Site Detention

Where on-site detention is enforceable for future commercial and industrial developments, a curve number of 77 has been used. The low curve number allows for the regulatory intent that runoff will not be increased above preexisting conditions by these developments.

Time of Concentration

Time of concentration is defined by SCS as the time it takes for runoff to travel from the hydraulically most distant point in a watershed to the watershed outlet. The time of concentration for each subdrainage area was based on a sum of the overland flow time and the travel time in street gutters.

To estimate overland flow times for each subdrainage area the Upland Method has been used. Velocities used in the Upland method formula were taken from Figure 2.2.

The gutter flow travel time is defined as the time required for water to flow to the concentration point of a subdrainage area after it has reached the street. Gutter flow times of concentration have been estimating using figures contained in the "City of Phoenix Storm Drain Design Manual".

In no case was a time of concentration of less than 10 minutes used for any subdrainage area. Use of times of concentration less than 10 minutes results in TR-20 runoff calculations that are very inaccurate.

HYDROLOGIC CRITERIA

Rainfall Depths

Table 2.5 presents rainfall depths used for the 10-year, 50-year, 100-year and 500-year frequency storms.

The 10-year, 50-year and 100-year depths have been used for a number of previous studies in the Cave Creek watershed. The 500-year depth has been extrapolated using Gumbel's extreme value method in accordance with guidelines adopted by the National Weather Service.

CURVE NUMBER SELECTION BASED ON SOIL TYPE AND ZONING

ZONING	SOIL TYPE "B"	SOIL TYPE "C"	SOIL TYPE "D"
C-0	88		
C-1	92		
C-2	92		
C-3	92		
PSC	95		
IND PK	95		
IND-1	95		
P-1	95		
PAD 6	80	88	
PAD 8	82		
PAD 10	84		
PAD 11	84		
PAD 12	84		
PAD 13	85		
PAD 14	86		
PAD R1-8	82		
R-2	84		
R-3	85		90
R-3A	90		
R-4	86		
R-4A	86		
R-5	86		
R 1-6	84		
R 1-7	83		
R 1-8	82	87	90
R 1-10	81	86	
R 1-14	80		
R 1-18	80		
R 1-35	78		
RE-35	79		87
RE-43	77		
S-1	77		86

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TABLE 2.4

UPPER EAST FORK - CAVE CREEK AREA DRAINAGE MASTER STUDY

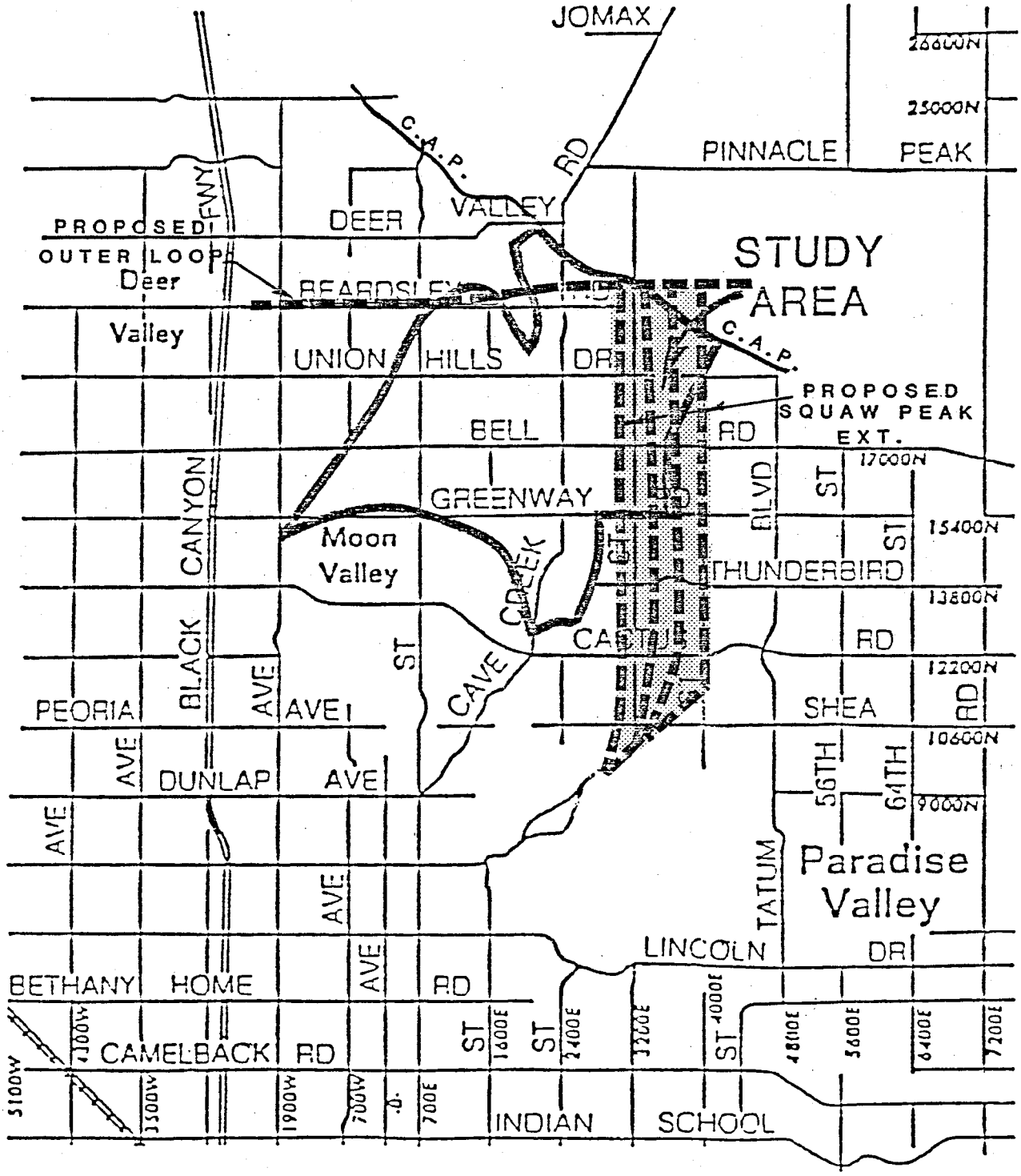

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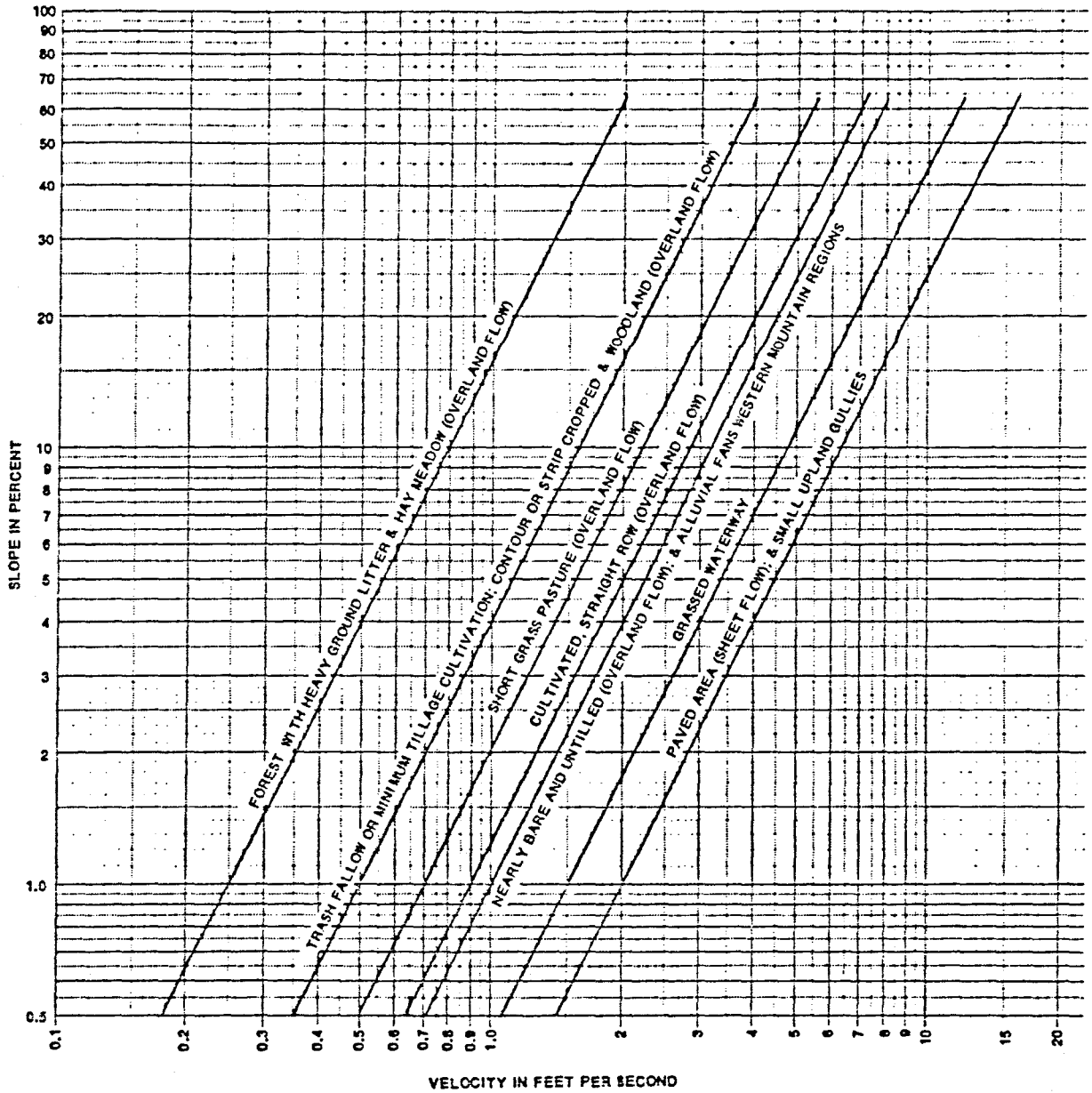
FIGURE 1.1



Velocities for upland method of estimating T_c

NBS/LOWRY

FIGURE 2.2

CITY OF PHOENIX
24-HOUR RAINFALL DEPTHS

RETURN PERIOD (YEARS)	RAINFALL DEPTH (INCHES)
10	2.53
50	3.57
100	4.04
500	5.07

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TABLE 2.5

24-Hour Rainfall Distribution

Table 2.6 presents the 24-hour rainfall distribution used in this study. This 24-hour distribution has the shape of an S-curve that is steeper than the Type I and Type II curves normally used by the Soil Conservation Service for TR-20 modeling. This S-curve has been used in numerous drainage studies in the Phoenix area.

COMPUTER MODELING TECHNIQUES

TR-20 Runoff Modeling

Runoff has been modeled throughout the study area using the Soil Conservation Service TR-20 model for the 10-year, 50-year, 100-year and 500-year frequency storms.

The TR-20 program can compute surface runoff for any synthetic or natural rainstorm. It takes into account conditions affecting runoff such as sizes of drainage areas, rainfall intensity vs time, time of concentration, soil permeability, channel flow characteristics and storage volumes.

From this input data, hydrographs are developed for all drainage areas at collection points. Using these hydrographs, flows are then routed through a drainage system and combined with other hydrographs to develop composite hydrographs. The peak discharges are then tabulated in summary tables. The SCS method of estimating direct runoff from storm rainfall is based on methods developed by SCS hydrologists at their small watershed research sites scattered throughout the United States.

The most recent version of the TR-20 model has been used in this study.

The updated version differs from previous versions in that the convex routing procedure is no longer used and has been replaced by the Att-Kin (Attenuated Kinematic) routing procedure. Use of the Att-Kin procedure requires assumptions regarding channel cross sections for modeling purposes. Figure 2.3 shows typical cross sections used to develop the Att-Kin coefficients ("X" and "m"). Nomographs, shown on Figures 2.4 and 2.5 have been used to solve for the Att-Kin coefficients for trapezoidal channels. For circular pipes, values for "x" and "m" are based on the following formulas taken from the United States Army Corps of Engineers HEC 1 Users Manual, Figure 3.6, page 25:

$$X = (0.804/n) \times S^{1/2} \times D^{1/6}$$

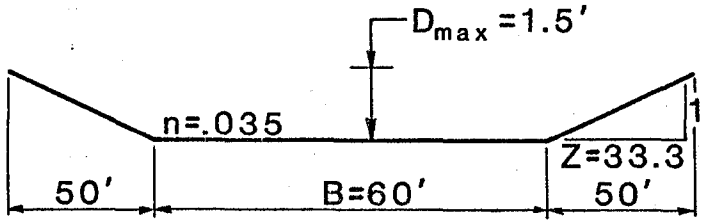
$$m = 5/4$$

24 HOUR RAINFALL DISTRIBUTION

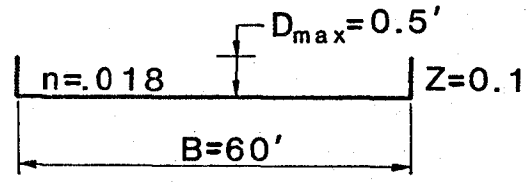
TIME (HOUR)	ACCUMULATIVE RAINFALL	TIME (HOUR)	ACCUMULATIVE RAINFALL
0	.000	12.5	.83
.5	.004	13.0	.86
1.0	.008	13.5	.88
1.5	.013	14.0	.893
2.0	.018	14.5	.907
2.5	.022	15.0	.92
3.0	.026	15.5	.924
3.5	.031	16.0	.928
4.0	.035	16.5	.933
4.5	.040	17.0	.937
5.0	.044	17.5	.942
5.5	.048	18.0	.947
6.0	.053	18.5	.951
6.5	.057	19.0	.956
7.0	.062	19.5	.96
7.5	.066	20.0	.964
8.0	.071	20.5	.969
8.5	.075	21.0	.973
9.0	.08	21.5	.978
9.5	.093	22.0	.982
10.0	.107	22.5	.987
10.5	.12	23.0	.991
11.0	.14	23.5	.995
11.5	.17	24.0	1.00
12.0	.50		

TABLE 2.6

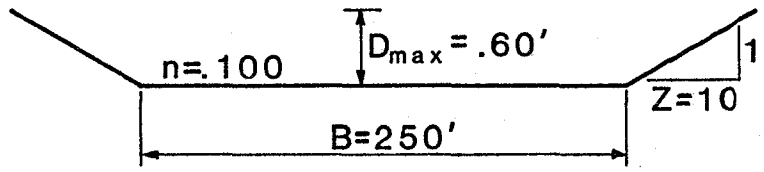
CROSS-SECTIONS USED FOR DETERMINING "X" & "m" IN THE EQUATION $Q=XA^m$ IN THE Att-Kin ROUTING PROCEDURE



STREET FLOW
(FLOW IN EXCESS OF CURB CAPACITY)



STREET FLOW
(FLOW CONTAINED WITHIN STREET)



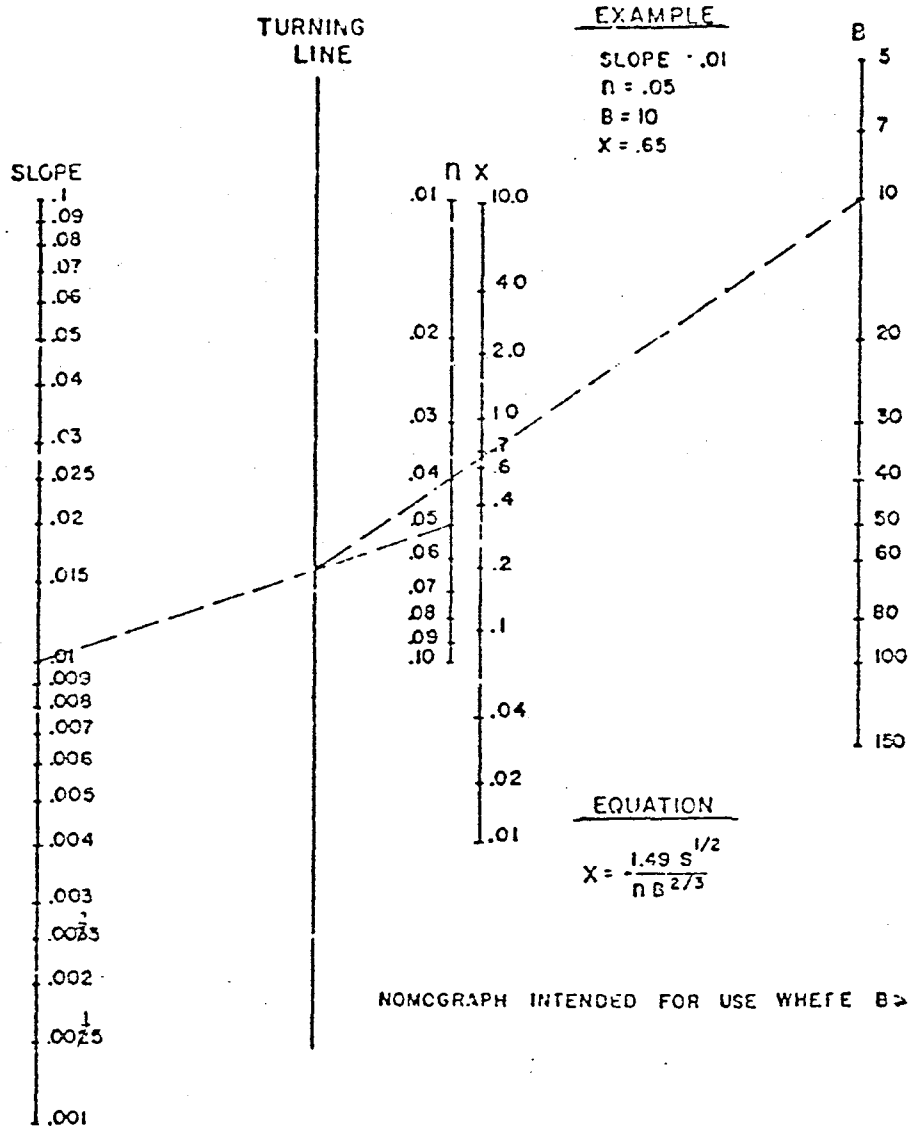
OVERLAND FLOW
(NATURAL DESERT)

FIGURE 2.3

NOMOGRAPH FOR ESTIMATING X FOR A TRAPEZOIDAL CHANNEL

$Q = XA^M$

SLOPE = BOTTOM SLOPE (FT/FT)
n = MANNING'S n
B = BOTTOM WIDTH (FT)



EXAMPLE

SLOPE = .01
n = .05
B = 10
X = .65

EQUATION

$$X = \frac{1.49\, S^{1/2}}{n\, B^{2/3}}$$

NOMOGRAPH INTENDED FOR USE WHERE B > 5 FT.

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FIGURE 2.4

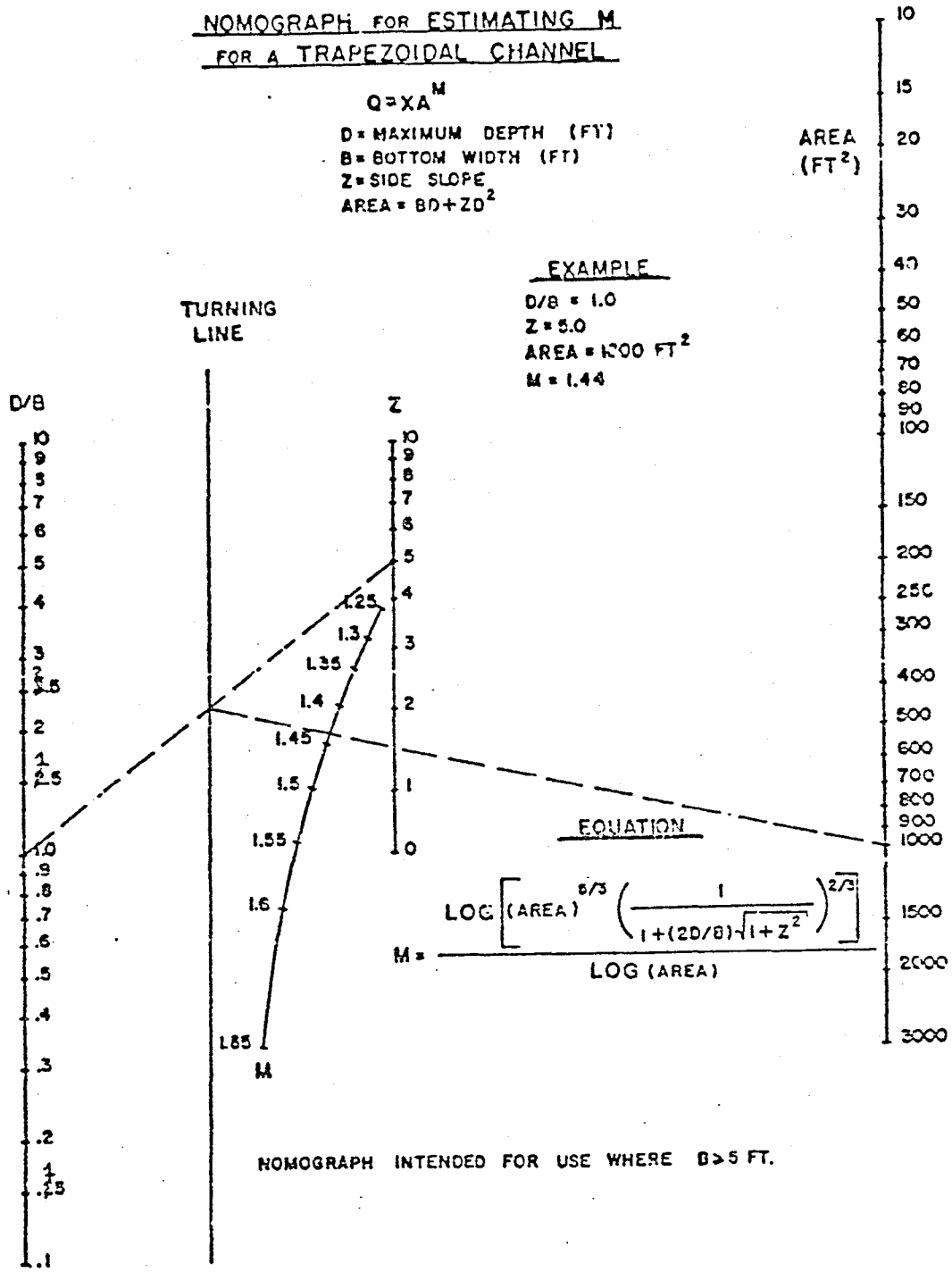

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FIGURE 2.5

For natural channels, rating tables have been input into the TR-20 model. The model then computes coefficients from the input rating curve.

Two-Dimensional Finite Element Diffusion Model

The TR-20 model has been developed to model channelized flow. Much of the Upper East Fork Cave Creek study area consists of alluvial fan topography. Runoff over alluvial fan terrain is not always channelized. To account for this, the TR-20 model was supplemented by using a two-dimensional finite element diffusion model developed by Dr. Gary Guymon of the University of California, Irvine. The finite element model can be used to identify runoff paths over an alluvial fan. Runoff paths identified by the finite element model were then used as input into the TR-20 model.

In the finite element model, each 660 FT. square element in a floodplain grid is modeled as a separate diffusion equation. Diffusion equations are developed for each element by considering the complete hydraulic equation for two-dimensional flow within each element, and assuming inertial terms are negligible. Solving the mathematics then requires the solution of as many simultaneous equations as the sum of the number of grid squares and the number of grid boundaries, and repeating this process for each 0.001-hour time increment. A small simulation time step is required because an explicit method is used to solve the dynamic equations of fluid motion.

Input to the finite element diffusion model included elevations for the center of each grid cell, a Manning's roughness coefficient (n) of 0.035 estimated for this study area, hydrographs to simulate runoff entering the finite element grid at various locations, and a hyetograph to simulate rainfall over the grid during the simulation.

An average Manning's n of 0.035 has been used to simulate all overland flow for a 100-year storm in the finite element diffusion model. This value was arrived at after consulting with Dr. Gary Guymon the developer of the model during a visit by Dr. Guymon to the site. The 0.035 Manning's"n" considers the effects of all impediments to overland flow in a typical 660 square-foot cell within the model. This approximation was felt to be sufficiently accurate since the purpose of the diffusion model was solely to determine the path of overland flow as opposed to its magnitude, depth or velocity.

HEC-2 Modeling of Open Channels

Water surface profiles along all proposed open channels have been modeled using the United States Corps of Engineers HEC-2 program.

HYDRAULIC DESIGN CRITERIA

Channels have been designed to flow with 2 feet of freeboard. For maintenance purposes, all open channels have been designed to have a minimum bottom width of 8 feet. Typical Manning's "n" values have been assigned as follows:

Type of Channel	Manning's "n"
Earth lined channels	.020
Concrete lined channels	.015
Box culverts	.015

Pipes have been designed to flow in open channel flow with a Manning's "n" of 0.012.

COST ESTIMATING

Table 2.7 (not included in this draft) summarizes estimated construction costs used in preparing this study.

Operation and maintenance costs are summarized in Table 2.8 (not included in this draft). Life cycle costs have been capitalized over a 40-year life using an 8% discount rate.

CHAPTER 3

EXISTING CONDITIONS

SUMMARY

This chapter summarizes results obtained using the two-dimensional finite element diffusion model and the TR-20 model of existing conditions. The results of the model are then compared with the results of other studies.

AREAS OF FLOODING

The two-dimensional finite element diffusion model has been used to identify runoff patterns for a 100 year flood. Results are summarized on Plate 3.1 (not included in this draft).

Of particular interest is the alluvial fan pattern observed in the area along the East fork south of Grover Street. Two noticeable breakout locations are observed. One breakout occurs along 21st Street to the south of the identified channel. A second divergence occurs at Bell Road near 18th Street where flow appears to split to the west and to the southwest.

Results of the finite element diffusion model have been used to determine runoff patterns input into the TR-20 model.

RUNOFF QUANTITIES

Plate 3.2 (not included in this draft) summarizes runoff quantities computed using the TR-20 model for the 100-year storm. Reaches having runoff flows exceeding 1000 cfs in the model are also identified on this figure.

COMPARISON WITH PREVIOUS STUDIES

Flows computed for the Upper East Fork of Cave Creek at the Confluence of Cave Creek and the East Fork of Cave Creek compare with previous studies as follows:

Study	100-yr Runoff
Upper East Fork ADMS (This Study)	9606 cfs
FEMA Flood Insurance Study (Corp of Engineers)	9000 cfs
Greenway Road Location Study (Dibble & Associates)	9500 cfs

At other locations, larger discrepancies have occurred. These differences result from a.) differences in drainage area boundaries assigned to the various subwatersheds b.) differences in curve numbers c.) differences in routing.

FEMA Flood Insurance Study

Flows assigned to the Upper East Fork of Cave Creek north of Bell Road are greater in the FEMA Study than were computed for existing conditions in this study. The difference is accounted for by the fact that subdrainage areas to the east of the Upper East Fork were assumed by FEMA to contribute to the Upper East Fork runoff. These areas have been routed in this study through a separate sub drainage area.

Greenway Road Location Study

Flows computed in this study for existing conditions exceed design flows used in the Greenway Road Location Study in the areas east of 7th Street.

Runoff quantities compare favorably with design criteria used in the Greenway Road Location Study to the west of 7th Street.

CHAPTER 4

ALTERNATIVE ANALYSIS

INTRODUCTION

The analysis of alternative drainage plans in an alluvial fan is a complex process. When nature is allowed to "decide" the preferred drainageways in alluvial terrain, the result is typically a complex network of braided flowpaths in which new "alternative" networks frequently appear after major storm events. Typically, manmade flood control improvements will match the preestablished natural channels. Where channels are undefined, or vary with time or storm intensity, the identification of optimum locations for flood control improvements can prove to be very difficult.

The complexity of master planning in alluvial fan terrain may be said to result from the many choices or "degrees of freedom" available to the planner. A summary of these master planning "degrees of freedom" follows.

DEGREES OF FREEDOM IN FLOODPLAIN MASTER PLANNING

Alignment of Conveyance Facilities

The topography of the Upper East Fork Cave Creek Watershed allows choices in whether major conveyance improvements are to run from north to south, from east to west, from northeast to southwest or in different directions in different subdrainage areas.

A constraint on this degree of freedom is that portions of the Greenway Channel and Upper East Fork alignments are well defined. Where channels are well established, these channels must be incorporated into the master plan.

Avoidance of major development areas will also serve as a constraint limiting the options available for planning in some areas.

Interval of Conveyance Facilities

Another choice involves the interval or spacing of the major conveyance works. Conceivably, these improvements could be planned at 1/2-mile, 1-mile, 1-1/2-mile, or even 2-mile intervals. This choice involves a tradeoff. Increasing the interval also increases the size requirements of improvements and visibility of those facilities constructed.

Type of Conveyance Facilities

Once alignments for conveyance facilities are identified, the type of conveyance facility remains as another degree of freedom. Choices available include conventional alternatives such as buried pipelines, buried box culverts, streets with inverted crowns, concrete-lined open channels, rock-lined open channels, earth-lined open channels, and grass-lined open channels. Another choice would be a joint-use alternative such as the Indian Bend Wash linear park drainageway in Scottsdale.

Reliance on Detention vs. Conveyance

Retarding the rate of flow through detention basins and drop structures will result in lower peak discharges. This allows conveyance facilities to be downsized. The degree to which detention works are incorporated into a master plan is another degree of freedom open to the planner.

A constraint on this degree of freedom is that the integrity of the outflow hydrograph from the Upper East Fork Watershed must be preserved or improved to prevent overloading the Arizona Canal Diversion Channel downstream. This constraint requires that detention be used to a large degree to offset increases in runoff due to development.

The use of detention will also make it possible to keep many conveyance facilities underground. The disadvantages of open channels in residential areas make the use of detention areas very desireable.

Reliance on Nonstructural Solutions

In addition to conveyance and detention, one floodplain management alternative is to purchase right-of-way, remove existing buildings and/or prevent construction of new facilities within the 100-year floodplain. Viable nonstructural solutions include relocation of mobile home parks, purchase and removal of scattered homesites, and rezoning or adding zoning stipulations on existing properties.

Acceptance of Risk

Another choice open to the planner is the return period or degree of risk acceptable within a planning area. One can design improvements to carry a 10-year storm, a 50-year storm, a 100-year storm, and even a 500-year storm. Generally as the acceptable return period increases, the cost of improvements also increases. At some point risk must be accepted when it becomes too expensive to eliminate it.

SCREENING OF ALTERNATIVES

Using the various degrees of freedom listed above, it would be possible to generate a vast number of reasonable alternatives for floodplain management in the Upper East Fork Cave Creek Watershed. This study focuses on four alternatives.

To screen the many possible alternatives down to the four selected, several choices were made at the onset of the alternative evaluation process. These choices were as follows.

1. Alignments of conveyance facilities have been selected to optimize the use of existing drainage improvements, vacant detention sites, and open alignment corridors. Feasibility of alignment corridors has been evaluated using aerial photographs along with extensive field reconnaissance.

2. Intervals of conveyance facilities have been established at 1/2 mile wherever feasible and compatible with existing conditions.

3. The types of conveyance facilities have been selected to minimize visibility to the public, as well as to minimize life-cycle costs. Measures taken to this end include:

   a. The use of buried pipelines to carry flows up to a maximum practical limit of approximately 500 cfs depending on available slopes. (Street conveyance has been used to supplement pipeline conveyance in several instances.)

   b. The use of buried box culverts to carry flows too large for economic pipeline sizes up to a maximum practical limit of approximately 1000 cfs depending on available slopes.

   c. For flows in excess of 1000 cfs, it is not considered feasible to bury conveyance facilities. Open channels are needed to carry flows this large.

4. Reliance on detention has been heavily emphasized due to concerns about the effects of future areawide development on the integrity of the watershed outflow hydrograph. Any increase in the outflow hydrograph can result in overloading the Arizona Canal Diversion Channel downstream.

5. Alternatives have been sized and developed for a 100-year return period.

DESCRIPTION OF ALTERNATIVES

The above screening procedure was used to formulate four alternative drainage plans. These alternatives are described below.

Alternative 1 - Non-Structural Alternative

This alternative emphasizes the use of right-of-way purchases and regulatory measures for area-wide floodplain management. It minimizes reliance on immediate capital expenditures and widespread capital improvements. Under this alternative, drainage would be permitted to continue to follow its existing course during storm events. Carefully planned right-of-way acquisition and zoning would be used to reduce risk within the path of expected floods.

Although this alternative is attractive from the standpoint of limiting costs in the immediate future, the issue of institutional feasibility must be assessed prior to its implementation. Historically, efforts to control or prevent construction in flood areas in the Upper East Fork watershed have not been fully successful. The feasibility of extensive property acquisition is also doubtful both for economic and institutional reasons.

Alternative - 2 Improvement of Designated FEMA Floodway

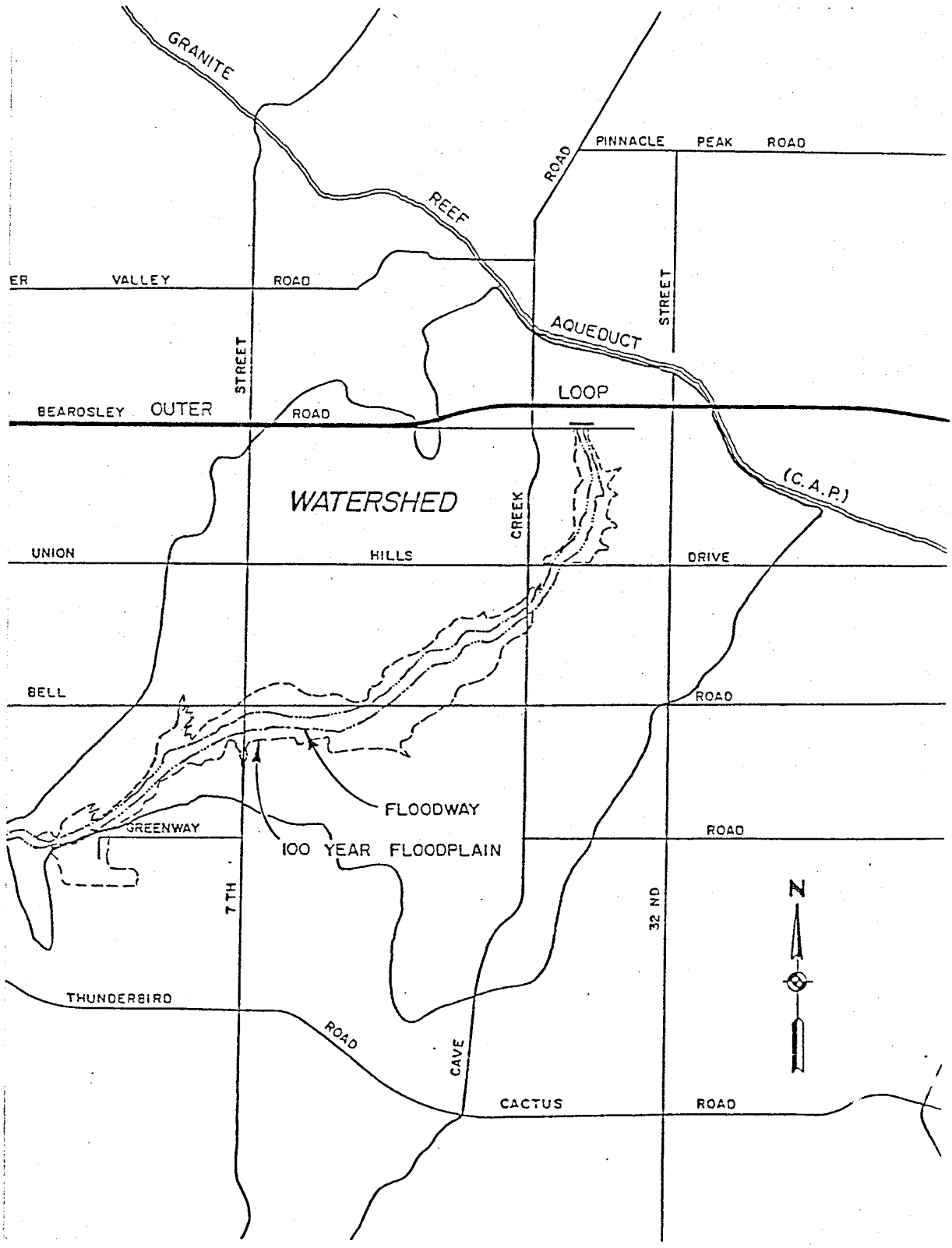
The Federal Emergency Management Agency (FEMA) has designated a floodway routing for the Upper East Fork of Cave Creek shown on Figure 4.1. Under this alternative, improvements would be made along the FEMA alignment and its tributaries as shown on Figure 4.2.

A field inspection of the FEMA floodway has shown that extensive regrading and construction has occurred along sections of this alignment. Figure 4.2 shows the locations of encroachments observed during field inspection. Construction of conveyance facilities in these locations would be expensive, and would noticeably disrupt existing neighborhoods along the alignment.

Alternative 3 - Underground Structure Alternative

Figure 4.3 shows the proposed alignments for Alternative 3. This alternative uses conventional methods of conveyance. Box structures and pipelines are used wherever possible to avoid permanent disruption of existing neighborhoods. A number of detention basins are included in this alternative to ensure that peak flows are kept within ranges that can be conveyed using underground conduits.

FEMA DESIGNATED FLOODWAY ROUTING



NBS/LOWRY

FIGURE 4.1

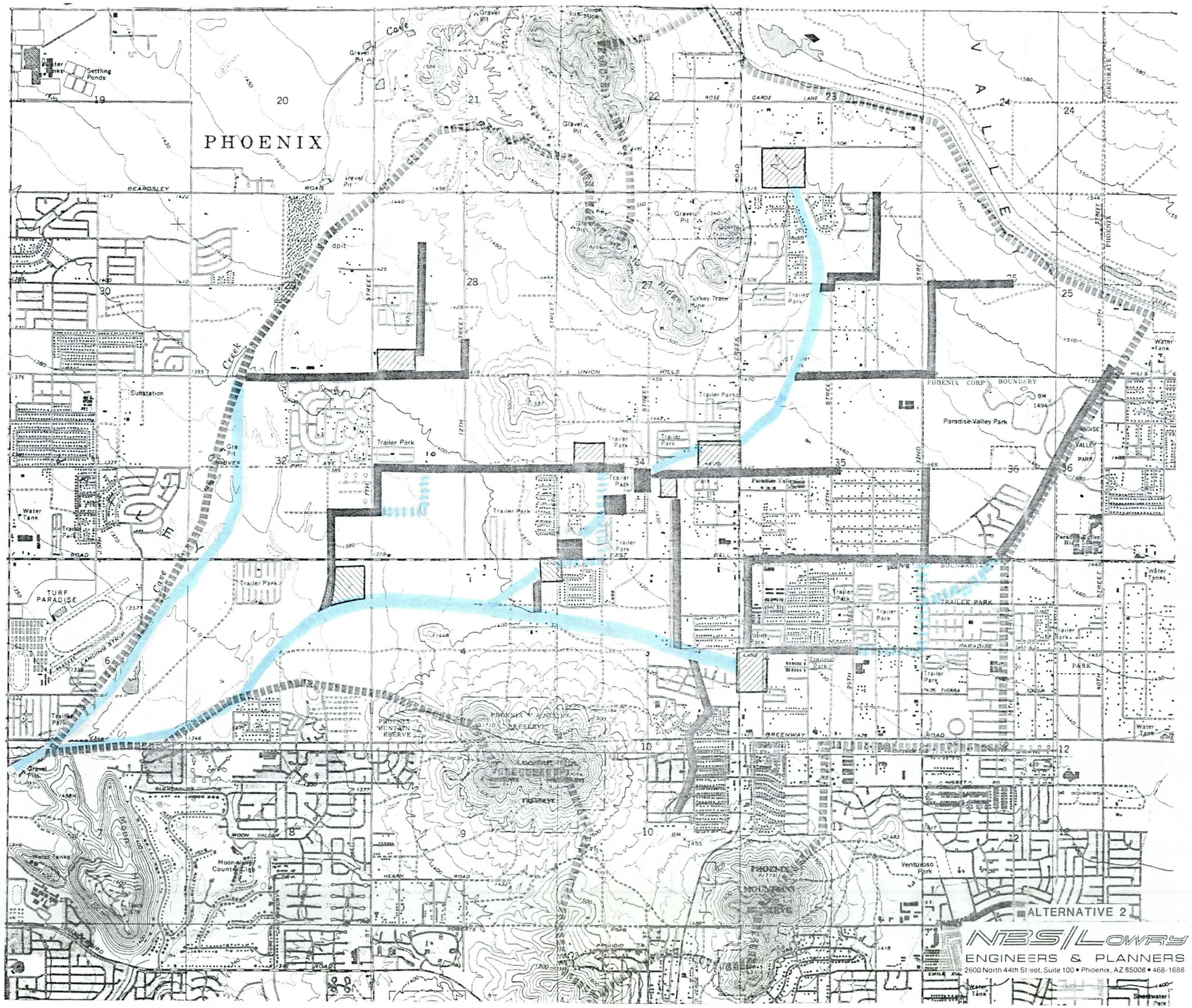
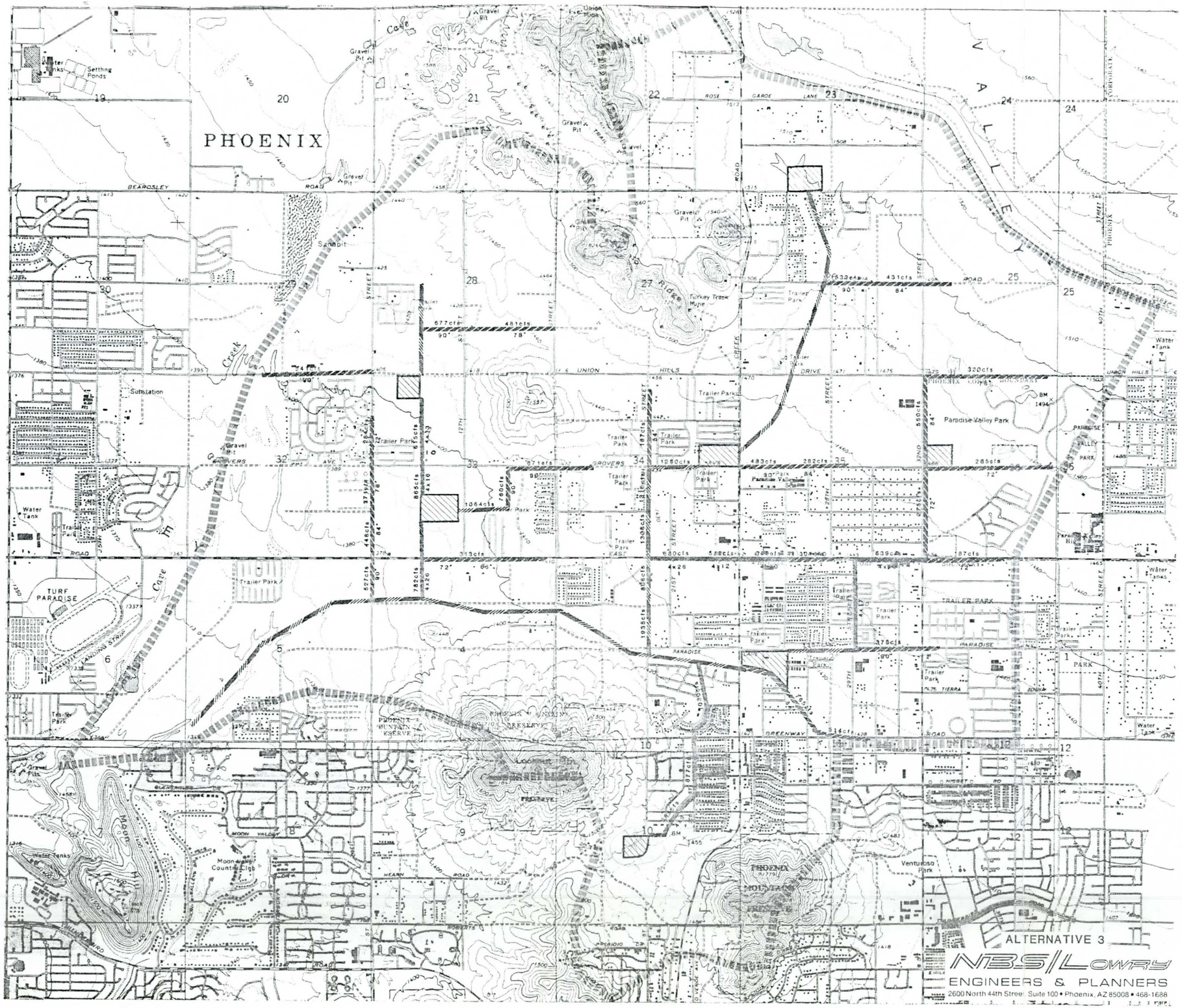

PHOENIX
VALLEY
Setthing Ponds
Gravel Pit
BEARDSLEY ROAD
ROSE GARDEN LANE
Turkey Track Mine
Trailer Park
Substation
Paradise Valley Park
PHOENIX CORP. BOUNDARY
Water Tank
TURF PARADISE
Moon Valley Country Club
Venturoso Park
TRAILER PARK
PARADISE
GREENWAY ROAD
ALTERNATIVE 2
NBS/LOWRY
ENGINEERS & PLANNERS
2600 North 44th Street, Suite 100 • Phoenix, AZ 85008 • 468-1688

FIGURE 4.2



SUBJECT TO REVISION

FIGURE 4.3

Alignment corridors along Bell Road and 20th Street have been selected for large conveyance facilities.

In the case of Bell Road, these facilities would be buried. Extensive reconstruction of Bell Road is now planned by the Maricopa County Highway Department. It is proposed that box conduits and pipelines be installed in conjunction with this roadway construction to minimize disruption of traffic during construction.

A field inspection of the 20th Street alignment revealed that there is adequate room on the east side of 20th Street to construct a large open channel with minimal disruption of traffic and existing improvements.

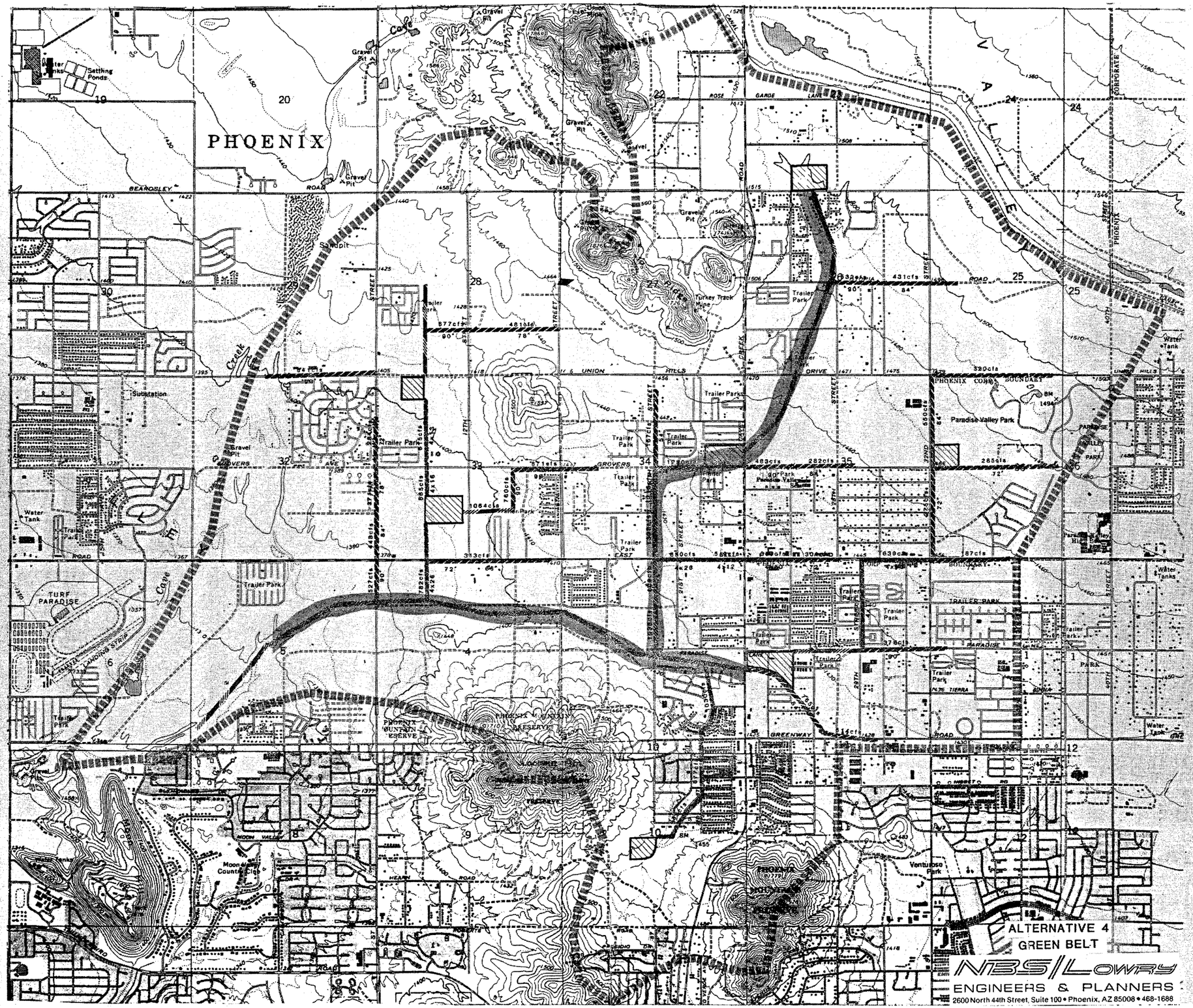
The channel in 20th Street would divert flow from the existing FEMA alignment of the Upper East Fork of Cave Creek which now contains encroachments identified on Figure 4.2.

Alternative 4 - Multi-Use Alternative

Figure 4.4 shows the proposed alignment concepts for Alternative 4. The alignments in Alternative 4 are identical to those in Alternative 3. However these two alternatives differ in the aesthetic treatment of open channel areas.

Alternative 4 has been developed using a linear park concept. This concept would be similar to that used in the development of the Indian Bend Wash project in Scottsdale, except that greater use of native desert vegetation would be made along its alignment. Conceivably, a system of bikepaths, nature trails, exercise courses and picnic facilities could be developed in a joint use project serving both recreation and flood control needs of the local community.

Implementation of Alternative 4 would require the cooperation and cofunding of the Parks Department of the City of Phoenix and/or Maricopa County. In addition to costing more for initial construction, this alternative would commit the City and County Parks departments to maintaining the dedicated park areas. While having many benefits to the public, this alternative cannot be undertaken without a commitment of the Parks Departments to undertake the project with the County Flood Control District.



SUBJECT TO REVISION

FIGURE 4.4

EVALUATION OF ALTERNATIVES

Method of Evaluation

Evaluation of alternatives must be accomplished in light of numerous criteria, the judgement of which is subjective to varying degrees. To achieve a consensus ranking of alternatives, the "Multi-Attribute Utility Analysis" technique has been used. This technique, described in detail by Payne in the references, has been classified as a "formalized systematic version of common sense".

Briefly, the Multi-Attribute Utility Analysis technique involves first establishing evaluation criteria and their relative weights. Then a score is assigned for each criteria for each alternative. Alternatives are then ranked based on scores assigned by the judges for each evaluation criteria.

Subjective evaluations were made using the "Delphi" method. Evaluators secretly assigned scores to each criteria for each alternative, and were then given an opportunity to privately revise their scores after seeing the judgments of the other evaluators. This technique was used to reduce the possibility that one member of the evaluation team might exert a disproportionate influence over the other evaluators. The "Delphi" technique is also discussed in further detail in the references.

Evaluation Criteria

To objectively evaluate each alternative in light of its strengths and weaknesses, the following eight evaluation criteria have been used.

Constructability: A field reconnaissance was conducted for each alternative to determine and rate the difficulty of construction and its effect on adjoining neighborhoods and commercial traffic.

First Cost: Alternatives were ranked according to their first cost.

Annual Cost: Alternatives were ranked according to their annual cost of operation, maintenance, risk premiums and other recurring annual costs.

Compatibility with Existing Structures: Alternatives were rated according to their compatibility with existing flood control structures both within the study area and downstream.

Aesthetics: Alternatives were rated according to their expected visual impact.

Safety: This category addressed any potential risk to the public due to construction, accidental injury after construction, or potential injury or drowning during flood events.

Effect on Neighborhoods: Open Channels can effect neighborhoods much the same as freeways or other large public improvements. A fenced channel splits a neighborhood in two. Some alternatives involve relocation or removal of homes.

Institutional Feasibility: Implementation of any master plan requires cooperation among many agencies. Further, nonstructural elements of a plan must be enforceable to succeed. Alternatives were rated on the relative ease of implementing each alternative within existing institutional frameworks.

Results

The Engineer's evaluation team has rated the four alternatives giving equal weight to each of the above eight criteria. Based on this evaluation, the above alternatives were ranked as follows in decreasing order of preference.

Alternative 3 - Underground Structure Alternative
Alternative 4 - Multi-Use Alternative
Alternative 1 - Non-Structural Alternative
Alternative 2 - Improvement of Designated FEMA Floodway

Table 4.1 shows the scoring for each alternative based on the evaluation criteria. A maximum possible score of 12 was allowed for each of the above criteria.

Alternative 3, the Underground Structure Alternative, is the Engineer's evaluation team's recommended alternative. Alternative 3 scored 72 points out of a possible total of 96.

Alternative 4, the Multi-use Alternative was ranked a close second. This alternative would have been the preferred alternative had the Engineer's evaluation team been assured of a viable commitment by the City of Phoenix and Maricopa County Parks Departments to take over such a project after construction.

Comparative costs for Alternatives 3 and 4 are presented in Tables 4.2 and 4.3.

RECOMMENDED ALTERNATIVE

Plate 4.1 shows the recommended alternative, including sizes and design flows for all conveyance and detention facilities.

TABLE 4.1
ENGINEER'S RANKING OF ALTERNATIVES

		ALT 1 NON STRUCTURAL	ALT 2 FEMA ALIGNMENT	ALT 3 UNDERGROUND STRUCTURE	ALT 4 MULTI-USE	MAX POSS SCORE
1	CONSTRUCTABILITY	8	4	10	7	12
2	FIRST COST	12	3	9	6	12
3	ANNUAL COST	6	8	8	6	12
4	COMPATIBILITY WITH EXISTING STRUCTURES	5	5	11	9	12
5	AESTHETICS	5	5	8	12	12
6	SAFETY	3	7.5	8.5	11	12
7	EFFECT ON NEIGHBORHOODS	6	4	7.5	10.5	12
8	INSTITUTIONAL FEASIBILITY	4	7	10	9	12
TOTAL SCORE		49	43.5	72	70.5	96
RELATIVE RANK		3	4	1	2	

ESTIMATED COST IN 1986 DOLLARS
ALTERNATIVE 3 - CONVENTIONAL ALTERNATIVE

PROJECT	QTY	UNIT COST	TOTAL
UNION HILLS DRIVE STORM DRAIN - 7TH ST TO CAVE CREEK			
90-INCH PIPE	3500 LF	$360	$1,260,000
SUBTOTAL			$1,260,000
GREENWAY CHANNEL - CAVE CREEK TO CAVE CREEK RD			
EARTH LINED CHANNEL	LF	COST NOT INCLUDED	
7TH STREET STORM DRAIN - GREENWAY CHANNEL TO MICHIGAN AV			
90-INCH PIPE	1320 LF	$360	$475,200
84-INCH PIPE	1320 LF	$336	$443,520
78-INCH PIPE	1320 LF	$312	$411,840
72-INCH PIPE	1320 LF	$288	$380,160
SUBTOTAL			$1,710,720
9TH STREET STORM DRAIN - GREENWAY CHANNEL TO UTOPIA RD			
4' X 26' BOX CULVERT	2000 LF	$1,080	$2,160,000
CAMPO BELLO DETENTION BASIN	25 AC		
PROPERTY ACQUISITION	25 AC	$40,000	$1,000,000
DETENTION BASIN EXCAVATION	242000 CY	$0.75	$181,500
HAULOFF	242000 CY	$4.00	$968,000
4' X 16' BOX CULVERT	1500 LF	$720	$1,080,000
4' X 13' BOX CULVERT	2000 LF	$612	$1,224,000
UNION HILLS DETENTION BASIN	13 AC		
PROPERTY ACQUISITION	13 AC	$40,000	$520,000
DETENTION BASIN EXCAVATION	125840 CY	$0.75	$94,380
HAULOFF	125840 CY	$4.00	$503,360
CONCRETE LINED CHANNEL	2800 LF	$250	$700,000
SUBTOTAL			$8,431,240
BELL ROAD STORM DRAIN - 9TH ST TO 16TH ST			
72-INCH PIPE	1320 LF	$288	$380,160
66-INCH PIPE	2640 LF	$264	$696,960
SUBTOTAL			$1,077,120
CAMPO BELLO DRIVE CHANNEL			
CONCRETE LINED CHANNEL	1320 LF	$250	$330,000
SUBTOTAL			$330,000
14TH ST / GROVERS AV STORM DRAIN - CAMPO BELLO DR TO 18TH ST			
90-INCH PIPE	3960 LF	$360	$1,425,600
SUBTOTAL			$1,425,600

TABLE 4.2

WESTCOTT DRIVE STORM DRAIN - 9TH ST TO 16TH ST			
90-INCH PIPE	1320 LF	$360	$475,200
78-INCH PIPE	2640 LF	$312	$823,680
SUBTOTAL			$1,298,880
20TH STREET CHANNEL - GREENWAY CHANNEL TO BELL ROAD			
PROPERTY ACQUIS/UNDEVELOPED	5.0 AC	$40,000	$200,000
PRIVATE RESIDENCES	5 EA	$160,000	$800,000
CONCRETE LINED CHANNEL	2900 LF	$400	$1,160,000
SUBTOTAL			$2,160,000
20TH STREET CHANNEL - BELL ROAD TO GROVERS AV			
PROPERTY ACQUIS/UNDEVELOPED	5.0 AC	$40,000	$200,000
CONCRETE LINED CHANNEL	2640 LF	$400	$1,056,000
BELL ROAD CULVERT	100 LF	$1,440	$144,000
SUBTOTAL			$1,400,000
20TH STREET STORM DRAIN - GROVERS AV TO UNION HILLS DR			
54-INCH PIPE	2640 LF	$216	$570,240
SUBTOTAL			$570,240
BELL ROAD STORM DRAIN - 20TH ST TO 28TH ST			
4'X 26' BOX CULVERT	1320 LF	$1,080	$1,425,600
4'X 12' BOX CULVERT	1320 LF	$576	$760,320
4'X 10' BOX CULVERT	1320 LF	$504	$665,280
72-INCH PIPE	1320 LF	$288	$380,160
SUBTOTAL			$3,231,360
GROVERS AV CHANNEL & DETENTION BASIN - 20TH ST TO CAVE CREEK RD			
PROPERTY ACQUIS/UNDEVELOPED	5.0 AC	$40,000	$200,000
PRIVATE RESIDENCES	3 EA	$160,000	$480,000
CONCRETE LINED CHANNEL	1500 LF	$400	$600,000
DETENTION BASIN	19 AC		
PROPERTY ACQUISITION	19 AC	$40,000	$760,000
DETENTION BASIN EXCAVATION	183920 CY	$0.75	$137,940
HAULOFF	183920 CY	$4.00	$735,680
SUBTOTAL			$2,913,620
GROVERS AV STORM DRAIN - CAVE CREEK RD TO 28TH ST			
90-INCH PIPE	1320 LF	$360	$475,200
84-INCH PIPE	1400 LF	$336	$470,400
SUBTOTAL			$945,600

TABLE 4.2

UPPER EAST FORK CHANNEL - UNION HILLS RD TO UTOPIA RD

PROPERTY ACQUIS/TRAILER PADS	20 LOTS	$40,000	$800,000
PROPERTY ACQUIS/UNDEVELOPED	4.0 AC	$40,000	$160,000
PRIVATE RESIDENCES	5 EA	$160,000	$800,000
CONCRETE LINED CHANNEL	3200 LF	$400	$1,280,000
SUBTOTAL			$3,040,000

UTOPIA RD STORM DRAIN

90-INCH PIPE	1600 LF	$360	$576,000
84-INCH PIPE	2000 LF	$336	$672,000
SUBTOTAL			$1,248,000

UPPER EAST FORK CHANNEL - UTOPIA RD TO BEARDSLEY RD

PROPERTY ACQUIS/BACK SIDE OF	25 LOTS	$5,000	$125,000
PROPERTY ACQUIS/UNDEVELOPED	2.0 AC	$40,000	$80,000
CONCRETE LINED CHANNEL	3200 LF	$250	$800,000
SUBTOTAL			$1,005,000

UPPER EAST FORK, BEARDSLEY RD DETENTION BASIN

DETENTION BASIN	18 AC		
PROPERTY ACQUISITION	18 AC	$40,000	$720,000
DETENTION BASIN EXCAVATION	174240 CY	$0.75	$130,680
HAULOFF	174240 CY	$4.00	$696,960
SUBTOTAL			$1,547,640

22ND STREET STORM DRAIN - GREENWAY CHNL TO ACOMA DR

4'X 20' BOX CULVERT	2500 LF	$864	$2,160,000
4'X 16' BOX CULVERT	2000 LF	$720	$1,440,000
4' X 5' BOX CULVERT	2000 LF	$324	$648,000
DETENTION BASIN	12 AC		
PROPERTY ACQUISITION	12 AC	$40,000	$480,000
DETENTION BASIN EXCAVATION	116160 CY	$0.75	$87,120
HAULOFF	116160 CY	$4.00	$464,640
SUBTOTAL			$5,279,760

GREENWAY AVE STORM DRAIN - CAVE CREEK RD TO 29TH ST

84-INCH PIPE	3000 LF	$336	$1,008,000
90-INCH PIPE	2000 LF	$360	$720,000
SUBTOTAL			$1,728,000

PARADISE LANE CHANNEL & DETENTION BASIN - CAVE CREEK RD TO 29TH ST

DETENTION BASIN	12 AC		
PROPERTY ACQUISITION	12 AC	$40,000	$480,000
DETENTION BASIN EXCAVATION	116160 CY	$0.75	$87,120
HAULOFF	116160 CY	$4.00	$464,640
CONCRETE LINED CHANNEL	2100 LF	$250	$525,000
SUBTOTAL			$1,556,760

PARADISE LANE STORM DRAIN			
90-INCH PIPE	2100 LF	$360	$756,000
SUBTOTAL			$756,000
29TH STREET/BELL ROAD STORM DRAIN - PARADISE LN TO 36TH ST			
4'X 17' BOX CULVERT	2640 LF	$756	$1,995,840
4'X 13' BOX CULVERT	2100 LF	$612	$1,285,200
72-INCH PIPE	2500 LF	$288	$720,000
SUBTOTAL			$4,001,040
32ND ST STORM DRAIN			
72-INCH PIPE	2640 LF	$288	$760,320
SUBTOTAL			$760,320
PARADISE VALLEY PARK DETENTION BASIN			
DETENTION BASIN	14 AC		
PROPERTY ACQUISITION	14 AC	$40,000	$560,000
DETENTION BASIN EXCAVATION	135520 CY	$0.75	$101,640
HAULOFF	135520 CY	$4.00	$542,080
CONCRETE LINED CHANNEL	3000 LF	$250	$750,000
SUBTOTAL			$1,953,720
GRAND TOTAL			$49,630,620

TABLE 4.2

ESTIMATED COST IN 1986 DOLLARS
ALTERNATIVE 4 - MULTIUSE ALTERNATIVE

PROJECT	QTY	UNIT COST	TOTAL
UNION HILLS DRIVE STORM DRAIN - 7TH ST TO CAVE CREEK			
90-INCH PIPE	3500 LF	$360	$1,260,000
SUBTOTAL			$1,260,000
GREENWAY CHANNEL - CAVE CREEK TO CAVE CREEK RD			
EARTH LINED CHANNEL	LF	COST NOT INCLUDED	
7TH STREET STORM DRAIN - GREENWAY CHANNEL TO MICHIGAN AV			
90-INCH PIPE	1320 LF	$360	$475,200
84-INCH PIPE	1320 LF	$336	$443,520
78-INCH PIPE	1320 LF	$312	$411,840
72-INCH PIPE	1320 LF	$288	$380,160
SUBTOTAL			$1,710,720
9TH STREET STORM DRAIN - GREENWAY CHANNEL TO UTOPIA RD			
4' X 26' BOX CULVERT	2000 LF	$1,080	$2,160,000
CAMPO BELLO DETENTION BASIN	25 AC		
PROPERTY ACQUISITION	25 AC	$40,000	$1,000,000
DETENTION BASIN EXCAVATION	242000 CY	$0.75	$181,500
HAULOFF	242000 CY	$4.00	$968,000
4' X 16' BOX CULVERT	1500 LF	$720	$1,080,000
4' X 13' BOX CULVERT	2000 LF	$612	$1,224,000
UNION HILLS DETENTION BASIN	13 AC		
PROPERTY ACQUISITION	13 AC	$40,000	$520,000
DETENTION BASIN EXCAVATION	125840 CY	$0.75	$94,380
HAULOFF	125840 CY	$4.00	$503,360
CONCRETE LINED CHANNEL	2800 LF	$250	$700,000
SUBTOTAL			$8,431,240
BELL ROAD STORM DRAIN - 9TH ST TO 16TH ST			
72-INCH PIPE	1320 LF	$288	$380,160
66-INCH PIPE	2640 LF	$264	$696,960
SUBTOTAL			$1,077,120
CAMPO BELLO DRIVE CHANNEL			
CONCRETE LINED CHANNEL	1320 LF	$250	$330,000
SUBTOTAL			$330,000
14TH ST / GROVERS AV STORM DRAIN - CAMPO BELLO DR TO 18TH ST			
90-INCH PIPE	3960 LF	$360	$1,425,600
SUBTOTAL			$1,425,600

TABLE 4.3

WESTCOTT DRIVE STORM DRAIN - 9TH ST TO 16TH ST			
90-INCH PIPE	1320 LF	$360	$475,200
78-INCH PIPE	2640 LF	$312	$823,680
SUBTOTAL			$1,298,880
20TH STREET CHANNEL - GREENWAY CHANNEL TO BELL ROAD			
PROPERTY ACQUIS/UNDEVELOPED	23.3 AC	$40,000	$932,048
PRIVATE RESIDENCES	15 EA	$160,000	$2,400,000
MASS EXCAVATION	245889 CY	$0.75	$184,417
HAULOFF	245889 CY	$4.00	$983,556
DROP STRUCTURES	3 EA	$280,000	$840,000
EARTH LINED CHANNEL	2900 LF	$100	$290,000
SUBTOTAL			$5,630,021
20TH STREET CHANNEL - BELL ROAD TO GROVERS AV			
PROPERTY ACQUIS/UNDEVELOPED	18.2 AC	$40,000	$727,273
PRIVATE RESIDENCES	5 EA	$160,000	$800,000
MASS EXCAVATION	179867 CY	$0.75	$134,900
HAULOFF	179867 CY	$4.00	$719,468
DROP STRUCTURES	1 EA	$240,000	$240,000
EARTH LINED CHANNEL	2640 LF	$100	$264,000
BELL ROAD CULVERT	100 LF	$1,440	$144,000
SUBTOTAL			$3,029,641
20TH STREET STORM DRAIN - GROVERS AV TO UNION HILLS DR			
54-INCH PIPE	2640 LF	$216	$570,240
SUBTOTAL			$570,240
BELL ROAD STORM DRAIN - 20TH ST TO 28TH ST			
4'X 26' BOX CULVERT	1320 LF	$1,080	$1,425,600
4'X 12' BOX CULVERT	1320 LF	$576	$760,320
4'X 10' BOX CULVERT	1320 LF	$504	$665,280
72-INCH PIPE	1320 LF	$288	$380,160
SUBTOTAL			$3,231,360
GROVERS AV CHANNEL & DETENTION BASIN - 20TH ST TO CAVE CREEK RD			
PROPERTY ACQUIS/UNDEVELOPED	7.6 AC	$40,000	$303,030
PRIVATE RESIDENCES	10 EA	$160,000	$1,600,000
MASS EXCAVATION	160356 CY	$0.75	$120,267
HAULOFF	160356 CY	$4.00	$641,424
DROP STRUCTURES	2 EA	$200,000	$400,000
EARTH LINED CHANNEL	1500 LF	$100	$150,000
DETENTION BASIN	19 AC		
PROPERTY ACQUISITION	19 AC	$40,000	$760,000
DETENTION BASIN EXCAVATION	183920 CY	$0.75	$137,940
HAULOFF	183920 CY	$4.00	$735,680
SUBTOTAL			$4,848,341

TABLE 4.3

GROVERS AV STORM DRAIN - CAVE CREEK RD TO 28TH ST			
90-INCH PIPE	1320 LF	$360	$475,200
84-INCH PIPE	1400 LF	$336	$470,400
SUBTOTAL			$945,600
UPPER EAST FORK CHANNEL - UNION HILLS RD TO UTOPIA RD			
PROPERTY ACQUIS/TRAILER PADS	60 LOTS	$40,000	$2,400,000
PROPERTY ACQUIS/UNDEVELOPED	7.6 AC	$40,000	$303,030
PRIVATE RESIDENCES	10 EA	$160,000	$1,600,000
MASS EXCAVATION	202933 CY	$0.75	$152,200
HAULOFF	202933 CY	$4.00	$811,732
DROP STRUCTURES	2 EA	$200,000	$400,000
EARTH LINED CHANNEL	3200 LF	$100	$320,000
SUBTOTAL			$5,986,962
UTOPIA RD STORM DRAIN			
90-INCH PIPE	1600 LF	$360	$576,000
84-INCH PIPE	2000 LF	$336	$672,000
SUBTOTAL			$1,248,000
UPPER EAST FORK CHANNEL - UTOPIA RD TO BEARDSLEY RD			
PROPERTY ACQUIS/BACK SIDE OF	25 LOTS	$20,000	$500,000
PROPERTY ACQUIS/UNDEVELOPED	4.5 AC	$40,000	$181,818
PRIVATE RESIDENCES	5 EA	$160,000	$800,000
MASS EXCAVATION	109711 CY	$0.75	$82,283
HAULOFF	109711 CY	$4.00	$438,844
DROP STRUCTURES	2 EA	$120,000	$240,000
EARTH LINED CHANNEL	3200 LF	$100	$320,000
SUBTOTAL			$2,562,945
UPPER EAST FORK, BEARDSLEY RD DETENTION BASIN			
DETENTION BASIN	18 AC		
PROPERTY ACQUISITION	18 AC	$40,000	$720,000
DETENTION BASIN EXCAVATION	174240 CY	$0.75	$130,680
HAULOFF	174240 CY	$4.00	$696,960
SUBTOTAL			$1,547,640
22ND STREET STORM DRAIN - GREENWAY CHNL TO ACOMA DR			
4'X 20' BOX CULVERT	2500 LF	$864	$2,160,000
4'X 16' BOX CULVERT	2000 LF	$720	$1,440,000
4' X 5' BOX CULVERT	2000 LF	$324	$648,000
DETENTION BASIN	12 AC		
PROPERTY ACQUISITION	12 AC	$40,000	$480,000
DETENTION BASIN EXCAVATION	116160 CY	$0.75	$87,120
HAULOFF	116160 CY	$4.00	$464,640
SUBTOTAL			$5,279,760

TABLE 4.3

GREENWAY AVE STORM DRAIN - CAVE CREEK RD TO 29TH ST			
84-INCH PIPE	3000 LF	$336	$1,008,000
90-INCH PIPE	2000 LF	$360	$720,000
SUBTOTAL			$1,728,000
PARADISE LANE CHANNEL & DETENTION BASIN - CAVE CREEK RD TO 29TH ST			
DETENTION BASIN	12 AC		
PROPERTY ACQUISITION	12 AC	$40,000	$480,000
DETENTION BASIN EXCAVATION	116160 CY	$0.75	$87,120
HAULOFF	116160 CY	$4.00	$464,640
CONCRETE LINED CHANNEL	2100 LF	$250	$525,000
SUBTOTAL			$1,556,760
PARADISE LANE STORM DRAIN			
90-INCH PIPE	2100 LF	$360	$756,000
SUBTOTAL			$756,000
29TH STREET/BELL ROAD STORM DRAIN - PARADISE LN TO 36TH ST			
4'X 17' BOX CULVERT	2640 LF	$756	$1,995,840
4'X 13' BOX CULVERT	2100 LF	$612	$1,285,200
72-INCH PIPE	2500 LF	$288	$720,000
SUBTOTAL			$4,001,040
32ND ST STORM DRAIN			
72-INCH PIPE	2640 LF	$288	$760,320
SUBTOTAL			$760,320
PARADISE VALLEY PARK DETENTION BASIN			
DETENTION BASIN	14 AC		
PROPERTY ACQUISITION	14 AC	$40,000	$560,000
DETENTION BASIN EXCAVATION	135520 CY	$0.75	$101,640
HAULOFF	135520 CY	$4.00	$542,080
CONCRETE LINED CHANNEL	3000 LF	$250	$750,000
SUBTOTAL			$1,953,720
GRAND TOTAL			$61,169,910

TABLE 4.3

Using the TR-20 watershed model, hydrographs have been developed and peak flows computed for each reach of the recommended alternative. The peak flows have then been used to size the various pipelines, box culverts and open channels that comprise this alternative.

Computations used to develop the recommended alternative are included in the appendix to this report. These computations include:

TR-20 Computations of peak design flows

Hydraulic Grade Line computations for all closed conduits (not included in this draft)

HEC-2 Water Surface Profiles for all open channels (not included in this draft).

Detailed development of the various components of the recommended Area Drainage Master Plan is addressed in Chapter 5.

IMPACT ON GREENWAY PARKWAY CHANNEL

Implementation of the selected alternative will involve reevaluating the design of the Greenway Parkway Channel in light of changes in channel design flows that would result. In particular, the following should be noted:

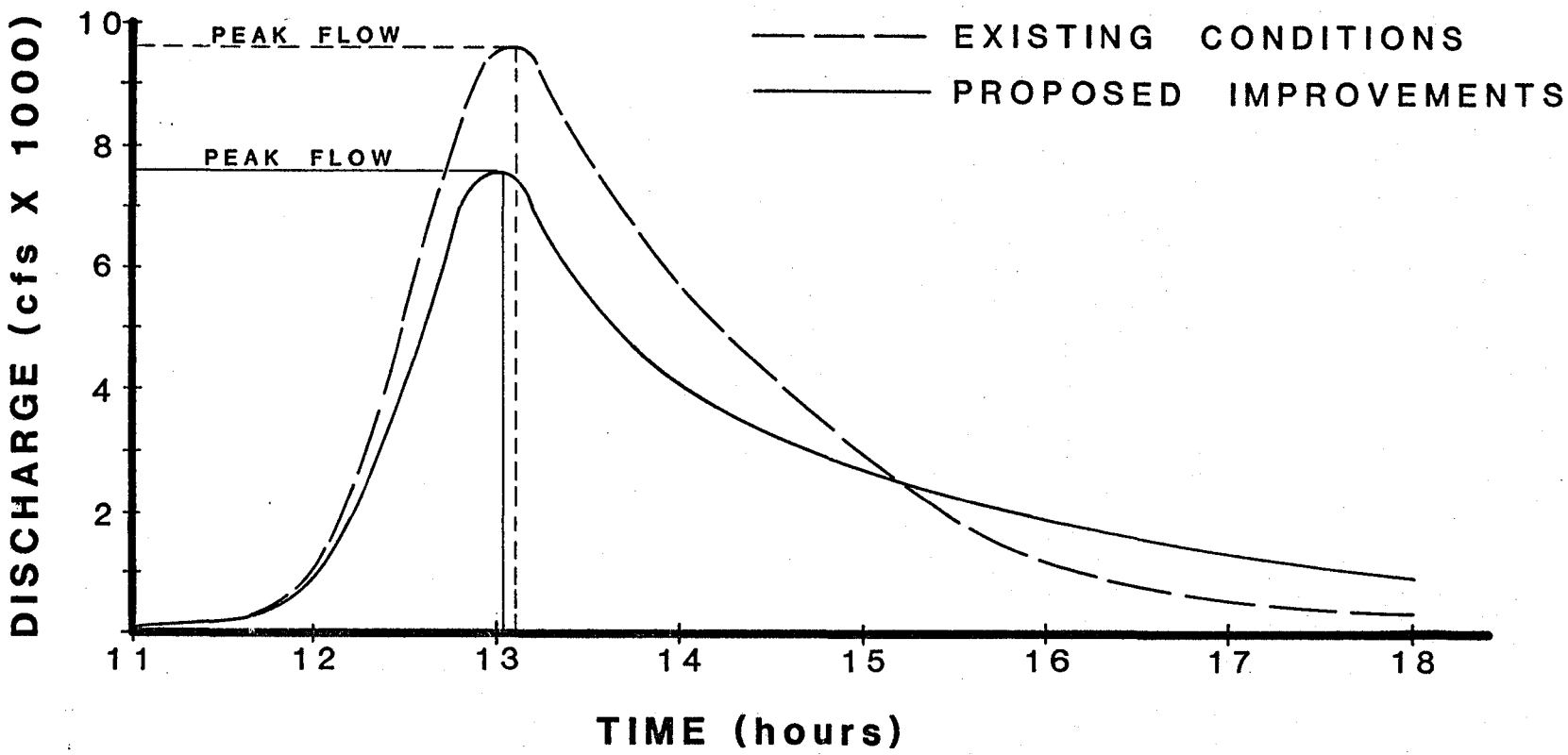
Design flows downstream from 12th Street have been reduced due to the detention provided in the Master Plan.

Design flows between 12th Street and 20th Street have increased because the East Fork of Cave Creek would be diverted under the Master Plan and enter the channel at 20th Street rather than downstream at 12th Street.

IMPACT ON DOWNSTREAM STRUCTURES

A key consideration in the development of an Area Drainage Master Plan for the Upper East Fork Cave Creek watershed is that the projected peak watershed outflow into Cave Creek must not exceed the current peak outflow. As development proceeds, the total volume of runoff into Cave Creek will increase as the percentage of impervious surface in the study area grows. This cannot be avoided. Sufficient detention has been built into the recommended alternative to ensure that the peak runoff at buildout will be less than it is now. Figure 4.5 shows a comparison of the existing condition watershed outflow hydrograph and that which would be expected following implementation of the proposed Master Plan.

OUTFLOW HYDROGRAPHS FROM DRAINAGE AREA



NBS/LOWRY

FIGURE 4.5

CHAPTER 5

PRELIMINARY PLAN

PROPOSED IMPROVEMENTS

RIGHT OF WAY

UTILITY INTERFERENCE

AESTHETICS

ESTIMATED COST

CHAPTER 6

PHASING AND IMPLEMENTATION

CAPITAL IMPROVEMENT PHASING

SOURCES OF FUNDS

CAPITAL IMPROVEMENT PHASING

Priority 1 Improvements

Priority 2 Improvements

Priority 3 Improvements

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```
*****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

JOB TR-20                                          SUMMARY   NOPLOTS
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TITLE 000 WITH PROPOSED IMPROVEMENTS
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 8          0.          .004        .008        .0130       .018
 8          .022        .026        .031        .035        .04
 8          .044        .048        .053        .057        .062
 8          .066        .071        .075        .080        .093
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 8          .830        .860        .880        .893        .907
 8          .920        .924        .928        .933        .937
 8          .942        .947        .951        .956        .960
 8          .964        .969        .973        .978        .982
 8          .987        .991        .995        1.00        1.00
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 8                      1502.8      13.3        5.1
 8                      1503.2      29.5        9.1
 8                      1503.6      53.4        14.1
 8                      1504.0      85.8        20.0
 8                      1504.4      100.7       30.8
 8                      1504.8      169.0       50.3
 8                      1505.2      289.0       78.5
 8                      1505.6      469.8       115.4
 8                      1506.0      470.9       161.1
 8                      1506.4      952.6       295.5
 8                      1506.8      1764.7      462.7
 8                      1507.2      2878.8      662.8
 8                      1507.6      4328.4      895.6
 8                      1508.0      6145.9      1161.3
 8                      1508.4      8331.5      1460.9
 8                      1508.8      10956.2     1795.8
 9 ENDTBL
 2 XSECTN   008         1.0
 8                      1494.0      0.0         0.0
 8                      1494.3      7.4         5.7
 8                      1494.6      23.9        12.0
 8                      1494.9      47.8        18.8
 8                      1495.2      78.9        26.3
 8                      1495.5      117.0       34.3
 8                      1495.8      162.2       42.9
 8                      1496.1      165.4       53.5
 8                      1496.4      175.4       84.2
 8                      1496.7      302.7       140.5
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 8                      1497.0      527.8       222.4
 8                      1497.3      868.5       329.9
 8                      1497.6      1343.8      463.0
 8                      1497.9      1972.3      621.8
 8                      1498.2      2837.4      803.3
 8                      1498.5      3901.4      998.3
 8                      1498.8      5131.8      1206.2
 8                      1499.1      6532.4      1426.8
 8                      1499.4      8107.5      1660.4
 8                      1499.7      9861.7      1906.7
 9 ENDTBL
 2 XSECTN    014        1.0
 8                      1484.0      0.0         0.0
 8                      1484.3      4.5         3.5
 8                      1484.6      14.6        7.4
 8                      1484.9      29.3        11.7
 8                      1485.2      48.4        16.4
 8                      1485.5      72.0        21.6
 8                      1485.8      100.0       27.1
 8                      1486.1      132.3       33.0
 8                      1486.4      168.7       39.4
 8                      1486.7      210.3       46.4
 8                      1487.0      257.3       53.8
 8                      1487.3      309.9       61.7
 8                      1487.6      368.3       70.1
 8                      1487.9      432.9       78.9
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 8                      1488.5      490.0       142.0
 8                      1488.8      520.2       220.5
 8                      1489.1      843.7       330.9
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 9 ENDTBL
 2 XSECTN    027        1.0
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 8                      1468.9      25.6        12.0
 8                      1469.2      43.5        17.4
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 8                      1469.8      94.1        30.2
 8                      1470.1      127.2       37.5
 8                      1470.4      165.8       45.7
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 8                      1471.3      320.8       74.5
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 9 ENDTBL
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 8                        1452.6      50.6       19.9
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 8                        1453.2      162.1      41.3
 8                        1453.4      210.4      48.7
 8                        1453.6      263.8      56.3
 8                        1453.8      322.2      64.1
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 8                        1454.6      566.6     114.7
 8                        1454.8      685.9     129.2
 8                        1455.0      814.4     143.9
 8                        1455.2      952.0     158.8
 8                        1455.4     1098.3     173.9
 8                        1455.6     1183.6     189.8
 8                        1455.8     1357.3     206.7
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 9 ENDTBL
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**********80-80 LIST OF INPUT DATA (CONTINUED)**********

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8                    1501.6      489.83      91.32
8                    1502.       516.32      98.42
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8                    1454.2      21.34       11.16
8                    1454.6      34.86       14.99
8                    1455.0      48.94       18.88
8                    1455.4      61.93       22.83
8                    1455.8      68.09       26.84
8                    1456.2      94.67       30.90
8                    1456.6      105.22      35.03
8                    1457.0      114.8       39.21
8                    1457.4      123.65      43.45
8                    1457.8      131.9       47.76
8                    1458.2      139.66      52.12
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9 ENDTBL
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**********80-80 LIST OF INPUT DATA (CONTINUED)**********

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8                       1450.0      900.        6.32
9 ENDTBL
3 STRUCT      39
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8                       1415.8      673.17      58.16
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8                       1416.6      958.87      75.59
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8                       1445.6      197.39      24.97
8                       1446.0      275.31      31.41
8                       1446.4      359.5       37.92
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8                       1447.2      542.26      51.18
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**********************80-80 LIST OF INPUT DATA (CONTINUED)*********************

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 9 ENDTBL
 3 STRUCT       59
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 8                        1407.4       183.14       25.06
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 8                        1408.6       290.9        38.41
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 3 STRUCT       69
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 8                        1391.2       66.76        26.40
 8                        1391.6       114.9        35.38
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 8                        1392.8       285.6        62.84
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 8                        1395.2       577.27       120.22
 8                        1395.6       612.29       130.11
 8                        1396.0       645.41       140.08
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 6 RUNOFF 1 001        5 .148          95.          .3
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 6 REACH  3 003    5   7 1000.         .04          1.66
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 6 ADDHYD 4 006   5 6 7
 6 REACH  3 008   7   1 1600.
 6 RUNOFF 1 007       5 .117        77.          .69
 6 REACH  3 008   5   2 1400.
 6 RUNOFF 1 019       5 .022        95.          .167
 6 RUNOFF 1 004       6 .195        95.          .22
 6 REACH  3 004   5   7 1800.        .05         1.66
 6 ADDHYD 4 004   6 7 5
 6 RUNOFF 1 005       6 .125        77.          .56
 6 REACH  3 005   5   7 1400.        .05         1.66
 6 ADDHYD 4 005   6 7 5
 6 REACH  3 008   5   3 2100.
 6 ADDHYD 4 008   1 2 4
 6 ADDHYD 4 008   3 4 1
 6 RUNOFF 1 018       5 .184        78.          .72
 6 REACH  3 008   5   2 1900.        .04         1.66
 6 ADDHYD 4 008   1 2 3
 6 RUNOFF 1 008       5 .131        78.          .75
 6 ADDHYD 4 008   3 5 1
 6 RESVOR 2     08 1   3 1496.0
 6 REACH  3 014   3   5 3000.
 6 RUNOFF 1 009       6 .066        79.          .93
 6 REACH  3 014   6   7 2700.
 6 ADDHYD 4 014   5 7 6
 6 RUNOFF 1 010       4 .095        77.          .56
 6 REACH  3 011   4   5 2640.        .44         1.54
 6 RUNOFF 1 011       7 .234        79.          .84
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 6 REACH  3 013   4   5 1320.        6.75        1.25
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 6 RUNOFF 1 144       5 .132        79.          .93
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 6 REACH  3 014   5   7 1320.        6.82        1.25
 6 ADDHYD 4 014   6 7 5
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 6 ADDHYD 4 014   4 5 6
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**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 RUNOFF 1 014       5 .177        83.          .39
6 ADDHYD 4 014   5 6 4
6 REACH  3 027   4   7 3000.
6 RUNOFF 1 027       5 .188        82.         1.2
6 ADDHYD 4 027   5 7 6
6 RUNOFF 1 017       5 .059        95.          .17
6 REACH  3 025   5   7 2200.       .05         1.66
6 RUNOFF 1 025       5 .089        83.          .43
6 ADDHYD 4 025   5 7 4
6 REACH  3 027   4   5 1700.
6 ADDHYD 4 027   5 6 7
6 RUNOFF 1 026       6 .067        85.          .31
6 ADDHYD 4 027   6 7 5
6 REACH  3 037   5   4 3000.
6 RUNOFF 1 037       5 .125        83.          .25
6 ADDHYD 4 037   4 5 6
6 RESVOR 2    37 6   4 1446.0
6 RUNOFF 1 024       5 .198        86.          .46
6 REACH  3 037   5   6 2100.       .41         1.66
6 ADDHYD 4 037   4 6 5
6 RUNOFF 1 028       4 .156        82.          .93
6 REACH  3 036   4   6 3500.       .06         1.66
6 RUNOFF 1 036       4 .125        83.          .48
6 ADDHYD 4 036   4 6 7
6 RUNOFF 1 034       4 .125        84.          .73
6 REACH  3 035   4   6 1320.       .31         1.54
6 RUNOFF 1 035       4 .125        83.          .49
6 ADDHYD 4 035   4 6 3
6 REACH  3 036   3   4 1320.       4.54        1.25
6 ADDHYD 4 036   4 7 6
6 REACH  3 037   6   7 1320.       4.59        1.25
6 ADDHYD 4 037   5 7 4
6 RESVOR 2    43 4   6 1444.0
6 RUNOFF 1 143       5 .0625       85.          .53
6 ADDHYD 4 143   5 6 7
6 REACH  3 039   7   6 1640.       1.76        1.45
6 RUNOFF 1 039       5 .0625       85.          .53
6 ADDHYD 4 039   5 6 7
6 RUNOFF 1 038       4 .125        85.          .44
6 REACH  3 039   4   5 1320.       8.22        1.25
6 ADDHYD 4 039   5 7 6
6 REACH  3 085   6   7 1320.       1.59        1.44
6 RUNOFF 1 085       6 .063        84.          .52
6 ADDHYD 4 085   6 7 5
6 REACH  3 084   5   6 1320.       1.59        1.44
6 RUNOFF 1 084       5 .063        84.          .52
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 ADDHYD 4 084   5 6 1
6 RUNOFF 1 091       6 .125        86.          .47
6 REACH  3 090   6   5 1320.       7.05         1.25
6 RUNOFF 1 090       6 .109        85.          .63
6 ADDHYD 4 090   5 6 4
6 REACH  3 088   4   7 1320.       1.17         1.67
6 RUNOFF 1 089       4 .047        84.          .39
6 REACH  3 088   4   5 2000.       .22          1.54
6 RUNOFF 1 088       4 .094        87.          .75
6 ADDHYD 4 088   4 5 6
6 ADDHYD 4 088   6 7 5
6 REACH  3 087   5   7 1320.       1.21         1.67
6 RUNOFF 1 086       4 .063        86.          .27
6 REACH  3 087   4   5 1320.       .44          1.54
6 ADDHYD 4 087   5 7 6
6 RUNOFF 1 087       5 .063        87.          .52
6 ADDHYD 4 087   5 6 7
6 REACH  3 084   7   6 1320.       .36          1.67
6 ADDHYD 4 084   1 6 5
6 REACH  3 105   5   6 1320.       1.15         1.46
6 RUNOFF 1 105       5 .063        78.          .63
6 ADDHYD 4 105   5 6 7
6 RUNOFF 1 101       4 .047        89.          .52
6 REACH  3 102   4   5 1320.       .02          1.66
6 RUNOFF 1 102       6 .063        82.          .63
6 ADDHYD 4 102   5 6 4
6 REACH  3 105   4   5 1320.       .02          1.66
6 ADDHYD 4 105   5 7 6
6 REACH  3 104   6   7 1500.       1.09         1.46
6 RUNOFF 1 104       5 .069        78.          .67
6 ADDHYD 4 104   5 7 1
6 RUNOFF 1 012       5 .07         82.          .42
6 REACH  3 029   5   6 3800.       .04          1.66
6 RUNOFF 1 029       5 .25         81.          1.03
6 ADDHYD 4 029   5 6 7
6 RUNOFF 1 030       5 .25         79.          .97
6 REACH  3 029   5   6 2640.       6.00         1.25
6 ADDHYD 4 029   6 7 5
6 REACH  3 033   5   6 2640.       7.53         1.25
6 RUNOFF 1 033       5 .234        80.          1.14
6 ADDHYD 4 033   5 6 7
6 RUNOFF 1 031       4 .084        83.          .58
6 REACH  3 032   4   5 3400.       .03          1.66
6 RUNOFF 1 032       6 .18         80.          .93
6 ADDHYD 4 032   5 6 4
6 REACH  3 033   4   5 3800.       5.64         1.25
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 ADDHYD 4 033   5 7 6
6 RESVOR 2    33 6   7
6 REACH  3 093   7   6 2640.       5.57        1.25
6 RUNOFF 1 093       5 .195        84.         .45
6 ADDHYD 4 093   5 6 7
6 RUNOFF 1 094       4 .139        84.         .34
6 REACH  3 093   4   5 2000.       4.69        1.25
6 ADDHYD 4 093   5 7 6
6 REACH  3 092   6   7 2000.       1.27        1.67
6 RUNOFF 1 092       5 .125        86.         .47
6 ADDHYD 4 092   5 7 6
6 REACH  3 097   6   7 2640.       .89         1.67
6 RUNOFF 1 097       6 .188        87.         .53
6 ADDHYD 4 097   6 7 4
6 RUNOFF 1 095       5 .125        86.         .98
6 REACH  3 096   5   6 1320.       .2          1.54
6 RUNOFF 1 096       5 .125        82.         .51
6 ADDHYD 4 096   5 6 7
6 REACH  3 097   7   6 2000.       4.19        1.25
6 ADDHYD 4 097   4 6 5
6 REACH  3 098   5   6 800.        1.67        1.44
6 RUNOFF 1 098       5 .094        86.         .37
6 ADDHYD 4 098   5 6 7
6 REACH  3 099   7   6 1200.       1.67        1.44
6 RUNOFF 1 099       5 .094        86.         .49
6 ADDHYD 4 099   5 6 7
6 RUNOFF 1 141       4 .188        87.         .53
6 REACH  3 140   4   5 1320.       3.25        1.25
6 RUNOFF 1 140       4 .125        86.         .44
6 ADDHYD 4 140   4 5 6
6 RUNOFF 1 137       4 .078        80.         .49
6 ADDHYD 4 140   4 6 3
6 REACH  3 139   3   5 2200.       3.21        1.25
6 RUNOFF 1 139       6 .188        87.         .43
6 ADDHYD 4 139   5 6 4
6 ADDHYD 4 139   4 7 6
6 RUNOFF 1 136       4 .066        95.         .17
6 REACH  3 138   4   5 3000.       .17         1.66
6 RUNOFF 1 138       4 .203        84.         .24
6 ADDHYD 4 138   4 5 7
6 REACH  3 139   7   5 2000.       .05         1.66
6 ADDHYD 4 139   5 6 7
6 RUNOFF 1 100       5 .078        86.         .39
6 ADDHYD 4 139   5 7 6
6 RESVOR 2    39 6   2 1413.0
6 RUNOFF 1 129       5 .108        82.         .17
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 RUNOFF 1 130       6 .031        91.         .17
6 ADDHYD 4 129   5 6 7
6 REACH  3 127   7   6 2500.       .08         1.66
6 RUNOFF 1 128       4 .036        80.         .17
6 REACH  3 127   4   5 2300.       .08         1.66
6 ADDHYD 4 127   5 6 7
6 RUNOFF 1 127       5 .159        82.         .21
6 ADDHYD 4 127   5 7 6
6 RUNOFF 1 132       4 .145        89.         .27
6 RUNOFF 1 133       5 .08         95.         .17
6 ADDHYD 4 132   4 5 7
6 REACH  3 131   7   5 2000.       .17         1.66
6 RUNOFF 1 131       4 .119        86.         .27
6 ADDHYD 4 131   4 5 7
6 ADDHYD 4 131   6 7 5
6 RESVOR 2    31 5   4 1453.0
6 REACH  3 126   4   6 1500.       .56         1.67
6 RUNOFF 1 126       5 .158        95.         .28
6 ADDHYD 4 126   5 6 7
6 REACH  3 134   7   6 1500.       1.21        1.67
6 RUNOFF 1 135       4 .042        95.         .17
6 REACH  3 134   4   5 3200.       .13         1.66
6 ADDHYD 4 134   5 6 7
6 RUNOFF 1 134       5 .197        85.         .31
6 ADDHYD 4 134   5 7 6
6 RUNOFF 1 125       5 .117        83.         .17
6 ADDHYD 4 134   5 6 7
6 REACH  3 124   7   6 2400.       .90         1.67
6 RUNOFF 1 124       5 .219        84.         .25
6 ADDHYD 4 124   5 6 7
6 REACH  3 124   2   5 900.        .96         1.51
6 ADDHYD 4 124   5 7 6
6 RUNOFF 1 103       5 .081        84.         .26
6 ADDHYD 4 124   5 6 7
6 REACH  3 104   7   6 1320.       .96         1.51
6 ADDHYD 4 104   1 6 5
6 REACH  3 107   5   6 1000.       .85         1.53
6 RUNOFF 1 107       5 .059        82.         .42
6 ADDHYD 4 107   5 6 7
6 RUNOFF 1 123       6 .213        95.         .25
6 ADDHYD 4 107   6 7 5
6 REACH  3 108   5   3 1700.       .85         1.53
6 RUNOFF 1 106       5 .063        79.         .56
6 REACH  3 108   5   6 700.        .08         1.66
6 RUNOFF 1 108       5 .025        83.         .28
6 ADDHYD 4 108   5 6 7
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 RUNOFF 1 109       5 .063        84.          .29
6 ADDHYD 4 108   5 7 6
6 ADDHYD 4 108   3 6 7
6 REACH  3 110   7   6 1320.       .85          1.53
6 RUNOFF 1 110       5 .073        78.          .56
6 ADDHYD 4 110   5 6 7
6 RUNOFF 1 122       6 .355        85.          .29
6 ADDHYD 4 110   6 7 5
6 REACH  3 111   5   6 1320.       1.07         1.53
6 RUNOFF 1 111       5 .07         77.          .56
6 ADDHYD 4 111   5 6 7
6 REACH  3 112   7   6 1320.       .04          1.63
6 RUNOFF 1 112       5 .061        77.          .46
6 ADDHYD 4 112   5 6 7
6 RUNOFF 1 121       5 .25         95.          .17
6 ADDHYD 4 112   5 7 1
6 RUNOFF 1 049       5 .086        95.          .19
6 REACH  3 048   5   6 1320.       .04          1.66
6 RUNOFF 1 020       5 .064        95.          .17
6 REACH  3 048   5   7 2640.       .04          1.66
6 ADDHYD 4 048   6 7 5
6 RUNOFF 1 048       6 .125        82.          .6
6 ADDHYD 4 048   5 6 7
6 REACH  3 056   7   6 1866.       .12          1.66
6 RUNOFF 1 056       5 .063        82.          .25
6 ADDHYD 4 056   5 6 7
6 REACH  3 057   7   6 1320.       1.87         1.44
6 RUNOFF 1 057       5 .063        82.          .25
6 ADDHYD 4 057   5 6 7
6 RUNOFF 1 043       5 .047        90.          .17
6 RUNOFF 1 021       6 .189        87.          .58
6 ADDHYD 4 021   5 6 4
6 REACH  3 046   4   5 2640.       9.38         1.25
6 RUNOFF 1 047       3 .125        82.          .31
6 REACH  3 046   3   4 1320.       .51          1.54
6 RUNOFF 1 046       6 .125        82.          .29
6 ADDHYD 4 046   4 6 3
6 ADDHYD 4 046   3 5 6
6 REACH  3 057   6   5 1320.       6.49         1.25
6 ADDHYD 4 057   5 7 6
6 REACH  3 059   6   4 1320.       1.87         1.44
6 RUNOFF 1 045       5 .125        90.          .51
6 REACH  3 059   5   6 1400.       .11          1.66
6 ADDHYD 4 059   4 6 7
6 RUNOFF 1 059       5 .063        82.          .25
6 ADDHYD 4 059   5 7 6
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
6 RESVOR 2    59 6   7 1405.
6 REACH  3 066   7   6 660.        1.64        1.67
6 RUNOFF 1 066       5 .063        84.         .46
6 ADDHYD 4 066   5 6 7
6 REACH  3 067   7   6 1320.       1.19        1.67
6 RUNOFF 1 067       5 .063        88.         .25
6 ADDHYD 4 067   5 6 7
6 RUNOFF 1 044       5 .125        87.         .3
6 REACH  3 067   5   6 1320.       .25         1.54
6 ADDHYD 4 067   6 7 5
6 REACH  3 069   5   6 1320.       1.14        1.67
6 RUNOFF 1 069       5 .063        81.         .62
6 ADDHYD 4 069   5 6 2
6 RUNOFF 1 023       5 .091        95.         .23
6 REACH  3 041   5   6 3000.       .24         1.66
6 RUNOFF 1 022       5 .153        87.         .47
6 REACH  3 041   5   7 2800.       .24         1.66
6 ADDHYD 4 041   6 7 5
6 RUNOFF 1 041       6 .172        84.         .38
6 ADDHYD 4 041   5 6 7
6 REACH  3 042   7   6 2500.       6.89        1.25
6 RUNOFF 1 042       5 .078        87.         .22
6 ADDHYD 4 042   5 6 7
6 REACH  3 078   7   6 1320.       4.69        1.25
6 RUNOFF 1 078       5 .063        86.         .27
6 ADDHYD 4 078   5 6 4
6 RUNOFF 1 040       5 .094        82.         .51
6 REACH  3 082   5   6 1400.       .10         1.66
6 RUNOFF 1 082       5 .063        84.         .27
6 ADDHYD 4 082   5 6 7
6 REACH  3 081   7   6 1320.       .22         1.54
6 RUNOFF 1 081       5 .063        84.         .52
6 ADDHYD 4 081   5 6 7
6 REACH  3 078   7   6 1320.       .09         1.66
6 ADDHYD 4 078   4 6 5
6 REACH  3 077   5   6 1320.       2.34        1.44
6 RUNOFF 1 077       5 .063        86.         .38
6 ADDHYD 4 077   5 6 7
6 ADDHYD 4 069   2 7 5
6 RESVOR 2    69 5   6 1390.
6 REACH  3 075   6   2 520.        .52         1.67
6 RUNOFF 1 083       5 .063        85.         .52
6 REACH  3 080   5   6 1320.       .23         1.54
6 RUNOFF 1 080       5 .063        82.         .45
6 ADDHYD 4 080   5 6 7
6 REACH  3 079   7   6 1320.       .23         1.54
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
 6 RUNOFF 1 079       5 .063        88.          .25
 6 ADDHYD 4 079   5 6 7
 6 REACH  3 076   7   6 1320.       8.49         1.25
 6 RUNOFF 1 076       5 .063        86.          .25
 6 ADDHYD 4 076   5 6 7
 6 REACH  3 075   7   6 1320.       7.05         1.25
 6 ADDHYD 4 075   2 6 5
 6 RUNOFF 1 075       6 .063        95.          .52
 6 ADDHYD 4 075   5 6 7
 6 REACH  3 112   7   6 1320.       .41          1.67
 6 ADDHYD 4 112   1 6 2
 6 REACH  3 113   2   5 1320.       .04          1.63
 6 RUNOFF 1 113       6 .053        91.          .52
 6 ADDHYD 4 113   5 6 7
 6 RUNOFF 1 120       5 .231        87.          .30
 6 ADDHYD 4 113   5 7 1
 6 RUNOFF 1 058       5 .063        84.          .25
 6 REACH  3 060   5   6 1320.       .25          1.54
 6 RUNOFF 1 060       5 .063        81.          .49
 6 ADDHYD 4 060   5 6 7
 6 REACH  3 065   7   6 1320.       .28          1.54
 6 RUNOFF 1 065       5 .047        82.          .49
 6 ADDHYD 4 065   5 6 7
 6 REACH  3 068   7   6 1320.       6.82         1.25
 6 RUNOFF 1 068       5 .063        85.          .25
 6 ADDHYD 4 068   5 6 7
 6 REACH  3 070   7   6 1320.       6.14         1.25
 6 RUNOFF 1 070       5 .063        86.          .25
 6 ADDHYD 4 070   5 6 7
 6 REACH  3 074   7   6 1320.       6.75         1.25
 6 RUNOFF 1 074       5 .063        90.          .24
 6 ADDHYD 4 074   5 6 7
 6 REACH  3 113   7   6 1320.       3.11         1.25
 6 ADDHYD 4 113   1 6 2
 6 REACH  3 114   2   1 3000.       .04          1.63
 6 RUNOFF 1 064       5 .25         82.          .33
 6 REACH  3 072   5   6 2640.       .18          1.54
 6 RUNOFF 1 072       5 .125        83.          .49
 6 ADDHYD 4 072   5 6 7
 6 REACH  3 114   7   6 2000.       .05          1.66
 6 RUNOFF 1 115       5 .094        82.          .45
 6 ADDHYD 4 114   5 6 7
 6 RUNOFF 1 071       5 .125        83.          .49
 6 REACH  3 114   5   6 2200.       .05          1.66
 6 ADDHYD 4 114   6 7 5
 6 RUNOFF 1 114       6 .128        85.          1.19
```

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 1	RUNOFF	.15	1	2	.08	.0	4.04	24.00	3.46	---	12.45	248.49	1679.0
XSECTION 2	RUNOFF	.10	1	2	.08	.0	4.04	24.00	3.46	---	12.44	165.73	1708.6
XSECTION 3	REACH	.15	1	2	.08	.0	4.04	24.00	3.45	---	12.63	244.59	1652.7
XSECTION 3	REACH	.10	1	2	.08	.0	4.04	24.00	3.44	---	12.70	158.51	1634.1
XSECTION 3	ADDHYD	.25	1	2	.08	.0	4.04	24.00	3.45	---	12.65	400.78	1635.9
XSECTION 3	RUNOFF	.05	1	2	.08	.0	4.04	24.00	1.83	---	12.52	51.36	1092.7
XSECTION 3	ADDHYD	.29	1	2	.08	.0	4.04	24.00	3.19	---	12.59	446.92	1530.5
XSECTION 6	RUNOFF	.11	1	2	.08	.0	4.04	24.00	2.13	---	12.71	106.85	980.3
XSECTION 6	REACH	.29	1	2	.08	.0	4.04	24.00	3.18	1505.54	12.71	443.03	1517.2
XSECTION 6	ADDHYD	.40	1	2	.08	.0	4.04	24.00	2.90	1506.07	12.71	549.88	1371.3
XSECTION 8	REACH	.40	1	2	.08	.0	4.04	24.00	2.89	1497.00	12.86	531.54	1325.5
XSECTION 7	RUNOFF	.12	1	2	.08	.0	4.04	24.00	1.83	---	12.65	106.65	911.5
XSECTION 8	REACH	.12	1	2	.08	.0	4.04	24.00	1.82	1495.41	12.77	105.14	898.7
XSECTION 19	RUNOFF	.02	1	2	.08	.0	4.04	24.00	3.47	---	12.44	37.85	1720.5
XSECTION 4	RUNOFF	.19	1	2	.08	.0	4.04	24.00	3.46	---	12.44	330.80	1696.4
XSECTION 4	REACH	.02	1	2	.08	.0	4.04	24.00	3.43	---	12.97	31.76	1443.6
XSECTION 4	ADDHYD	.22	1	2	.08	.0	4.04	24.00	3.46	---	12.45	351.51	1619.9
XSECTION 5	RUNOFF	.13	1	2	.08	.0	4.04	24.00	1.83	---	12.59	122.65	981.2
XSECTION 5	REACH	.22	1	2	.08	.0	4.04	24.00	3.45	---	12.62	342.38	1577.8
XSECTION 5	ADDHYD	.34	1	2	.08	.0	4.04	24.00	2.85	---	12.61	464.83	1359.2
XSECTION 8	REACH	.34	1	2	.08	.0	4.04	24.00	2.84	1496.88	12.85	436.28	1275.7
XSECTION 8	ADDHYD	.52	1	2	.08	.0	4.04	24.00	2.65	1497.09	12.84	633.31	1222.6
XSECTION 8	ADDHYD	.86	1	2	.08	.0	4.04	24.00	2.73	1497.43	12.85	1069.56	1243.7
XSECTION 18	RUNOFF	.18	1	2	.08	.0	4.04	24.00	1.90	---	12.67	171.98	934.7
XSECTION 8	REACH	.18	1	2	.08	.0	4.04	24.00	1.89	1495.70	12.98	146.42	795.7
XSECTION 8	ADDHYD	1.04	1	2	.08	.0	4.04	24.00	2.58	1497.51	12.86	1208.88	1157.9
XSECTION 8	RUNOFF	.13	1	2	.08	.0	4.04	24.00	1.90	---	12.68	119.20	909.9
XSECTION 8	ADDHYD	1.18	1	2	.08	.0	4.04	24.00	2.50	1497.58	12.84	1315.07	1119.2
STRUCTURE 8	RESVOR	1.18	1	2	.08	.0	4.04	24.00	2.29	1501.22	13.48	463.39	394.4
XSECTION 14	REACH	1.18	1	2	.08	.0	4.04	24.00	2.29	1488.19	13.68	459.38	391.0
XSECTION 9	RUNOFF	.07	1	2	.08	.0	4.04	24.00	1.97	---	12.78	56.70	859.0
XSECTION 14	REACH	.07	1	2	.08	.0	4.04	24.00	1.97	1485.27	12.96	53.63	812.6

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 14	ADDHYD	1.24	1	2	.08	.0	4.04	24.00	2.27	1488.43	13.57	483.32	389.5
XSECTION 10	RUNOFF	.09	1	2	.08	.0	4.04	24.00	1.83	---	12.59	93.22	981.2
XSECTION 11	REACH	.09	1	2	.08	.0	4.04	24.00	1.82	---	12.75	86.58	911.4
XSECTION 11	RUNOFF	.23	1	2	.08	.0	4.04	24.00	1.97	---	12.72	212.10	906.4
XSECTION 11	ADDHYD	.33	1	2	.08	.0	4.04	24.00	1.93	---	12.73	298.55	907.5
XSECTION 13	REACH	.33	1	2	.08	.0	4.04	24.00	1.93	---	12.73	298.55	907.5
XSECTION 13	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.22	---	12.59	140.57	1124.5
XSECTION 13	ADDHYD	.45	1	2	.08	.0	4.04	24.00	2.01	---	12.68	431.13	949.6
XSECTION 144	RUNOFF	.13	1	2	.08	.0	4.04	24.00	1.97	---	12.78	113.39	859.0
XSECTION 14	REACH	.13	1	2	.08	.0	4.04	24.00	1.97	1485.91	12.89	111.92	847.9
XSECTION 13	ADDHYD	.59	1	2	.08	.0	4.04	24.00	2.00	---	12.71	532.09	908.0
XSECTION 14	REACH	.59	1	2	.08	.0	4.04	24.00	2.00	1488.81	12.71	532.09	908.0
XSECTION 14	ADDHYD	1.83	1	2	.08	.0	4.04	24.00	2.18	1489.04	12.87	775.35	424.4
XSECTION 16	RUNOFF	.12	1	2	.08	.0	4.04	24.00	2.56	---	12.54	155.97	1310.7
XSECTION 15	REACH	.12	1	2	.08	.0	4.04	24.00	2.56	---	12.64	155.01	1302.6
XSECTION 15	RUNOFF	.07	1	2	.08	.0	4.04	24.00	2.21	---	12.74	71.32	977.0
XSECTION 15	ADDHYD	.19	1	2	.08	.0	4.04	24.00	2.43	---	12.66	224.76	1170.6
XSECTION 14	ADDHYD	2.02	1	2	.08	.0	4.04	24.00	2.21	1489.19	12.80	979.73	485.3
XSECTION 14	RUNOFF	.18	1	2	.08	.0	4.04	24.00	2.31	---	12.51	227.94	1287.8
XSECTION 14	ADDHYD	2.20	1	2	.08	.0	4.04	24.00	2.21	1489.28	12.69	1121.09	510.5
XSECTION 27	REACH	2.20	1	2	.08	.0	4.04	24.00	2.20	1472.75	12.97	1006.29	458.2
XSECTION 27	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.20	---	12.91	157.15	835.9
XSECTION 27	ADDHYD	2.38	1	2	.08	.0	4.04	24.00	2.20	1472.85	12.96	1162.68	487.7
XSECTION 17	RUNOFF	.06	1	2	.08	.0	4.04	24.00	3.47	---	12.44	101.41	1718.8
XSECTION 25	REACH	.06	1	2	.08	.0	4.04	24.00	3.43	---	12.88	89.43	1515.7
XSECTION 25	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.31	---	12.52	113.22	1272.2
XSECTION 25	ADDHYD	.15	1	2	.08	.0	4.04	24.00	2.76	---	12.56	188.52	1273.8
XSECTION 27	REACH	.15	1	2	.08	.0	4.04	24.00	2.75	1470.52	12.68	184.47	1246.4
XSECTION 27	ADDHYD	2.53	1	2	.08	.0	4.04	24.00	2.24	1472.93	12.91	1313.23	518.7
XSECTION 26	RUNOFF	.07	1	2	.08	.0	4.04	24.00	2.48	---	12.47	93.38	1393.7
XSECTION 27	ADDHYD	2.60	1	2	.08	.0	4.04	24.00	2.24	1472.94	12.89	1331.60	512.4
XSECTION 37	REACH	2.60	1	2	.08	.0	4.04	24.00	2.24	1455.76	13.02	1319.42	507.7
XSECTION 37	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.31	---	12.46	169.10	1352.8
XSECTION 37	ADDHYD	2.72	1	2	.08	.0	4.04	24.00	2.24	1455.78	13.01	1338.13	491.2
STRUCTURE 37	RESVOR	2.72	1	2	.08	.0	4.04	24.00	2.22	1450.68	13.04	1336.00	490.5
XSECTION 24	RUNOFF	.20	1	2	.08	.0	4.04	24.00	2.57	---	12.52	268.81	1357.6

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 37	REACH	.20	1	2	.08	.0	4.04	24.00	2.56	1453.61	12.61	266.68	1346.9
XSECTION 37	ADDHYD	2.92	1	2	.08	.0	4.04	24.00	2.24	1455.92	12.88	1463.79	501.0
XSECTION 28	RUNOFF	.16	1	2	.08	.0	4.04	24.00	2.21	---	12.76	149.43	957.9
XSECTION 36	REACH	.16	1	2	.08	.0	4.04	24.00	2.19	---	13.27	117.40	752.6
XSECTION 36	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.30	---	12.54	155.70	1245.6
XSECTION 36	ADDHYD	.28	1	2	.08	.0	4.04	24.00	2.24	---	12.62	201.90	718.5
XSECTION 34	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.38	---	12.64	141.66	1133.3
XSECTION 35	REACH	.13	1	2	.08	.0	4.04	24.00	2.38	---	12.76	139.31	1114.5
XSECTION 35	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.30	---	12.54	154.91	1239.3
XSECTION 35	ADDHYD	.25	1	2	.08	.0	4.04	24.00	2.34	---	12.61	281.50	1126.0
XSECTION 36	REACH	.25	1	2	.08	.0	4.04	24.00	2.34	---	12.61	281.50	1126.0
XSECTION 36	ADDHYD	.53	1	2	.08	.0	4.04	24.00	2.29	---	12.61	483.34	910.2
XSECTION 37	REACH	.53	1	2	.08	.0	4.04	24.00	2.29	1454.45	12.61	483.34	910.2
XSECTION 37	ADDHYD	3.45	1	2	.08	.0	4.04	24.00	2.25	1456.35	12.73	1888.83	547.0
STRUCTURE 43	RESVOR	3.45	1	2	.08	.0	4.04	24.00	2.18	1450.05	13.53	1271.16	368.1
XSECTION 143	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.48	---	12.55	80.11	1281.8
XSECTION 143	ADDHYD	3.52	1	2	.08	.0	4.04	24.00	2.18	---	13.45	1280.48	364.2
XSECTION 39	REACH	3.52	1	2	.08	.0	4.04	24.00	2.18	---	13.45	1280.48	364.2
XSECTION 39	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.48	---	12.55	80.11	1281.8
XSECTION 39	ADDHYD	3.58	1	2	.08	.0	4.04	24.00	2.19	---	13.40	1292.14	361.1
XSECTION 38	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.48	---	12.52	167.08	1336.7
XSECTION 39	REACH	.13	1	2	.08	.0	4.04	24.00	2.48	---	12.52	167.08	1336.7
XSECTION 39	ADDHYD	3.70	1	2	.08	.0	4.04	24.00	2.20	---	13.39	1307.88	353.2
XSECTION 85	REACH	3.70	1	2	.08	.0	4.04	24.00	2.20	---	13.39	1307.88	353.2
XSECTION 85	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.55	79.29	1258.6
XSECTION 85	ADDHYD	3.77	1	2	.08	.0	4.04	24.00	2.20	---	13.38	1317.82	349.9
XSECTION 84	REACH	3.77	1	2	.08	.0	4.04	24.00	2.20	---	13.38	1317.82	349.9
XSECTION 84	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.55	79.29	1258.6
XSECTION 84	ADDHYD	3.83	1	2	.08	.0	4.04	24.00	2.20	---	13.37	1327.94	346.8
XSECTION 91	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.57	---	12.52	169.21	1353.7
XSECTION 90	REACH	.13	1	2	.08	.0	4.04	24.00	2.57	---	12.52	169.21	1353.7
XSECTION 90	RUNOFF	.11	1	2	.08	.0	4.04	24.00	2.47	---	12.58	132.92	1219.5
XSECTION 90	ADDHYD	.23	1	2	.08	.0	4.04	24.00	2.52	---	12.54	301.14	1286.9
XSECTION 88	REACH	.23	1	2	.08	.0	4.04	24.00	2.52	---	12.54	301.14	1286.9
XSECTION 89	RUNOFF	.05	1	2	.08	.0	4.04	24.00	2.39	---	12.50	62.16	1322.6
XSECTION 88	REACH	.05	1	2	.08	.0	4.04	24.00	2.38	---	12.75	56.34	1198.7

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
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A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 88	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.65	---	12.64	115.03	1223.7
XSECTION 88	ADDHYD	.14	1	2	.08	.0	4.04	24.00	2.56	---	12.68	169.57	1202.6
XSECTION 88	ADDHYD	.38	1	2	.08	.0	4.04	24.00	2.54	---	12.57	464.64	1239.0
XSECTION 87	REACH	.38	1	2	.08	.0	4.04	24.00	2.54	---	12.57	464.64	1239.0
XSECTION 86	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.46	90.81	1441.4
XSECTION 87	REACH	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.55	89.42	1419.3
XSECTION 87	ADDHYD	.44	1	2	.08	.0	4.04	24.00	2.54	---	12.57	553.92	1264.7
XSECTION 87	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.65	---	12.54	85.98	1364.8
XSECTION 87	ADDHYD	.50	1	2	.08	.0	4.04	24.00	2.55	---	12.57	639.53	1276.5
XSECTION 84	REACH	.50	1	2	.08	.0	4.04	24.00	2.55	---	12.57	639.53	1276.5
XSECTION 84	ADDHYD	4.33	1	2	.08	.0	4.04	24.00	2.24	---	12.68	1745.51	403.1
XSECTION 105	REACH	4.33	1	2	.08	.0	4.04	24.00	2.24	---	12.68	1745.51	403.1
XSECTION 105	RUNOFF	.06	1	2	.08	.0	4.04	24.00	1.90	---	12.61	61.30	973.0
XSECTION 105	ADDHYD	4.39	1	2	.08	.0	4.04	24.00	2.24	---	12.67	1805.76	411.1
XSECTION 101	RUNOFF	.05	1	2	.08	.0	4.04	24.00	2.84	---	12.53	67.37	1433.4
XSECTION 102	REACH	.05	1	2	.08	.0	4.04	24.00	2.82	---	13.03	52.85	1124.5
XSECTION 102	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.22	---	12.60	70.08	1112.4
XSECTION 102	ADDHYD	.11	1	2	.08	.0	4.04	24.00	2.47	---	12.69	108.28	984.4
XSECTION 105	REACH	.11	1	2	.08	.0	4.04	24.00	2.46	---	13.11	89.97	817.9
XSECTION 105	ADDHYD	4.50	1	2	.08	.0	4.04	24.00	2.24	---	12.68	1866.17	414.4
XSECTION 104	REACH	4.50	1	2	.08	.0	4.04	24.00	2.24	---	12.68	1866.17	414.4
XSECTION 104	RUNOFF	.07	1	2	.08	.0	4.04	24.00	1.90	---	12.64	65.89	954.9
XSECTION 104	ADDHYD	4.57	1	2	.08	.0	4.04	24.00	2.24	---	12.68	1934.78	423.2
XSECTION 12	RUNOFF	.07	1	2	.08	.0	4.04	24.00	2.22	---	12.52	86.92	1241.7
XSECTION 29	REACH	.07	1	2	.08	.0	4.04	24.00	2.18	---	13.39	49.58	708.3
XSECTION 29	RUNOFF	.25	1	2	.08	.0	4.04	24.00	2.13	---	12.82	218.50	874.0
XSECTION 29	ADDHYD	.32	1	2	.08	.0	4.04	24.00	2.14	---	12.88	243.13	759.8
XSECTION 30	RUNOFF	.25	1	2	.08	.0	4.04	24.00	1.97	---	12.80	208.97	835.9
XSECTION 29	REACH	.25	1	2	.08	.0	4.04	24.00	1.97	---	12.88	208.57	834.3
XSECTION 29	ADDHYD	.57	1	2	.08	.0	4.04	24.00	2.06	---	12.88	451.69	792.4
XSECTION 33	REACH	.57	1	2	.08	.0	4.04	24.00	2.06	---	12.88	451.69	792.4
XSECTION 33	RUNOFF	.23	1	2	.08	.0	4.04	24.00	2.04	---	12.89	185.73	793.7
XSECTION 33	ADDHYD	.80	1	2	.08	.0	4.04	24.00	2.06	---	12.88	637.40	792.8
XSECTION 31	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.30	---	12.57	99.02	1178.8
XSECTION 32	REACH	.08	1	2	.08	.0	4.04	24.00	2.26	---	13.34	60.30	717.9
XSECTION 32	RUNOFF	.18	1	2	.08	.0	4.04	24.00	2.05	---	12.77	160.51	891.7

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SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 32	ADDHYD	.26	1	2	.08	.0	4.04	24.00	2.12	---	12.85	193.67	733.6
XSECTION 33	REACH	.26	1	2	.08	.0	4.04	24.00	2.11	---	12.97	192.08	727.6
XSECTION 33	ADDHYD	1.07	1	2	.08	.0	4.04	24.00	2.07	---	12.90	827.43	774.7
STRUCTURE 33	RESVOR	1.07	1	2	.08	.0	4.04	24.00	1.70	1468.04	14.35	154.64	144.8
XSECTION 93	REACH	1.07	1	2	.08	.0	4.04	24.00	1.69	---	14.45	154.63	144.8
XSECTION 93	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.39	---	12.52	253.10	1297.9
XSECTION 93	ADDHYD	1.26	1	2	.08	.0	4.04	24.00	1.80	---	12.56	271.20	214.7
XSECTION 94	RUNOFF	.14	1	2	.08	.0	4.04	24.00	2.39	---	12.49	186.62	1342.6
XSECTION 93	REACH	.14	1	2	.08	.0	4.04	24.00	2.39	---	12.57	186.28	1340.2
XSECTION 93	ADDHYD	1.40	1	2	.08	.0	4.04	24.00	1.86	---	12.57	457.47	326.3
XSECTION 92	REACH	1.40	1	2	.08	.0	4.04	24.00	1.86	---	12.57	457.47	326.3
XSECTION 92	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.57	---	12.52	169.21	1353.7
XSECTION 92	ADDHYD	1.53	1	2	.08	.0	4.04	24.00	1.91	---	12.55	625.56	409.7
XSECTION 97	REACH	1.53	1	2	.08	.0	4.04	24.00	1.91	---	12.55	625.56	409.7
XSECTION 97	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.66	---	12.54	254.23	1352.3
XSECTION 97	ADDHYD	1.71	1	2	.08	.0	4.04	24.00	2.00	---	12.55	879.63	512.9
XSECTION 95	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.55	---	12.77	132.85	1062.8
XSECTION 96	REACH	.13	1	2	.08	.0	4.04	24.00	2.55	---	12.92	129.15	1033.2
XSECTION 96	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.22	---	12.55	148.27	1186.2
XSECTION 96	ADDHYD	.25	1	2	.08	.0	4.04	24.00	2.38	---	12.64	251.35	1005.4
XSECTION 97	REACH	.25	1	2	.08	.0	4.04	24.00	2.38	---	12.72	250.77	1003.1
XSECTION 97	ADDHYD	1.96	1	2	.08	.0	4.04	24.00	2.04	---	12.58	1108.54	564.1
XSECTION 98	REACH	1.96	1	2	.08	.0	4.04	24.00	2.04	---	12.58	1108.54	564.1
XSECTION 98	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.57	---	12.49	131.63	1400.3
XSECTION 98	ADDHYD	2.06	1	2	.08	.0	4.04	24.00	2.07	---	12.56	1236.35	600.5
XSECTION 99	REACH	2.06	1	2	.08	.0	4.04	24.00	2.07	---	12.56	1236.35	600.5
XSECTION 99	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.56	---	12.53	126.50	1345.7
XSECTION 99	ADDHYD	2.15	1	2	.08	.0	4.04	24.00	2.09	---	12.56	1362.25	632.7
XSECTION 141	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.66	---	12.54	254.23	1352.3
XSECTION 140	REACH	.19	1	2	.08	.0	4.04	24.00	2.66	---	12.54	254.23	1352.3
XSECTION 140	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.57	---	12.52	170.38	1363.0
XSECTION 140	ADDHYD	.31	1	2	.08	.0	4.04	24.00	2.62	---	12.53	425.44	1359.2
XSECTION 137	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.06	---	12.55	88.26	1131.6
XSECTION 140	ADDHYD	.39	1	2	.08	.0	4.04	24.00	2.51	---	12.53	513.57	1313.5
XSECTION 139	REACH	.39	1	2	.08	.0	4.04	24.00	2.50	---	12.62	511.01	1306.9
XSECTION 139	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.66	---	12.51	263.45	1401.3

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A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

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ALTERNATE 1 STORM 1													
XSECTION 139	ADDHYD	.58	1	2	.08	.0	4.04	24.00	2.55	---	12.56	764.27	1320.0
XSECTION 139	ADDHYD	2.73	1	2	.08	.0	4.04	24.00	2.19	---	12.56	2126.45	778.4
XSECTION 136	RUNOFF	.07	1	2	.08	.0	4.04	24.00	3.47	---	12.44	113.44	1718.8
XSECTION 138	REACH	.07	1	2	.08	.0	4.04	24.00	3.44	---	12.69	107.87	1634.5
XSECTION 138	RUNOFF	.20	1	2	.08	.0	4.04	24.00	2.40	---	12.46	283.21	1395.1
XSECTION 138	ADDHYD	.27	1	2	.08	.0	4.04	24.00	2.65	---	12.47	384.32	1428.7
XSECTION 139	REACH	.27	1	2	.08	.0	4.04	24.00	2.64	---	12.61	357.88	1330.4
XSECTION 139	ADDHYD	3.00	1	2	.08	.0	4.04	24.00	2.23	---	12.57	2479.01	826.1
XSECTION 100	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.57	---	12.50	108.52	1391.3
XSECTION 139	ADDHYD	3.08	1	2	.08	.0	4.04	24.00	2.24	---	12.56	2585.49	839.7
STRUCTURE 39	RESVOR	3.08	1	2	.08	.0	4.04	24.00	2.14	1418.13	12.88	1552.51	504.2
XSECTION 129	RUNOFF	.11	1	2	.08	.0	4.04	24.00	2.23	---	12.45	148.01	1370.4
XSECTION 130	RUNOFF	.03	1	2	.08	.0	4.04	24.00	3.05	---	12.44	50.71	1635.7
XSECTION 129	ADDHYD	.14	1	2	.08	.0	4.04	24.00	2.41	---	12.45	198.69	1429.4
XSECTION 127	REACH	.14	1	2	.08	.0	4.04	24.00	2.40	---	12.72	177.95	1280.2
XSECTION 128	RUNOFF	.04	1	2	.08	.0	4.04	24.00	2.07	---	12.45	46.93	1303.7
XSECTION 127	REACH	.04	1	2	.08	.0	4.04	24.00	2.05	---	12.85	36.47	1013.1
XSECTION 127	ADDHYD	.17	1	2	.08	.0	4.04	24.00	2.32	---	12.74	211.70	1209.7
XSECTION 127	RUNOFF	.16	1	2	.08	.0	4.04	24.00	2.23	---	12.45	213.56	1343.1
XSECTION 127	ADDHYD	.33	1	2	.08	.0	4.04	24.00	2.28	---	12.49	389.78	1167.0
XSECTION 132	RUNOFF	.14	1	2	.08	.0	4.04	24.00	2.85	---	12.45	222.42	1533.9
XSECTION 133	RUNOFF	.08	1	2	.08	.0	4.04	24.00	3.47	---	12.44	137.50	1718.8
XSECTION 132	ADDHYD	.22	1	2	.08	.0	4.04	24.00	3.07	---	12.45	359.78	1599.0
XSECTION 131	REACH	.22	1	2	.08	.0	4.04	24.00	3.06	---	12.53	354.39	1575.1
XSECTION 131	RUNOFF	.12	1	2	.08	.0	4.04	24.00	2.57	---	12.46	171.53	1441.4
XSECTION 131	ADDHYD	.34	1	2	.08	.0	4.04	24.00	2.89	---	12.49	519.69	1510.7
XSECTION 131	ADDHYD	.68	1	2	.08	.0	4.04	24.00	2.59	---	12.49	909.47	1341.4
STRUCTURE 31	RESVOR	.68	1	2	.08	.0	4.04	24.00	2.25	1459.04	13.15	154.67	228.1
XSECTION 126	REACH	.68	1	2	.08	.0	4.04	24.00	2.25	---	13.24	154.64	228.1
XSECTION 126	RUNOFF	.16	1	2	.08	.0	4.04	24.00	3.46	---	12.44	265.71	1681.7
XSECTION 126	ADDHYD	.84	1	2	.08	.0	4.04	24.00	2.47	---	12.49	373.04	446.2
XSECTION 134	REACH	.84	1	2	.08	.0	4.04	24.00	2.47	---	12.49	373.04	446.2
XSECTION 135	RUNOFF	.04	1	2	.08	.0	4.04	24.00	3.47	---	12.44	72.19	1718.8
XSECTION 134	REACH	.04	1	2	.08	.0	4.04	24.00	3.44	---	12.80	64.58	1537.6
XSECTION 134	ADDHYD	.88	1	2	.08	.0	4.04	24.00	2.52	---	12.50	429.42	489.1
XSECTION 134	RUNOFF	.20	1	2	.08	.0	4.04	24.00	2.48	---	12.47	274.55	1393.7

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 134	ADDHYD	1.07	1	2	.08	.0	4.04	24.00	2.51	---	12.49	703.34	654.3
XSECTION 125	RUNOFF	.12	1	2	.08	.0	4.04	24.00	2.32	---	12.45	164.16	1403.1
XSECTION 134	ADDHYD	1.19	1	2	.08	.0	4.04	24.00	2.49	---	12.47	864.80	725.5
XSECTION 124	REACH	1.19	1	2	.08	.0	4.04	24.00	2.49	---	12.47	864.80	725.5
XSECTION 124	RUNOFF	.22	1	2	.08	.0	4.04	24.00	2.40	---	12.46	303.53	1386.0
XSECTION 124	ADDHYD	1.41	1	2	.08	.0	4.04	24.00	2.48	---	12.47	1168.11	827.9
XSECTION 124	REACH	3.08	1	2	.08	.0	4.04	24.00	2.14	---	12.88	1552.51	504.2
XSECTION 124	ADDHYD	4.49	1	2	.08	.0	4.04	24.00	2.25	---	12.56	2305.48	513.5
XSECTION 103	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.40	---	12.46	112.17	1384.9
XSECTION 124	ADDHYD	4.57	1	2	.08	.0	4.04	24.00	2.25	---	12.55	2411.70	527.6
XSECTION 104	REACH	4.57	1	2	.08	.0	4.04	24.00	2.25	---	12.55	2411.70	527.6
XSECTION 104	ADDHYD	9.14	1	2	.08	.0	4.04	24.00	2.24	---	12.58	4258.59	465.8
XSECTION 107	REACH	9.14	1	2	.08	.0	4.04	24.00	2.24	1419.14	12.58	4258.59	465.8
XSECTION 107	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.22	---	12.52	73.26	1241.7
XSECTION 107	ADDHYD	9.20	1	2	.08	.0	4.04	24.00	2.24	1419.16	12.58	4329.97	470.5
XSECTION 123	RUNOFF	.21	1	2	.08	.0	4.04	24.00	3.46	---	12.44	359.53	1687.9
XSECTION 107	ADDHYD	9.41	1	2	.08	.0	4.04	24.00	2.27	1419.23	12.56	4641.67	493.0
XSECTION 108	REACH	9.41	1	2	.08	.0	4.04	24.00	2.27	---	12.56	4641.67	493.0
XSECTION 106	RUNOFF	.06	1	2	.08	.0	4.04	24.00	1.98	---	12.58	66.28	1052.0
XSECTION 108	REACH	.06	1	2	.08	.0	4.04	24.00	1.98	---	12.70	64.54	1024.4
XSECTION 108	RUNOFF	.03	1	2	.08	.0	4.04	24.00	2.31	---	12.47	33.45	1338.1
XSECTION 108	ADDHYD	.09	1	2	.08	.0	4.04	24.00	2.07	---	12.55	91.42	1038.9
XSECTION 109	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.47	86.13	1367.2
XSECTION 108	ADDHYD	.15	1	2	.08	.0	4.04	24.00	2.21	---	12.51	175.11	1159.7
XSECTION 108	ADDHYD	9.57	1	2	.08	.0	4.04	24.00	2.27	---	12.56	4814.76	503.3
XSECTION 110	REACH	9.57	1	2	.08	.0	4.04	24.00	2.27	---	12.56	4814.76	503.3
XSECTION 110	RUNOFF	.07	1	2	.08	.0	4.04	24.00	1.90	---	12.58	74.20	1016.5
XSECTION 110	ADDHYD	9.64	1	2	.08	.0	4.04	24.00	2.27	---	12.56	4888.82	507.2
XSECTION 122	RUNOFF	.35	1	2	.08	.0	4.04	24.00	2.48	---	12.47	497.17	1400.5
XSECTION 110	ADDHYD	9.99	1	2	.08	.0	4.04	24.00	2.28	---	12.55	5365.28	536.8
XSECTION 111	REACH	9.99	1	2	.08	.0	4.04	24.00	2.28	---	12.55	5365.28	536.8
XSECTION 111	RUNOFF	.07	1	2	.08	.0	4.04	24.00	1.83	---	12.59	68.69	981.2
XSECTION 111	ADDHYD	10.06	1	2	.08	.0	4.04	24.00	2.27	---	12.55	5433.58	539.9
XSECTION 112	REACH	10.06	1	2	.08	.0	4.04	24.00	2.27	---	12.64	5378.33	534.4
XSECTION 112	RUNOFF	.06	1	2	.08	.0	4.04	24.00	1.83	---	12.55	63.36	1038.7
XSECTION 112	ADDHYD	10.12	1	2	.08	.0	4.04	24.00	2.27	---	12.64	5438.26	537.1

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
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A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 121	RUNOFF	.25	1	2	.08	.0	4.04	24.00	3.47	---	12.44	429.70	1718.8
XSECTION 112	ADDHYD	10.37	1	2	.08	.0	4.04	24.00	2.29	---	12.61	5612.14	540.9
XSECTION 49	RUNOFF	.09	1	2	.08	.0	4.04	24.00	3.46	---	12.44	146.94	1708.6
XSECTION 48	REACH	.09	1	2	.08	.0	4.04	24.00	3.44	---	12.70	140.68	1635.8
XSECTION 20	RUNOFF	.06	1	2	.08	.0	4.04	24.00	3.47	---	12.44	110.00	1718.8
XSECTION 48	REACH	.06	1	2	.08	.0	4.04	24.00	3.43	---	12.99	89.76	1402.5
XSECTION 48	ADDHYD	.15	1	2	.08	.0	4.04	24.00	3.44	---	12.74	218.80	1458.6
XSECTION 48	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.22	---	12.59	142.93	1143.5
XSECTION 48	ADDHYD	.28	1	2	.08	.0	4.04	24.00	2.88	---	12.66	353.80	1286.5
XSECTION 56	REACH	.28	1	2	.08	.0	4.04	24.00	2.88	---	12.79	346.68	1260.7
XSECTION 56	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.23	---	12.46	83.11	1319.1
XSECTION 56	ADDHYD	.34	1	2	.08	.0	4.04	24.00	2.76	---	12.59	386.92	1144.7
XSECTION 57	REACH	.34	1	2	.08	.0	4.04	24.00	2.76	---	12.59	386.92	1144.7
XSECTION 57	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.23	---	12.46	83.11	1319.1
XSECTION 57	ADDHYD	.40	1	2	.08	.0	4.04	24.00	2.67	---	12.55	463.22	1155.2
XSECTION 43	RUNOFF	.05	1	2	.08	.0	4.04	24.00	2.95	---	12.44	75.70	1610.6
XSECTION 21	RUNOFF	.19	1	2	.08	.0	4.04	24.00	2.65	---	12.55	249.78	1321.6
XSECTION 21	ADDHYD	.24	1	2	.08	.0	4.04	24.00	2.71	---	12.48	319.12	1352.2
XSECTION 46	REACH	.24	1	2	.08	.0	4.04	24.00	2.71	---	12.48	319.12	1352.2
XSECTION 47	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.23	---	12.48	161.49	1291.9
XSECTION 46	REACH	.13	1	2	.08	.0	4.04	24.00	2.22	---	12.58	160.03	1280.2
XSECTION 46	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.23	---	12.47	162.41	1299.3
XSECTION 46	ADDHYD	.25	1	2	.08	.0	4.04	24.00	2.22	---	12.51	317.51	1270.0
XSECTION 46	ADDHYD	.49	1	2	.08	.0	4.04	24.00	2.46	---	12.49	635.94	1308.5
XSECTION 57	REACH	.49	1	2	.08	.0	4.04	24.00	2.46	---	12.49	635.94	1308.5
XSECTION 57	ADDHYD	.89	1	2	.08	.0	4.04	24.00	2.56	---	12.52	1098.96	1239.0
XSECTION 59	REACH	.89	1	2	.08	.0	4.04	24.00	2.56	---	12.52	1098.96	1239.0
XSECTION 45	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.94	---	12.52	183.10	1464.8
XSECTION 59	REACH	.13	1	2	.08	.0	4.04	24.00	2.93	---	12.64	178.98	1431.9
XSECTION 59	ADDHYD	1.01	1	2	.08	.0	4.04	24.00	2.60	---	12.53	1271.89	1256.8
XSECTION 59	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.23	---	12.46	83.11	1319.1
XSECTION 59	ADDHYD	1.07	1	2	.08	.0	4.04	24.00	2.58	---	12.52	1353.71	1259.3
STRUCTURE 59	RESVOR	1.07	1	2	.08	.0	4.04	24.00	2.44	1411.33	13.05	538.39	500.8
XSECTION 66	REACH	1.07	1	2	.08	.0	4.04	24.00	2.44	---	13.05	538.39	500.8
XSECTION 66	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.53	81.13	1287.7
XSECTION 66	ADDHYD	1.14	1	2	.08	.0	4.04	24.00	2.44	---	12.80	567.63	498.8

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A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 67	REACH	1.14	1	2	.08	.0	4.04	24.00	2.44	---	12.80	567.63	498.8
XSECTION 67	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.76	---	12.45	95.29	1512.5
XSECTION 67	ADDHYD	1.20	1	2	.08	.0	4.04	24.00	2.46	---	12.60	614.96	512.0
XSECTION 44	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.66	---	12.47	182.98	1463.9
XSECTION 67	REACH	.13	1	2	.08	.0	4.04	24.00	2.66	---	12.57	179.72	1437.8
XSECTION 67	ADDHYD	1.33	1	2	.08	.0	4.04	24.00	2.47	---	12.60	796.54	600.7
XSECTION 69	REACH	1.33	1	2	.08	.0	4.04	24.00	2.47	---	12.60	796.54	600.7
XSECTION 69	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.14	---	12.60	69.10	1096.8
XSECTION 69	ADDHYD	1.39	1	2	.08	.0	4.04	24.00	2.46	---	12.60	865.45	623.1
XSECTION 23	RUNOFF	.09	1	2	.08	.0	4.04	24.00	3.46	---	12.44	154.39	1696.6
XSECTION 41	REACH	.09	1	2	.08	.0	4.04	24.00	3.45	---	12.62	150.72	1656.3
XSECTION 22	RUNOFF	.15	1	2	.08	.0	4.04	24.00	2.66	---	12.52	212.40	1388.2
XSECTION 41	REACH	.15	1	2	.08	.0	4.04	24.00	2.65	---	12.73	204.76	1338.3
XSECTION 41	ADDHYD	.24	1	2	.08	.0	4.04	24.00	2.95	---	12.68	351.07	1438.8
XSECTION 41	RUNOFF	.17	1	2	.08	.0	4.04	24.00	2.39	---	12.50	227.58	1323.2
XSECTION 41	ADDHYD	.42	1	2	.08	.0	4.04	24.00	2.72	---	12.55	564.00	1355.8
XSECTION 42	REACH	.42	1	2	.08	.0	4.04	24.00	2.72	---	12.55	564.00	1355.8
XSECTION 42	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.66	---	12.45	116.72	1496.4
XSECTION 42	ADDHYD	.49	1	2	.08	.0	4.04	24.00	2.71	---	12.52	670.65	1357.6
XSECTION 78	REACH	.49	1	2	.08	.0	4.04	24.00	2.71	---	12.52	670.65	1357.6
XSECTION 78	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.46	90.81	1441.4
XSECTION 78	ADDHYD	.56	1	2	.08	.0	4.04	24.00	2.69	---	12.50	759.98	1364.4
XSECTION 40	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.22	---	12.55	111.50	1186.2
XSECTION 82	REACH	.09	1	2	.08	.0	4.04	24.00	2.21	---	12.70	106.20	1129.7
XSECTION 82	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.40	---	12.46	86.69	1376.0
XSECTION 82	ADDHYD	.16	1	2	.08	.0	4.04	24.00	2.29	---	12.53	182.58	1162.9
XSECTION 81	REACH	.16	1	2	.08	.0	4.04	24.00	2.28	---	12.64	176.15	1122.0
XSECTION 81	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.55	79.29	1258.6
XSECTION 81	ADDHYD	.22	1	2	.08	.0	4.04	24.00	2.31	---	12.61	253.29	1151.3
XSECTION 78	REACH	.22	1	2	.08	.0	4.04	24.00	2.31	---	12.73	245.32	1115.1
XSECTION 78	ADDHYD	.78	1	2	.08	.0	4.04	24.00	2.58	---	12.53	976.52	1256.8
XSECTION 77	REACH	.78	1	2	.08	.0	4.04	24.00	2.58	---	12.53	976.52	1256.8
XSECTION 77	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.49	87.65	1391.3
XSECTION 77	ADDHYD	.84	1	2	.08	.0	4.04	24.00	2.58	---	12.53	1064.47	1267.2
XSECTION 69	ADDHYD	2.23	1	2	.08	.0	4.04	24.00	2.51	---	12.55	1920.28	861.5
STRUCTURE 69	RESVOR	2.23	1	2	.08	.0	4.04	24.00	2.29	1395.58	13.67	610.20	273.8

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SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 75	REACH	2.23	1	2	.08	.0	4.04	24.00	2.29	---	13.67	610.20	273.8
XSECTION 83	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.48	---	12.54	81.54	1294.3
XSECTION 80	REACH	.06	1	2	.08	.0	4.04	24.00	2.47	---	12.68	78.44	1245.1
XSECTION 80	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.22	---	12.53	77.30	1226.9
XSECTION 80	ADDHYD	.13	1	2	.08	.0	4.04	24.00	2.35	---	12.58	151.78	1204.6
XSECTION 79	REACH	.13	1	2	.08	.0	4.04	24.00	2.34	---	12.71	147.72	1172.4
XSECTION 79	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.76	---	12.45	95.29	1512.5
XSECTION 79	ADDHYD	.19	1	2	.08	.0	4.04	24.00	2.48	---	12.53	226.03	1195.9
XSECTION 76	REACH	.19	1	2	.08	.0	4.04	24.00	2.48	---	12.53	226.03	1195.9
XSECTION 76	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.46	91.40	1450.7
XSECTION 76	ADDHYD	.25	1	2	.08	.0	4.04	24.00	2.50	---	12.50	313.40	1243.7
XSECTION 75	REACH	.25	1	2	.08	.0	4.04	24.00	2.50	---	12.50	313.40	1243.7
XSECTION 75	ADDHYD	2.48	1	2	.08	.0	4.04	24.00	2.32	---	12.83	702.96	283.3
XSECTION 75	RUNOFF	.06	1	2	.08	.0	4.04	24.00	3.45	---	12.50	101.37	1609.0
XSECTION 75	ADDHYD	2.54	1	2	.08	.0	4.04	24.00	2.34	---	12.68	782.37	307.5
XSECTION 112	REACH	2.54	1	2	.08	.0	4.04	24.00	2.34	---	12.68	782.37	307.5
XSECTION 112	ADDHYD	12.92	1	2	.08	.0	4.04	24.00	2.30	---	12.61	6389.57	494.6
XSECTION 113	REACH	12.92	1	2	.08	.0	4.04	24.00	2.30	---	12.71	6355.35	491.9
XSECTION 113	RUNOFF	.05	1	2	.08	.0	4.04	24.00	3.04	---	12.52	79.44	1498.9
XSECTION 113	ADDHYD	12.97	1	2	.08	.0	4.04	24.00	2.30	---	12.70	6423.06	495.1
XSECTION 120	RUNOFF	.23	1	2	.08	.0	4.04	24.00	2.66	---	12.47	338.15	1463.9
XSECTION 113	ADDHYD	13.20	1	2	.08	.0	4.04	24.00	2.31	---	12.68	6612.03	500.8
XSECTION 58	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.40	---	12.46	87.32	1386.0
XSECTION 60	REACH	.06	1	2	.08	.0	4.04	24.00	2.39	---	12.65	84.26	1337.4
XSECTION 60	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.14	---	12.54	73.55	1167.5
XSECTION 60	ADDHYD	.13	1	2	.08	.0	4.04	24.00	2.26	---	12.59	155.41	1233.4
XSECTION 65	REACH	.13	1	2	.08	.0	4.04	24.00	2.26	---	12.70	153.07	1214.8
XSECTION 65	RUNOFF	.05	1	2	.08	.0	4.04	24.00	2.22	---	12.54	56.56	1203.4
XSECTION 65	ADDHYD	.17	1	2	.08	.0	4.04	24.00	2.25	---	12.64	204.43	1181.7
XSECTION 68	REACH	.17	1	2	.08	.0	4.04	24.00	2.25	---	12.64	204.43	1181.7
XSECTION 68	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.48	---	12.46	89.38	1418.7
XSECTION 68	ADDHYD	.24	1	2	.08	.0	4.04	24.00	2.31	---	12.53	284.31	1204.7
XSECTION 70	REACH	.24	1	2	.08	.0	4.04	24.00	2.31	---	12.53	284.31	1204.7
XSECTION 70	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.57	---	12.46	91.40	1450.7
XSECTION 70	ADDHYD	.30	1	2	.08	.0	4.04	24.00	2.37	---	12.51	371.34	1242.0
XSECTION 74	REACH	.30	1	2	.08	.0	4.04	24.00	2.37	---	12.51	371.34	1242.0

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 74	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.95	---	12.45	99.42	1578.1
XSECTION 74	ADDHYD	.36	1	2	.08	.0	4.04	24.00	2.47	---	12.49	469.05	1295.7
XSECTION 113	REACH	.36	1	2	.08	.0	4.04	24.00	2.47	---	12.49	469.05	1295.7
XSECTION 113	ADDHYD	13.56	1	2	.08	.0	4.04	24.00	2.31	---	12.66	6957.17	512.9
XSECTION 114	REACH	13.56	1	2	.08	.0	4.04	24.00	2.31	---	12.81	6722.76	495.6
XSECTION 64	RUNOFF	.25	1	2	.08	.0	4.04	24.00	2.22	---	12.48	319.51	1278.1
XSECTION 72	REACH	.25	1	2	.08	.0	4.04	24.00	2.22	---	12.63	296.29	1185.2
XSECTION 72	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.30	---	12.54	154.91	1239.3
XSECTION 72	ADDHYD	.38	1	2	.08	.0	4.04	24.00	2.25	---	12.60	447.05	1192.1
XSECTION 114	REACH	.38	1	2	.08	.0	4.04	24.00	2.24	---	12.84	413.71	1103.2
XSECTION 115	RUNOFF	.09	1	2	.08	.0	4.04	24.00	2.22	---	12.53	115.33	1226.9
XSECTION 114	ADDHYD	.47	1	2	.08	.0	4.04	24.00	2.23	---	12.74	483.72	1031.4
XSECTION 71	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.30	---	12.54	154.91	1239.3
XSECTION 114	REACH	.13	1	2	.08	.0	4.04	24.00	2.29	---	12.91	131.16	1049.3
XSECTION 114	ADDHYD	.59	1	2	.08	.0	4.04	24.00	2.25	---	12.78	606.24	1020.6
XSECTION 114	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.46	---	12.90	118.86	928.6
XSECTION 114	ADDHYD	.72	1	2	.08	.0	4.04	24.00	2.28	---	12.80	722.31	1000.4
XSECTION 114	ADDHYD	14.29	1	2	.08	.0	4.04	24.00	2.31	---	12.81	7444.87	521.1
XSECTION 119	RUNOFF	.23	1	2	.08	.0	4.04	24.00	2.38	---	12.82	221.79	960.2
XSECTION 114	ADDHYD	14.52	1	2	.08	.0	4.04	24.00	2.31	---	12.81	7666.59	528.1
XSECTION 118	REACH	14.52	1	2	.08	.0	4.04	24.00	2.30	---	12.96	7451.99	513.3
XSECTION 118	RUNOFF	.23	1	2	.08	.0	4.04	24.00	2.11	---	13.17	153.26	663.5
XSECTION 118	ADDHYD	14.75	1	2	.08	.0	4.04	24.00	2.30	---	12.96	7595.18	515.0
XSECTION 50	RUNOFF	.13	1	2	.08	.0	4.04	24.00	1.83	---	12.59	130.51	974.0
XSECTION 52	REACH	.13	1	2	.08	.0	4.04	24.00	1.82	---	12.90	108.62	810.6
XSECTION 52	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.14	---	12.57	70.78	1123.4
XSECTION 52	ADDHYD	.20	1	2	.08	.0	4.04	24.00	1.92	---	12.73	161.14	818.0
XSECTION 55	REACH	.20	1	2	.08	.0	4.04	24.00	1.91	---	12.89	155.57	789.7
XSECTION 55	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.31	---	12.46	85.23	1352.8
XSECTION 55	ADDHYD	.26	1	2	.08	.0	4.04	24.00	2.01	---	12.56	195.23	750.9
XSECTION 51	RUNOFF	.06	1	2	.08	.0	4.04	24.00	2.31	---	12.45	88.13	1398.9
XSECTION 55	REACH	.06	1	2	.08	.0	4.04	24.00	2.30	---	12.73	78.97	1253.6
XSECTION 55	ADDHYD	.32	1	2	.08	.0	4.04	24.00	2.07	---	12.58	267.28	827.5
XSECTION 53	REACH	.32	1	2	.08	.0	4.04	24.00	2.06	---	12.73	258.80	801.2
XSECTION 53	RUNOFF	.08	1	2	.08	.0	4.04	24.00	2.40	---	12.48	114.25	1360.1
XSECTION 53	ADDHYD	.41	1	2	.08	.0	4.04	24.00	2.13	---	12.59	348.24	855.6

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
XSECTION 61	REACH	.41	1	2	.08	.0	4.04	24.00	2.13	---	12.73	330.37	811.7
XSECTION 61	RUNOFF	.10	1	2	.08	.0	4.04	24.00	2.31	---	12.46	137.98	1352.8
XSECTION 61	ADDHYD	.51	1	2	.08	.0	4.04	24.00	2.16	---	12.57	421.69	828.5
XSECTION 62	REACH	.51	1	2	.08	.0	4.04	24.00	2.16	---	12.65	421.22	827.5
XSECTION 62	RUNOFF	.13	1	2	.08	.0	4.04	24.00	2.21	---	12.73	127.63	981.8
XSECTION 62	ADDHYD	.64	1	2	.08	.0	4.04	24.00	2.17	---	12.66	546.58	855.4

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

		HYDROGRAPH INFORMATION							ROUTING PARAMETERS										
		INFLOW		OUTFLOW		OUTFLOW+ INTERV.AREA						Q AND A EQUATION						PEAK TRAVEL TIME	
XSEC ID	REACH LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	BASE-FLOW (CFS)	VOLUME ABOVE BASE (IN)	MAIN TIME INCR (HR)	ITER-ATION #	COEFF (X)	POWER (M)	LENGTH FACTOR (K*)	PEAK RATIO O/I (Q*)	S/Q @PEAK (K) (SEC)	ATT-KIN COEFF (C)	STOR-AGE (HR)	KINE-MATIC (HR)
ALTERNATE 1 STORM 1																			
3	1000	247	12.5	244	12.6	---	---	0	3.46	.08	1	.040	1.66	.049	.989	468	.47	.08	.13
3	1400	162	12.5	158	12.7	---	---	0	3.46	.08	1	.040	1.66	.112	.974	775	.31	.08	.22
6	1600	446	12.6	443	12.7	---	---	0	3.19	.08	1	1.53	1.21	.049	.992	329	.61	.16	.09
8	1600	550	12.7	531	12.9	---	---	0	2.90	.08	1	.655	1.24	.085	.967	540	.42	.16	.15
8	1400	107	12.6	105	12.8	---	---	0	1.83	.08	1	.542	1.52	.026	.982	278	.68?	.16	.08
4	1800	37	12.5	32	13.0	348	12.5	0	3.47	.08	1	.050	1.66	.362	.861	1571	.17	.08	.45
5	1400	348	12.5	342	12.6	---	---	0	3.46	.08	1	.050	1.66	.051	.983	500	.45	.08	.14
8	2100	463	12.6	434	12.9	---	---	0	2.85	.08	1	.643	1.24	.123	.938	729	.33	.16	.20
8	1900	172	12.6	146	13.0	---	---	0	1.90	.08	1	.040	1.66	.184	.852	1029	.25	.24	.29
14	3000	463	13.4	459	13.7	---	---	0	2.29	.08	1	1.06	1.32	.018	.992	488	.46	.24	.14
14	2700	57	12.8	54	13.0	483	13.6	0	1.97	.08	1	.699	1.51	.065	.948	577	.40	.16	.16
11	2640	93	12.6	86	12.7	298	12.7	0	1.83	.08	1	.440	1.54	.091	.929	596	.39	.16	.17
13	1320	298	12.7	298	12.7	429	12.6	0	1.93	.08	0	6.75	1.25	.007	1.000	73	1.00?	.00	.00
14	2640	113	12.8	112	12.9	---	---	0	1.97	.08	1	2.10	1.40	.027	.988	287	.67?	.08	.08
14	1320	532	12.7	532	12.7	---	---	0	2.00	.08	0	6.82	1.25	.006	1.000	65	1.00?	.00	.00
15	1300	156	12.6	155	12.6	224	12.6	0	2.56	.08	1	.540	1.54	.018	.995	214	.80?	.08	.06
27	3000	1119	12.7	1006	13.0	1163	13.0	0	2.21	.08	2	.561	1.26	.063	.899	895	.28	.24	.25
25	2200	99	12.5	89	12.9	189	12.6	0	3.47	.08	1	.050	1.66	.264	.905	1297	.20	.08	.37
27	1700	189	12.6	183	12.7	---	---	0	2.76	.08	1	.793	1.40	.035	.973	324	.62	.16	.09
37	3000	1331	12.9	1319	13.0	1336	13.0	0	2.24	.08	1	.498	1.48	.010	.990	310	.63	.16	.09
37	2100	267	12.6	266	12.6	---	---	0	2.57	.08	1	.410	1.66	.018	.997	235	.76?	.08	.07
36	3500	149	12.8	117	13.3	201	12.6	0	2.21	.08	1	.060	1.66	.300	.789	1571	.17	.32	.46
35	1320	142	12.6	139	12.8	280	12.6	0	2.38	.08	1	.310	1.54	.030	.979	323	.62	.16	.09
36	1320	280	12.6	280	12.6	---	---	0	2.34	.08	0	4.54	1.25	.011	1.000	102	1.00?	.00	.00
37	1320	481	12.6	481	12.6	---	---	0	2.29	.08	0	4.59	1.25	.007	1.000	91	1.00?	.00	.00
39	1640	1280	13.4	1280	13.4	1290	13.4	0	2.18	.08	0	1.76	1.45	.001	1.000	83	1.00?	.00	.00
39	1320	166	12.6	166	12.6	---	---	0	2.48	.08	0	8.22	1.25	.008	1.000	70	1.00?	.00	.00
85	1320	1307	13.4	1307	13.4	1317	13.4	0	2.20	.08	0	1.59	1.44	.001	1.000	74	1.00?	.00	.00
84	1320	1317	13.4	1317	13.4	1328	13.4	0	2.20	.08	0	1.59	1.44	.001	1.000	74	1.00?	.00	.00
90	1320	168	12.6	168	12.6	301	12.6	0	2.57	.08	0	7.05	1.25	.009	1.000	79	1.00?	.00	.00
88	1320	301	12.6	301	12.6	---	---	0	2.52	.08	0	1.17	1.67	.002	1.000	73	1.00?	.00	.00
88	2000	62	12.5	56	12.7	169	12.6	0	2.39	.08	1	.220	1.54	.156	.906	816	.30	.16	.23

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

		HYDROGRAPH INFORMATION							ROUTING PARAMETERS										
		INFLOW		OUTFLOW		OUTFLOW+ INTERV.AREA						Q AND A EQUATION						PEAK TRAVEL TIME	
XSEC ID	REACH LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	BASE-FLOW (CFS)	VOLUME ABOVE BASE (IN)	MAIN TIME INCR (HR)	ITER-ATION #	COEFF (X)	POWER (M)	LENGTH FACTOR (K*)	PEAK RATIO O/I (Q*)	S/Q @PEAK (K) (SEC)	ATT-KIN COEFF (C)	STOR-AGE (HR)	KINE-MATIC (HR)
ALTERNATE 1 STORM 1																			
87	1320	464	12.6	464	12.6	---	---	0	2.54	.08	0	1.21	1.67	.002	1.000	60	1.00?	.00	.00
87	1320	91	12.5	89	12.6	554	12.6	0	2.57	.08	1	.440	1.54	.034	.987	301	.65	.08	.08
84	1320	639	12.6	639	12.6	---	---	0	2.55	.08	0	.360	1.67	.004	1.000	109	1.00?	.00	.00
105	1320	1737	12.6	1737	12.6	1798	12.6	0	2.24	.08	0	1.15	1.46	.001	1.000	78	1.00?	.00	.00
102	1320	67	12.6	53	13.0	108	12.7	0	2.84	.08	1	.020	1.66	.389	.787	1576	.17	.24	.46
105	1320	108	12.7	90	13.1	---	---	0	2.47	.08	1	.020	1.66	.192	.832	1304	.20	.32	.38
104	1500	1859	12.7	1859	12.7	1924	12.6	0	2.24	.08	0	1.09	1.46	.001	1.000	90	1.00?	.00	.00
29	3800	86	12.6	49	13.4	243	12.9	0	2.22	.08	1	.040	1.66	1.120	.575	2935	.09?	.24	.83
29	2640	209	12.8	209	12.9	---	---	0	1.97	.08	1	6.00	1.25	.018	.998	173	.91?	.08	.05
33	2640	452	12.9	452	12.9	637	12.9	0	2.06	.08	0	7.53	1.25	.010	1.000	124	1.00?	.00	.00
32	3400	99	12.6	60	13.4	193	12.9	0	2.30	.08	1	.030	1.66	.996	.609	2725	.10	.40	.83
33	3800	193	12.9	192	13.0	---	---	0	2.12	.08	1	5.64	1.25	.023	.994	266	.70?	.08	.07
93	2640	155	14.3	155	14.5	271	12.6	0	1.70*	.08	1	5.57	1.25	.003	1.000	195	.85?	.16	.05
93	2000	187	12.5	186	12.6	---	---	0	2.39	.08	1	4.69	1.25	.023	.998	163	.94?	.08	.05
92	2000	457	12.6	457	12.6	625	12.6	0	1.86*	.08	0	1.27	1.67	.001	1.000	89	1.00?	.00	.00
97	2640	625	12.6	625	12.6	879	12.6	0	1.91	.08	0	.890	1.67	.001	1.000	128	1.00?	.00	.00
96	1320	133	12.8	129	13.0	251	12.6	0	2.55	.08	1	.200	1.54	.039	.971	439	.49	.16	.12
97	2000	251	12.6	251	12.7	---	---	0	2.38	.08	1	4.19	1.25	.017	.998	168	.92?	.08	.05
98	800	1107	12.6	1107	12.6	1236	12.6	0	2.04	.08	0	1.67	1.44	.001	1.000	46	1.00?	.00	.00
99	1200	1236	12.6	1236	12.6	1362	12.6	0	2.07	.08	0	1.67	1.44	.002	1.000	66	1.00?	.00	.00
140	1320	254	12.6	254	12.6	423	12.6	0	2.66	.08	0	3.25	1.25	.016	1.000	136	1.00?	.00	.00
139	2200	512	12.6	510	12.6	764	12.6	0	2.51	.08	1	3.21	1.25	.027	.997	199	.84?	.08	.06
138	3000	111	12.5	107	12.7	384	12.5	0	3.47	.08	1	.170	1.66	.120	.972	809	.30	.08	.23
139	2000	384	12.5	356	12.6	---	---	0	2.65	.08	1	.050	1.66	.110	.926	687	.35	.16	.19
127	2500	195	12.5	178	12.7	---	---	0	2.41	.08	1	.080	1.66	.177	.912	847	.29	.08	.24
127	2300	46	12.5	36	12.9	211	12.7	0	2.07	.08	1	.080	1.66	.443	.782	1382	.19	.16	.40
131	2000	355	12.5	353	12.6	520	12.5	0	3.07	.08	1	.170	1.66	.032	.992	339	.60	.08	.09
126	1500	155	13.1	155	13.3	373	12.5	0	2.25*	.08	1	.560	1.67	.001	1.000	168	.92?	.16	.05
134	1500	373	12.5	373	12.5	---	---	0	2.47	.08	0	1.21	1.67	.000	1.000	74	1.00?	.00	.00
134	3200	70	12.5	65	12.8	428	12.5	0	3.47	.08	1	.130	1.66	.236	.918	1214	.21	.08	.34
124	2400	864	12.5	864	12.5	1167	12.5	0	2.49	.08	0	.900	1.67	.002	1.000	102	1.00?	.00	.00
124	900	1553	12.9	1553	12.9	---	---	0	2.14	.08	0	.960	1.51	.001	1.000	51	1.00?	.00	.00

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

		HYDROGRAPH INFORMATION							ROUTING PARAMETERS									PEAK TRAVEL TIME	
		INFLOW		OUTFLOW		OUTFLOW+ INTERV.AREA						Q AND A EQUATION							
XSEC ID	REACH LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	BASE-FLOW (CFS)	VOLUME ABOVE BASE (IN)	MAIN TIME INCR (HR)	ITER-ATION #	COEFF (X)	POWER (M)	LENGTH FACTOR (K*)	PEAK RATIO O/I (Q*)	S/Q @PEAK (K) (SEC)	ATT-KIN COEFF (C)	STOR-AGE (HR)	KINE-MATIC (HR)
ALTERNATE 1 STORM 1																			
104	1320	2410	12.6	2410	12.6	---	---	0	2.25	.08	0	.960	1.51	.001	1.000	65	1.00?	.00	.00
107	1000	4245	12.6	4245	12.6	4318	12.6	0	2.24	.08	0	.850	1.53	.000	1.000	40	1.00?	.00	.00
108	1700	4641	12.6	4641	12.6	---	---	0	2.27	.08	0	.850	1.53	.001	1.000	66	1.00?	.00	.00
108	700	66	12.6	64	12.7	91	12.6	0	1.98	.08	1	.080	1.66	.037	.974	365	.57	.16	.10
110	1320	4815	12.6	4815	12.6	4889	12.6	0	2.27	.08	0	.850	1.53	.001	1.000	51	1.00?	.00	.00
111	1320	5362	12.6	5362	12.6	5430	12.6	0	2.28	.08	0	1.07	1.53	.000	1.000	42	1.00?	.00	.00
112	1320	5430	12.6	5378	12.6	5438	12.6	0	2.27	.08	1	.040	1.63	.004	.990	210	.81?	.08	.06
48	1320	144	12.5	140	12.7	---	---	0	3.46	.08	1	.040	1.66	.110	.975	766	.32	.08	.21
48	2640	107	12.5	90	13.0	218	12.7	0	3.47	.08	1	.040	1.66	.423	.835	1724	.15	.08	.50
56	1866	354	12.6	347	12.8	386	12.6	0	2.88	.08	1	.120	1.66	.032	.980	391	.54	.16	.11
57	1320	386	12.6	386	12.6	463	12.6	0	2.76	.08	0	1.87	1.44	.005	1.000	96	1.00?	.00	.00
46	2640	319	12.5	319	12.5	---	---	0	2.71	.08	0	9.38	1.25	.012	1.000	111	1.00?	.00	.00
46	1320	161	12.5	160	12.6	316	12.5	0	2.23	.08	1	.510	1.54	.023	.990	223	.78?	.08	.06
57	1320	635	12.5	635	12.5	---	---	0	2.46	.08	0	6.49	1.25	.007	1.000	65	1.00?	.00	.00
59	1320	1086	12.6	1086	12.6	---	---	0	2.56	.08	0	1.87	1.44	.004	1.000	70	1.00?	.00	.00
59	1400	182	12.6	179	12.6	1262	12.6	0	2.94	.08	1	.110	1.66	.039	.983	403	.53	.08	.11
66	660	538	13.0	538	13.0	568	12.8	0	2.44	.08	0	1.64	1.67	.000	1.000	24	1.00?	.00	.00
67	1320	568	12.8	568	12.8	613	12.6	0	2.44	.08	0	1.19	1.67	.000	1.000	56	1.00?	.00	.00
67	1320	183	12.5	180	12.6	---	---	0	2.66	.08	1	.250	1.54	.040	.982	339	.60	.08	.09
69	1320	793	12.6	793	12.6	861	12.6	0	2.47	.08	0	1.14	1.67	.000	1.000	50	1.00?	.00	.00
41	3000	153	12.5	150	12.6	---	---	0	3.46	.08	1	.240	1.66	.069	.986	579	.40	.08	.16
41	2800	211	12.6	205	12.7	350	12.6	0	2.66	.08	1	.240	1.66	.056	.971	475	.47	.08	.13
42	2500	564	12.6	564	12.6	668	12.5	0	2.72	.08	0	6.89	1.25	.014	1.000	120	1.00?	.00	.00
78	1320	668	12.5	668	12.5	758	12.5	0	2.71	.08	0	4.69	1.25	.009	1.000	84	1.00?	.00	.00
82	1400	111	12.6	106	12.7	181	12.6	0	2.22	.08	1	.100	1.66	.068	.950	518	.43	.16	.15
81	1320	181	12.6	176	12.6	252	12.6	0	2.29	.08	1	.220	1.54	.040	.972	370	.56	.08	.10
78	1320	252	12.6	245	12.7	---	---	0	2.31	.08	1	.090	1.66	.035	.972	376	.55	.08	.11
77	1320	972	12.6	972	12.6	1059	12.6	0	2.58	.08	0	2.34	1.44	.003	1.000	62	1.00?	.00	.00
75	520	610	13.7	610	13.7	---	---	0	2.29*	.08	0	.520	1.67	.000	1.000	35	1.00?	.00	.00
80	1320	81	12.6	78	12.7	152	12.6	0	2.48	.08	1	.230	1.54	.062	.958	476	.46	.16	.13
79	1320	152	12.6	148	12.7	224	12.6	0	2.35	.08	1	.230	1.54	.043	.974	383	.55	.16	.11
76	1320	224	12.6	224	12.6	313	12.5	0	2.48	.08	0	8.49	1.25	.006	1.000	65	1.00?	.00	.00

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS
(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK
A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

		HYDROGRAPH INFORMATION							ROUTING PARAMETERS									PEAK TRAVEL TIME	
		INFLOW		OUTFLOW		OUTFLOW+ INTERV.AREA						Q AND A EQUATION							
XSEC ID	REACH LENGTH (FT)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	PEAK (CFS)	TIME (HR)	BASE-FLOW (CFS)	VOLUME ABOVE BASE (IN)	MAIN TIME INCR (HR)	ITER-ATION #	COEFF (X)	POWER (M)	LENGTH FACTOR (K*)	PEAK RATIO O/I (Q*)	S/Q @PEAK (K) (SEC)	ATT-KIN COEFF (C)	STOR-AGE (HR)	KINE-MATIC (HR)
ALTERNATE 1 STORM 1																			
75	1320	313	12.5	313	12.5	---	---	0	2.50	.08	0	7.05	1.25	.007	1.000	70	1.00?	.00	.00
112	1320	781	12.7	781	12.7	---	---	0	2.34	.08	0	.410	1.67	.000	1.000	93	1.00?	.00	.00
113	1320	6370	12.6	6350	12.7	6416	12.7	0	2.30	.08	1	.040	1.63	.003	.997	198	.84?	.08	.05
60	1320	87	12.5	84	12.6	155	12.6	0	2.40	.08	1	.250	1.54	.064	.968	440	.49	.08	.12
65	1320	155	12.6	153	12.7	204	12.6	0	2.26	.08	1	.280	1.54	.038	.986	334	.60	.16	.09
68	1320	204	12.6	204	12.6	283	12.6	0	2.25	.08	0	6.82	1.25	.009	1.000	78	1.00?	.00	.00
70	1320	283	12.6	283	12.6	370	12.5	0	2.31	.08	0	6.14	1.25	.009	1.000	80	1.00?	.00	.00
74	1320	370	12.5	370	12.5	469	12.5	0	2.37	.08	0	6.75	1.25	.007	1.000	70	1.00?	.00	.00
113	1320	469	12.5	469	12.5	---	---	0	2.47	.08	0	3.11	1.25	.015	1.000	125	1.00?	.00	.00
114	3000	6947	12.6	6722	12.8	---	---	0	2.31	.08	1	.040	1.63	.012	.968	434	.50	.16	.12
72	2640	319	12.5	296	12.6	443	12.6	0	2.22	.08	1	.180	1.54	.128	.927	691	.34	.16	.19
114	2000	443	12.6	412	12.8	483	12.7	0	2.25	.08	1	.050	1.66	.096	.929	649	.36	.08	.18
114	2200	155	12.6	131	12.9	---	---	0	2.30	.08	1	.050	1.66	.234	.846	1086	.23	.16	.31
118	4000	7665	12.8	7452	13.0	7595	13.0	0	2.31	.08	1	.050	1.66	.012	.972	418	.51	.16	.12
52	1500	130	12.6	109	12.9	161	12.7	0	1.83	.08	1	.030	1.66	.227	.835	1079	.24	.24	.31
55	1320	161	12.7	156	12.9	195	12.6	0	1.92	.08	1	.090	1.66	.037	.965	450	.49	.16	.13
55	1867	87	12.5	79	12.7	---	---	0	2.31	.08	1	.090	1.66	.172	.908	813	.30	.08	.23
53	1200	267	12.6	259	12.7	347	12.6	0	2.07	.08	1	.090	1.66	.020	.970	335	.60	.16	.09
61	2100	347	12.6	330	12.7	422	12.6	0	2.13	.08	1	.110	1.66	.035	.952	467	.47	.16	.13
62	2000	422	12.6	421	12.6	546	12.6	0	2.16	.08	1	4.19	1.25	.013	.999	152	.97?	.08	.04

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
STRUCTURE 69	2.23	
ALTERNATE 1		610.20
STRUCTURE 59	1.07	
ALTERNATE 1		538.39
STRUCTURE 43	3.45	
ALTERNATE 1		1271.16
STRUCTURE 39	3.08	
ALTERNATE 1		1552.51
STRUCTURE 37	2.72	
ALTERNATE 1		1336.00
STRUCTURE 33	1.07	
ALTERNATE 1		154.64
STRUCTURE 31	.68	
ALTERNATE 1		154.67
STRUCTURE 8	1.18	
ALTERNATE 1		463.39
XSECTION 1	.15	
ALTERNATE 1		248.49
XSECTION 2	.10	
ALTERNATE 1		165.73
XSECTION 3	.29	
ALTERNATE 1		446.92
XSECTION 4	.22	
ALTERNATE 1		351.51
XSECTION 5	.34	
ALTERNATE 1		464.83
XSECTION 6	.40	
ALTERNATE 1		549.88

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 7	.12	
ALTERNATE 1		106.65
XSECTION 8	1.18	
ALTERNATE 1		1315.07
XSECTION 9	.07	
ALTERNATE 1		56.70
XSECTION 10	.09	
ALTERNATE 1		93.22
XSECTION 11	.33	
ALTERNATE 1		298.55
XSECTION 12	.07	
ALTERNATE 1		86.92
XSECTION 13	.59	
ALTERNATE 1		532.09
XSECTION 14	2.20	
ALTERNATE 1		1121.09
XSECTION 15	.19	
ALTERNATE 1		224.76
XSECTION 16	.12	
ALTERNATE 1		155.97
XSECTION 17	.06	
ALTERNATE 1		101.41
XSECTION 18	.18	
ALTERNATE 1		171.98
XSECTION 19	.02	
ALTERNATE 1		37.85
XSECTION 20	.06	
ALTERNATE 1		110.00

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 21	.24	
ALTERNATE 1		319.12
XSECTION 22	.15	
ALTERNATE 1		212.40
XSECTION 23	.09	
ALTERNATE 1		154.39
XSECTION 24	.20	
ALTERNATE 1		268.81
XSECTION 25	.15	
ALTERNATE 1		188.52
XSECTION 26	.07	
ALTERNATE 1		93.38
XSECTION 27	2.60	
ALTERNATE 1		1331.60
XSECTION 28	.16	
ALTERNATE 1		149.43
XSECTION 29	.57	
ALTERNATE 1		451.69
XSECTION 30	.25	
ALTERNATE 1		208.97
XSECTION 31	.08	
ALTERNATE 1		99.02
XSECTION 32	.26	
ALTERNATE 1		193.67
XSECTION 33	1.07	
ALTERNATE 1		827.43
XSECTION 34	.13	
ALTERNATE 1		141.66

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 35	.25	
ALTERNATE 1		281.50
XSECTION 36	.53	
ALTERNATE 1		483.34
XSECTION 37	3.45	
ALTERNATE 1		1888.83
XSECTION 38	.13	
ALTERNATE 1		167.08
XSECTION 39	3.70	
ALTERNATE 1		1307.88
XSECTION 40	.09	
ALTERNATE 1		111.50
XSECTION 41	.42	
ALTERNATE 1		564.00
XSECTION 42	.49	
ALTERNATE 1		670.65
XSECTION 43	.05	
ALTERNATE 1		75.70
XSECTION 44	.13	
ALTERNATE 1		182.98
XSECTION 45	.13	
ALTERNATE 1		183.10
XSECTION 46	.49	
ALTERNATE 1		635.94
XSECTION 47	.13	
ALTERNATE 1		161.49
XSECTION 48	.28	
ALTERNATE 1		353.80

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 49	.09	
ALTERNATE 1		146.94
XSECTION 50	.13	
ALTERNATE 1		130.51
XSECTION 51	.06	
ALTERNATE 1		88.13
XSECTION 52	.20	
ALTERNATE 1		161.14
XSECTION 53	.41	
ALTERNATE 1		348.24
XSECTION 55	.32	
ALTERNATE 1		267.28
XSECTION 56	.34	
ALTERNATE 1		386.92
XSECTION 57	.89	
ALTERNATE 1		1098.96
XSECTION 58	.06	
ALTERNATE 1		87.32
XSECTION 59	1.07	
ALTERNATE 1		1353.71
XSECTION 60	.13	
ALTERNATE 1		155.41
XSECTION 61	.51	
ALTERNATE 1		421.69
XSECTION 62	.64	
ALTERNATE 1		546.58
XSECTION 64	.25	
ALTERNATE 1		319.51

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 65	.17	
ALTERNATE 1		204.43
XSECTION 66	1.14	
ALTERNATE 1		567.63
XSECTION 67	1.33	
ALTERNATE 1		796.54
XSECTION 68	.24	
ALTERNATE 1		284.31
XSECTION 69	2.23	
ALTERNATE 1		1920.28
XSECTION 70	.30	
ALTERNATE 1		371.34
XSECTION 71	.13	
ALTERNATE 1		154.91
XSECTION 72	.38	
ALTERNATE 1		447.05
XSECTION 74	.36	
ALTERNATE 1		469.05
XSECTION 75	2.54	
ALTERNATE 1		782.37
XSECTION 76	.25	
ALTERNATE 1		313.40
XSECTION 77	.84	
ALTERNATE 1		1064.47
XSECTION 78	.78	
ALTERNATE 1		976.52
XSECTION 79	.19	
ALTERNATE 1		226.03

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 80	.13	
ALTERNATE 1		151.78
XSECTION 81	.22	
ALTERNATE 1		253.29
XSECTION 82	.16	
ALTERNATE 1		182.58
XSECTION 83	.06	
ALTERNATE 1		81.54
XSECTION 84	4.33	
ALTERNATE 1		1745.51
XSECTION 85	3.77	
ALTERNATE 1		1317.82
XSECTION 86	.06	
ALTERNATE 1		90.81
XSECTION 87	.50	
ALTERNATE 1		639.53
XSECTION 88	.38	
ALTERNATE 1		464.64
XSECTION 89	.05	
ALTERNATE 1		62.16
XSECTION 90	.23	
ALTERNATE 1		301.14
XSECTION 91	.13	
ALTERNATE 1		169.21
XSECTION 92	1.53	
ALTERNATE 1		625.56
XSECTION 93	1.40	
ALTERNATE 1		457.47

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 94	.14	
ALTERNATE 1		186.62
XSECTION 95	.13	
ALTERNATE 1		132.85
XSECTION 96	.25	
ALTERNATE 1		251.35
XSECTION 97	1.96	
ALTERNATE 1		1108.54
XSECTION 98	2.06	
ALTERNATE 1		1236.35
XSECTION 99	2.15	
ALTERNATE 1		1362.25
XSECTION 100	.08	
ALTERNATE 1		108.52
XSECTION 101	.05	
ALTERNATE 1		67.37
XSECTION 102	.11	
ALTERNATE 1		108.28
XSECTION 103	.08	
ALTERNATE 1		112.17
XSECTION 104	9.14	
ALTERNATE 1		4258.59
XSECTION 105	4.50	
ALTERNATE 1		1866.17
XSECTION 106	.06	
ALTERNATE 1		66.28
XSECTION 107	9.41	
ALTERNATE 1		4641.67

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

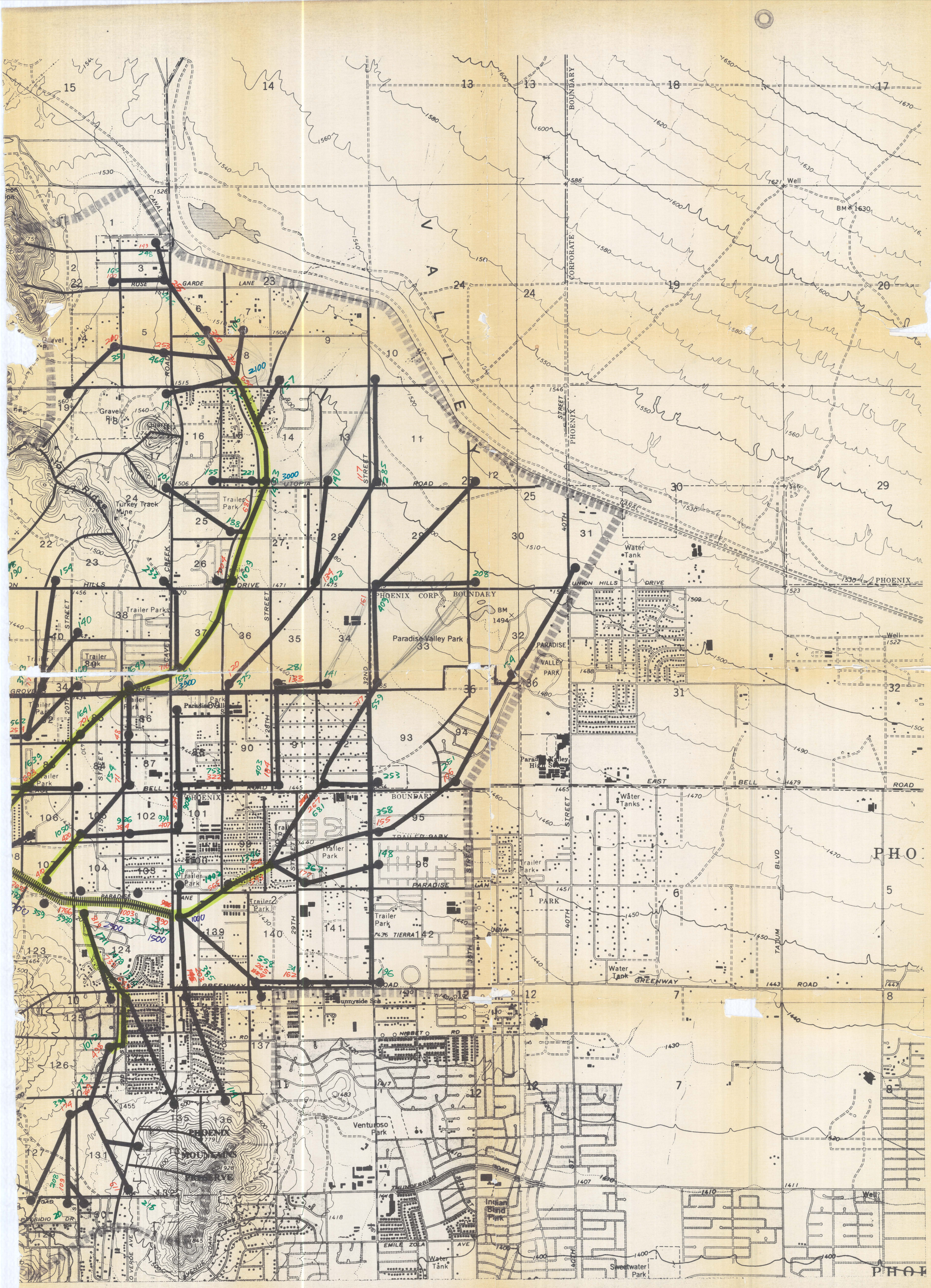
XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 108	9.57	
ALTERNATE 1		4814.76
XSECTION 109	.06	
ALTERNATE 1		86.13
XSECTION 110	9.99	
ALTERNATE 1		5365.28
XSECTION 111	10.06	
ALTERNATE 1		5433.58
XSECTION 112	12.92	
ALTERNATE 1		6389.57
XSECTION 113	13.56	
ALTERNATE 1		6957.17
XSECTION 114	14.52	
ALTERNATE 1		7666.59
XSECTION 115	.09	
ALTERNATE 1		115.33
XSECTION 118	14.75	
ALTERNATE 1		7595.18
XSECTION 119	.23	
ALTERNATE 1		221.79
XSECTION 120	.23	
ALTERNATE 1		338.15
XSECTION 121	.25	
ALTERNATE 1		429.70
XSECTION 122	.35	
ALTERNATE 1		497.17
XSECTION 123	.21	
ALTERNATE 1		359.53

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

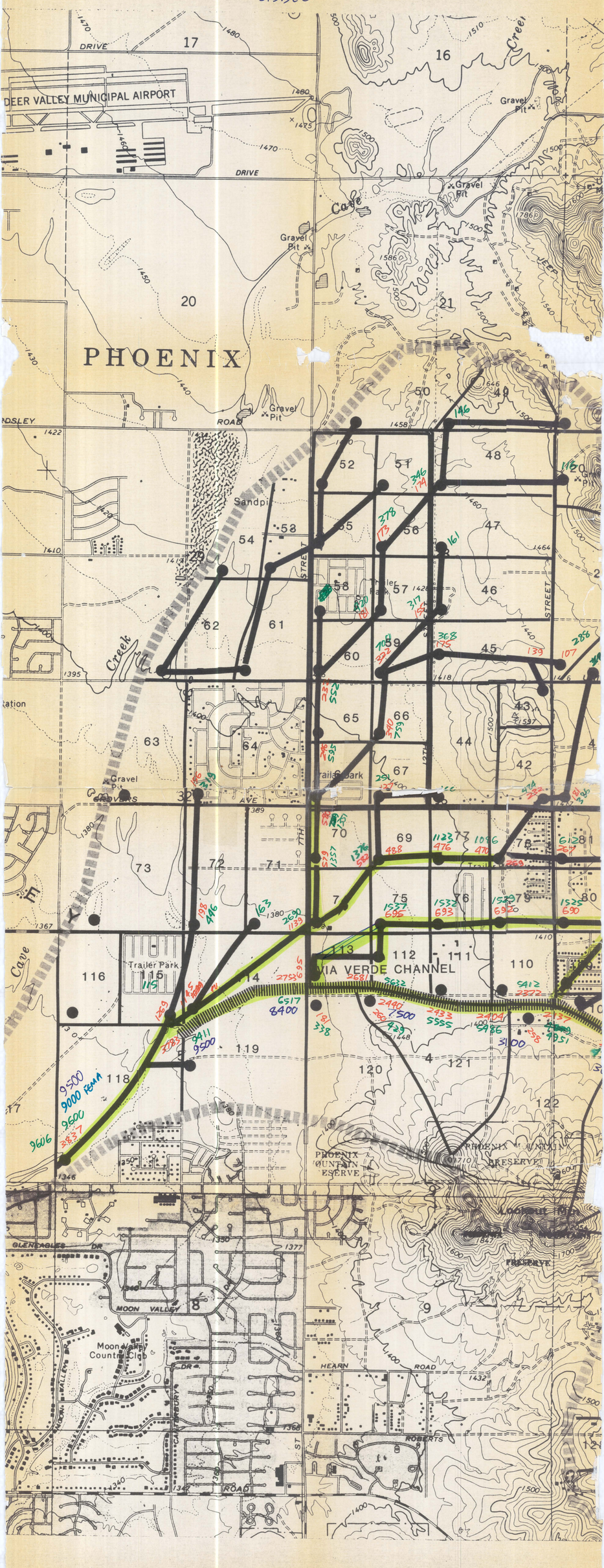
XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 124	4.57	
ALTERNATE 1		2411.70
XSECTION 125	.12	
ALTERNATE 1		164.16
XSECTION 126	.84	
ALTERNATE 1		373.04
XSECTION 127	.33	
ALTERNATE 1		389.78
XSECTION 128	.04	
ALTERNATE 1		46.93
XSECTION 129	.14	
ALTERNATE 1		198.69
XSECTION 130	.03	
ALTERNATE 1		50.71
XSECTION 131	.68	
ALTERNATE 1		909.47
XSECTION 132	.22	
ALTERNATE 1		359.78
XSECTION 133	.08	
ALTERNATE 1		137.50
XSECTION 134	1.19	
ALTERNATE 1		864.80
XSECTION 135	.04	
ALTERNATE 1		72.19
XSECTION 136	.07	
ALTERNATE 1		113.44
XSECTION 137	.08	
ALTERNATE 1		88.26

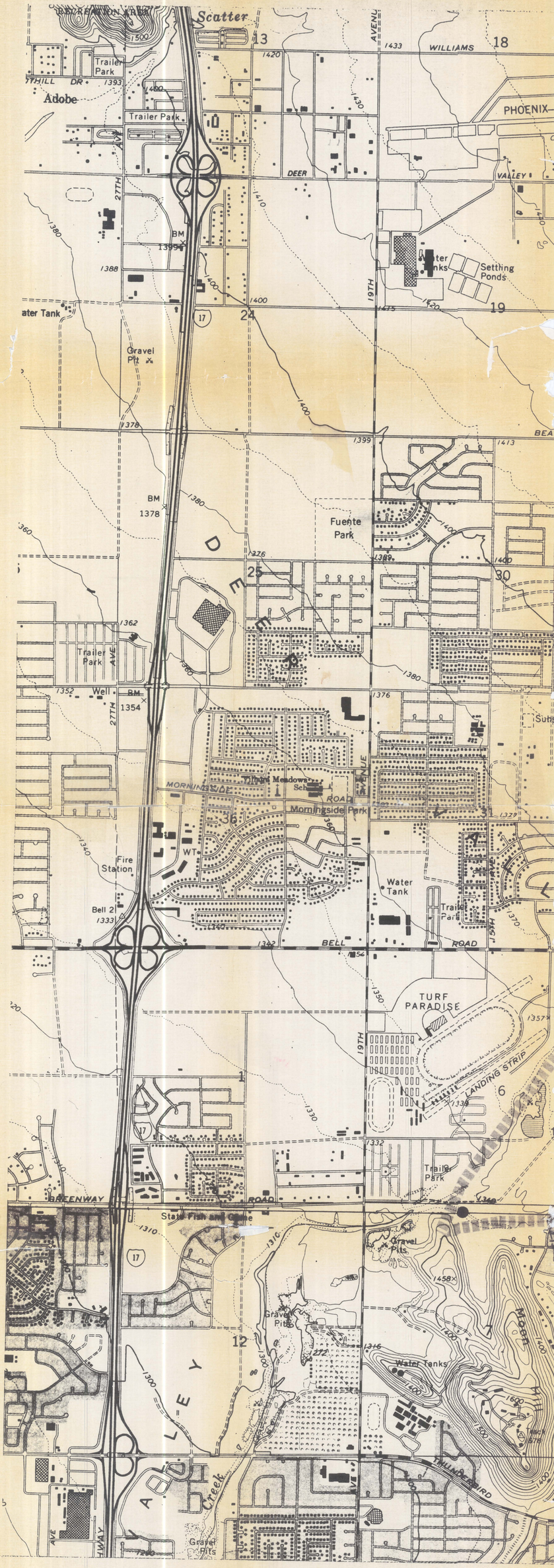
SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
XSECTION 138	.27	
ALTERNATE 1		384.32
XSECTION 139	3.08	
ALTERNATE 1		2585.49
XSECTION 140	.39	
ALTERNATE 1		513.57
XSECTION 141	.19	
ALTERNATE 1		254.23
XSECTION 143	3.52	
ALTERNATE 1		1280.48
XSECTION 144	.13	
ALTERNATE 1		113.39


ROSE GARDE LANE
CANAL
UTOPIA ROAD
PHOENIX CORP BOUNDARY
UNION HILLS DRIVE
PARADISE VALLEY PARK
EAST BELL ROAD
GREENWAY ROAD
Paradise Valley Park
Trailer Park
Turkey Track Mine
Gravel Pit
Water Tank
Water Tanks
Venturoso Park
Indian Bend Park
Sweetwater Park
Well
BM 1630
BM 1494
PHOENIX MOUNTAINS
PHOENIX
PHO

TR-20 10 YR
TR-20 100-YR
DIBBLE




Scatter
Trailer Park
Adobe
Trailer Park
WILLIAMS
PHOENIX
DEER
VALLEY
27TH
19TH
BM
1399
Water Tanks
Settling Ponds
Gravel Pit
BM
1378
Fuente Park
Trailer Park
Well
BM
1354
MORNINGSIDE
Tilney Meadows Sch
ROAD
Morningside Park
Fire Station
WT
Bell 2
Water Tank
Trailer Park
BELL
ROAD
TURF PARADISE
LANDING STRIP
Trailer Park
GREENWAY
ROAD
State Fish and Game
Gravel Pits
Gravel Pits
Water Tanks
MOUNT
THUNDERBIRD
Creek
Gravel Pits