DEADMAN'S WASH AREA DRAINAGE MASTER STUDY

VOLUME 1, REPORT

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FLOODPLAIN MANAGEMENT SECTION

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EXECUTIVE SUMMARY

This report documents the hydrologic and engineering analyses made during the development of a Conceptual Master Drainage Plan for the Deadman's Wash Watershed in northwestern Maricopa County. The total area of the watershed as shown in Figure 1 is 32.57 square miles (sq. mi.); approximately 6.85 sq. mi. of the watershed is south of Carefree highway, an area designated as "Future City of Phoenix". The remaining 25.7 sq. mi. is under the auspices of Maricopa County. Deadman's Wash is tributary to New River, which provides much of the western boundary of the watershed. The study was developed under the guidance of a steering committee comprised of members from the City of Phoenix Engineering, Planning and Parks and Recreation Departments, Maricopa County Flood Control District, and the Arizona State Land Department.

The original scope of work for this study was to develop a conceptual drainage plan for the area assuming flows under future developed conditions. This was later modified based upon the assumption that future development will include site retention/detention to maintain pre-development flows to a design using flows generated for existing land use conditions. The drainage plan design was to include two systems: a storm sewer for the watershed within the City of Phoenix, designed for the runoff from the 2 year 24 hour precipitation, and a system of structural and non-structural measures for the entire watershed which will convey the runoff generated by the 100 year 24 hour precipitation. The final step in the conceptual design was the development of a preliminary cost estimate for the recommended future system.

To arrive at the final product, SEA divided the study into three phases: the hydrologic modeling, conceptual design of the drainage measures and the cost estimate. The first phase was the development of the hydrologic model of the watershed using the Corps of Engineers' HEC-1 program to determine the design flows for existing and future land use conditions for the 2 year 24 hour precipitation and the 100 year 24 hour precipitation.

The model results for the 100 year 24 hour existing conditions (Case 1) were verified by independent calculations using the U.S. Geological Survey's linear regression equation for estimating flows within Arizona and using the Soil Conservation Service's TR-20. After verification of the model results, the second phase was begun which consisted of the design of the storm sewer system and the drainage alternatives. The resulting flows, with the designed features in the model runs are contained in Appendix A of this report. The last phase of the study was the development of preliminary cost estimates for the drainage plan alternatives.

The following sections of this report contain a detailed description of the development of the hydrologic model and the conceptual master drainage plan. The hydrologic analyses for each of the 5 study cases are summarized as follows:

CASE 1: Existing watershed conditions model for the 100-year, 24-hour storm. This model was developed to identify flood hazard areas and to provide data for design of channels and roadway crossing structures at Carefree Highway and the future arterial roadway alignments.

CASE 2: Future watershed conditions model for the 2-year and 100-year, 24-hour storm. This model was developed using the existing terrain with adjustments for future land use as outlined in the "General Plan - Peripheral Areas C and D", "General Plan for Phoenix 1985-2000". The City of Phoenix eliminated Case 2 from the study based on the requirement for future development to include site retention/detention to maintain pre-development flows.

CASE 3: Existing watershed conditions model for the 100-year, 24-hour storm. This model was developed by modifying the Case 1 model to route runoff through the recommended system of channels and structural measures.

CASE 4: Existing watershed conditions model for the 2-year, 24-hour storm. This model was developed to evaluate the recommended storm drainage system within the future City of Phoenix Boundary (below Carefree Highway).

CASE 5: Existing watershed conditions for the 100-year, 24-hour storm. This model was developed by modifying the Case 3 model to route runoff through the recommended channel system augmented by the recommended storm drain system.

The Conceptual Drainage and Storm Drain Plan consists of natural channels, lined and unlined channels, landscaped recreation corridors, bridges, and a storm drain system located in the proposed arterial roadway alignments south of Carefree Highway.

The main channel of Deadman's Wash along with the mountainous area east of Interstate 17 (I-17) have been designated as no action areas. After review of the hydraulics with the City of Phoenix staff it was determined that channel improvements and right-of-way requirements in the main channel would be cost prohibitive. The channels in these areas are well defined and in most cases maintain the 100-year runoff within their banks. The exception in these no-action areas is the crossing of the main channel and Carefree Highway where a bridge structure is proposed to replace the existing dip sections. The existing flood plain upstream from the Carefree Highway crossing is relatively flat and broad. This area will require some channelization to direct flows through the proposed bridge structure.

The capacity of the existing bridge structure (see Figure 6) on the I-17 crossing at the main channel of Deadman's Wash was checked and determined to be adequate in handling the 100-year flows anticipated at this design point.

A system of cross culverts (see Figure 6) under I-17 from the traffic interchange at Carefree Highway to the northern boundary of the study area was also analyzed. This system conveys runoff from the east side of I-17 to the west side with one culvert, immediately north of the main channel, draining from west to east. See Table 4 for existing culvert characteristics and Table 5 for runoff vs. capacity.

Preliminary costs and right-of-way acquisition requirements were prepared for the recommended channels, bridges and storm drain system. They are as follows:

FUTURE CITY OF PHOENIX AREA (south of Carefree Highway)

Alternate A:

Earthen Channels	$ 47,050,822
285.3 Acres required for Right-of-Way	

Alternate B:

Concrete Lined Channels	$ 48,392,707
141.9 Acres required for Right-of-Way	

Alternate C:

Earthen Channels with landscaped corridors	$ 50,996,502
346.0 Acres required for Right-of-Way	

MARICOPA COUNTY (north of Carefree Highway)

Alternate A:

Earthen Channels	$ 4,248,933
177.3 Acres required for Right-of-Way	

Alternate B:

Concrete Channels	$ 18,715,153
94.2 Acres required for Right-of-Way	

Alternate C:

Earthen Channels with landscaped corridors	$ 5,953,308
186.6 Acres required for Right-of-Way	

DRAINAGE AREA DESCRIPTION

The Deadman's Wash watershed is outlined on Figure 1. The watershed area, some 32.5 square miles, encompasses a diverse physiographic environment, from steeply sloping mountain fronts to more moderately sloped alluvial fans and finally to the gently sloping floodplain of New River. The watershed is split along the long axis by Interstate 17 and along the width in the south by Carefree Highway. The four U.S.G.S. 7.5 minute quadrangle sheets which cover the area, in clockwise fashion are: Daisy Mountain, New River SE, Biscuit Flat and New River.

Daisy Mountain, located in the northeast corner of the watershed provides the highest topographic elevation at 3176 feet above mean sea level (msl) and is the headwater of Deadman's Wash. Several other unnamed mountains, maximum elevation of 2193 feet above msl are located in the east center of the watershed and a smaller promontory forms the southern boundary of the watershed before Deadman's Wash joins New River. The higher elevations are characterized by steep slopes, bare rock or a thin veneer of relatively impervious soils and little vegetation cover, all of which contribute to larger volume of runoff per unit area peaking in a much shorter time than at lower elevations The mountains provide the source material for the alluvial fans which have developed over time at the base of the mountain fronts.

The hydrology of alluvial fans is a complex process caused by the abrupt change in slope and the absence of well defined channels across the fan. See Figure 2 for location of existing major washes. Stream channels which are well defined in the immediate mountain area become braided once the slope decreases. This results in a complex pattern of shallow widespread overland flow during major flow events. These channels are not stable and will change with time as erosion and deposition occur during the ascending and descending limbs of the flood hydrograph. The alluvial fans are cut by Carefree Highway which traverses the watershed almost perpendicular to the direction

of flow. Flow is transmitted across the highway in existing dip sections where bridge structures D,G,K,N and R are proposed. See Figure 9 for structure location and Tables 10 and 11 for descriptions.

HYDROLOGIC MODELING

The hydrologic modeling, as already indicated, was prepared using the kinematic wave option in the 1988 version of the U.S. Army Corps of Engineers (COE) Hec-1 rainfall/runoff simulation computer model. The program is described extensively by the COE in the user's manual for Hec-1 and in their Training Document Number 10, Introduction and Application of Kinematic Wave Techniques Using Hec-1. Briefly, the model requires that sub-watersheds be divided into a main channel, typical collector channels and up to two typical overland flow planes. The descriptive data used as input to the model for each of these areas are representations of average conditions over the sub-watershed and not a specific flow path. The data needed by the kinematic wave option of the model are channel width, side slope, roughness coefficient, and channel slope. The kinematic wave option was selected because runoff processes can be calculated using readily measurable geographic features and is easily adapted to fit any number of physical realities, including an undeveloped watershed having both steep mountain slopes and alluvial fans in one sub-watershed.

Output from Hec-1 contains a summary of discharge and time to peak values for each sub-watershed, as well as hydrographs for selected locations. Flow paths within the watershed and between the sub-watersheds are designed in the model to follow the natural path of the water as closely as possible. Runoff is calculated in the uppermost watershed first, routed down the stream channel and combined or routed down the next watershed in the system. This sequence of routing is shown in Figures 3A and 3B. The number of watersheds created a problem in running the Hec-1 program, so the model was split into two smaller areas which would each be modeled separately. The upper watershed, sub-watersheds 1 through 28, was modeled in one run with the hydrograph for sub-watershed 28 input to the lower watershed model to provide one coherent simulation.

To facilitate the design of the storm drain system, Carefree Highway was chosen as the dividing line between the two model runs. That area which is north of Carefree Highway is in Maricopa County and not included in the Conceptual Storm Drain Plan. The area south of Carefree Highway is designated as future City of Phoenix and was modeled with the 2-year, 24-hour runoff routed through the proposed storm drain system. Part of the development of the hydrologic modeling study was the verification of the model data and method of analysis. Two methods were used to verify the calculations: the U.S.G.S. linear regression equation developed by Roesske for the Arizona Department of Transportation (1978), and the SCS TR-20 graphical method. A discussion of the verification results is provided on page 14 and a graphical representation of each method can be found on Figures 6A and 6B.

SUB-WATERSHED DELINEATION

As expected in the alluvial basins of the arid southwest, the 32.5 square mile watershed had numerous tributary streams and heterogeneous physical characteristics, so the watershed had to be divided into smaller areas of uniform hydrologic parameters. The first step in the determination of the sub-watersheds is to define the hydraulic divide and the most likely stream paths. Using the topographic maps, aerial photographs, I-17 and Carefree Highway As-builts, and site visits, the most probable path of flow was defined and the sub-watershed boundaries identified (see Figure 3). This first step resulted in 44 sub-watersheds being delineated. The second step in this procedure involved subdividing the topographic sub-watersheds into smaller areas having similar physical characteristics such as soil types and slopes. This resulted in the removal of sub-watershed 38 and the subdividing of sub-watersheds 8, 9, 17, 18, 19, 21, and 35, for a total of 50 sub-basins. See Figures 3A and 3B for sub-watershed routing schematics. The sub-watershed characteristics are listed in Table 1.

LAND USE

The majority of the watershed is undeveloped (Fig. 4). Current zoning is 0 to 1 dwelling units per acre (du/ac) with existing residences mainly trailers on large acreage. Development at this time consists of the Black Canyon Shooting Range, Pioneer Village, and a federal correctional facility. The percent imperviousness for the existing conditions Hec-1 model was developed by identifying structures on the aerial photographs, transferring the data to a watershed overlay and calculating the area involved. Future land use, although ultimately not used in the development of the drainage plan, was developed within the City area using the Land Use and Circulation Plan for the peripheral areas C and D and for the County area using existing zoning, 0 to 1 du/ac.

SOIL TYPE AND VEGETATION

Soils information is necessary to model infiltration capacity of the soils and the potential for runoff from the watershed. The Soil Conservation Service publishes maps of soil type within an area as well as other pertinent data such as the hydrologic soil group and infiltration rates. The soils data for this area are contained on Sheets 10, 11, 22, and 23 of the Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona (SCS, 1986).

SCS has developed a method of relating soils having similar runoff potential using a classification system called hydrologic soil group. All soils are assigned a letter A, B, C, or D based upon runoff potential. The A soils are the most permeable and generate the least amount of runoff, while the D soils are the least permeable and generate the most runoff. The soils for Deadman's Wash were plotted, Figure 5, and the percent of each soil within each sub-watershed calculated. These data are listed in Table 2. The vast majority of the watershed has hydrologic soil group D (86 percent), with minor amounts of hydrologic soil group C (3 percent) along the mountain fronts, and hydrologic soil group B (10.25 percent) along the main channel of Deadman's Wash. There is no hydrologic soil group A within the watershed.

Vegetation within the Deadman's Wash watershed is typical of the Sonoran Desert environment consisting of bursage, palo verde, cactus, mesquite, and miscellaneous grasses and forbs. Although the watershed is largely undeveloped, the presence of stock tanks and cattle tracks indicates that the land is grazed by livestock. Vegetation cover density was estimated to be 15 percent.

RUNOFF CURVE NUMBER

One method of estimating infiltration and interception losses in Hec-1 is by using the SCS curve number. Determination of the curve number is made using the soil type, vegetation type and density, antecedent moisture conditions of the soil, and land use. These parameters have been related by the SCS to different runoff conditions on a watershed. A base curve number was developed for each of the four hydrologic soil groups assuming a cover density of 15% and "desert brush" vegetation type. The base curve number for B soils is 75, C soils is 83, and D soils is 86. Only a few of the very small sub-watersheds were entirely of one hydrologic soil group, so it was necessary to calculate a weighted curve number for each sub-watershed based on the percent of each soil group within that watershed. These calculations are shown in Table 2. The final curve numbers ranged from a low of 80 to a high of 86. These curve numbers for existing conditions were used in all the Hec-1 models.

OVERLAND FLOW PARAMETERS

The overland flow parameters for the sub-watersheds were selected based upon engineering judgement and average conditions within the sub-watersheds. In general, flows in the smaller sub-watersheds will reach a concentration point or channel within 500 feet. Land slopes were calculated using the topographic map. For watersheds having both mountain front and alluvial fan slopes, two overland flow planes were used, one for the steeper area and one representing the flatter sloped area. These flows are collected and routed to a main channel. A listing of a sample Hec-1 data file showing the overland flow parameters on the UK data cards is contained in Table 3.

CHANNEL ROUTING PARAMETERS

Flow from the overland flow planes is collected in the main channel and routed downstream assuming open-channel flow conditions. For the purpose of this study flow depths are based on "normal depths" and velocities are average velocities within the flow profile. A more detailed study would be required to evaluate abrupt changes in channel geometry or gradually varied flow which is beyond the scope of this study. Data needed for the kinematic wave option include channel length, slope, shape and roughness. The kinematic wave function will not calculate the attenuation of the peak with distance along the channel. Channel lengths and slopes were measured directly from the U.S.G.S. quadrangle maps. The channels were assumed to be trapezoidal in shape. The bottom widths and side slopes were based on field measurements, aerial photographs and engineering judgment. Roughness coefficients for the natural channels range from 0.045 to 0.050. These values were based on a comparison of the watershed washes with the roughness coefficients given in the report Roughness Coefficients for Stream Channels in Arizona, by Aldridge and Garrett, U.S.G.S. Open File Report, 1973. Channel parameters are listed on the RK cards.

PRECIPITATION

As directed by the scope of work for this study, two different precipitation events were used to design the storm drain and the drainage facilities. The City requested that the runoff from the 2 year 24 hour precipitation be used for the storm drain design and the runoff from the 100 year 24 hour precipitation be used for the drainage facility design. In addition, the City requested the use of a 10 square mile areal reduction factor of 0.985 to simulate a storm pattern of 10 square miles. Rainfall depths for the watershed were determined using the Precipitation - Frequency Atlas of the Western United States, Volume VIII - Arizona, 1973. The 2 year 24 hour precipitation before areal reduction is 1.8 inches, after areal reduction, 1.77 inches. The 100 year 24 hour precipitation is 4.44 inches before reduction, 4.33 inches after reduction.

The City requested that the precipitation be distributed with time using the SCS Type IIA rainfall distribution. This distribution is shown in Table 4.

MODEL VERIFICATION

The Hec-1 computer model for Case 1 was verified by independent methods. The methods employed were the U.S. Geological Surveys linear regression equation for estimating flows in Arizona and the Soil Conservation Services' TR-20. See Figures 6A and 6B for comparisons.

The USGS linear regression equation gave erratic results due to failure to recognize abnormal, site-specific hydrologic characteristics. In over half of the sub-watersheds the peak discharge was slightly higher than that of the Hec-1 model results. Those sub-watersheds producing lower peaks than the Hec-1 model were substantially lower in the USGS method.

Field observation and engineering judgement are used to determine average basin characteristics for input in the Kinematic wave option of the Hec-1 computer program. These detailed input parameters provide a more accurate model of the actual site conditions.

The SCS TR-20 method produced peaks consistantly lower than either the Hec-1 or the USGS method. This is due to the flatter curves used in the SCS hydrograph as opposed to the hydrographs calculated from the data input into the Hec-1 Kinematic wave model.

HYDROLOGIC MODELS

CASE 1: Existing watershed conditions model for the 100-year, 24-hour storm. The entire watershed was too large to model in one run and was divided into two smaller models. The dip crossings along Carefree Highway were to be analyzed for upgrade improvements and provided a logical break between the upper and lower watersheds. Carefree Highway also separates the City of Phoenix, to the south, from unincorporated Maricopa County, to the north.

The 100-year, 24-hour peak runoff for each sub-watershed is shown on Tables 3a and 3b. The main channel of Deadman's Wash, see Figure 1, was analyzed for possible channel improvements and those results were reviewed by the City of Phoenix. Due to the large quantity of flow in this reach, channelization and right-of-way requirements were substantial. The existing channels are well defined and 100-year flows are maintained within the banks with one exception at the crossing of the main channel and Carefree Highway where a bridge structure is proposed. The floodplain immediately upstream from this crossing is broad and flat and will require reshaping of the existing channel at the approach and outlet of the proposed structure. In review sessions with the City of Phoenix staff, it was determined that the main channel along with the channels in the sub-watersheds above Carefree Highway (Maricopa County portion) were to remain in the present condition for model analysis in Cases 3, 4 and 5. The exceptions are sub-watersheds 44 (Tributary A), 29 (Tributary B), 31 (Tributary C), and 35a and 32 (Tributary D) where channel improvements are proposed. See Figure 10 for locations.

Structural crossings were anticipated for sub-watersheds 28, 29, 31, 35a and 44 at Carefree Highway. A separate Case 1 Model was prepared for this analysis and the results were used to size the Carefree Highway structures (See Table 8).

As-built information from the Arizona Department of Transportation (ADOT) was used to analyze a system of cross culverts along Interstate 17 (I-17), shown in Figure 5. Although some of these culverts appeared to be undersized, it was assumed for purposes of the Hec-1 hydrology, to allow runoff to pass unrestricted. See Table 5 for culvert capacities and Table 6 for calculated runoff vs. culvert capacity. The results of the Case 1 hydrology are contained in Table 1A.

CASE 2: Future watershed conditions model for the 2-year and 100-year, 24-hour storm. These models were prepared using the existing terrain with adjustments for future land use. On the basis of the requirement for future development to provide site detention/retention to maintain pre-development flows, the City of Phoenix staff decided to eliminate case 2 from the study. See Table 1B for model results.

CASE 3: Existing watershed conditions model for the 100-year, 24-hour storm. The Case 1 Model was modified to route runoff, based on existing watershed characteristics, through the proposed system of channel alternatives. The results of the model with channel improvements in place can be found in Table 1C.

CASE 4: Existing watershed conditions model for the 2-year, 24-hour storm below Carefree Highway. A trunk line storm drain was proposed for the future arterial roadway alignments within the City Limits of the City of Phoenix. This model was developed to provide design data for sizing the proposed trunk lines.

The future arterial roadway alignments were plotted on a map of the sub-watersheds and the storm drain trunk lines were laid out (See Fig. 8). All storm drain lines ultimately daylight in the main channel within each sub-watershed. Table 1D contains the results of the model run with the proposed storm drain system in place.

Each segment of the storm drain was sized and analyzed with the "Circular Channel Analysis Computer Program", Version 1.5, 1986, Dodson and Associates. A summary of the conceptual storm drain capacities is contained in Table 7.

CASE 5: Existing watershed conditions model for the 100-year, 24-hour storm routed through the recommended channel system augmented by the recommended storm drain system. The Case 3 Model was revised to include the Case 4 storm drain system.

The majority of the existing channels above Carefree Highway are to remain natural, but channel improvements are proposed for subwatersheds 29, 31, 33, 35A, and 44. The model includes existing natural channels, improved channels and the conceptual storm drain plan. The results are contained in Table 1E.

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U.S. Army Corps of Engineers, 1987, HEC-1 Flood Hydrograph Package User's Manual.*

U.S. Army Corps of Engineers, 1979, Introduction and Application of Kinematic Wave Routing Techniques using HEC-1, Training Document 10.

* The documentation for the model was revised in 1987, the model was revised in 1988.

TABLES

TABLE 1A
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE I
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK (HRS.)	PEAK RUNOFF (CFS)
1	0.46	6.00	733
2	1.05	6.25	2,502
3	0.37	6.00	742
4	1.15	6.00	2,673
5	0.87	6.25	4,202
6	0.71	6.25	1,008
7	0.17	6.25	4,082
8a	1.43	6.25	2,176
8b	0.07	6.25	8,290
9a	0.77	6.25	1,264
9b	0.08	6.25	6,447
10	0.58	6.00	1,292
11a	0.68	6.25	1,654
11b	0.00	6.25	5,126
12	1.80	6.00	3,160
13	0.71	6.25	1,058
14	0.10	6.00	3,689
15	0.08	6.00	195
16	1.65	6.25	2,225
17a	1.15	6.25	1,827
17b	0.12	6.25	17,904
18a	0.15	6.00	327
18b	0.02	6.00	359
19a	0.35	6.00	838
19b	0.05	6.00	875
20	0.10	6.00	251
21a	0.13	6.25	17,578
21b	0.15	6.25	17,558
22	0.74	6.00	1,776
23	0.31	6.25	17,486
24	0.52	6.00	850
25	0.58	6.25	1,633
26	0.60	6.25	2,326
27	0.92	6.25	20,082

TABLE 1A
SUMMARY OF SUB-WATERSHED CHARACTERISTICS (Continued)
CASE I
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK (HRS.)	PEAK RUNOFF (CFS)
28	0.87	6.25	19,829
29	2.03	6.50	1,686
30	0.38	6.50	1,814
31	0.72	6.50	4,409
32	0.20	6.00	464
33	0.69	6.00	1,424
34	0.36	6.00	775
35a	0.61	6.25	2,392
35b	0.24	6.25	964
36	0.87	6.50	3,849
37	0.45	6.00	849
39	0.11	6.00	255
40	0.10	6.50	6,165
41	0.30	6.50	25,753
42	0.59	6.00	990
43	0.66	6.50	26,256
44	4.39	7.50	2,203
OUTFLOW TO NEW RIVER		6.50	27,844

TABLE 1B
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE II
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK(HRS.)	PEAK RUNOFF (CFS)
1	0.46	6.00	1,120
2	1.05	6.25	2,905
3	0.37	6.00	887
4	1.15	6.00	2,718
5	0.87	6.25	4,399
6	0.71	6.00	1,168
7	0.17	6.25	4,862
8a	1.43	6.25	2,484
8b	0.07	6.25	9,815
9a	0.77	6.25	1,360
9b	0.08	6.00	7,224
10	0.58	6.00	1,341
11a	0.68	6.00	2,069
11b	0.005	6.00	6,482
12	1.80	6.00	3,766
13	0.71	6.25	1,128
14	0.10	6.00	4,658
15	0.08	6.00	202
16	1.65	6.25	2,979
17a	1.15	6.25	1,956
17b	0.12	6.25	21,012
18a	0.15	6.00	356
18b	0.02	6.00	394
19a	0.35	6.00	967
19b	0.05	6.00	1,050
20	0.10	6.00	251
21a	0.13	6.25	20,767
21b	0.51	6.25	20,968
22	0.74	6.00	1,949
23	0.31	6.25	20,906
24	0.52	6.00	1,075
25	0.58	6.25	1,808
26	0.60	6.25	2,577
27	0.92	6.25	24,068
28	0.87	6.50	22,633

TABLE 1B (continued)
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE II
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK(HRS.)	PEAK RUNOFF (CFS)
29	2.03	6.50	2,158
30	0.38	6.50	2,363
31	0.72	6.50	5,095
32	0.20	6.00	496
33	0.69	6.00	1,953
34	0.36	6.00	115
35a	0.61	6.00	3,427
35b	1.24	6.00	1,276
36	0.87	6.50	4,643
37	0.45	6.00	1,070
39	0.11	6.00	279
40	0.10	6.50	7,365
41	0.30	6.50	30,007
42	0.59	6.00	1,388
43	0.66	6.50	30,499
44	4.39	7.25	2,866
OUTFLOW TO NEW RIVER		6.50	32,861

TABLE 1C
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE III
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK (HRS.)	PEAK RUNOFF (CFS)
28	0.63	6.50	19,829
29	2.03	6.75	1,592
30	0.38	6.75	1,731
31	0.72	7.00	3,018
32	0.20	6.00	464
33	0.69	6.00	1,337
34	0.36	6.00	775
35a	0.61	6.50	1,954
35b	0.24	6.25	889
36	0.87	7.00	2,687
37	0.45	6.00	618
39	0.11	6.00	241
40	0.10	6.50	4,657
41	0.30	6.25	22,273
42	0.59	6.25	890
43	0.66	6.50	23,062
44	4.39	7.50	2,203
OUTFLOW TO NEW RIVER		6.50	24,650

TABLE 1D
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE IV
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK (HRS.)	PEAK RUNOFF (CFS)
1	0.46	6.25	106
28	0.63	6.75	29
29	0.47	7.00	63
30	0.38	7.50	97
31	0.63	6.75	176
35a	0.32	7.25	36
35b	0.24	7.50	25
36	0.87	8.75	101
37	0.45	6.50	90
39	0.11	6.25	29
40	0.10	7.50	238
41	0.30	7.00	277
42	0.59	6.75	96
43	0.66	7.00	397
44	1.10	7.25	138
OUTFLOW TO NEW RIVER		7.00	533

TABLE 1E
SUMMARY OF SUB-WATERSHED CHARACTERISTICS
CASE V
100-YEAR; 24-HOUR STORM

SUB-WATERSHED NUMBER	AREA (SQ.MI.)	TIME TO PEAK (HRS.)	PEAK RUNOFF (CFS)
28	0.63	6.50	19,829
29	2.03	6.75	1,591
30	0.38	6.75	1,654
31	0.72	7.00	2,891
32	0.20	6.00	464
33	0.69	6.00	1,324
34	0.36	6.00	771
35a	0.61	6.50	1,832
35b	0.24	6.25	831
36	0.87	7.00	2,460
37	0.45	6.25	609
39	0.11	6.00	241
40	0.10	7.00	4,645
41	0.30	6.50	22,582
42	0.59	6.25	818
43	0.66	6.50	23,154
44	4.39	6.75	3,511
OUTFLOW TO NEW RIVER		6.50	26,392

TABLE 2

HYDROLOGIC SOILS GROUP DATA

SUB-WATERSHED NUMBER	SOILS GROUP B (%) CURVE NO.75	SOILS GROUP C (%) CURVE NO.83	SOILS GROUP D (%) CURVE NO.86	WEIGHTED CURVE NO.
1	0.00	16.88	83.12	85.49
2	6.03	0.00	93.97	85.34
3	7.28	11.11	81.61	84.87
4	1.88	0.00	98.12	85.79
5	11.44	6.47	82.09	84.55
6	15.24	0.00	84.76	84.32
7	43.22	0.00	56.78	81.25
8a	13.47	2.58	83.95	84.44
8b	13.47	2.58	83.95	84.44
9a	6.50	0.00	93.50	85.32
9b	56.90	0.00	43.10	79.74
10	1.72	16.26	82.02	85.32
11a	41.31	18.86	39.83	80.89
11b	41.31	18.86	39.83	80.89
12	14.65	24.68	60.67	83.65
13	0.61	21.77	77.62	85.28
14	22.54	0.00	77.46	83.52
15	8.77	0.00	91.23	85.04
16	0.52	0.00	99.48	85.94
17a	2.99	0.00	97.01	85.67
17b	51.22	0.00	48.78	80.37
18a	35.58	0.00	64.42	82.09
18b	16.67	0.00	83.33	84.17
19a	8.26	0.00	91.74	85.09
19b	48.65	10.81	40.54	80.32
20	0.00	0.00	100.00	86.00
21a	21.51	0.00	78.49	83.63
21b	42.37	3.11	54.52	81.25
22	12.04	0.00	87.96	84.68
23	37.09	0.00	62.91	81.92
24	0.00	0.00	100.00	86.00
25	0.00	0.00	100.00	86.00
26	18.38	0.00	81.62	83.98

TABLE 2

HYDROLOGIC SOILS GROUP DATA(Continued)

SUB-WATERSHED NUMBER	SOILS GROUP B (%) CURVE NO.75	SOILS GROUP C (%) CURVE NO.83	SOILS GROUP D (%) CURVE NO.86	WEIGHTED CURVE NO.
27	6.26	0.00	93.74	85.31
28	45.12	0.00	54.88	81.04
29	2.40	0.00	97.60	87.74
32	16.31	0.00	83.69	84.21
33	12.13	0.00	87.87	84.67
34	5.95	5.56	88.49	85.18
35a	5.01	0.00	94.99	85.45
44	2.18	0.00	97.82	85.76

TABLE 3
SAMPLE HEC-1 DATA FILE

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

1     ID        DEADMAN'S WASH --- CASE I - 100 YEARS, 24-HOUR DESIGN
STORM-2         ID    EXISTING CONDITIONS
3     ID        KINEMATIC WAVE ROUTING
4     IT      15   96
5     IO       3    0
6     IN      30

7     KK        SB1 SUBWATERSHED 1
8     KM        RUNOFF FROM SB1
9     KO
10    BA    0.46
11    LS0      0
12    PB    4.33
13    PC       0 .005  .009  .010  .013  .019  .021  .028  .032  .044
14    PC    .057 .100  .660  .745  .776  .800  .816  .830  .840  .850
15    PC    .861 .868  .878  .884  .891  .900  .905  .912  .919  .923
16    PC    .930 .934  .939  .944  .950  .958  .961  .963  .969  .971
17    PC    .974 .979  .981  .985  .989  .991  .993  .996 1.000
18    UK    .500 .040   .15  100
19    RK    1500 .017  .050   .09 TRAP     2    1
20    RK    7700   25  .045       TRAP     8    3
21    DX       5    6     6

22    KK        SB2 SUBWATERSHED2
23    KM        RUNOFF FROM SB2
24    KO
25    BA    1.05
26    LS       0 85.3    20
27    UK    500.  .04   .15  100
28    RK   3000. .015   .05   .15 TRAP     2    1
29    RK  13300 .013  .045       TRAP     3  YES
30    DX       7          5     5

31    KK        SB3 SUBWATERSHED 3
32    KM        RUNOFF
33    KO
34    BA     .37
35    LS       0 84.9     6
36    UK     250  .20   .15  100
37    RK   1000.  .10   .05   .04 TRAP          1
38    RK    6000 .028  .045       TRAP     3    1
39    DX       5          6     6
```

TABLE 4
SCS TYPE IIA RAINFALL DISTRIBUTION

TIME ELAPSED (HOURS)	CUMULATIVE PRECIPITATION (PERCENT)	TIME ELAPSED (MINUTES)	CUMULATIVE PRECIPITATION (PERCENT)
0.0	0.000	12.5	.900
0.5	.005	13.0	.905
1.0	.009	13.5	.912
1.5	.010	14.0	.919
2.0	.013	14.5	.923
2.5	.019	15.0	.930
3.0	.021	15.5	.934
3.5	.028	16.0	.939
4.0	.032	16.5	.944
4.5	.044	17.0	.950
5.0	.057	17.5	.958
5.5	.100	18.0	.961
6.0	.660	18.5	.963
6.5	.745	19.0	.969
7.0	.776	19.5	.971
7.5	.800	20.0	.974
8.0	.816	20.5	.979
8.5	.830	21.0	.981
9.0	.840	21.5	.985
9.5	.850	22.0	.989
10.0	.861	22.5	.991
10.5	.868	23.0	.993
11.0	.878	23.5	.996
11.5	.884	24.0	1.000
12.0	.891		

TABLE 5

I-17 CULVERT CAPACITY

*CULVERT	SLOPE	CAPACITY
1. 8'X3 RCB	0.58%	240 CFS
2. 24" RCP	0.40% (Assumed)	16 CFS
3. 3-8'X7' RCB	1.00%	3,300 CFS
4. 6'X7' RCB	0.40%	480 CFS
5. 30" RCP	7.00%	120 CFS
6. 42" RCP	1.50%	135 CFS
7. 6'X7' RCB	0.80%	650 CFS
8. 2-36" RCP	2.40%	240 CFS
9. 24" RCP	1.30%	28 CFS
10. 36" RCP	1.30%	80 CFS
11. 30" RCP	1.00%	45 CFS
12. 36" RCP	2.40%	115 CFS
13. 36" RCP	2.10%	105 CFS
14. 2-8' X 6' RCB	0.20%	800 CFS
15. 2-6' X 5' RCB	1.00%	940 CFS
4 SPAN BRIDGE ~ 1830 SF	0.40%	21,400 CFS

* NOTE: FOR CULVERT LOCATIONS SEE FIGURE 5.

TABLE 6

RUNOFF VS. CAPACITY
EXISTING CULVERTS IN INTERSTATE 17 (I-17)

SUB-WATERSHED NUMBER	100-YEAR PEAK RUNOFF (CFS)	*I-17 CULVERT NUMBER	CAPACITY (CFS)
34	775	1	240
33	1,424	2,3	3,316
32	464	4	480
20	251	5	135
19a	838	6,7	785
18a	327	8,9,10,11,12,13	613
8b+9b+16	16,962	4 SPAN BRIDGE	21,400
2	2,502	14	1,600
1	733	15	940

* NOTE: FOR LOCATION OF CULVERTS SEE FIGURE 5.

TABLE 7

CONCEPTUAL STORM DRAIN CAPACITY SUMMARY

CONDUIT NO.	DESIGN DISCHARGE (CFS)	CONDUIT SIZE (INCHES)	LENGTH (FT.)
1	32.9	36	2500
2	18.3	30	2000
3	2.3	18	800
4	6.0	18	1100
5	2.2	18	800
6	4.8	18	800
7	10.3	24	1200
8	7.3	24	1200
9	10.5	24	2700
10	5.1	18	1300
11	4.8	18	1200
12	1.8	18	1000
13	11.2	24	1700
14	10.3	24	1100
15	17.7	30	3000
16	11.0	24	500
17	1.5	18	400
18	2.5	18	2000
19	2.8	18	1100
20	15.8	24	1200
21	4.0	18	1500
22	5.6	18	700
23A	4.8	18	500
23B	1.3	18	400
24A	1.7	18	400
24B	2.9	18	400
25	1.9	18	400
26	3.2	18	500
27	0.6	18	500
28	20.6	24	2800
29	18.2	30	800
30A	6..2	18	900
30B	10.4	24	1000
31	7.1	24	1500
32	18.3	30	2800
33	4.9	18	1200
34	34.3	36	1700

TABLE 7

CONCEPTUAL STORM DRAIN CAPACITY SUMMARY (continued)

CONDUIT NO.	DESIGN DISCHARGE (CFS)	CONDUIT SIZE (INCHES)	LENGTH (FT.)
35A	7.0	18	2000
35B	21.9	30	4000
36A	4.6	18	1200
36B	6.0	18	800
37	6.8	18	1300
38	0.9	18	600
39A	10.3	24	1300
39B	23.3	30	1700
40	24.7	18	700
41	2.0	18	700
42A	34.2	36	1200
42B	13.8	24	1500
43	7.5	18	1000
44	18.3	30	1800
45	0.4	18	300
46	2.4	18	400
47	1.9	18	1100
48	7.4	24	800
49	0.8	18	500
50A	12.8	24	700
50B	19.8	30	1400
51	2.1	18	600
52	2.9	18	500

NOTE: FOR LOCATIONS SEE FIGURE 8.

TABLE 8 CHANNEL DESIGN PARAMETERS (BELOW CAREFREE HWY.)

EARTHEN LINED CHANNELS		PEAK FLOW(CFS)	SLOPE (FT./FT.)	SIDE-SLOPE	DEPTH (FT.)	BOTTOM WIDTH(FT.)	TOP WIDTH(FT.)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-					
B.	TRIBUTARY A						
B.1.	MAIN CHANNEL TO CAREFREE HWY.	2203	0.010	4:1	2.23	180	206
C.	TRIBUTARY B						
C.1.	MAIN CHANNEL TO CAREFREE HWY.	1686	0.008	4:1	2.55	130	158
D.	TRIBUTARY C						
D.1.	59TH AVE. TO CAREFREE HWY.*	4550	0.008		-N/A-		
E.	TRIBUTARY D						
E.1.	TRIBUTARY C TO 51ST AVE.	2687	0.005	4:1	3.01	200	232
E.2.	51ST AVE. TO CAREFREE HWY.	1954	0.007	4:1	3.18	110	144
F.	TRIBUTARY E						
F.1.	TRIBUTARY D TO I-17 INT.	889	0.007	4:1	2.32	85	112
G.	TRIBUTARY F						
G.1.	TRIBUTARY D TO HEADWATERS	618	0.010	4:1	1.75	80	100
H.	TRIBUTARY G						
H.1.	MAIN CHANNEL TO DIXILETA RD.	890	0.010	4:1	2.09	85	108

"DEPTH" INDICATES NORMAL WATER SURFACE DEPTH. (DOES NOT INCLUDE FREEBOARD)
"TOP WIDTH" INCLUDES FREEBOARD

* CHANNEL D.1. MUST BE CONCRETE LINED DUE TO FLOW QUANTITY. SEE TABLE 9.

FOR LOCATIONS SEE FIGURE 9

TABLE 9 CHANNEL DESIGN PARAMETERS (BELOW CAREFREE HWY.)

CONCRETE LINED CHANNELS		PEAK FLOW(CFS)	SLOPE (FT./FT.)	SIDE-SLOPE	DEPTH (FT.)	BOTTOM WIDTH(FT.)	TOP WIDTH(FT.)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-					
B.	TRIBUTARY A						
B.1.	MAIN CHANNEL TO CAREFREE HWY.	2203	0.010	2:1	2.18	80	98
C.	TRIBUTARY B						
C.1.	MAIN CHANNEL TO CAREFREE HWY.	1686	0.008	2:1	7.94	0	40
D.	TRIBUTARY C						
D.1.	59TH AVE. TO CAREFREE HWY.	4550	0.008	2:1	7.85	30	76
E.	TRIBUTARY D						
E.1.	TRIBUTARY C TO 51ST AVE.	2687	0.005	2:1	7.76	20	60
E.2.	51ST AVE. TO CAREFREE HWY.	1954	0.007	2:1	6.05	10	42
F.	TRIBUTARY E						
F.1.	TRIBUTARY D TO I-17 INT.	889	0.007	2:1	2.80	24	40
G.	TRIBUTARY F						
G.1.	TRIBUTARY D TO HEADWATERS	618	0.010	2:1	2.89	12	28
H.	TRIBUTARY G						
H.1.	MAIN CHANNEL TO DIXILETA RD.	890	0.010	2:1	2.78	20	36

"DEPTH" INDICATES NORMAL WATER SURFACE DEPTH. (DOES NOT INCLUDE FREEBOARD)
"TOP WIDTH" INCLUDES FREEBOARD

FOR LOCATIONS SEE FIGURE 9

TABLE 10 BRIDGE SUMMARY FOR EARTHEN LINED CHANNELS

BRIDGE STRUCTURE I.D.	LOCATION	PEAK FLOW (CFS)	AREA OF DECK (S.F.)
A	MAIN CHANNEL - 67TH AVE.	25,996	33,150
B	MAIN CHANNEL - 59TH AVE.	19,835	23,630
C	MAIN CHANNEL - DOVE VALLEY RD.	19,835	23,630
D	MAIN CHANNEL - CAREFREE HWY.	19,973	23,630
E	TRIBUTARY A - 67TH AVE.	2,203	18,360
F	TRIBUTARY A - DOVE VALLEY RD.	2,203	18,360
G	TRIBUTARY A - CAREFREE HWY.	2,203	18,360
H	TRIBUTARY B - 59TH AVE.	1,686	14,280
I	TRIBUTARY B - DOVE VALLEY RD.	1,686	14,280
J	TRIBUTARY B - 51ST AVE.	1,686	14,280
K	TRIBUTARY B - CAREFREE HWY.	1,686	14,280
*L	TRIBUTARY C - 51ST AVE.	4,550	7,310
*M	TRIBUTARY C - DOVE VALLEY RD.	4,550	7,310
*N	TRIBUTARY C - CAREFREE HWY.	4,550	7,310
O	TRIBUTARY D - 51ST AVE.	2,687	20,570
P	TRIBUTARY D - DOVE VALLEY RD.	1,954	13,090
Q	TRIBUTARY D - 43RD AVE.	1,954	13,090
R	TRIBUTARY D - CAREFREE HWY.	1,954	13,090
S	TRIBUTARY E - DOVE VALLEY RD.	889	10,030
T	TRIBUTARY E - 43RD. AVE.	889	10,030
U	TRIBUTARY F - LONE MOUNTAIN RD.	618	9,180
V	TRIBUTARY G - DIXILETA DRIVE	890	9,860

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL.

FOR LOCATIONS SEE FIGURE 9.

TABLE 11 BRIDGE SUMMARY FOR CONCRETE LINED CHANNELS

BRIDGE STRUCTURE I.D.	LOCATION	PEAK FLOW (CFS)	AREA OF DECK (S.F.)
*A	MAIN CHANNEL - 67TH AVE.	25,996	33,150
*B	MAIN CHANNEL - 59TH AVE.	19,835	23,630
*C	MAIN CHANNEL - DOVE VALLEY RD.	19,835	23,630
*D	MAIN CHANNEL - CAREFREE HWY.	19,973	23,630
E	TRIBUTARY A - 67TH AVE.	2,203	9,180
F	TRIBUTARY A - DOVE VALLEY RD.	2,203	9,180
G	TRIBUTARY A - CAREFREE HWY.	2,203	9,180
H	TRIBUTARY B - 59TH AVE.	1,686	4,250
I	TRIBUTARY B - DOVE VALLEY RD.	1,686	4,250
J	TRIBUTARY B - 51ST AVE.	1,686	4,250
K	TRIBUTARY B - CAREFREE HWY.	1,686	4,250
L	TRIBUTARY C - 51ST AVE.	4,550	7,310
M	TRIBUTARY C - DOVE VALLEY RD.	4,550	7,310
N	TRIBUTARY C - CAREFREE HWY.	4,550	7,310
O	TRIBUTARY D - 51ST AVE.	2,687	5,950
P	TRIBUTARY D - DOVE VALLEY RD.	1,954	4,420
Q	TRIBUTARY D - 43RD AVE.	1,954	4,420
R	TRIBUTARY D - CAREFREE HWY.	1,954	4,420
S	TRIBUTARY E - DOVE VALLEY RD.	889	4,250
T	TRIBUTARY E - 43RD. AVE.	889	4,250
U	TRIBUTARY F - LONE MOUNTAIN RD.	618	3,230
V	TRIBUTARY G - DIXILETA DRIVE	890	3,910

* TO REMAIN NATURAL EARTHEN CHANNEL

FOR LOCATIONS SEE FIGURE 9.

TABLE 12 CHANNEL DESIGN PARAMETERS (ABOVE CAREFREE HIGHWAY)

EARTHEN LINED CHANNELS		PEAK FLOW(CFS)	SLOPE (FT./FT.)	SIDE-SLOPE	DEPTH (FT.)	BOTTOM WIDTH(FT.)	TOP WIDTH(FT.)
A.	TRIBUTARY A	-NATURAL-					
A.1.	CAREFREE HWY. TO HEADWATERS	2203	0.010	4:1	2.23	180	206
B.	TRIBUTARY B						
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	1686	0.003	4:1	2.55	130	158
C.	TRIBUTARY C						
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE*	4550	0.008	N/A			
D.	TRIBUTARY D						
D.1.	CAREFREE HWY. TO I-17	1954	0.007	4:1	3.18	110	144
D.2.	I-17 TO HEADWATERS	1324	0.011	4:1	2.22	110	136

"DEPTH" INDICATES NORMAL WATER SURFACE DEPTH. (DOES NOT INCLUDE FREEBOARD)
"TOP WIDTH" INCLUDES FREEBOARD

* CHANNEL C.1. MUST BE CONCRETE LINED DUE TO FLOW QUANTITY. SEE TABLE 13.

FOR LOCATIONS SEE FIGURE 10.

TABLE 13 CHANNEL DESIGN PARAMETERS (ABOVE CAREFREE HIGHWAY)

CONCRETE LINED CHANNELS		PEAK FLOW(CFS)	SLOPE (FT./FT.)	SIDE-SLOPE	DEPTH (FT.)	BOTTOM WIDTH(FT.)	TOP WIDTH(FT.)
A.	TRIBUTARY A	-NATURAL-					
A.1.	CAREFREE HWY. TO HEADWATERS	2203	0.010	2:1	2.18	80	98
B.	TRIBUTARY B						
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	1686	0.003	2:1	7.94	0	40
C.	TRIBUTARY C						
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	4550	0.008	2:1	7.85	30	76
D.	TRIBUTARY D						
D.1.	CAREFREE HWY. TO I-17	1954	0.007	2:1	6.05	10	42
D.2.	I-17 TO HEADWATERS	1324	0.011	2:1	2.06	50	68

"DEPTH" INDICATES NORMAL WATER SURFACE DEPTH. (DOES NOT INCLUDE FREEBOARD)
"TOP WIDTH" INCLUDES FREEBOARD

FOR LOCATIONS SEE FIGURE 10.

TABLE 14

COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		LENGTH (FT.)	BOT. WIDTH (FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	11,200	180	3.25	206
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	13,200	130	3.50	158
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.*	13,100	30	11.50	76
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	9,200	200	4.00	232
E.2.	51ST AVE. TO CAREFREE HWY.	6,100	110	4.25	144
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	8,000	85	3.38	112
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	4,500	80	2.50	100
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	5,200	85	2.88	108

* FLOW QUANTITY REQUIRES CONC. LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT

NOTE:DEPTH INCLUDES FREEBOARD

TABLE 14

COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	627.25	260,193	3.00	780,579
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	504.00	246,400	3.00	739,200
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.*	1219.00	591,441	3.00	1,774,323
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	864.00	294,400	3.00	883,200
E.2.	51ST AVE. TO CAREFREE HWY.	539.75	121,944	3.00	365,832
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	332.93	98,646	3.00	295,938
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	225.00	37,500	3.00	112,500
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	277.92	53,525	3.00	160,575
				TOTAL	5,112,149

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT:

D.1.: CONC. LINING = 118,525 S.Y., UNIT COST = $30/S.Y., TOTAL COST = $3,555,750

TABLE 14

COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		CHANNEL TOP WIDTH (FT.)	BRIDGE WIDTH* (FT.)	AREA OF DECK (S.F.)	UNIT COST ($/S.F.)	TOTAL COST ($)
II.	BRIDGES					
A.	MAIN CHANNEL - 67TH AVE.	380	85	33,150	60	1,989,000
B.	MAIN CHANNEL - 59TH AVE.	268	85	23,630	60	1,417,800
C.	MAIN CHANNEL - DOVE VALLEY RD.	268	85	23,630	60	1,417,800
D.	MAIN CHANNEL - CAREFREE HWY.	268	85	23,630	60	1,417,800
E.	TRIBUTARY A - 67TH AVE.	206	85	18,360	60	1,101,600
F.	TRIBUTARY A - DOVE VALLEY RD.	206	85	18,360	60	1,101,600
G.	TRIBUTARY A - CAREFREE HWY.	206	85	18,360	60	1,101,600
H.	TRIBUTARY B - 59TH AVE.	158	85	14,280	60	856,800
I.	TRIBUTARY B - DOVE VALLEY RD.	158	85	14,280	60	856,800
J.	TRIBUTARY B - 51ST AVE.	158	85	14,280	60	856,800
K.	TRIBUTARY B - CAREFREE HWY.	158	85	14,280	60	856,800
L.	TRIBUTARY C - 51ST AVE.	76	85	7,310	60	438,600
M.	TRIBUTARY C - DOVE VALLEY ROAD	76	85	7,310	60	438,600
N.	TRIBUTARY C - CAREFREE HWY.	76	85	7,310	60	438,600
O.	TRIBUTARY D - 51ST AVE.	232	85	20,570	60	1,234,200
P.	TRIBUTARY D - DOVE VALLEY RD.	144	85	13,090	60	785,400
Q.	TRIBUTARY D - 43RD. AVE.	144	85	13,090	60	785,400
R.	TRIBUTARY D - CAREFREE HWY.	144	85	13,090	60	785,400
S.	TRIBUTARY E - DOVE VALLEY RD.	108	85	10,030	60	601,800
T.	TRIBUTARY E - 43RD AVE.	108	85	10,030	60	601,800
U.	TRIBUTARY F - LONE MOUNTAIN RD.	98	85	9,180	60	550,800
V.	TRIBUTARY G - DIXILETA DR.	106	85	9,180	60	591,600

* INCLUDES ABUTMENTS

TABLE 14 COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY
EARTHEN LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
1	36	2500	78.57	196,425
2	30	2000	66.93	133,860
3	18	800	55.29	44,232
4	18	1100	55.29	60,819
5	18	800	55.29	44,232
6	18	800	55.29	44,232
7	24	1200	59.17	71,004
8	24	1200	59.17	71,004
9	24	2700	59.17	159,759
10	18	1300	55.29	71,877
11	18	1200	55.29	66,348
12	18	1000	55.29	55,290
13	24	1700	59.17	100,589
14	24	1100	59.17	65,087
15	30	3000	66.93	200,790
16	24	500	59.17	29,585
17	18	400	55.29	22,116
18	18	2000	55.29	110,580
19	18	1100	55.29	60,819
20	30	1200	66.93	80,316
21	18	1500	55.29	82,935
22	24	700	59.17	41,419
23	24	900	59.17	53,253
24	18	800	55.29	44,232
25	18	400	55.29	22,116
26	18	500	55.29	27,645

TABLE 14 COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY (CONTINUED)
EARTHEN LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
27	18	500	55.29	27,645
28	30	2800	66.93	187,404
29	30	800	66.93	53,544
30A	24	900	59.17	53,253
30B	24	1000	59.17	59,170
31	24	1500	55.17	88,755
32	30	2800	66.93	187,404
33	30	1200	66.93	80,316
34	36	1700	78.57	133,569
35A	24	2000	59.17	118,340
35B	30	4000	66.93	267,720
35A	18	2000	55.29	110,580
36B	18	800	55.29	44,232
37	30	1300	66.93	87,009
38	18	600	55.29	33,174
39A	24	1300	59.17	76,921
39B	30	1700	66.93	113,781
40	30	700	66.93	46,851
41	18	700	55.29	38,703
42A	36	1200	78.57	94,284
42B	30	1500	66.93	100,395
43	24	1000	59.17	59,170
44	30	1800	66.93	120,474
45	18	300	55.29	16,587
46	24	400	59.17	23,668
47	24	1100	59.17	65,087

TABLE 14 COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY (CONTINUED)
EARTHEN LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
48	24	800	59.17	47,336
49	18	500	55.29	27,645
50A	36	700	78.57	54,999
50B	30	1,400	66.93	93,702
51	18	600	55.29	33,174
52	18	500	55.29	27,645
LINE A	30	11,200	66.98	749,616
LINE B	30	13,200	66.93	883,476
LINE B1	30	4,400	66.93	294,492
LINE C	30	13,100	66.93	876,783
LINE D	30	15,300	66.93	1,024,029
LINE E	30	8,000	66.93	535,440
LINE F	30	4,500	66.93	301,185
LINE G	30	5,200	66.93	348,036
			TOTAL	9,546,158

TABLE 14 COST ESTIMATE FOR ALTERNATE A: BELOW CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

IV. RIGHT-OF-WAY

		CORRIDOR WIDTH (FT.)	CORRIDOR LENGTH (FT.)	AREA (AC)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-		
B.	TRIBUTARY A			
B.1.	MAIN CHANNEL TO CAREFREE HWY.	236	11,200	60.7
C.	TRIBUTARY B			
C.1.	MAIN CHANNEL TO CAREFREE HWY.	188	13,200	57.0
D.	TRIBUTARY C			
D.1.	59TH AVE. TO CAREFREE HWY.	106	13,100	31.9
E.	TRIBUTARY D			
E.1.	TRIBUTARY C TO 51ST AVE.	262	9,200	55.3
E.2.	51ST AVE. TO CAREFREE HWY.	174	6,100	24.4
F.	TRIBUTARY E			
F.1.	TRIBUTARY D TO I-17 INT.	142	8,000	26.1
G.	TRIBUTARY F			
G.1.	TRIBUTARY D TO HEADWATERS	130	4,500	13.4
H.	TRIBUTARY G			
H.1.	MAIN CHANNEL TO DIXILETA RD.	138	5,200	16.5
			TOTAL	285.3

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		LENGTH (FT.)	BOT. WIDTH (FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	11,200	80	4.50	98
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	13,200	0	10.00	40
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.	13,100	30	11.50	76
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	9,200	20	10.00	60
E.2.	51ST AVE. TO CAREFREE HWY.	6,100	10	8.00	42
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	8,000	24	4.00	40
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	4,500	12	4.00	28
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	5,200	20	4.00	36

NOTE: DEPTH INCLUDES FREEBOARD

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	400.50	166,133	3.00	498,399
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	200.00	97,778	3.00	293,334
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.	609.50	295,720	3.00	887,160
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	400.00	136,296	3.00	408,888
E.2.	51ST AVE. TO CAREFREE HWY.	208.00	46,993	3.00	140,979
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	128.00	37,926	3.00	113,778
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	80.00	13,333	3.00	39,999
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	112.00	21,570	3.00	64,710
				TOTAL	2,447,247

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		CHANNEL WIDTH (FT.)	WIDTH* (FT.)	AREA OF DECK (S.F.)	UNIT COST ($/S.F.)	TOTAL COST ($)
II.	BRIDGES					
A.	MAIN CHANNEL - 67TH AVE.	380	85	33,150	60	1,989,000
B.	MAIN CHANNEL - 59TH AVE.	268	85	23,630	60	1,417,800
C.	MAIN CHANNEL - DOVE VALLEY RD.	268	85	23,630	60	1,417,800
D.	MAIN CHANNEL - CAREFREE HWY.	268	85	23,630	60	1,417,800
E.	TRIBUTARY A - 67TH AVE.	98	85	9,180	60	550,800
F.	TRIBUTARY A - DOVE VALLEY RD.	98	85	9,180	60	550,800
G.	TRIBUTARY A - CAREFREE HWY.	98	85	9,180	60	550,800
H.	TRIBUTARY B - 59TH AVE.	40	85	4,250	60	255,000
I.	TRIBUTARY B - DOVE VALLEY RD.	40	85	4,250	60	255,000
J.	TRIBUTARY B - 51ST AVE.	40	85	4,250	60	255,000
K.	TRIBUTARY B - CAREFREE HWY.	40	85	4,250	60	255,000
L.	TRIBUTARY C - 51ST AVE.	76	85	7,310	60	438,600
M.	TRIBUTARY C - DOVE VALLEY ROAD	76	85	7,310	60	438,600
N.	TRIBUTARY C - CAREFREE HWY.	76	85	7,310	60	438,600
O.	TRIBUTARY D - 51ST AVE.	60	85	5,950	60	357,000
P.	TRIBUTARY D - DOVE VALLEY RD.	42	85	4,420	60	265,200
Q.	TRIBUTARY D - 43RD. AVE.	42	85	4,420	60	265,200
R.	TRIBUTARY D - CAREFREE HWY.	42	85	4,420	60	265,200
S.	TRIBUTARY E - DOVE VALLEY RD.	40	85	4,250	60	255,000
T.	TRIBUTARY E - 43RD AVE.	40	85	4,250	60	255,000
U.	TRIBUTARY F - LONE MOUNTAIN RD.	28	85	3,230	60	193,800
V.	TRIBUTARY G - DIXILETA DR.	36	85	3,910	60	234,600
					TOTAL	20,226,600

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY
CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
1	36	2500	78.57	196,425
2	30	2000	66.93	133,860
3	18	800	55.29	44,232
4	18	1100	55.29	60,819
5	18	800	55.29	44,232
6	18	800	55.29	44,232
7	24	1200	59.17	71,004
8	24	1200	59.17	71,004
9	24	2700	59.17	159,759
10	18	1300	55.29	71,877
11	18	1200	55.29	66,348
12	18	1000	55.29	55,290
13	24	1700	59.17	100,589
14	24	1100	59.17	65,087
15	30	3000	66.93	200,790
16	24	500	59.17	29,585
17	18	400	55.29	22,116
18	18	2000	55.29	110,580
19	18	1100	55.29	60,819
20	30	1200	66.93	80,316
21	18	1500	55.29	82,935
22	24	700	59.17	41,419
23	24	900	59.17	53,253

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY (CONTINUED)
CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT ($/FT.)	TOTAL COST ($)
24	18	800	55.29	44,232
25	18	400	55.29	22,116
26	18	500	55.29	27,645
27	18	500	55.29	27,645
28	30	2800	66.93	187,404
29	30	800	66.93	53,544
30A	24	900	59.17	53,253
30B	24	1000	59.17	59,170
31	24	1500	55.17	88,755
32	30	2800	66.93	187,404
33	30	1200	66.93	80,316
34	36	1700	78.57	133,569
35A	24	2000	59.17	118,340
35B	30	4000	66.93	267,720
36A	18	2000	55.29	110,580
36B	18	800	55.29	44,232
37	30	1300	66.93	87,009
38	18	600	55.29	33,174
39A	24	1300	59.17	76,921
39B	30	1700	66.93	113,781
40	30	700	66.93	46,851
41	18	700	55.29	38,703
42A	36	1200	78.57	94,284
42B	30	1500	66.93	100,395

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY (CONTINUED)
CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT ($/FT.)	TOTAL COST ($)
43	24	1,000	59.17	59,170
44	30	1,800	66.93	120,474
45	18	300	55.29	16,587
46	24	400	59.17	23,668
47	24	1,100	59.17	65,087
48	24	800	59.17	47,336
49	18	500	55.29	27,645
50A	36	700	78.57	54,999
50B	30	1,400	66.93	93,702
51	18	600	55.29	33,174
52	18	500	55.29	27,645
LINE A	30	11,200	66.98	749,616
LINE B	30	13,200	66.93	883,476
LINE B1	30	4,400	66.93	294,492
LINE C	30	13,100	66.93	876,783
LINE D	30	15,300	66.93	1,024,029
LINE E	30	8,000	66.93	535,440
LINE F	30	4,500	66.93	301,185
LINE G	30	5,200	66.93	348,036
			TOTAL	9,546,158

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

IV. RIGHT-OF-WAY

		CORRIDOR WIDTH (FT.)	CORRIDOR LENGTH (FT.)	AREA (AC)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-		
B.	TRIBUTARY A			
B.1.	MAIN CHANNEL TO CAREFREE HWY.	128	11,200	32.9
C.	TRIBUTARY B			
C.1.	MAIN CHANNEL TO CAREFREE HWY.	70	13,200	21.2
D.	TRIBUTARY C			
D.1.	59TH AVE. TO CAREFREE HWY.	106	13,100	31.9
E.	TRIBUTARY D			
E.1.	TRIBUTARY C TO 51ST AVE.	90	9,200	19.0
E.2.	51ST AVE. TO CAREFREE HWY.	72	6,100	10.1
F.	TRIBUTARY E			
F.1.	TRIBUTARY D TO I-17 INT.	70	8,000	12.9
G.	TRIBUTARY F			
G.1.	TRIBUTARY D TO HEADWATERS	58	4,500	6.0
H.	TRIBUTARY G			
H.1.	MAIN CHANNEL TO DIXILETA RD.	66	5,200	7.9
			TOTAL	141.9

TABLE 15 COST ESTIMATE FOR ALTERNATE B: BELOW CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		LINING (S.Y.)	UNIT COST ($/S.Y.)	TOTAL COST ($)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-		
B.	TRIBUTARY A			
B.1.	MAIN CHANNEL TO CAREFREE HWY.	124,600	30	3,738,000
C.	TRIBUTARY B			
C.1.	MAIN CHANNEL TO CAREFREE HWY.	65,591	30	1,967,730
D.	TRIBUTARY C			
D.1.	59TH AVE. TO CAREFREE HWY.	118,525	30	3,555,750
E.	TRIBUTARY D			
E.1.	TRIBUTARY C TO 51ST AVE.	66,160	30	1,984,800
E.2.	51ST AVE. TO CAREFREE HWY.	31,027	30	930,810
F.	TRIBUTARY E			
F.1.	TRIBUTARY O TO I-17 INT.	37,234	30	1,117,020
G.	TRIBUTARY F			
G.1.	TRIBUTARY D TO HEADWATERS	14,944	30	448,320
H.	TRIBUTARY G			
H.1.	MAIN CHANNEL TO DIXILETA RD.	21,891	30	656,730
			TOTAL =	$ 14,399,160

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		LENGTH (FT.)	BOT. WIDTH (FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	11,200	180	3.25	206
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	13,200	130	3.50	158
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.	13,100	30	11.50	76
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	9,200	200	4.00	232
E.2.	51ST AVE. TO CAREFREE HWY.	6,100	110	4.25	144
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	8,000	85	3.38	112
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	4,500	80	2.50	100
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	5,200	85	2.88	108

NOTE: DEPTH INCLUDES FREEBOARD

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	627.25	260,193	3.00	780,579
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	504.00	246,400	3.00	739,200
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.*	1219.00	591,441	3.00	1,774,323
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	864.00	294,400	3.00	883,200
E.2.	51ST AVE. TO CAREFREE HWY.	539.75	121,994	3.00	365,832
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	332.93	98,646	3.00	295,938
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	225.00	37,500	3.00	112,500
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	277.92	53,525	3.00	160,575
				TOTAL	5,112,149

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT:

D.1.: CONC. LINING = 118,525 S.Y., UNIT COST = $30/S.Y., TOTAL COST = $3,555,750

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		CHANNEL TOP WIDTH (FT.)	BRIDGE WIDTH* (FT.)	AREA OF DECK (S.F.)	UNIT COST ($/S.F.)	TOTAL COST ($)
II.	BRIDGES					
A.	MAIN CHANNEL - 67TH AVE.	380	85	33,150	60	1,989,000
B.	MAIN CHANNEL - 59TH AVE.	268	85	23,630	60	1,417,800
C.	MAIN CHANNEL - DOVE VALLEY RD.	268	85	23,630	60	1,417,800
D.	MAIN CHANNEL - CAREFREE HWY.	268	85	23,630	60	1,417,800
E.	TRIBUTARY A - 67TH AVE.	206	85	18,360	60	1,101,600
F.	TRIBUTARY A - DOVE VALLEY RD.	206	85	18,360	60	1,101,600
G.	TRIBUTARY A - CAREFREE HWY.	206	85	18,360	60	1,101,600
H.	TRIBUTARY B - 59TH AVE.	158	85	14,280	60	856,800
I.	TRIBUTARY B - DOVE VALLEY RD.	158	85	14,280	60	856,800
J.	TRIBUTARY B - 51ST AVE.	158	85	14,280	60	856,800
K.	TRIBUTARY B - CAREFREE HWY.	158	85	14,280	60	856,800
L.	TRIBUTARY C - 51ST AVE.	76	85	7,310	60	438,600
M.	TRIBUTARY C - DOVE VALLEY ROAD	76	85	7,310	60	438,600
N.	TRIBUTARY C - CAREFREE HWY.	76	85	7,310	60	438,600
O.	TRIBUTARY D - 51ST AVE.	232	85	20,570	60	1,234,200
P.	TRIBUTARY D - DOVE VALLEY RD.	144	85	13,090	60	785,400
Q.	TRIBUTARY D - 43RD. AVE.	144	85	13,090	60	785,400
R.	TRIBUTARY D - CAREFREE HWY.	144	85	13,090	60	785,400
S.	TRIBUTARY E - DOVE VALLEY RD.	108	85	10,030	60	601,800
T.	TRIBUTARY E - 43RD AVE.	108	85	10,030	60	601,800
U.	TRIBUTARY F - LONE MOUNTAIN RD.	98	85	9,180	60	550,800
V.	TRIBUTARY G - DIXILETA DR.	106	85	9,860	60	591,600
					TOTAL	20,226,600

* INCLUDES ABUTMENTS

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
1	36	2500	78.57	196,425
2	30	2000	66.93	133,860
3	18	800	55.29	44,232
4	18	1100	55.29	60,819
5	18	800	55.29	44,232
6	18	800	55.29	44,232
7	24	1200	59.17	71,004
8	24	1200	59.17	71,004
9	24	2700	59.17	159,759
10	18	1300	55.29	71,877
11	18	1200	55.29	66,348
12	18	1000	55.29	55,290
13	24	1700	55.17	100,589
14	24	1100	55.17	65,087
15	30	3000	66.93	200,790
16	24	500	55.17	29,585
17	18	400	55.29	22,116
18	18	2000	55.29	110,580
19	18	1100	55.29	60,819
20	30	1200	66.93	80,316
21	18	1500	55.29	82,935
22	24	700	59.17	41,419

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY (CONTINUED)
CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
23	24	900	59.17	53,253
24	18	800	55.29	44,232
25	18	400	55.29	22,116
26	18	500	55.29	27,645
27	18	500	55.29	27,645
28	30	2800	66.93	187,404
29	30	800	66.93	53,544
30A	24	900	59.17	53,253
30B	24	1000	59.17	59,170
31	24	1500	55.17	88,755
32	30	2800	66.93	187,404
33	30	1200	66.93	80,316
34	36	1700	78.57	133,569
35A	24	2000	59.17	118,340
35B	30	4000	66.93	267,720
36A	18	2000	55.29	110,580
36B	18	800	55.29	44,232
37	30	1300	66.93	87,009
38	18	600	55.29	33,174
39A	24	1300	59.17	76,921
39B	30	1700	66.93	113,781
40	30	700	66.93	46,851
41	18	700	55.29	38,703
42A	36	1200	78.57	94,284

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY (CONTINUED)
CONCRETE LINED CHANNELS

III. STORM DRAIN

ID	SIZE (IN.)	LENGTH (FT.)	UNIT COST ($/FT.)	TOTAL COST ($)
42B	30	1500	66.93	100,395
43	24	1000	59.17	59,170
44	30	1800	66.93	120,474
45	18	300	55.29	16,587
46	24	400	59.17	23,668
47	24	1100	59.17	65,087
48	24	800	59.17	47,336
49	18	500	55.29	27,645
50A	36	700	78.57	54,999
50B	30	1,400	66.93	93,702
51	18	600	55.29	33,174
52	18	500	55.29	27,645
LINE A	30	11,200	66.98	749,616
LINE B	30	13,200	66.93	883,476
LINE B1	30	4,400	66.93	294,492
LINE C	30	13,100	66.93	876,783
LINE D	30	15,300	66.93	1,024,029
LINE E	30	8,000	66.93	535,440
LINE F	30	4,500	66.93	301,185
LINE G	30	5,200	66.93	348,036
			TOTAL	9,546,158

TABLE 16 COST ESTIMATE FOR ALTERNATE C: BELOW CAREFREE HIGHWAY

LANDSCAPE RECREATION CORRIDORS

IV. RIGHT-OF-WAY LANDSCAPING

		CORRIDOR WIDTH (FT.)	CORRIDOR LENGTH (FT.)	AREA (AC)	*TOTAL COST($)
A.	DEADMAN'S WASH (MAIN CHANNEL)	-NATURAL-			
B.	TRIBUTARY A				
B.1.	MAIN CHANNEL TO CAREFREE HWY.	236	11,200	60.7	455,250
C.	TRIBUTARY B				
C.1.	MAIN CHANNEL TO CAREFREE HWY.	200	13,200	60.6	454,545
D.	TRIBUTARY C				
D.1.	59TH AVE. TO CAREFREE HWY.**	200<106>	13,100	60.1<31.8>	212,250
E.	TRIBUTARY D				
E.1.	TRIBUTARY C TO 51ST AVE.	262	9,200	55.3	414,750
E.2.	51ST AVE. TO CAREFREE HWY.	200	6,100	28.0	210,000
F.	TRIBUTARY E				
F.1.	TRIBUTARY D TO I-17 INT.	200	8,000	36.7	275,250
G.	TRIBUTARY F				
G.1.	TRIBUTARY D TO HEADWATERS	200	4,500	20.7	155,250
H.	TRIBUTARY G				
H.1.	MAIN CHANNEL TO DIXILETA RD.	200	5,200	23.9	179,250
			TOTALS	346.0<31.8>	2,356,545

* BASED ON UNIT COST OF $7,500/ACRE FOR LANDSCAPING

** FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT. TOP WIDTH OF CONCRETE CHANNEL, 106', SUBTRACTED FROM CORRIDOR WIDTH FOR CALCULATION OF LANDSCAPE COSTS.

TABLE 17 SUMMARY OF COST ESTIMATES
DEADMAN'S WASH - FUTURE CITY PORTION (BELOW CAREFREE HWY.)
CONCEPTUAL DRAINAGE AND STORM DRAIN PLAN

			ESTIMATE
ALTERNATE A: EARTHEN CHANNELS			
1.	CHANNEL EXCAVATION		5,112,149
2.	CONCRETE LINING FOR REACH D.1.		3,555,750
3.	BRIDGES		20,226,600
4.	STORM DRAINS		9,546,158
5.	RIGHT-OF-WAY	285.3 ACRES	
	SUB-TOTAL		38,440,657
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT		5,766,099
	10% CONTINGENCY: CONSTRUCTION		3,844,066
	TOTAL		$ 47,050,822 PLUS 285.3 Ac.
ALTERNATE B: CONCRETE CHANNELS			
1.	CHANNEL EXCAVATION		2,447,247
2.	CONCRETE LINING		14,399,160
3.	BRIDGES		12,321,600
4.	STORM DRAINS		9,546,158
5.	RIGHT-OF-WAY	141.9 ACRES	
	SUB-TOTAL		38,714,165
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT		5,807,125
	10% CONTINGENCY: CONSTRUCTION		3,871,417
	TOTAL		$ 48,392,707 PLUS 141.9 Ac.
ALTERNATE C: EARTHEN CHANNELS WITH LANDSCAPING			
1.	CHANNEL EXCAVATION		5,112,149
2.	CONCRETE LINING FOR REACH D.1.		3,555,750
3.	BRIDGES		20,226,600
4.	STORM DRAINS		9,546,158
5.	LANDSCAPING		2,356,545
6.	RIGHT-OF-WAY	346.0 ACRES	
	SUBTOTAL		40,797,202
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT		6,119,580
	10% CONTINGENCY: CONSTRUCTION		4,079,720
	TOTAL		$ 50,996,502 PLUS 346.0 Ac.

TABLE 18 COST ESTIMATE FOR ALTERNATE A: ABOVE CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		LENGTH (FT.)	BOTTOM WIDTH(FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	TRIBUTARY A	24,600	180	3.25	206
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	3,400	130	3.50	158
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON* SHOOTING RANGE	2,000	30	11.50	76
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	4,000	110	4.25	144
D.2.	I-17 TO HEADWATERS	2,200	110	3.25	136

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT.

NOTE: DEPTH INCLUDES FREEBOARD

TABLE 18 COST ESTIMATE FOR ALTERNATE A: ABOVE CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	TRIBUTARY A	627.25	571,494	3.00	1,714,482
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	504.00	63,467	3.00	190,401
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON* SHOOTING RANGE	1219.00	90,296	3.00	270,888
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	539.75	79,963	3.00	239,889
D.2.	I-17 TO HEADWATERS	399.75	32,572	3.00	97,716
				TOTAL	2,513,376

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT.

CHANNEL C.1. CONCRETE LINING = 29,524 S.Y., UNIT COST = $30/S.Y. - TOTAL COST = 885,770

TABLE 18 COST ESTIMATE FOR ALTERNATE A: ABOVE CAREFREE HIGHWAY

EARTHEN LINED CHANNELS

		CORRIDOR WIDTH (FT.)	CORRIDOR LENGTH (FT.)	AREA (AC)
II.	RIGHT-OF-WAY			
A.	TRIBUTARY A	236	24,600	133.3
A.1.	CAREFREE HWY. TO HEADWATERS			
B.	TRIBUTARY B			
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	188	3,400	14.7
C.	TRIBUTARY C			
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	106	2,000	4.9
D.	TRIBUTARY D			
D.1.	CAREFREE HWY. TO I-17	174	4,000	16.0
D.2.	I-17 TO HEADWATERS	166	2,200	8.4
			TOTAL	177.3

TABLE 19 COST ESTIMATE FOR ALTERNATE B: ABOVE CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		LENGTH (FT.)	BOTTOM WIDTH(FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	TRIBUTARY A	24,600	80	4.50	98
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	3,400	0	10.00	40
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	2,000	30	11.50	76
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	4,000	10	8.00	42
D.2.	I-17 TO HEADWATERS	2,200	50	4.50	68

NOTE: DEPTH INCLUDES FREEBOARD

TABLE 19 COST ESTIMATE FOR ALTERNATE B: ABOVE CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	TRIBUTARY A	400.50	364,900	3.00	1,094,700
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	200.00	25,185	3.00	75,555
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	609.50	45,148	3.00	135,444
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	208.00	30,815	3.00	92,445
D.2.	I-17 TO HEADWATERS	265.50	21,633	3.00	64,899
				TOTAL	1,463,093

TABLE 19 COST ESTIMATE FOR ALTERNATE B: ABOVE CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		CORRIDOR WIDTH (FT.)	CORRIDOR LENGTH (FT.)	AREA (AC)
II.	RIGHT-OF-WAY			
A.	TRIBUTARY A	128	24,600	72.3
A.1.	CAREFREE HWY. TO HEADWATERS			
B.	TRIBUTARY B			
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	70	3,400	5.5
C.	TRIBUTARY C			
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	106	2,000	4.9
D.	TRIBUTARY D			
D.1.	CAREFREE HWY. TO I-17	72	4,000	6.6
D.2.	I-17 TO HEADWATERS	98	2,200	4.9
			TOTAL	94.2

TABLE 19 COST ESTIMATE FOR ALTERNATE B: ABOVE CAREFREE HIGHWAY

CONCRETE LINED CHANNELS

		LINING (S.Y.)	UNIT COST ($/S.Y.)	TOTAL COST ($)
I.	CHANNELS			
A.	TRIBUTARY A	328,681	30	9,860,430
A.1.	CAREFREE HWY. TO HEADWATERS			
B.	TRIBUTARY B			
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	33,789	30	1,013,670
C.	TRIBUTARY C			
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	29,524	30	885,720
D.	TRIBUTARY D			
D.1.	CAREFREE HWY. TO I-17	36,246	30	1,087,380
D.2.	I-17 TO HEADWATERS	22,061	30	661,830
			TOTAL	13,509,030

TABLE 20 COST ESTIMATE FOR ALTERNATE C: ABOVE CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		LENGTH (FT.)	BOTTOM WIDTH (FT.)	DEPTH (FT.)	TOP WIDTH (FT.)
I.	CHANNELS				
A.	TRIBUTARY A	24,600	180	3.25	206
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	3,400	130	3.50	158
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE*	2,000	30	11.50	76
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	4,000	110	4.25	144
D.2.	I-17 TO HEADWATERS	2,200	110	3.25	136

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT

NOTE: DEPTH INCLUDES FREEBOARD

TABLE 20 COST ESTIMATE FOR ALTERNATE C: ABOVE CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		AREA (S.F.)	VOLUME (C.Y.)	UNIT COST ($/C.Y.)	TOTAL COST ($)
I.	CHANNELS				
A.	TRIBUTARY A	627.25	571,494	3.00	1,714,482
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	504.00	63,467	3.00	190,401
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE*	1219.00	90,296	3.00	270,888
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	539.75	79,963	3.00	239,889
D.2.	I-17 TO HEADWATERS	399.75	32,572	3.00	97,716
					$ 2,513,376

* FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT: CHANNEL C.1. CONCRETE LINING = 29,524 S.Y., UNIT COST = $30/S.Y. - TOTAL COST = $ 885,720

TABLE 20 COST ESTIMATE FOR ALTERNATE C: ABOVE CAREFREE HIGHWAY

LANDSCAPED RECREATION CORRIDORS

		CORRIDOR WIDTH(FT.)	CORRIDOR LENGTH(FT.)	AREA (AC.)	* TOTAL COST($)
II.	RIGHT-OF-WAY LANDSCAPING				
A.	TRIBUTARY A	236	24,600	133.3	999,750
A.1.	CAREFREE HWY. TO HEADWATERS				
B.	TRIBUTARY B				
B.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE	200	3,400	15.6	117,000
C.	TRIBUTARY C				
C.1.	CAREFREE HWY. TO BLACK CANYON SHOOTING RANGE**	200 <106>	2,000	9.2 <4.8>	33,000
D.	TRIBUTARY D				
D.1.	CAREFREE HWY. TO I-17	200	4,000	18.4	138,000
D.2.	I-17 TO HEADWATERS	200	2,200	10.1	75,750

* BASED ON A UNIT COST OF $7500/ACRE FOR LANDSCAPING

** FLOW QUANTITY REQUIRES CONCRETE LINED CHANNEL PER MARICOPA COUNTY FLOOD CONTROL DISTRICT. TOP WIDTH OF CONCRETE CHANNEL, 106', SUBTRACTED FROM CORRIDOR WIDTH FOR CALCULATION OF LANDSCAPE COSTS.

TABLE 21 SUMMARY OF COST ESTIMATES
COUNTY PORTION (ABOVE CAREFREE HIGHWAY)
CONCEPTUAL DRAINAGE PLAN

		ESTIMATE
ALTERNATE A: EARTHEN CHANNELS		
1.	CHANNEL EXCAVATION	$ 2,513,376
2.	CONCRETE LINING FOR CHANNEL C.1.	885,770
3.	RIGHT-OF-WAY. . . . . 177.3 ACRES	
	SUBTOTAL	$ 3,399,146
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT	509,872
	10% CONTINGENCY: CONSTRUCTION	339,915
	TOTAL	$ 4,248,933 PLUS 177.3 AC.
ALTERNATE B: CONCRETE CHANNELS		
1.	CHANNEL EXCAVATION	$ 1,463,093
2.	CONCRETE LINING	13,509,030
3.	RIGHT-OF-WAY. . . . . 94.2 ACRES	
	SUBTOTAL	$ 14,972,123
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT	2,245,818
	10% CONTINGENCY: CONSTRUCTION	1,497,212
	TOTAL	$ 18,715,153 PLUS 94.2 AC.
ALTERNATE C: EARTHEN CHANNELS WITH LANDSCAPING		
1.	CHANNEL EXCAVATION	$ 2,513,376
2.	CONCRETE LINING FOR CHANNEL C.1.	885,770
3.	LANDSCAPING	1,363,500
4.	RIGHT-OF-WAY. . . . . 186.6 ACRES	
	SUB-TOTAL	$ 4,762,646
	15% CONTINGENCY: DESIGN, SURVEY AND CONSTRUCTION MANAGEMENT	714,397
	10% CONTINGENCY: CONSTRUCTION	476,265
	TOTAL	$ 5,953,308 PLUS 186.6 AC.

FIGURES

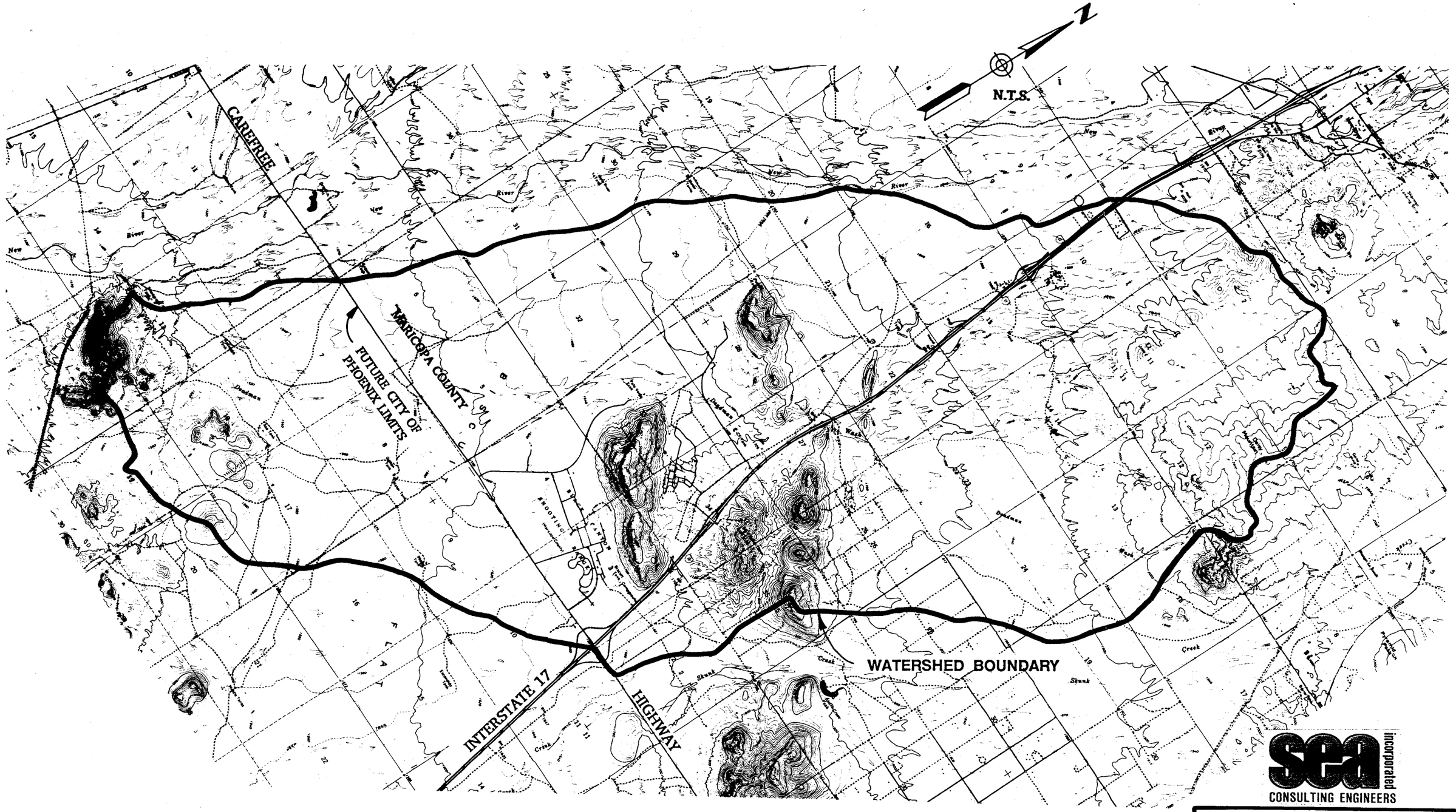


FIGURE: 1
DEADMAN'S WASH
WATERSHED BOUNDARY

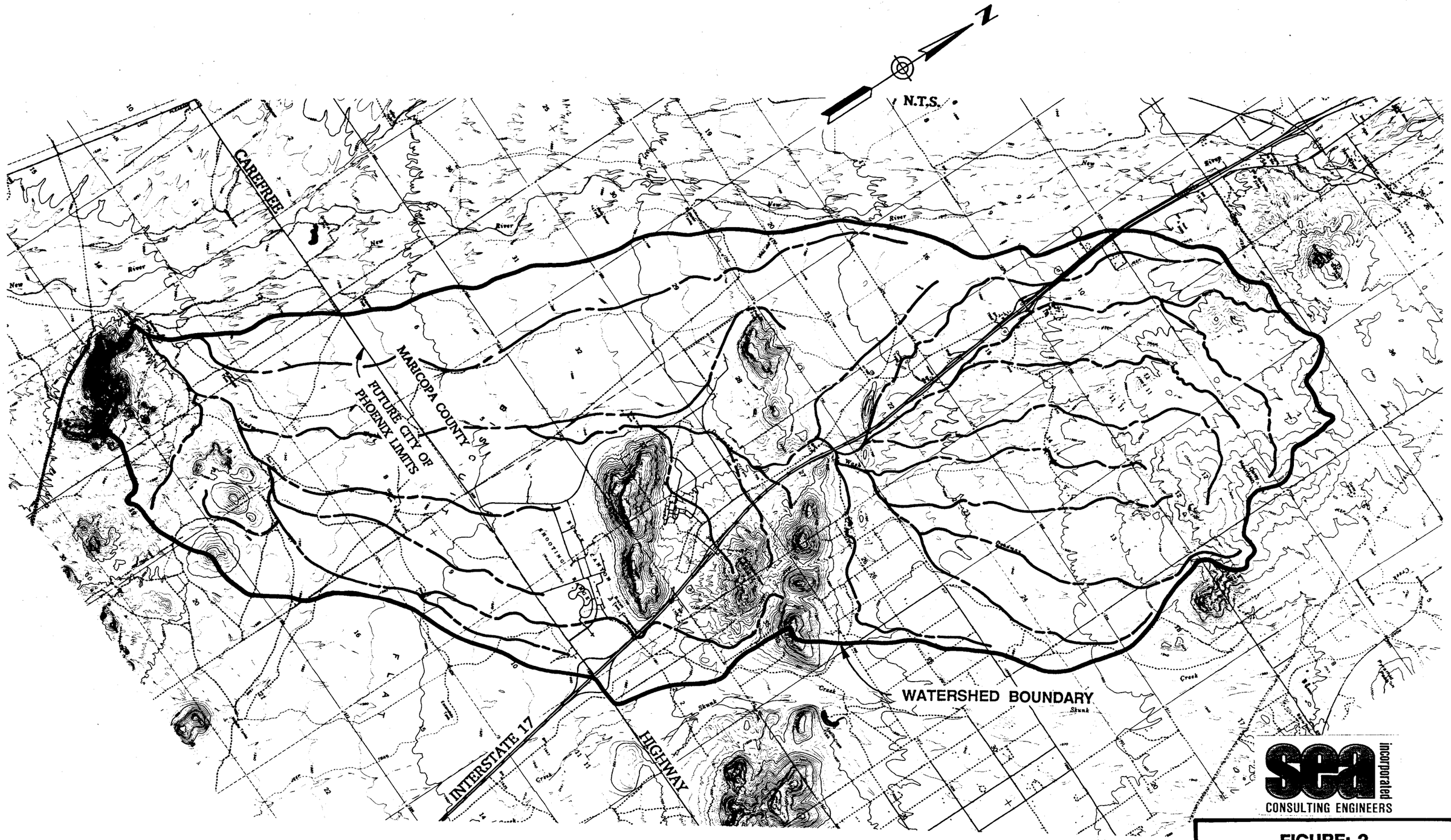


FIGURE: 2
DEADMAN'S WASH
EXISTING MAJOR WASHES

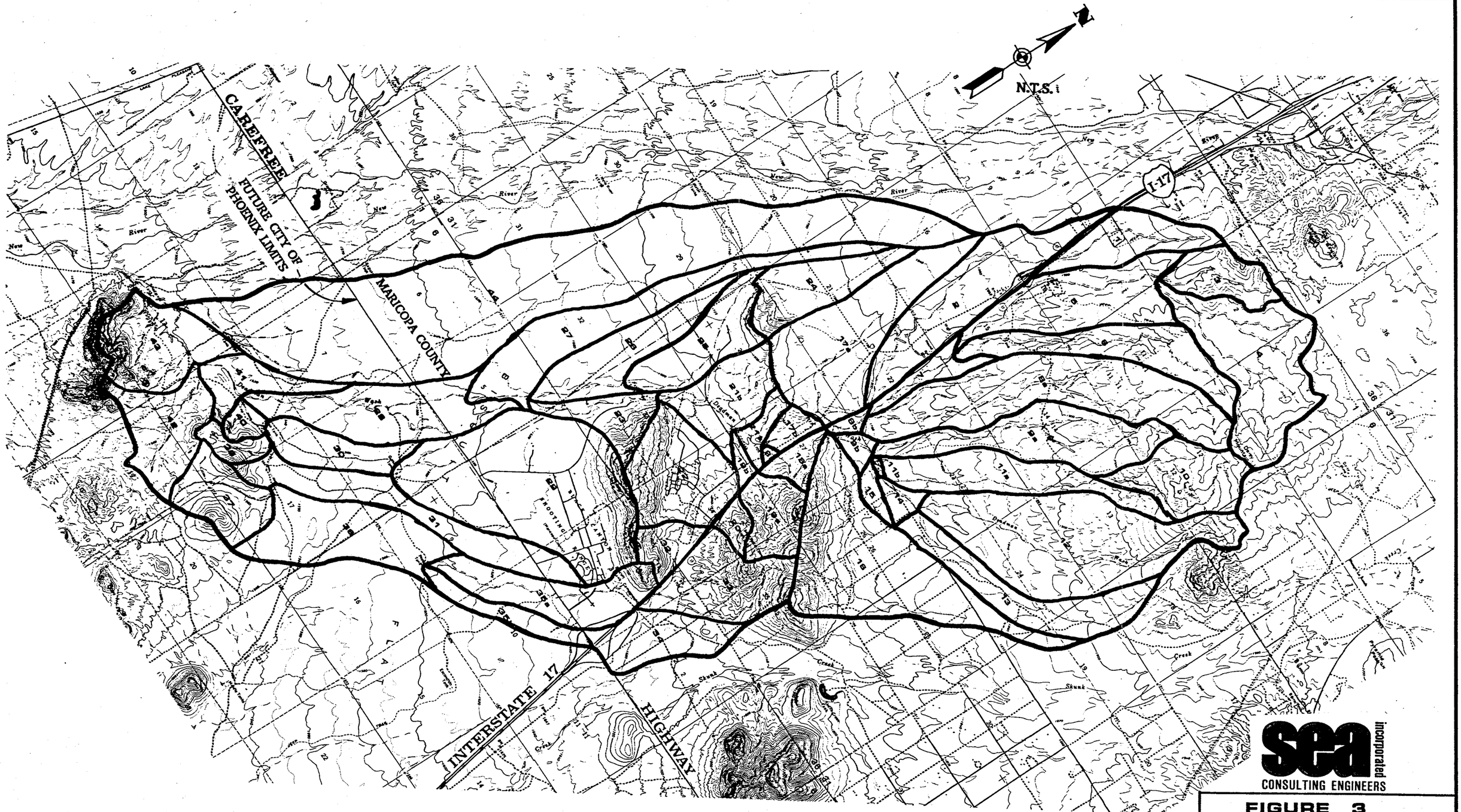
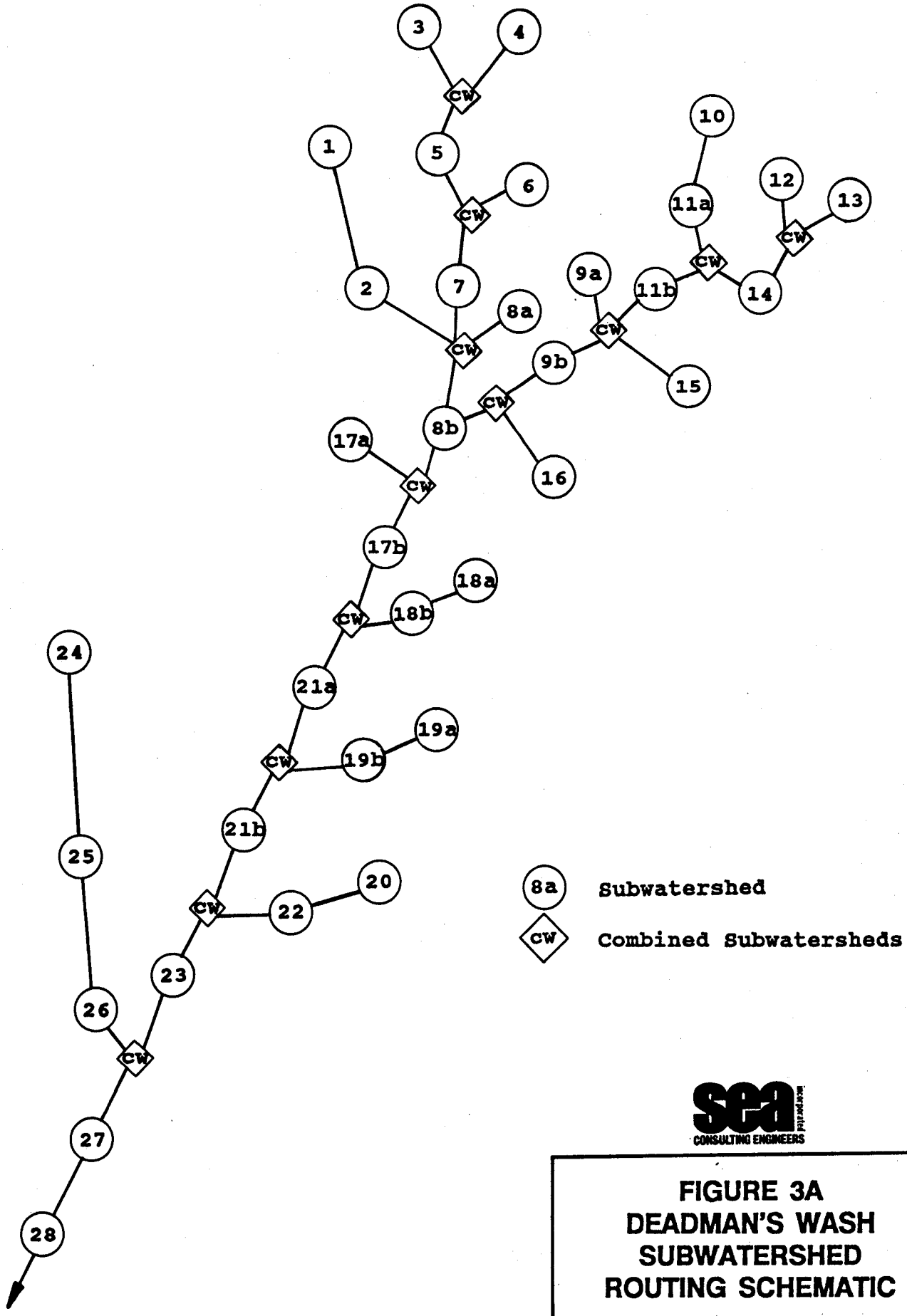
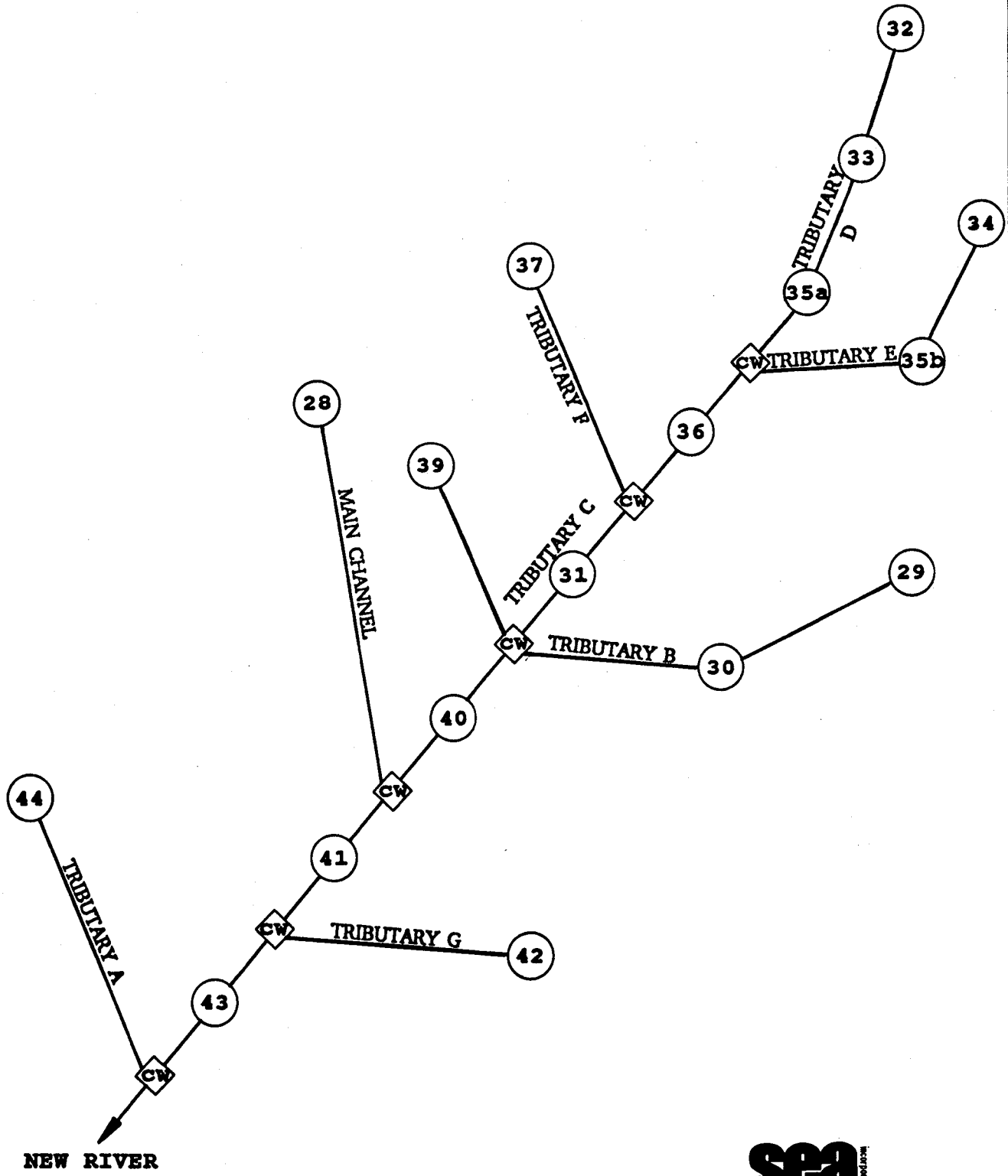


FIGURE 3
DEADMAN WASH
SUBWATERSHED
BOUNDARIES



sea incorporated
CONSULTING ENGINEERS

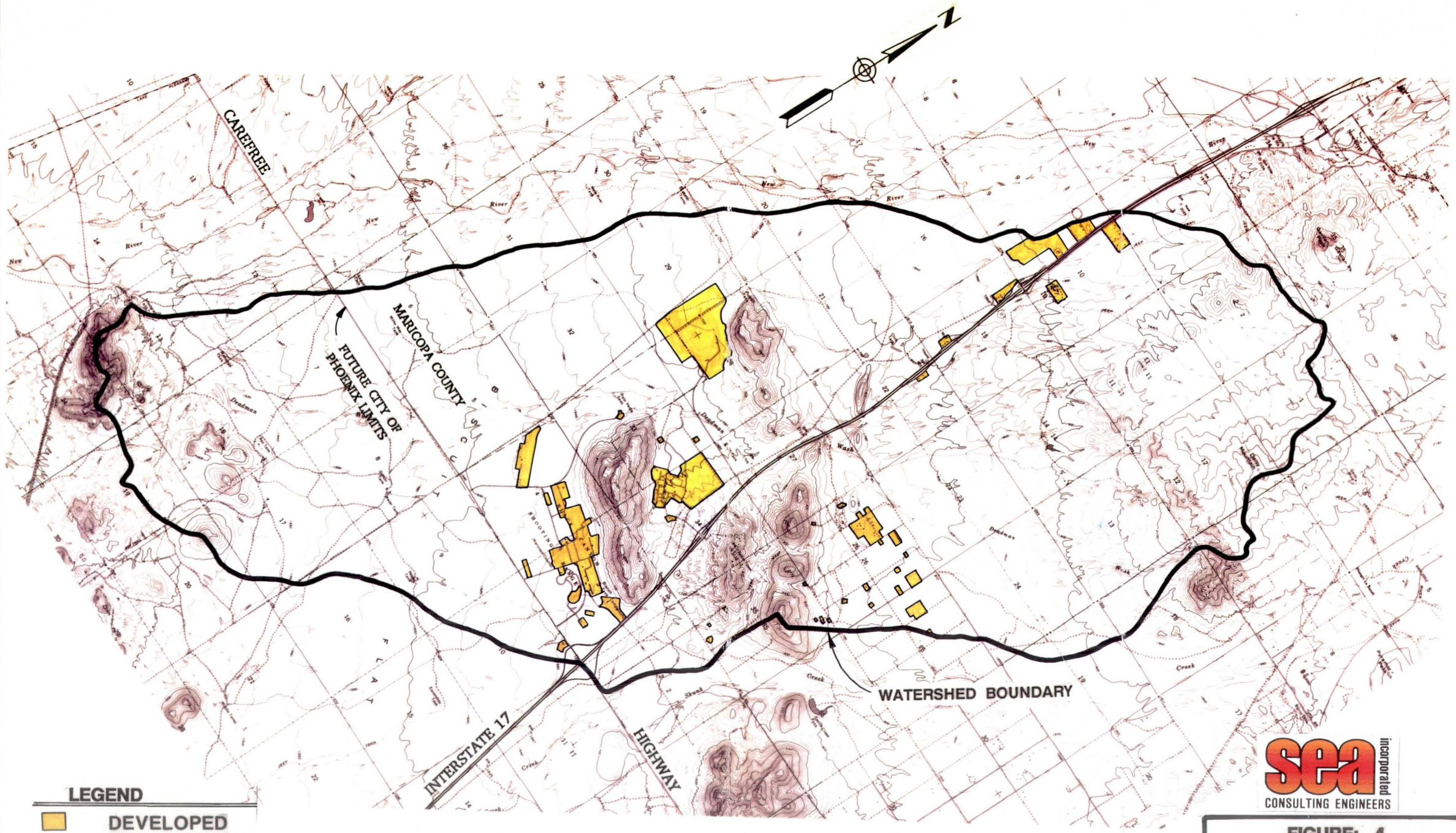
FIGURE 3A
DEADMAN'S WASH
SUBWATERSHED
ROUTING SCHEMATIC



31 Subwatershed

CW Combined Subwatersheds

FIGURE 3B
DEADMAN'S WASH
SUBWATERSHED
ROUTING SCHEMATIC



sea incorporated
CONSULTING ENGINEERS

FIGURE: 4
DEADMAN'S WASH
CURRENT LAND USE

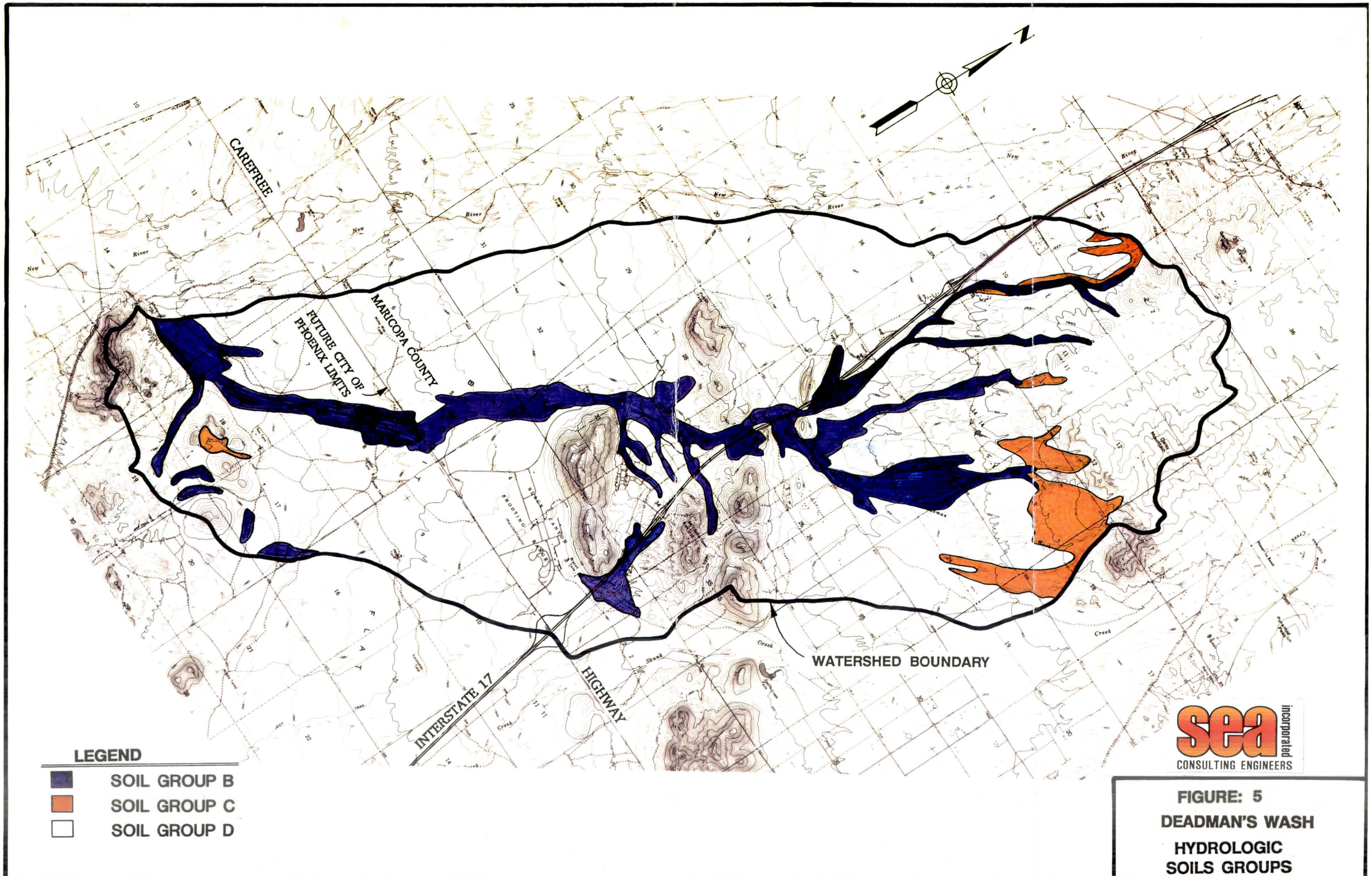


FIGURE: 5
DEADMAN'S WASH
HYDROLOGIC SOILS GROUPS

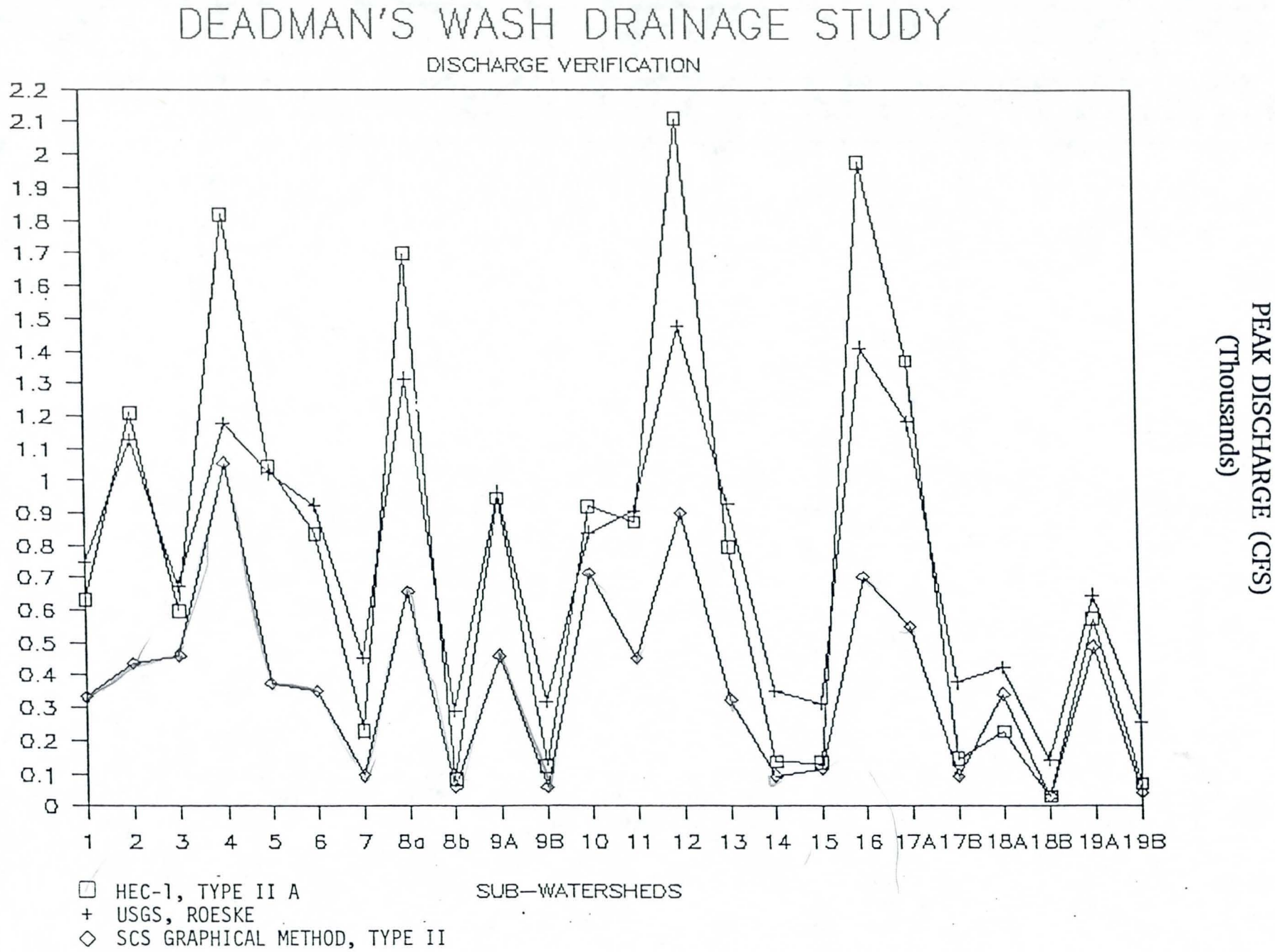

DEADMAN'S WASH DRAINAGE STUDY
DISCHARGE VERIFICATION
PEAK DISCHARGE (CFS)
(Thousands)
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8a 8b 9A 9B 10 11 12 13 14 15 16 17A 17B 18A 18B 19A 19B
SUB—WATERSHEDS
HEC-1, TYPE II A
USGS, ROESKE
SCS GRAPHICAL METHOD, TYPE II

FIGURE 6A

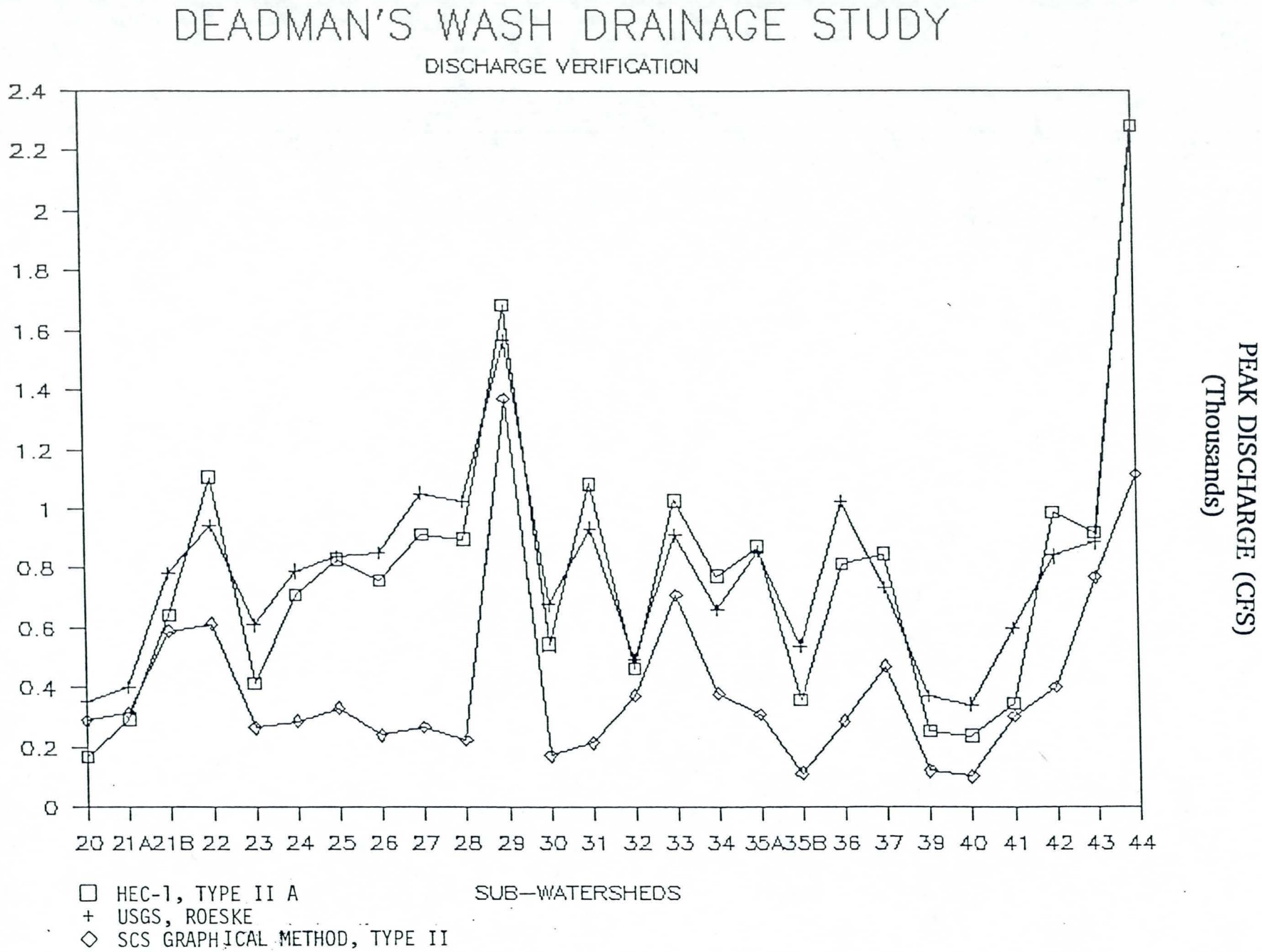

DEADMAN'S WASH DRAINAGE STUDY
DISCHARGE VERIFICATION
PEAK DISCHARGE (CFS)
(Thousands)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
20 21A21B 22 23 24 25 26 27 28 29 30 31 32 33 34 35A35B 36 37 39 40 41 42 43 44
SUB—WATERSHEDS
HEC-1, TYPE II A
USGS, ROESKE
SCS GRAPHICAL METHOD, TYPE II

FIGURE 6B

NOTE: SEE TABLE 5 FOR STRUCTURE LIST

sea incorporated
CONSULTING ENGINEERS

FIGURE 7
DEADMAN'S WASH
INTERSTATE 17
CULVERT SYSTEM

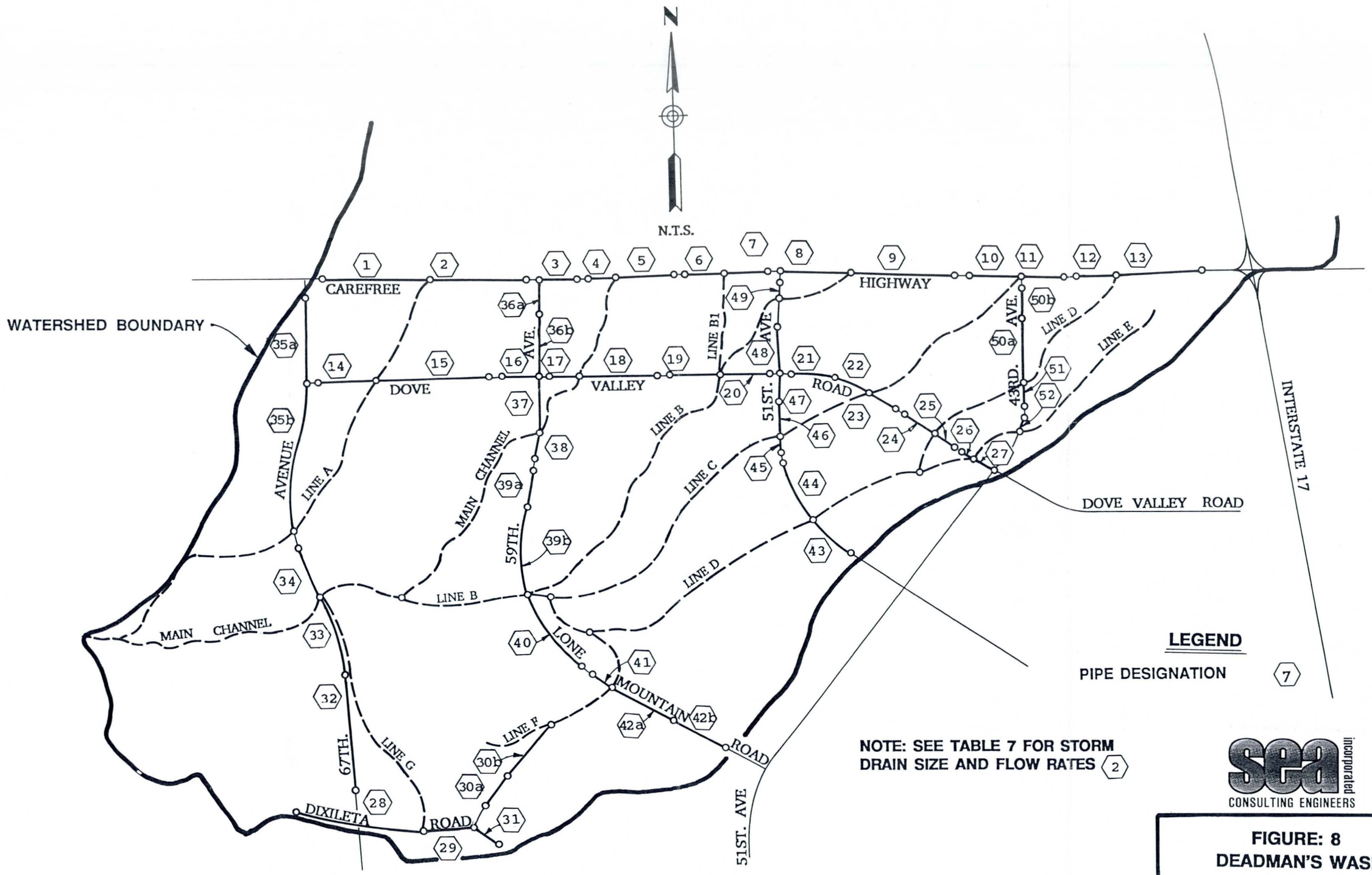


FIGURE: 8
DEADMAN'S WASH
CONCEPTUAL STORM DRAIN PLAN

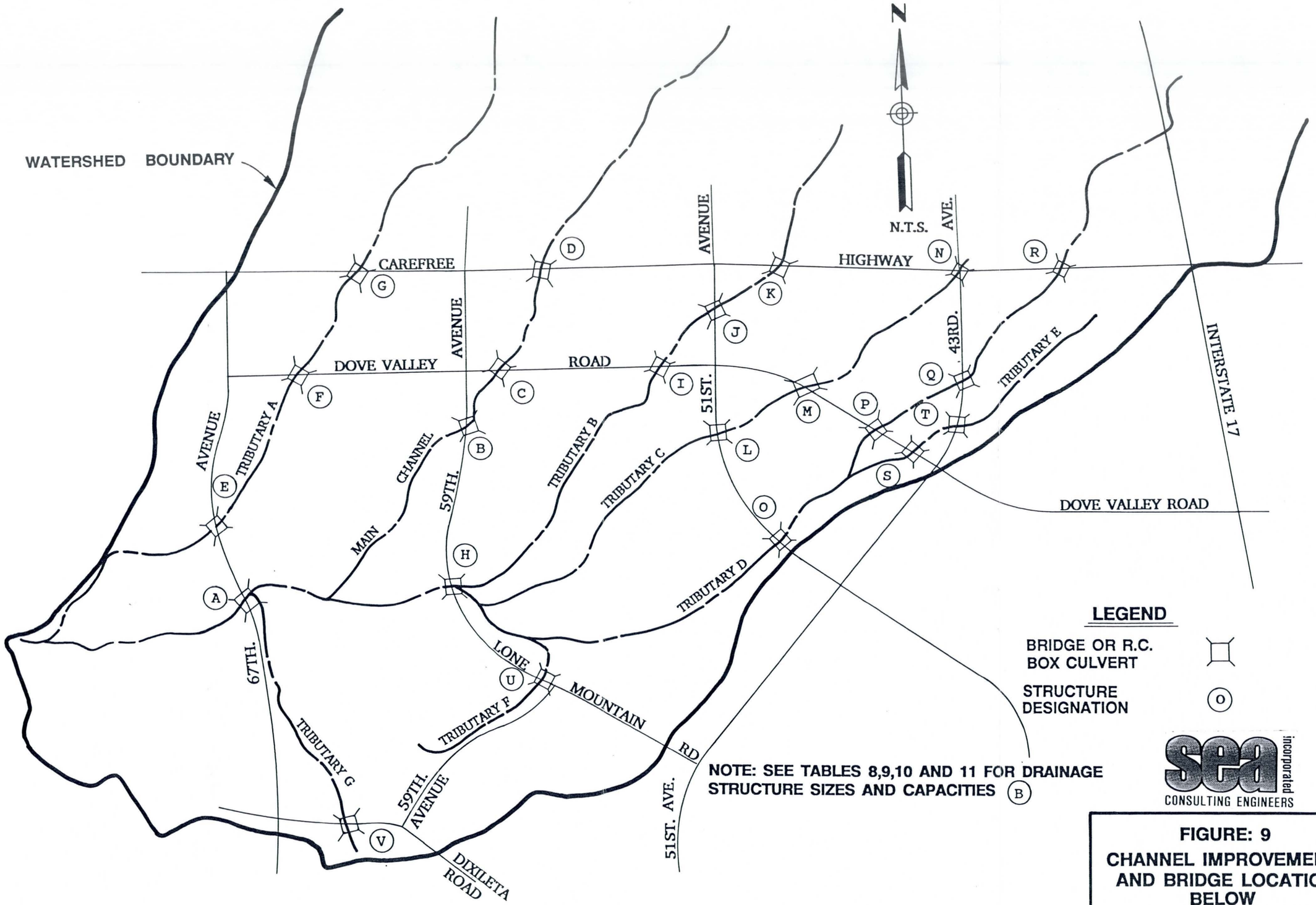


FIGURE: 9
CHANNEL IMPROVEMENTS AND BRIDGE LOCATIONS BELOW CAREFREE HIGHWAY

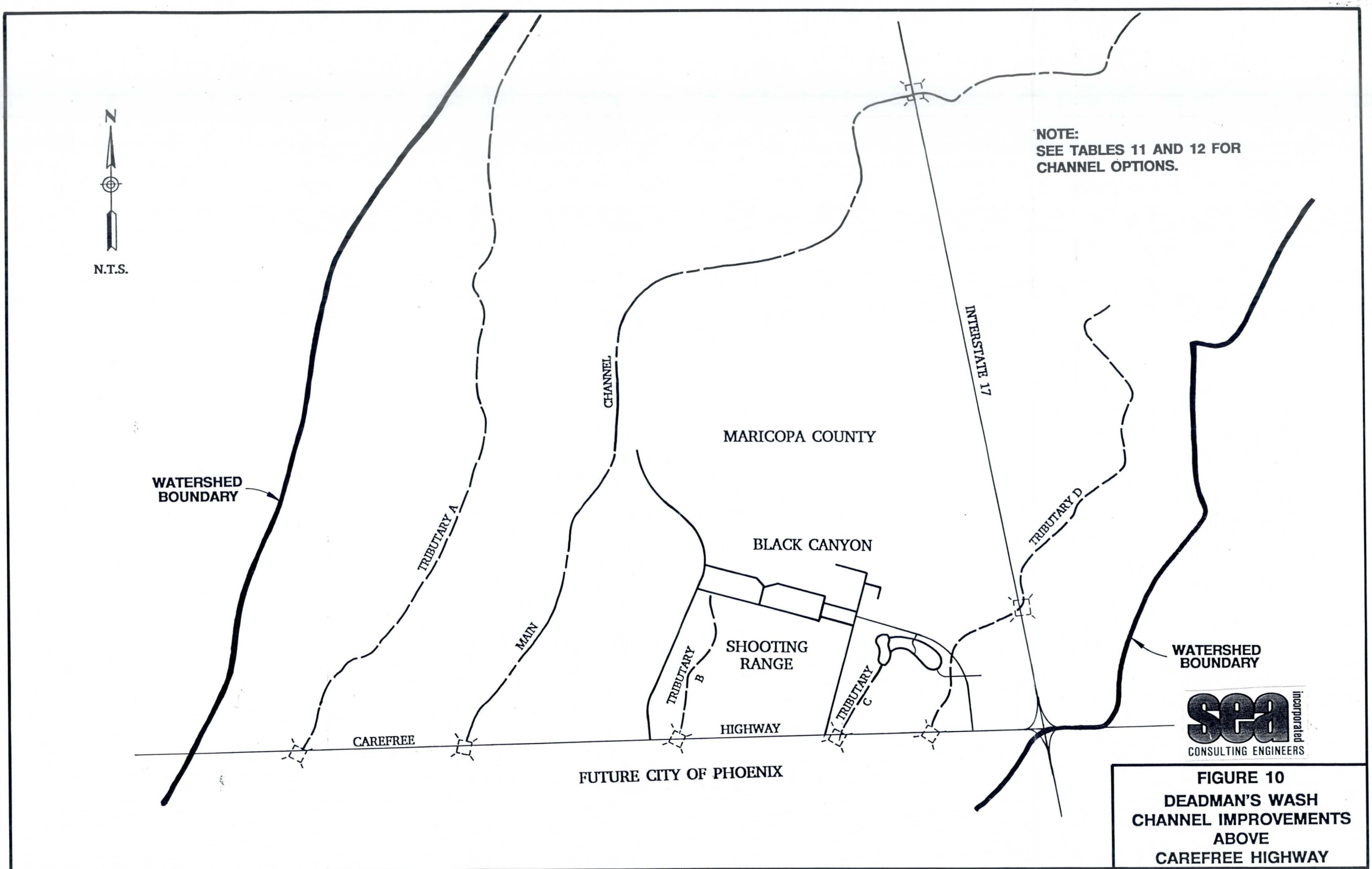


FIGURE 10
DEADMAN'S WASH
CHANNEL IMPROVEMENTS
ABOVE
CAREFREE HIGHWAY

ATTACHMENT "A"

PUBLIC HEARING - DEADMAN'S WASH

On Thursday, April 5, 1990 a public meeting was held at the Deer Valley Multigeneration Center, 2001 W. Wahalla Drv., Phoenix, Arizona. The public was invited to hear the presentations of basic concepts, methods, findings and recommendations of three Drainage Master Plans, including Deadman's Wash. Mr. Paul Kienow of the City of Phoenix opened the meeting with a discussion on the purpose and scope of the Drainage Master Plans. At the conclusion of the discussion Mr. Kienow introduced the consultants responsible for each Master Plan and presentations were then made by the Consultants.

The Deadman's Wash Area Drainage Master Plan was presented to the public by Craig L. Smith of SEA, Incorporated. He described the physical features of the watershed and discussed methods used to produce the results of the study. A brief description of the various options studied and the estimated costs were also presented.

Questions from the audience were entertained and seemed to be of a general nature, such as the effects of the master plans on plant life erosion, and future development. The major focus of the public seemed to be how to maintain the desert environment and rural atmosphere. There were no property owners or residents of the Deadman's Wash area present.

A list of attendees follows:

NAME	ADDRESS
Ken & Paula Doer	P. O. Box 1499 E. Res II, Phoenix, Arizona
Jeffrey Knoll	3547 W. Aire Libre Lane, Phoenix, Arizona
Steve & Rosalyn Heir	36015 N. 7th Ave., Phoenix, Arizona
Jack Moody	814 W. Pinte Ave., Phoenix, Arizona
Michael Pavlina	1013 W. Dansbury Rd., Phoenix, Arizona
Deloris Walker	P. O. Box 1340, Sun City, Arizona
Paul Kienow	City of Phoenix
Bob Cafarella	City of Phoenix
Donna Weiss	City of Phoenix
Dennis Knudsen	Higginson, Knudsen, Bell, Walker, Inc.
Tom Lenczycki	SEA, Inc.
Bob Darr	SEA, Inc.
Craig Smith	SEA, Inc.
Peter Miller	Jerry Jones Associates
Roger Baele	Jerry Jones Associates