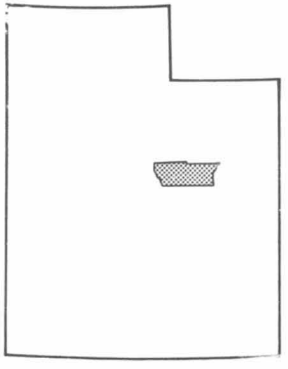
1993

Flood Insurance Study, Carbon County, Utah, Unincorporated Areas

Federal Emergency Management Agency

FLOOD INSURANCE STUDY

CARBON COUNTY, UTAH
UNINCORPORATED AREAS



REVISED: DECEMBER 3, 1993

Federal Emergency Management Agency

COMMUNITY NUMBER - 490032

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the unincorporated areas of Carbon County, Utah, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Carbon County to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Community base map selection and the identification of streams requiring detailed study were done in a meeting held on August 3, 1976, and attended by personnel of Nielsen, Maxwell & Wangsgard/Montgomery (the study contractor) and the Federal Insurance Administration and an official of Carbon County. Hydrologic analyses were coordinated by the study contractor with the U.S. Army Corps of Engineers; the U.S. Geological Survey; and, the Utah State Department of Transportation, District No. 4. Regional drainage area-frequency discharge relationships used in Carbon County were coordinated by the study contractor with those developed for similar hydrologic areas in Utah by the U.S. Army Corps of Engineers and the U.S. Geological Survey.

During the course of the study, flood elevations, flood boundaries, and floodway delineations were reviewed with community officials and with the State Coordinating Agent. The results of the work done by the study contractor were reviewed at a final coordination meeting held on April 10 and 11, 1978. This meeting was attended by personnel of the study contractor and the Federal Insurance Administration and community officials of Carbon County. No problems were encountered at the meeting.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Nielsen, Maxwell & Wangsgard/Montgomery, for the Federal Insurance Administration, under Contract No. H-4030. This work, which was completed in December 1977, covered all significant flooding sources affecting the unincorporated areas of Carbon County, Utah.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Carbon County, Utah. The area of study is shown on the Vicinity Map (Figure 1). The Cities of Helper, Price, Wellington, Sunnyside, East Carbon, Hiawatha, and Scofield were not included in this study.

Floods caused by overflow of the Price River and Cardinal, Meads, Spring Glen, and Spring Canyon Washes were studied by detailed methods. Flooding on several washes and creeks tributary to the Price River was studied by approximate methods.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1982.

2.2 Community Description

Carbon County lies in east-central Utah. The county was named Carbon because of the extensive coal deposits which occur in the mountains along the west, north, and east sides of the county. The northwest corner of the county is approximately 100 miles southeast of Salt Lake City, Utah.

The economy of Carbon County is based on coal mining, manufacturing, industry, agriculture, cattle raising, and tourism. A main line of the Denver and Rio Grande Western Railroad and several State and U.S. Highways traverse the county.

The U.S. Census population of the county in 1970 was 15,647, a decrease of 5,488 from the 1960 population. The U.S. Bureau of Economic and Business Research estimated that the 1975 population of the county was 18,900, while the Utah Population Work Committee estimated the 1976 population at 19,300 (Reference 1).

Price River, which heads in the high, mountainous Wasatch Plateau, is the main drainage in Carbon County. This river flows southeastward from the northwest to the south-central part of the county. Price River has numerous tributaries, including Soldier Creek, Coal Creek, Hayes Wash, Deadman Creek, Cardinal Wash, Meads Wash, Drunkards Wash, Pinnacle Canyon Wash, Gordon Creek, Garley Canyon Wash, Consumers Wash, Spring Glen Wash, Spring Canyon Wash, and Willow Creek.

The flood plain area with the highest degree of development occurs along the Price River from the City of Helper down to the City of Price.

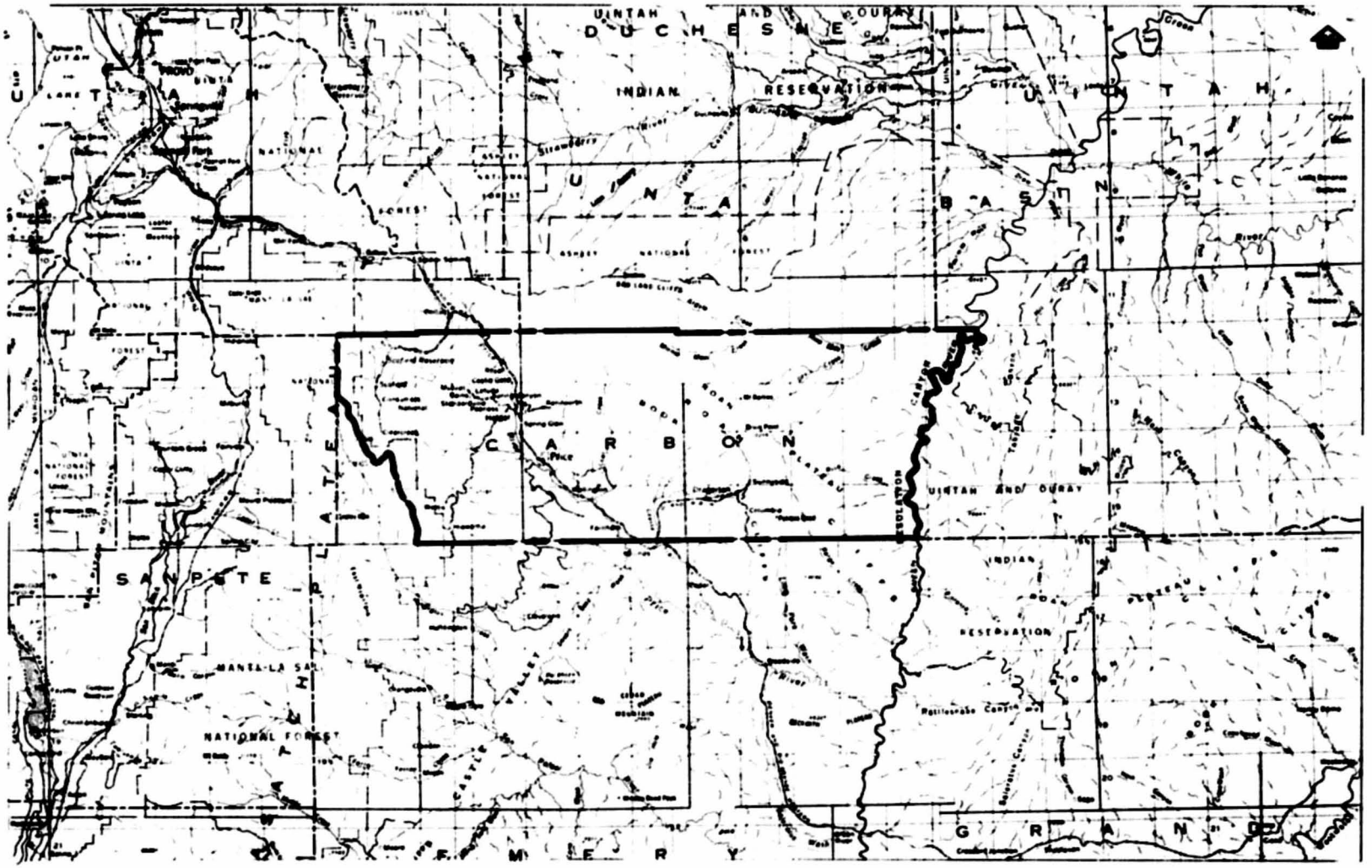

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

2.3 Principal Flood Problems

Low-lying areas of Carbon County are subject to periodic flooding caused by overflow of the Price River; Cardinal, Meads, Spring Glen, and Spring Canyon Washes; and, several other washes and creeks tributary to the Price River.

The flooding season is in the summer and fall, when cloudburst storms commonly occur. These storms are generally short in duration but may produce very intense rainfall and flash flooding. The July 4, 1977, flood on the Price River and Spring Canyon Wash was an example of the flash flooding that can result from intense summer thunderstorms (Figure 2).

The greatest historical flood on the Price River in the area from the City of Price to the canyon mouth above the City of Helper occurred on September 8, 1919. This flood was caused by a cloudburst above the City of Helper. The discharge was 12,000 cubic feet per second, as recorded at the Helper Gage located approximately 1.5 miles downstream of the city. Based on the hydrologic analysis performed as part of this study, this flood corresponds to the 200-year event at that point on the river.

2.4 Flood Protection Measures

As part of an ongoing State highway construction project, the Price River is being improved for a 2000-foot reach at the mouth of the Garley Canyon. Completion of the highway project is expected by July 1978. Scofield Dam, located on the Price River approximately 23 miles upstream from the City of Helper, is an existing structure that provides some flood protection for the Carbon County area. The dam became operational in 1926 but was rebuilt in 1945 after several partial failures of the original dam. Because of its location in the upper watershed of the Price River, the dam helps control snow-melt floods in Carbon County but does not provide flood protection for the cloudburst floods which commonly occur in the lower watershed.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year.

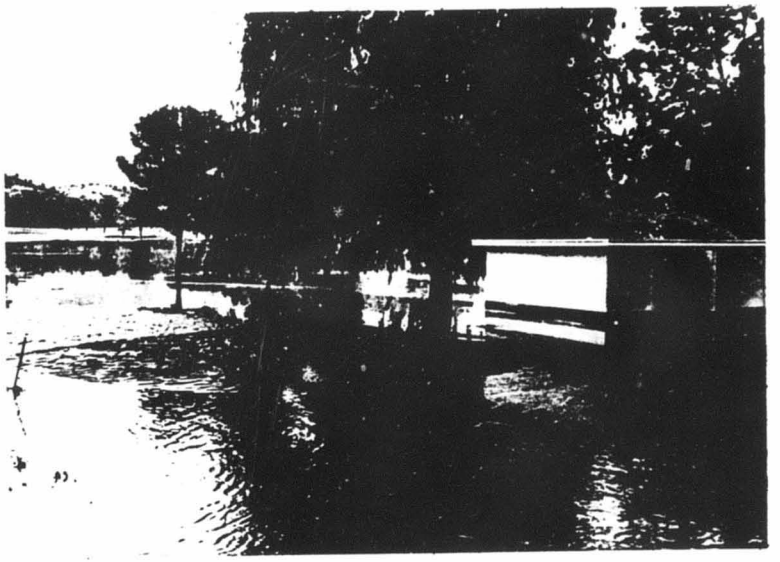

Figure 2. Looking North Toward No. 5 Tee, Carbon Country Club Golf Course, July 4, 1977 (Horizontal Lines on Bath House Show High-Water Mark.)

Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

Two gaging stations on Price River, one located approximately 1.5 miles downstream from the City of Helper and one approximately 1.7 miles upstream from the City of Helper, near Heiner, were the principal sources of data for defining discharge-frequency relationships for the Price River. The Helper gage was established in 1904 and discontinued in 1934. The Heiner gage was established in 1934 and discontinued in 1969. Values of the 10-, 50-, 100-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data (Reference 2), using flow data information from both of the gages.

To define discharge-frequency data for Cardinal, Meads, Spring Glen, and Spring Canyon Washes, a regional relationship of basin characteristics to streamflow characteristics was used.

Peak discharge-drainage area relationships for Price River and Cardinal, Meads, Spring Glen, and Spring Canyon Washes are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community. This analysis included the 2000-foot channel improvement that is being constructed as part of the State highway project.

Cross section data for streams in the area were obtained by photogrammetry (Reference 3). All bridges and culverts were surveyed and design drawings collected to obtain elevation data and structural geometry.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Price River					
Above Confluence With Cardinal Wash	655.0	4,315	9,013	11,791	20,590
Above Confluence With Meads Wash	649.3	4,295	8,972	11,736	20,496
At Main Street (Price, Utah)	646.0	4,285	8,951	11,709	20,448
Above Confluence With Gordon Creek	530.0	3,881	8,108	10,606	18,522
Above Confluence With Spring Glen Wash	491.0	3,736	7,804	10,208	17,827
Above Confluence with Spring Canyon Wash	465.0	3,635	7,594	9,934	17,349
Cardinal Wash					
At Mouth (At Price River)	15.0	592	2,055	3,195	7,365
Meads Wash					
At Mouth (At Price River)	6.1	287	1,147	1,848	4,520
Spring Glen Wash					
At Mouth (At Price River)	5.2	244	978	1,576	3,853
Spring Canyon Wash					
At Mouth (At Price River)	24.0	887	2,879	4,378	9,744

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficents (Manning's "n") for each stream were estimated by field inspection at each cross section and values obtained are presented in Table 2.

Table 2. Summary of Roughness Coefficients (Manning's "n")

Flooding Source	Channel	Overbank
Price River	0.022 - 0.035	0.032 - 0.120
Cardinal Wash	0.030 - 0.035	0.035 - 0.050
Meads Wash	0.028 - 0.040	0.035 - 0.060
Spring Glen Wash	0.050 - 0.070	0.030 - 0.090
Spring Canyon Wash	0.033 - 0.035	0.045 - 0.070

Water-surface profiles were developed using a HEC-2 step-backwater computer model (Reference 4). Profiles were determined for the 10-, 50-, 100-, and 500-year floods. The computation of flow depths for Spring Glen Wash revealed that, at two places along the wash, the capacity of the channel and overbanks was not sufficient to convey the 500-year flood, and at one of these places, the capacity was also insufficient to convey the 50- and 100-year floods. At cross section EH, 952 cubic feet per second (cfs) of the 500-year flood will leave the left overbank and travel overland in a southeasterly direction, eventually discharging into the Price River approximately 500 feet upstream from cross section AM. At the Main Street bridge, 271 cfs of the 50-year flood, 450 cfs of the 100-year flood, and 874 cfs of the 500-year flood will leave the channel, flow overland in a southeasterly direction to the Denver and Rio Grande Western Railroad embankment, and then flow in an easterly direction, eventually discharging into the Price River approximately 500 feet upstream from cross section AM. Hydraulic computations of the 100-year flow that leaves the channel at the Main Street bridge indicate that the depth will be less than 1.0 foot.

For the stream reaches below cross section EH and above the Main Street bridge, the 500-year water-surface profile is based on a reduced value of 2901 cfs. Below the Main Street bridge, the 500-, 100-, and 50-year profiles are based on reduced flows of 2027 cfs, 1126 cfs, and 707 cfs, respectively.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Approximate flood elevations for the lower reaches of the Price River, Soldier Creek, Coal Creek, the western tributary to Coal Creek, the northern watershed above Wellington, Hayes Wash, Deadman Creek, the upper reaches of Cardinal Wash, the upper reaches of Meads Wash, the southern tributary to Drunkards Wash, Drunkards Wash, Pinnacle Canyon Wash, Gordon Creek, Garley Canyon Wash, Consumers Wash, the eastern watershed to southern Spring Glen Wash, the upper reaches of Spring Glen Wash, the upper reaches of Spring Canyon Wash, Willow Creek, and the upper reaches of Price River were estimated on the basis of flows determined in connection with the regional relationship developed for this study and normal depth calculations.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at scale of 1:4800, with a contour interval of 2 feet (Reference 3).

In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Approximate flood boundaries in some portions of the study area were taken from the Federal Insurance Administration's Flood Hazard Boundary Map (Reference 5). All other approximate flood boundaries were delineated using topographic maps at a scale of 1:4800, with contour intervals of 2 feet or 20 feet (References 3 and 6, respectively).

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

During the computation of the water-surface profile for the 100-year flood, it was noted that hazardous velocities occurred in the upper reaches of the Price River and Spring Canyon Wash. Consequently, floodway determinations were limited to stream reaches below the corporate limits of Helper for the Price River, and no floodway was determined for Spring Canyon Wash. Along the lower reaches of the Price River and the reaches of Cardinal, Meads, and Spring Glen Washes at sections where high-velocity, supercritical flow occurred, the limits of the floodway were set at the 100-year flood boundaries. Limiting the floodway was done to avoid encroachments in areas of high-velocity flow where hazards due to scouring would occur.

The floodway for this study was computed on the basis of equal conveyance reduction from each side of the flood plain. However, encroachments were limited by the available flow area in the overbanks. Because Federal Insurance Administration requirements do not allow encroachments in the channel, the water surface was not raised 1.0 foot at those sections having little overbank flow areas.

The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Price River								
A	0	392[2]	1,335	8.9	5,462.0	5,462.0	5,462.9	0.9
B	1,070	582[2]	2,203	5.4	5,467.5	5,467.5	5,468.5	1.0
C	2,070	207[2]	1,040	11.3	5,472.3	5,472.3	5,472.3	0.0
D	3,750	389[2]	1,817	6.5	5,480.1	5,480.1	5,481.1	1.0
E	5,600	107[2]	768	15.3	5,489.6	5,489.6	5,489.6	0.0
F	7,120	349[2]	2,490	4.7	5,495.7	5,495.7	5,496.6	0.9
G	8,220	85	712	16.5	5,497.8	5,497.8	5,497.8	0.0
H	8,880	104	1,126	10.4	5,504.6	5,504.6	5,504.6	0.0
I	10,400	320	3,223	3.6	5,506.5	5,506.5	5,507.0	0.5
J	11,700	288[2]	1,897	6.2	5,507.2	5,507.2	5,507.8	0.6
K	12,150	269[2]	1,289	9.1	5,508.1	5,508.1	5,508.6	0.5
L	13,100	414[2]	2,176	5.4	5,511.5	5,511.5	5,512.5	1.0
M	14,000	159[2]	939	12.5	5,513.7	5,513.7	5,513.9	0.2
N	14,650	146	963	12.2	5,518.1	5,518.1	5,518.3	0.2
O	15,470	210	1,292	9.1	5,523.6	5,523.6	5,523.6	0.0
P	17,040	267	1,603	7.3	5,529.0	5,529.0	5,529.0	0.0
Q	18,910	550[2]	1,716	6.8	5,535.1	5,535.1	5,536.1	1.0
R	20,100	412[2]	1,630	7.2	5,540.9	5,540.9	5,541.7	0.8
S	21,510	100[2]	751	15.6	5,549.5	5,549.5	5,550.5	1.0
T	23,000	377[2]	3,505	3.3	5,562.9	5,562.9	5,563.6	0.7
U	24,560	493[2]	3,498	3.3	5,563.6	5,563.6	5,564.4	0.8
V	28,060	727[2]	3,701	2.9	5,586.2	5,586.2	5,586.2	0.0
W	36,730	252	1,058	10.0	5,617.9	5,617.9	5,617.9	0.0
X	39,770	843	1,490	7.0	5,633.4	5,633.4	5,633.4	0.0
Y	40,320	261	1,088	9.8	5,637.5	5,637.5	5,637.5	0.0
Z	40,900	126	789	13.2	5,640.0	5,640.0	5,640.0	0.0

[1]Feet Above Confluence With Cardinal Wash
[2]Width Outside Study Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

FLOODWAY DATA

PRICE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Price River (cont'd)								
AA	41,130	107	713	14.6	5,640.1	5,640.1	5,640.2	0.1
AB	41,345	87	714	14.6	5,641.3	5,641.3	5,641.3	0.0
AC	42,575	84	654	15.9	5,649.4	5,649.4	5,649.4	0.0
AD	42,925	117	1,749	6.0	5,653.8	5,653.8	5,653.8	0.0
AE	43,025	133	398	26.2	5,662.9	5,662.9	5,662.9	0.0
AF	44,785	92	754	13.8	5,680.0	5,680.0	5,680.0	0.0
AG	44,955	116	1,563	6.7	5,684.3	5,684.3	5,684.4	0.1
AH	45,330	391	4,669	2.2	5,685.1	5,685.1	5,685.2	0.1
AI	46,730	403	3,557	2.9	5,686.2	5,686.2	5,686.3	0.1
AJ	48,230	95	722	14.5	5,693.0	5,693.0	5,693.0	0.0
AK	48,705	196	1,662	6.3	5,702.0	5,702.0	5,702.0	0.0
AL	48,755	228	1,992	5.2	5,702.3	5,702.3	5,702.4	0.1
AM	50,875	245	994	10.3	5,709.2	5,709.2	5,709.8	0.6
AN	54,955	240	1,009	10.2	5,737.8	5,737.8	5,738.7	0.9
AO	57,875	134	792	13.0	5,758.6	5,758.6	5,759.3	0.7
AP	60,045	156	675	15.1	5,776.6	5,776.6	5,777.0	0.4

[1]Feet Above Confluence With Cardinal Wash

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

FLOODWAY DATA

PRICE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cardinal Wash								
CA	1,200	33	99	32.4	5,466.8	5,466.8	5,466.8	0.0
CB	1,500	33	218	14.7	5,474.3	5,474.3	5,474.3	0.0
CC	2,060	593	2,026	1.6	5,484.7	5,484.7	5,485.3	0.6
CD	2,360	45	223	14.4	5,483.7	5,483.7	5,483.7	0.0
Meads Wash								
A	200	24[2]	137	13.5	5,476.6	5,476.6	5,476.6	0.0
B	760	27[2]	258	7.2	5,487.5	5,487.5	5,487.5	0.0
C	1,410	28[2]	145	12.8	5,488.4	5,488.4	5,489.3	0.9
D	2,160	40[2]	190	9.7	5,497.5	5,497.5	5,497.8	0.3
AA	12,840	36	167	11.1	5,658.8	5,658.8	5,659.3	0.5
AB	13,510	51[2]	194	9.5	5,666.2	5,666.2	5,666.4	0.2
AC	14,070	26[2]	149	12.4	5,671.5	5,671.5	5,671.7	0.2
Spring Glen Wash								
EA	720	138	201	5.6	5,736.4	5,736.4	5,737.4	1.0
EB	1,160	71	63	11.1	5,743.4	5,743.4	5,743.9	0.5
EC	1,520	11	93	12.1	5,749.3	5,749.3	5,749.3	0.0
ED	1,760	44	238	4.7	5,759.0	5,759.0	5,759.0	0.0
EE	2,450	41	117	9.6	5,763.8	5,763.8	5,763.8	0.0
EF	2,620	51	123	9.1	5,769.0	5,769.0	5,769.0	0.0
EG	2,910	52	432	3.6	5,780.0	5,780.0	5,780.9	0.9
EH	3,990	55	161	9.8	5,798.2	5,798.2	5,798.3	0.1
EI	5,590	76	237	6.7	5,833.8	5,833.8	5,833.8	0.0

[1]Feet Above Confluence With Price River
[2]Width Extends Beyond Study Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

FLOODWAY DATA

CARDINAL WASH-MEADS WASH-SPRING GLEN WASH

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 3.

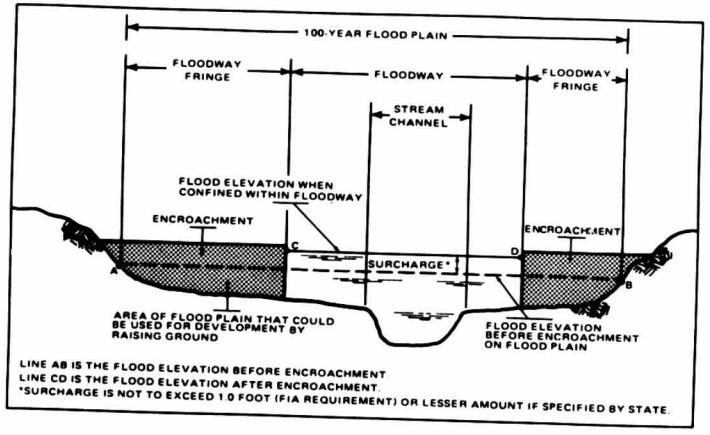

Figure 3. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the unincorporated areas of Carbon County.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet

Twenty-seven reaches meeting the above criteria were required for the flooding sources of the unincorporated areas of Carbon County. These included 15 reaches on the Price River, 5 reaches on Cardinal Wash, 3 reaches on Meads Wash, 3 reaches on Spring Glen Wash, and 1 reach on Spring Canyon Wash. The locations of the reaches are shown on the Flood Profiles (Exhibit 1).

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire unincorporated areas of Carbon County was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or Flood Hazard Factors determined.
Zones A2, A4-A11, A13, A15, and A21:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.
Zone D:	Areas of undetermined, but possible flood hazard.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Carbon County is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

In 1976, the U.S. Army Corps of Engineers, Sacramento District, performed a brief flood plain study on the Price River near the City of Price. The U.S. Geological Survey also performed a hydrologic analysis for the same

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Price River							
Reach 1	0435	-2.2	-0.7	1.8	020	A4	Varies - See Map
Reach 2	0435	-7.5	-2.5	5.4	075	A15	Varies - See Map
Reach 3	0435	-3.0	-0.8	2.5	030	A6	Varies - See Map
Reach 4	0435	-7.5	-3.1	1.1	075	A15	Varies - See Map
Reach 5	0270,0435	-4.4	-1.6	0.8	045	A9	Varies - See Map
Reach 6	0265,0270	-2.3	-0.8	0.3	025	A5	Varies - See Map
Reach 7	0265,0270	-4.1	-0.6	0.8	040	A8	Varies - See Map
Reach 8	0265,0270	-2.3	-0.2	0.8	025	A5	Varies - See Map
Reach 9	0265	-3.9	-1.0	3.3	040	A8	Varies - See Map
Reach 10	0265	-5.7	-1.5	3.9	055	A11	Varies - See Map
Reach 11	0265	-2.4	-0.6	2.6	025	A5	Varies - See Map
Reach 12	0265	-6.4	-1.8	5.0	065	A13	Varies - See Map
Reach 13	0255,0260 0265,0270	-2.6	-0.6	2.8	025	A5	Varies - See Map
Reach 14	0255	-3.6	-1.0	3.0	035	A7	Varies - See Map
Reach 15	0255	-5.0	-1.5	4.2	050	A10	Varies - See Map
Cardinal Wash							
Reach 1	0435	-2.0	-1.0	3.0	020	A4	Varies - See Map
Reach 2	0435	-10.8	-3.2	1.5	110	A21	Varies - See Map
Reach 3	0435	-7.6	-4.0	1.8	075	A15	Varies - See Map
Reach 4	0435	-4.5	-1.7	3.2	045	A9	Varies - See Map
Reach 5	0435	-3.0	-0.9	2.3	030	A6	Varies - See Map
Meads Wash							
Reach 1	0435	-2.2	-0.7	1.8	020	A4	Varies - See Map
Reach 2	0435	-3.1	-0.5	2.8	030	A6	Varies - See Map
Reach 3	0435	-7.4	-3.2	5.4	075	A15	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

PRICE RIVER-CARDINAL WASH-MEADS WASH

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Spring Glen Wash							
Reach 1	0270	-0.8	-0.4	0.5	010	A2	Varies - See Map
Reach 2	0270	-2.0	-1.9	1.4	020	A4	Varies - See Map
Reach 3	0270	-4.1	-1.1	1.4	040	A8	Varies - See Map
Spring Canyon Wash							
Reach 1	0255	-3.3	-1.5	2.9	035	A7	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SPRING GLEN WASH-SPRING CANYON WASH

area at the request of the Utah Department of Transportation, District No. 4. Both the U.S. Army Corps of Engineers' and the U.S. Geological Survey's hydrologic analyses were performed using log-Pearson Type III procedures (Reference 2); however, due to differences in interpretation of the available data at the two stream gages (i.e., Heiner and Helper), a significant difference in computed flow frequency information resulted.

As part of the hydrologic analysis performed in this Flood Insurance Study, a thorough review was made of the U.S. Army Corps of Engineers' and U.S. Geological Survey's analyses. Discussions were held with engineering personnel of the U.S. Army Corps of Engineers, the U.S. Geological Survey, and the Utah Department of Transportation, District No. 4. As a result of these discussions, as well as those with engineering personnel of the Federal Insurance Administration, a revised discharge-frequency relationship was developed on the basis of realistic, current interpretations of the available data. This revised discharge-frequency relationship for the Price River was utilized in this Flood Insurance Study. No other published studies relative to hydrology or flood profiles for Price River or Cardinal, Meads, Spring Glen, and Spring Canyon Washes in Carbon County are available.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Surveys, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, Room 311, 909 17th Street, Denver, Colorado 80202.

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9.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data.

9.1 First Revision

This study was revised on December 3, 1993, to modify the floodways, base flood elevations, and floodplain delineations of the Price River from approximately 3,500 feet downstream of the confluence with Meads Wash to approximately 6,360 feet upstream of 100 North Street; and of Meads Wash from the confluence with the Price River to approximately 2,000 feet upstream of 800 North Street. The information for this revision was obtained from a reanalysis of the Price River and Meads Wash, prepared by Love and Associates, Inc., Boulder, Colorado, under Federal Emergency Management Agency (FEMA) Contract No. EMW 90-C-3132.

An initial Consultation and Coordination Officer's (CCO) meeting was held in December 1989. Representatives of the City of Price, Carbon County, FEMA, and the study contractor attended. Other contacts were made with the U.S. Army Corps of Engineers and the Utah Department of Transportation, for the purpose of acquiring information.

This restudy used the hydrology from the previous Flood Insurance Study for Price River and Meads Wash.

The hydraulic analysis was based upon the construction of Utah State Highway 6, which caused realignment of the river bed. A levee was also constructed along the east bank of the Price River from Utah State Highway 6 to 100 North Street. The 500-year flood significantly overtops the levee, but does not overtop Highway 6. Two decks were used to model this split flow situation; therefore, two profiles are plotted for the 500-year flood (a "river-side" profile and a "city-side" profile).

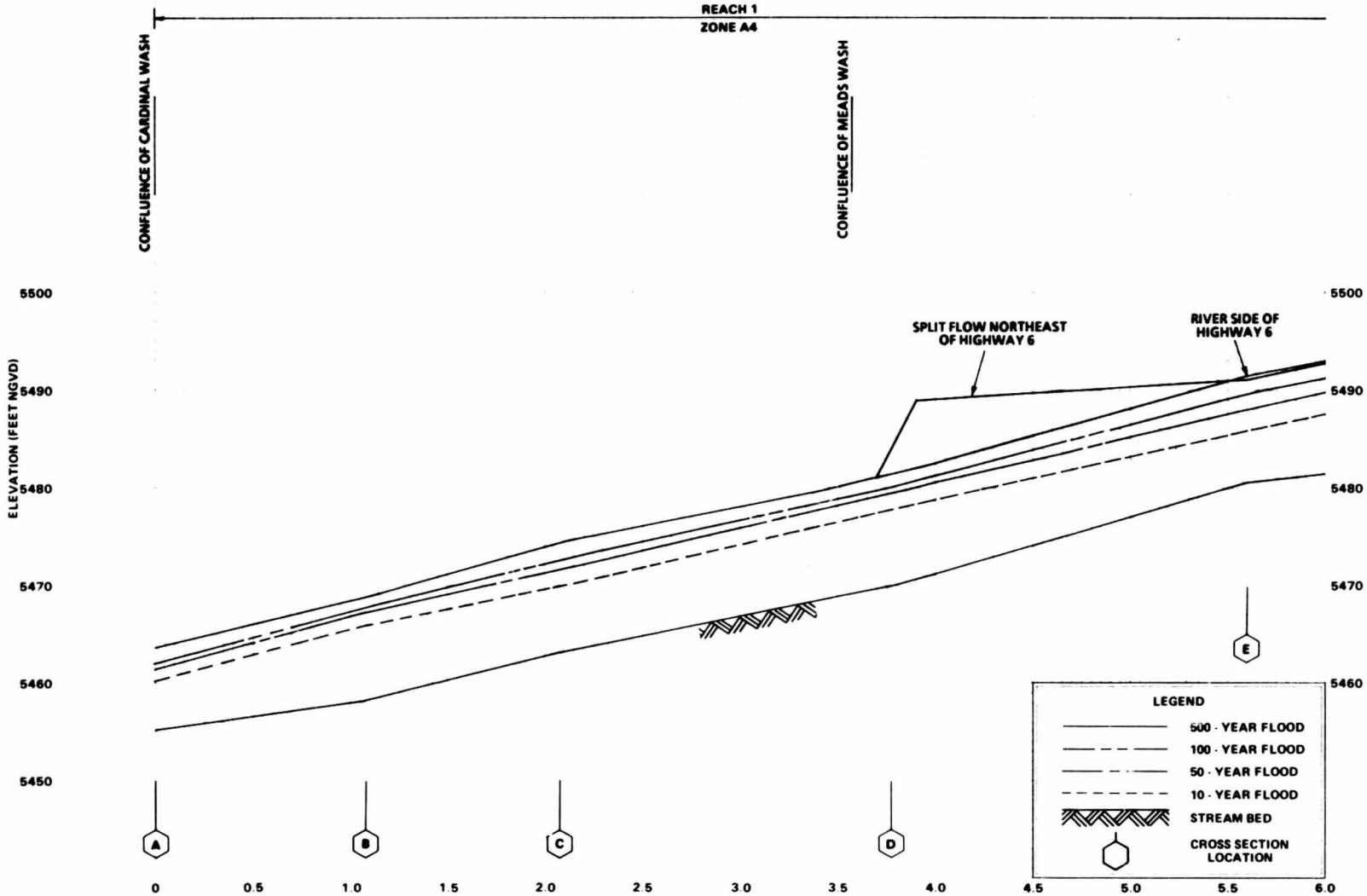
Also, both the "with levee" and "without levee" profiles for the 100-year flood are included for the levee reach. Channel migration due to erosion, extending now beyond the previous floodway, has also taken place in the Price River.

Flooding occurs on the east side of Utah State Highway 6 from the confluence of Meads Wash to approximately 2,000 feet upstream of Carbon Avenue because of passage of floodwaters through culverts under the highway, which drain the City of Price. The City Engineer confirmed that there are enough culverts connecting the two sides of the highway that water can back up from the river side and pond on the city side. Therefore, 100-year water-surface elevations are equal on both sides of the highway to account for the ponding effects. Areas of shallow flooding occur along State Highway 6 from approximately 2,000 feet upstream of Carbon Avenue to the Price River crossing and on the east side of the Price River on the upstream side of 100 North Street.

The starting water-surface elevation for the 100-year flood for Meads Wash was based on the slope-area method.

The starting water-surface elevation for Price River was obtained from the previous Flood Insurance Study.

Flood boundaries were delineated using topographic maps (Reference 7) with a scale of 1:4,800, and a contour interval of 4 feet.



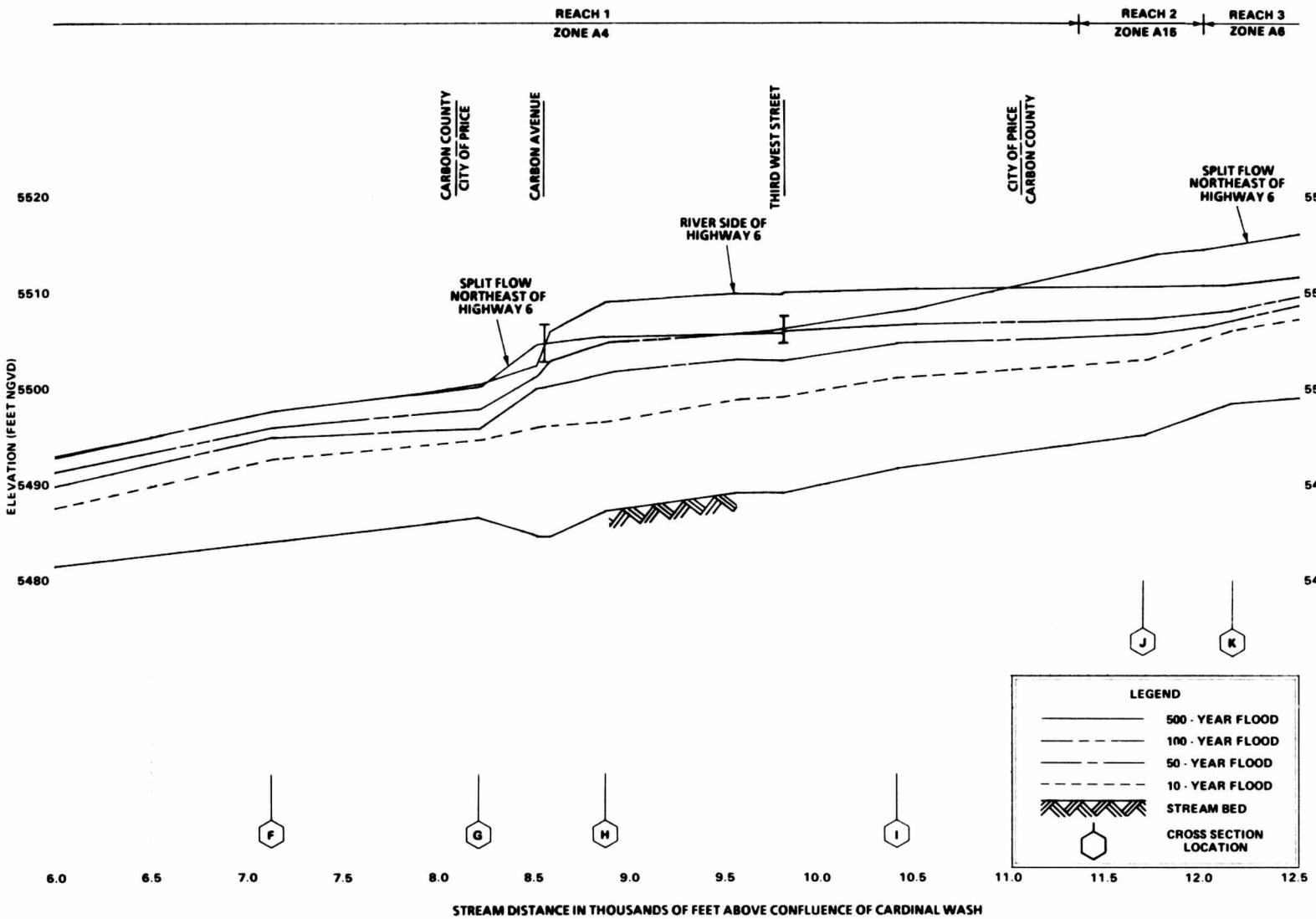
FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

01P



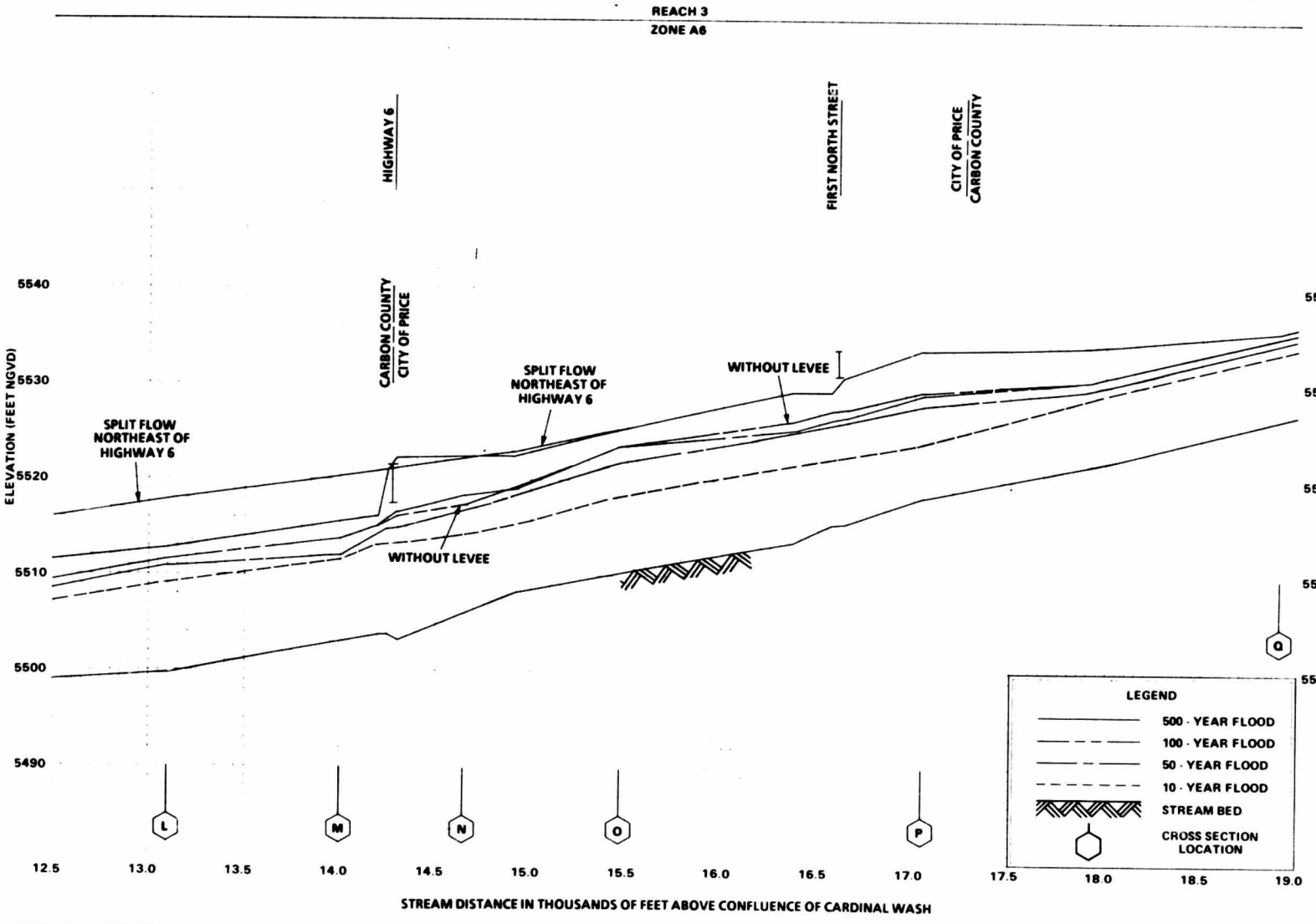
FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

02P



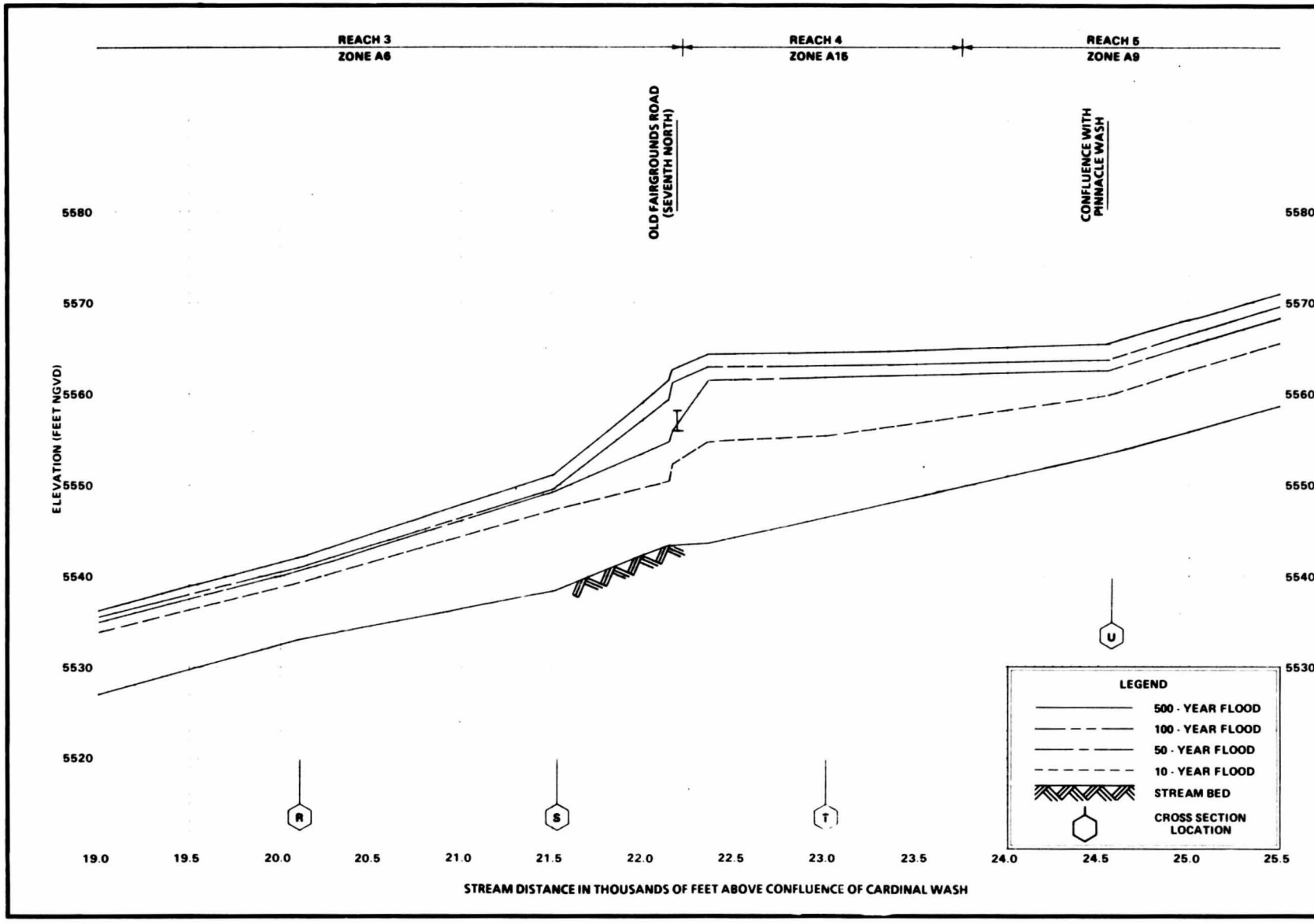
FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

03P



FLOOD PROFILES

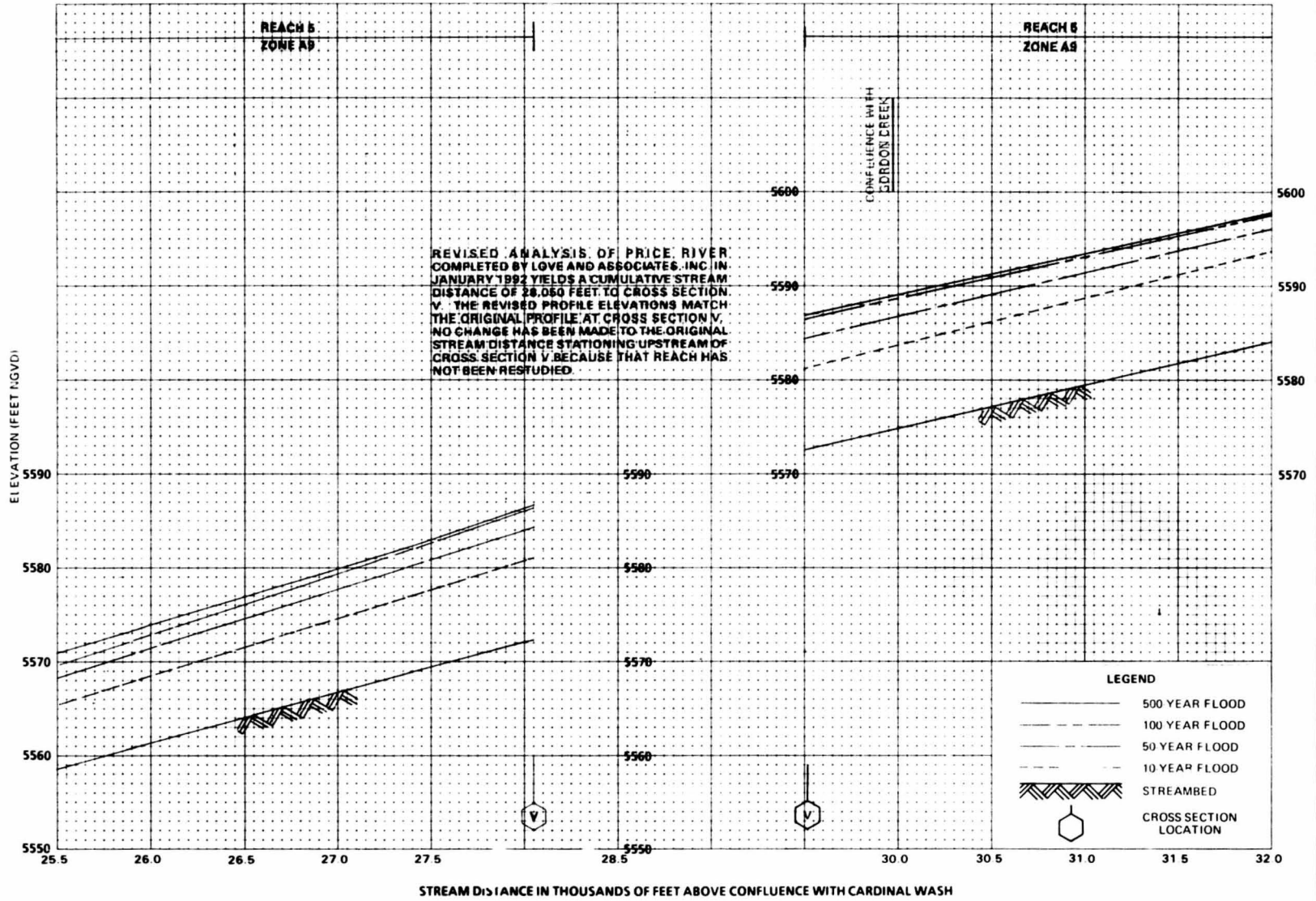
PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

~~04P~~

36



FLOOD PROFILES

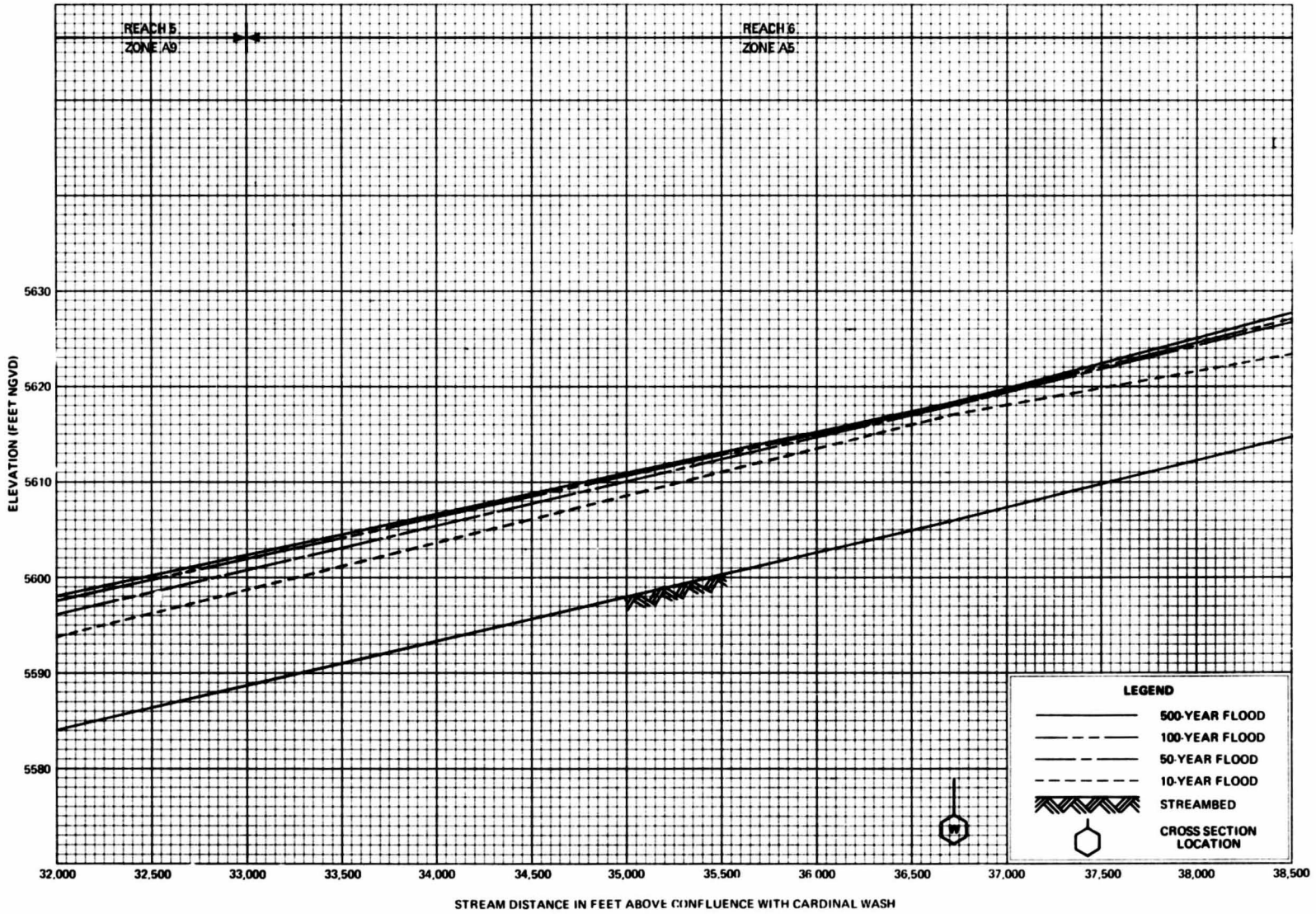
PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

05P



FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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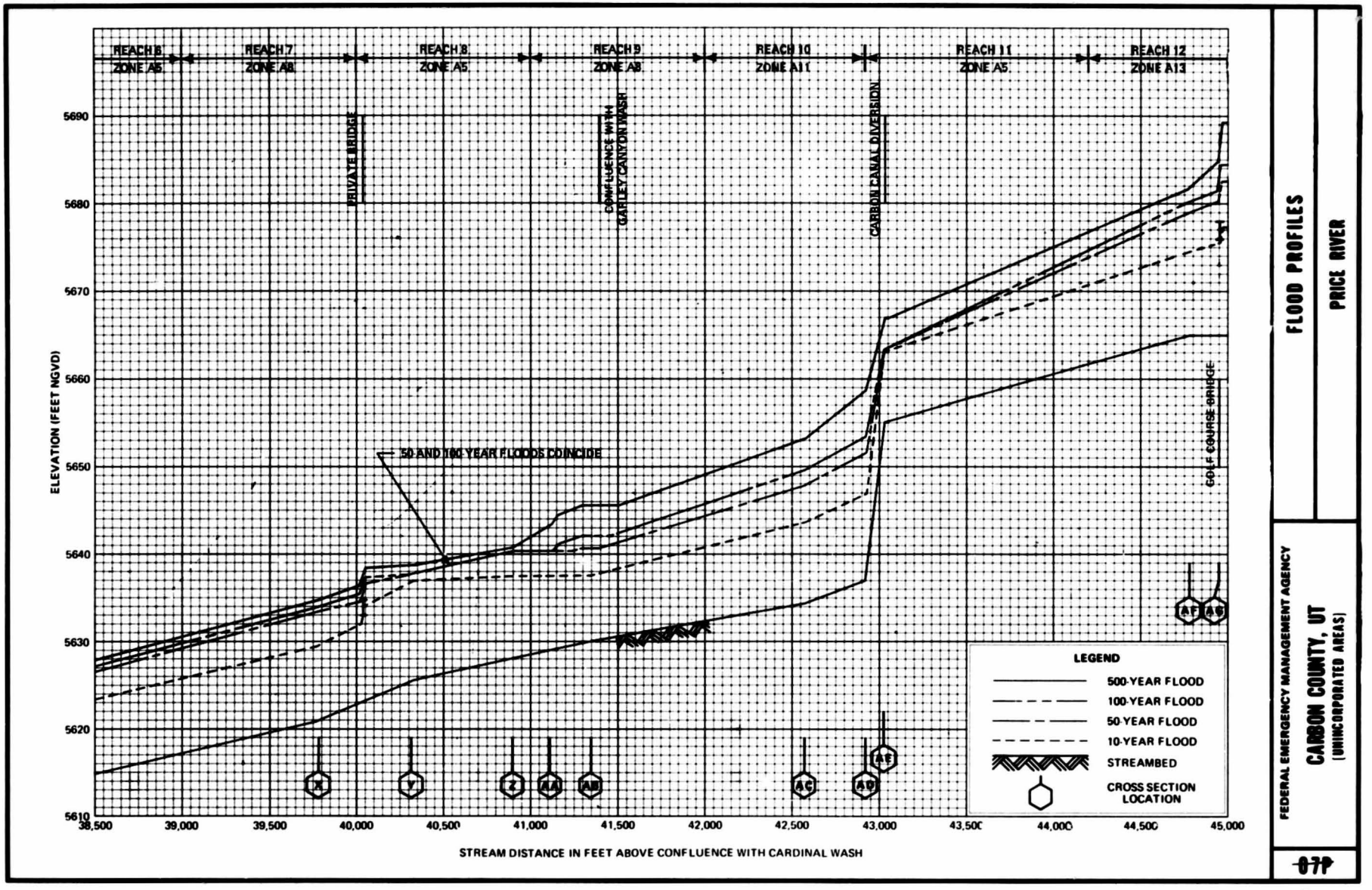


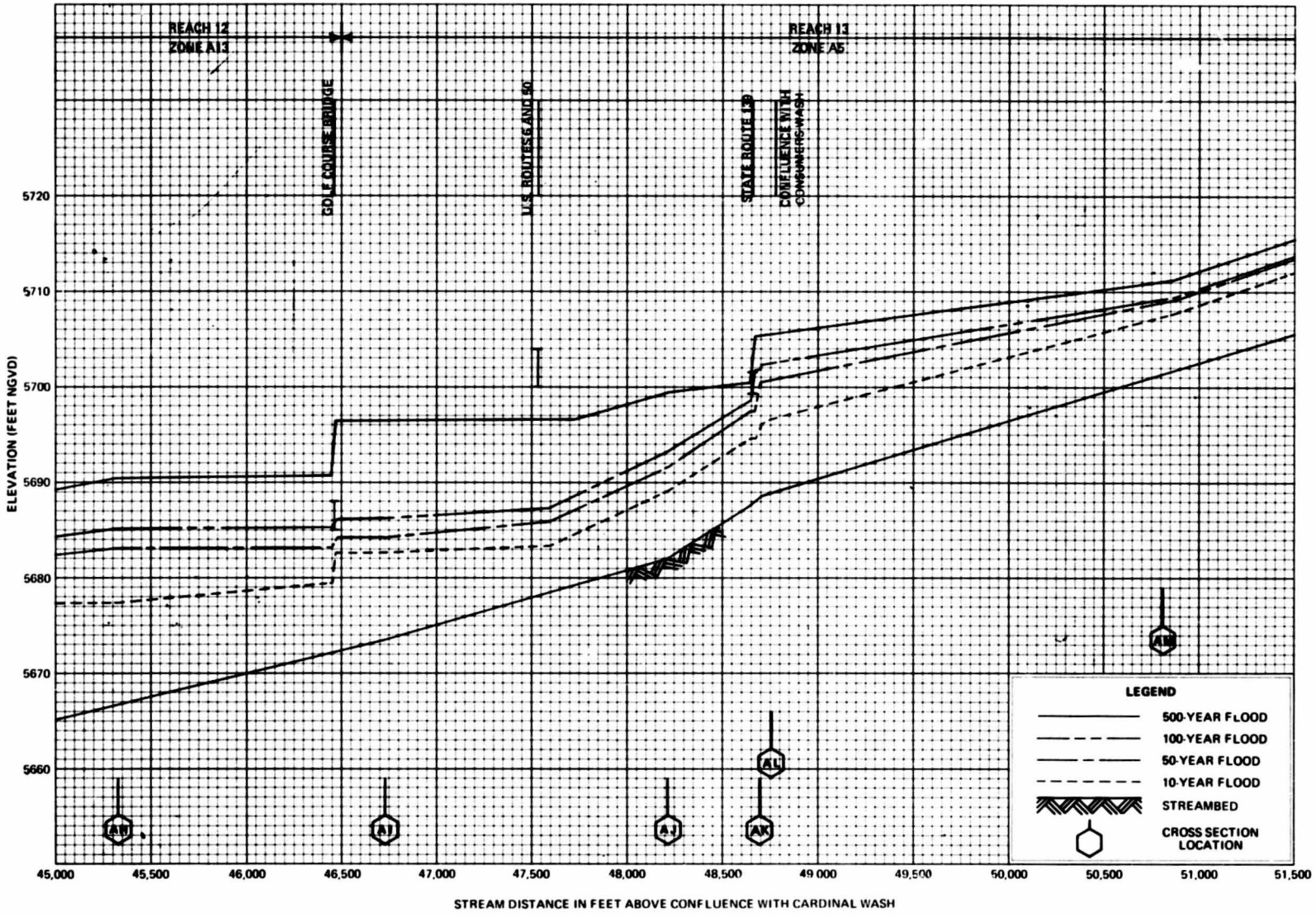
FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)



FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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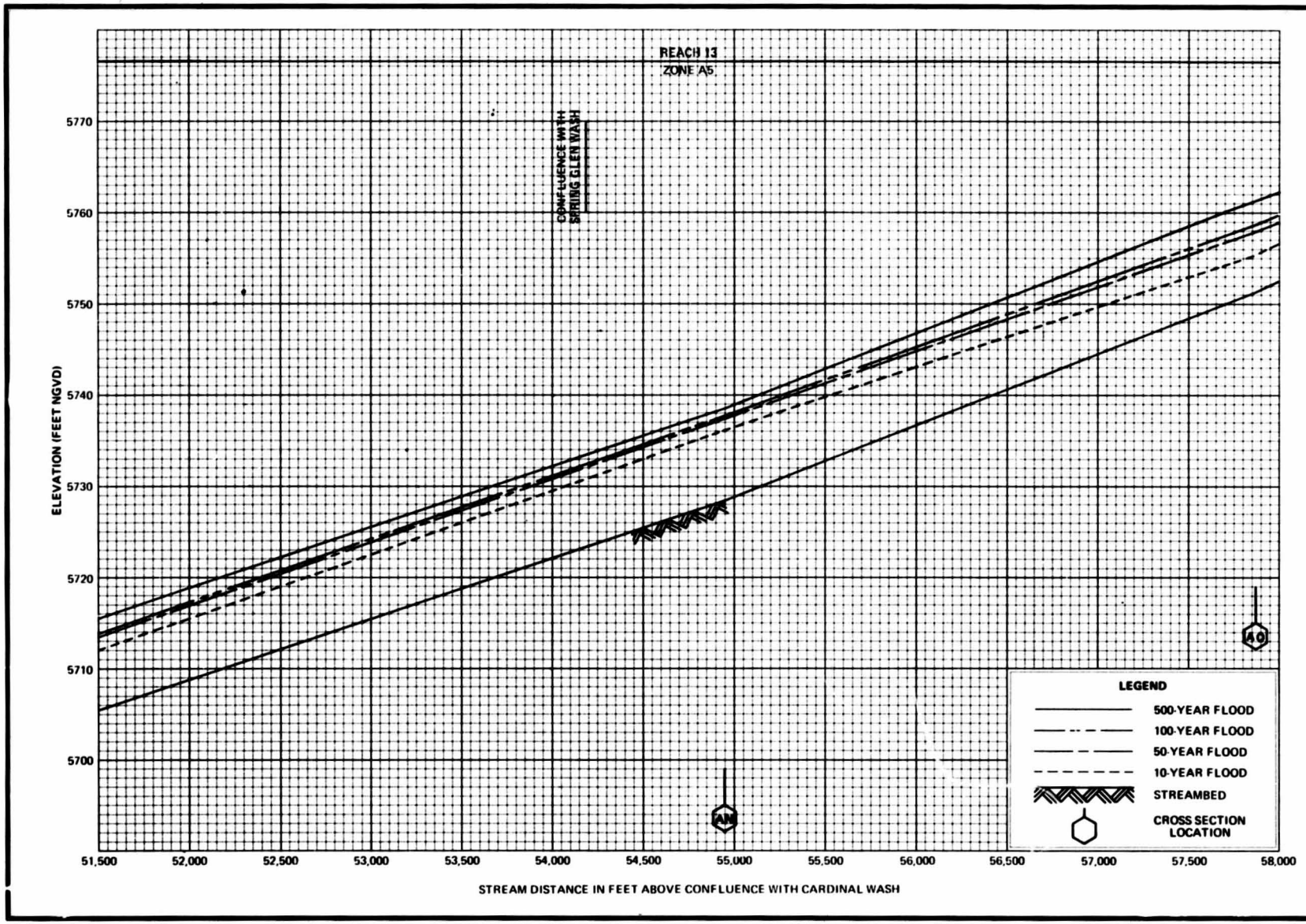

FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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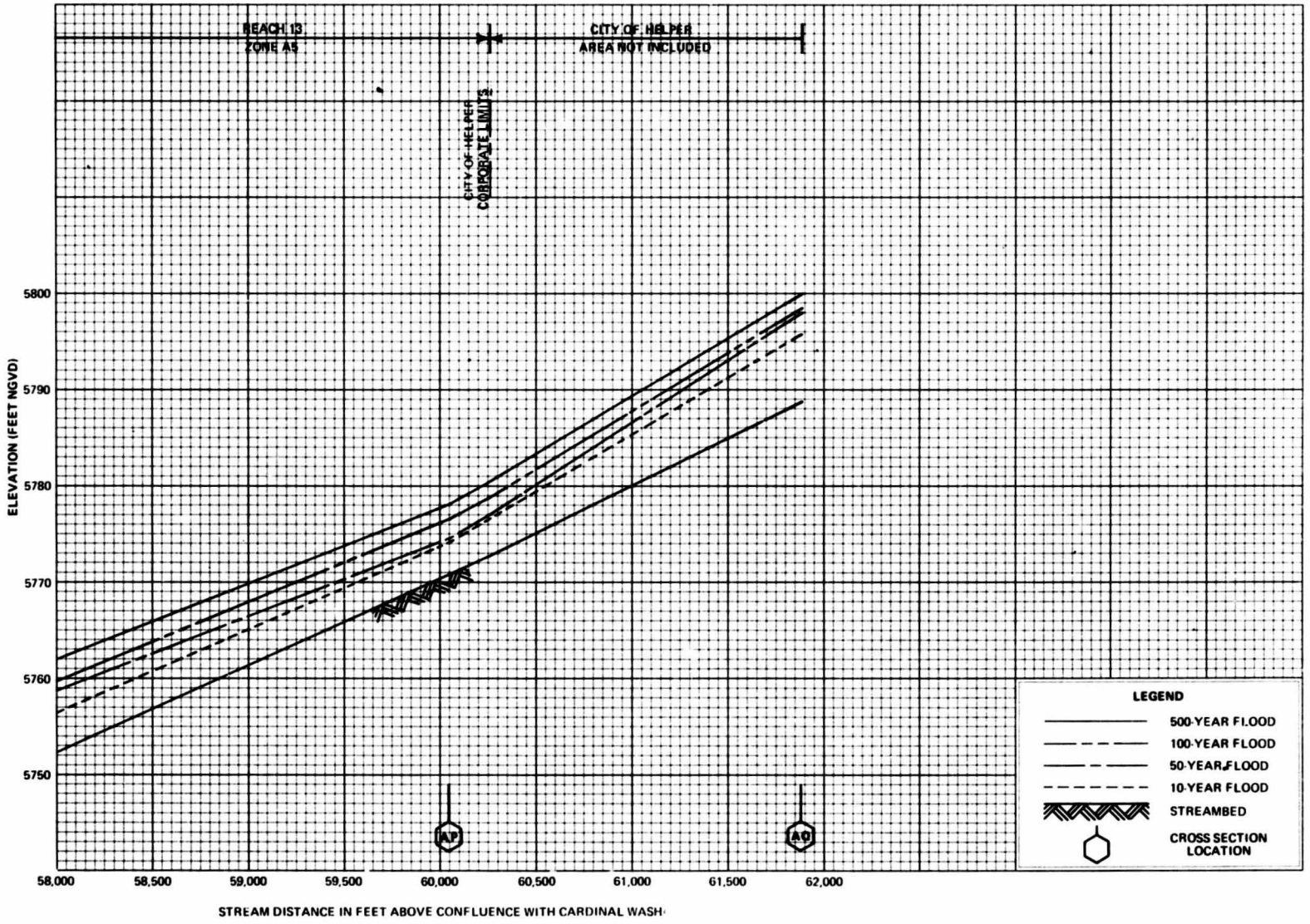


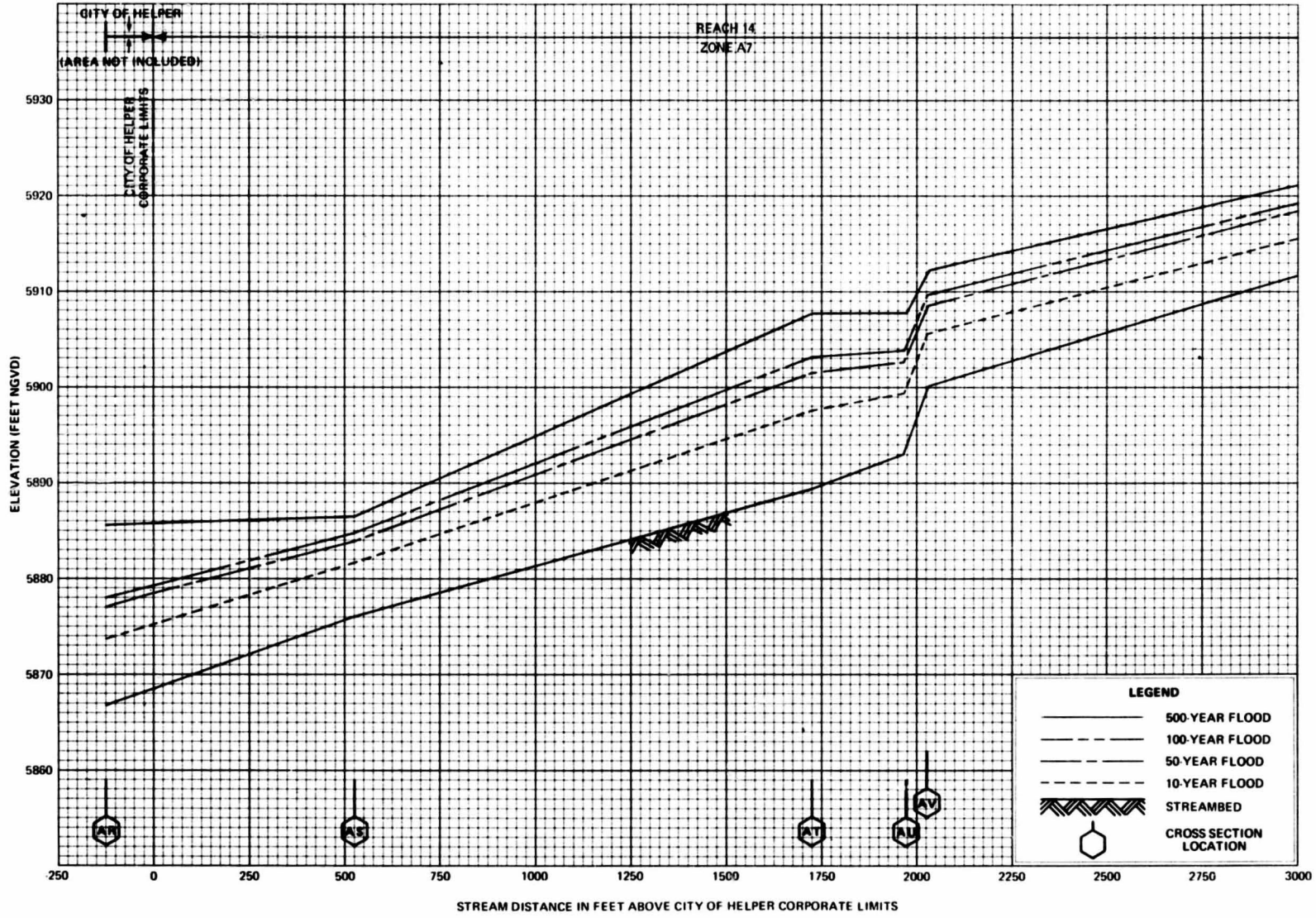
FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

10P



FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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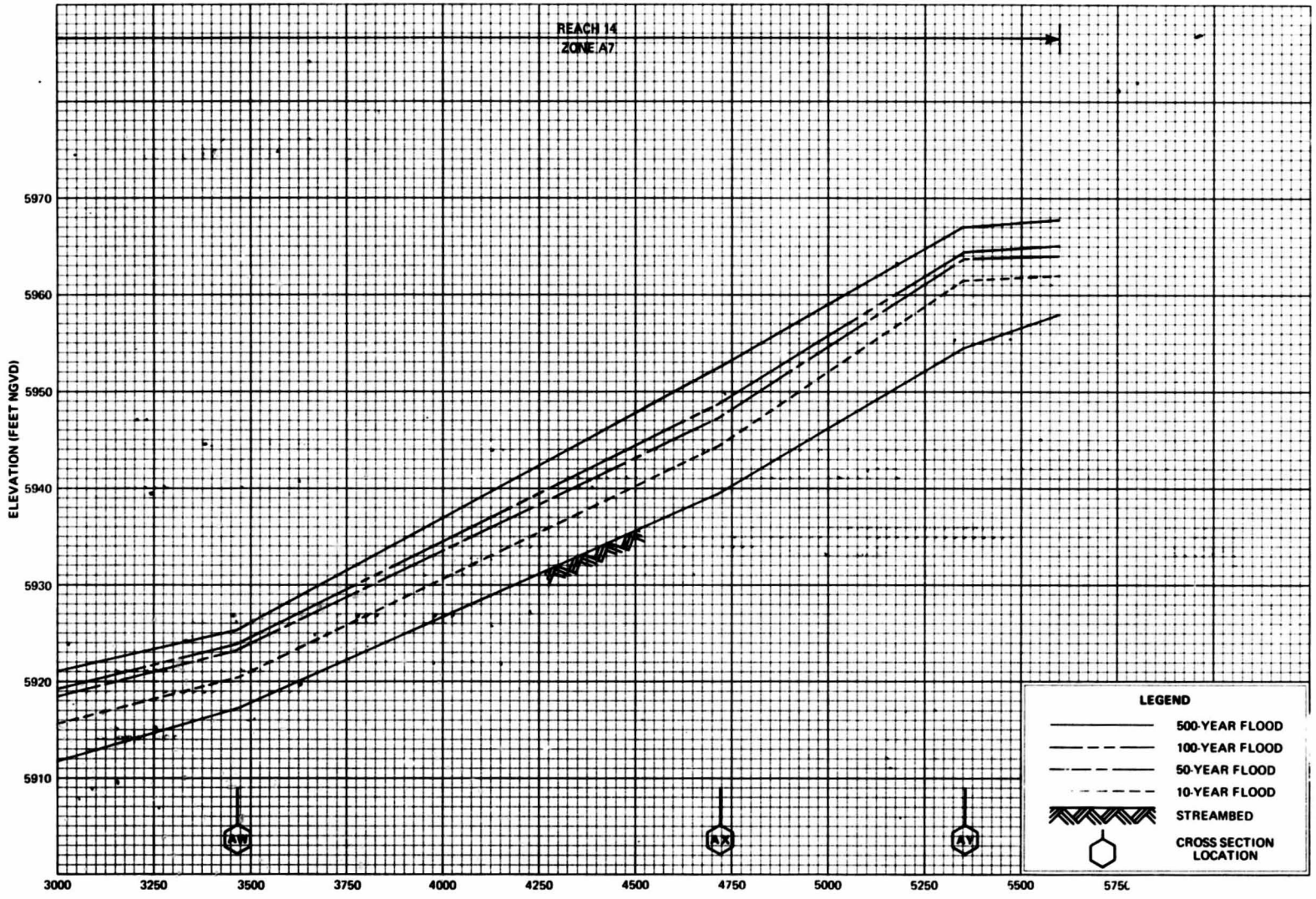

FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

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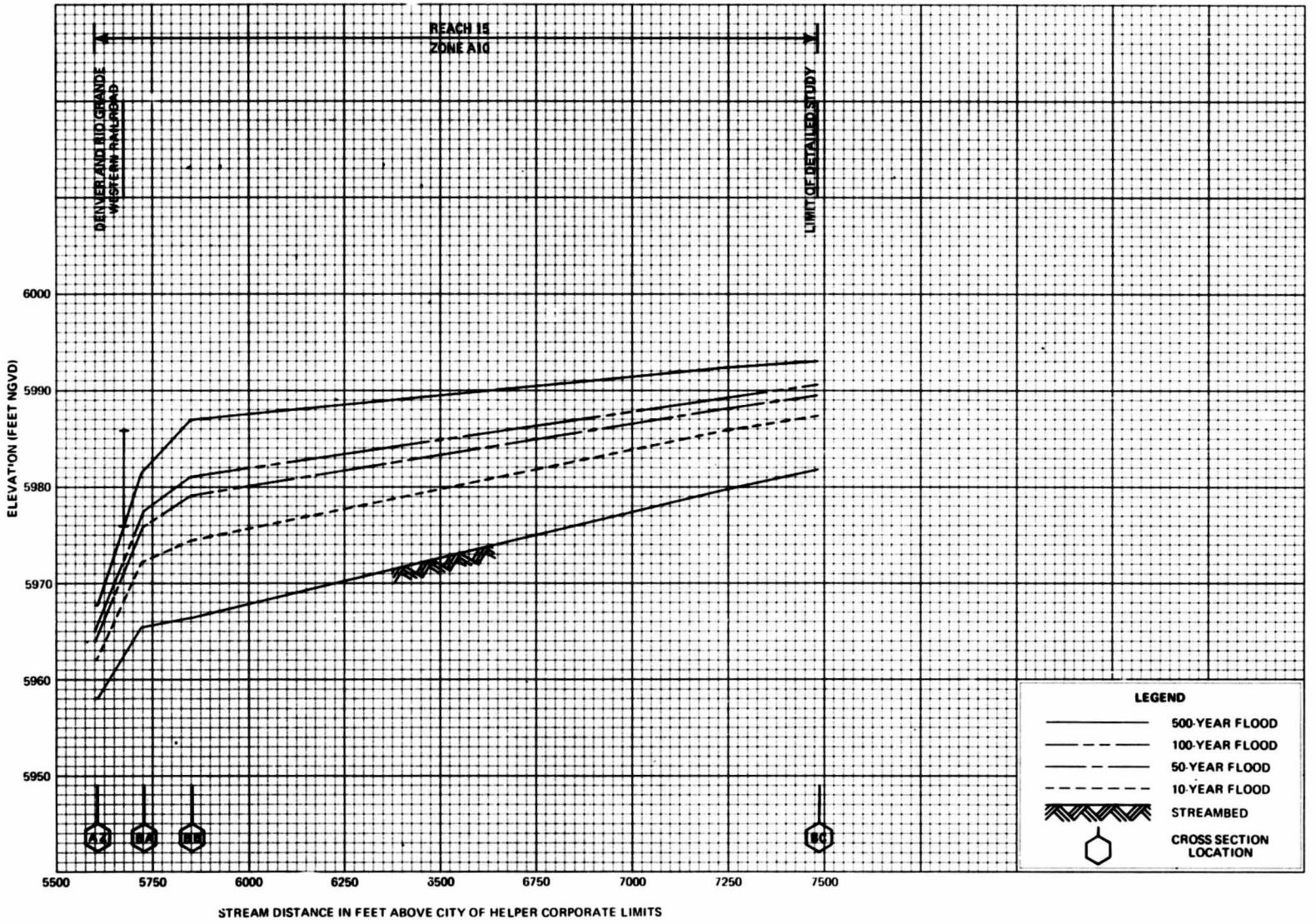

FLOOD PROFILES

PRICE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

13P

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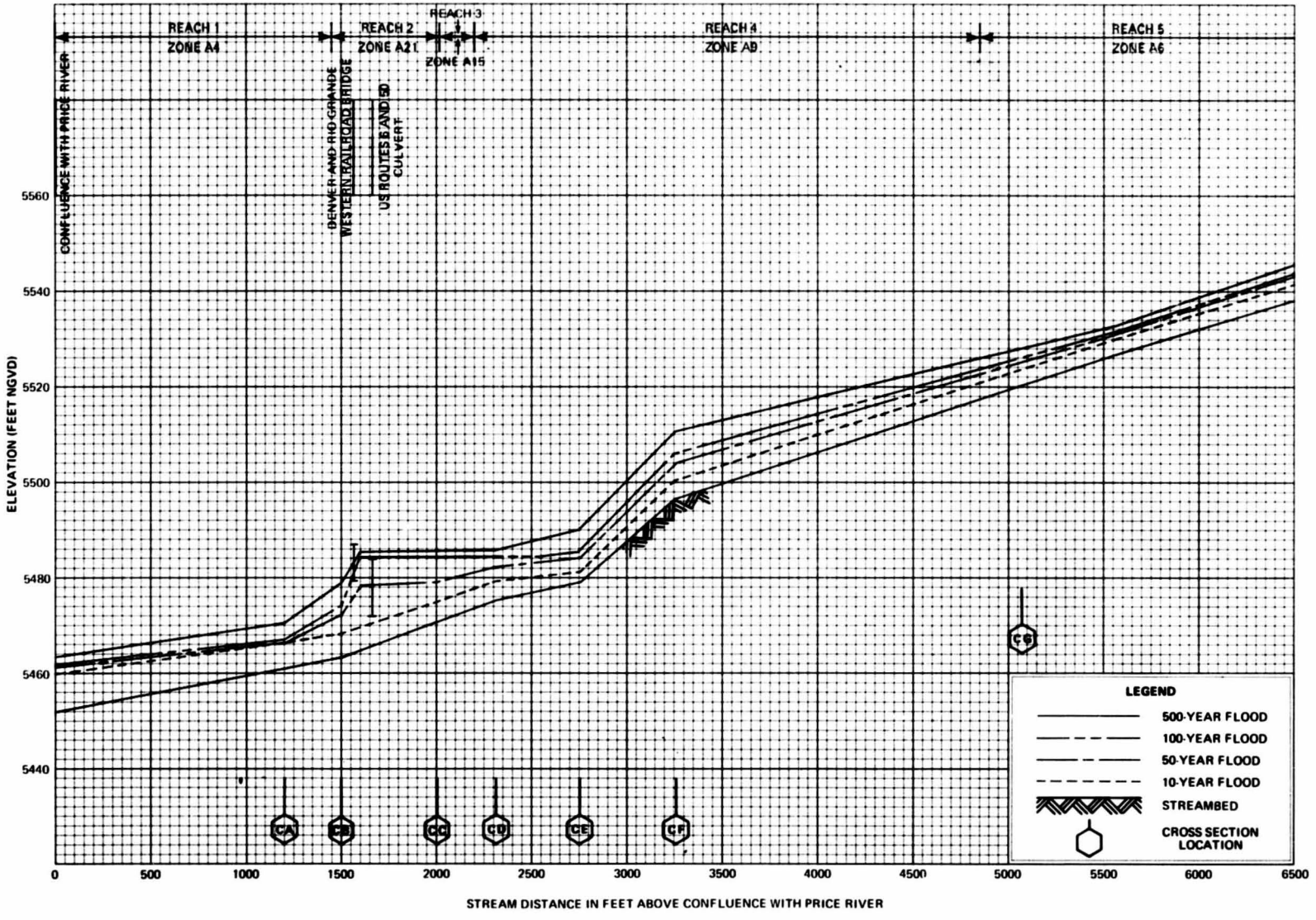

FLOOD PROFILES

CARDINAL WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

14P

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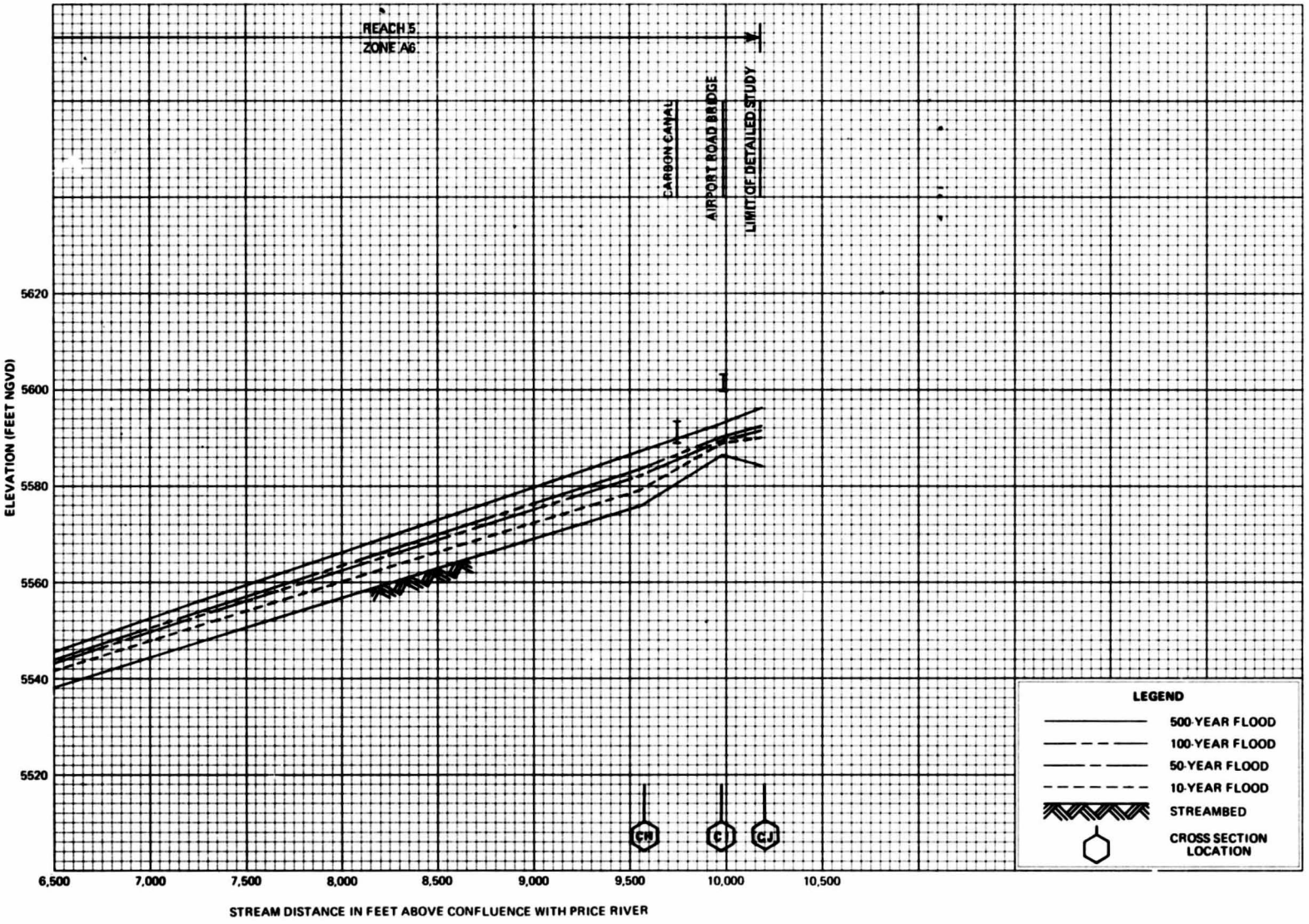

FLOOD PROFILES

CARDINAL WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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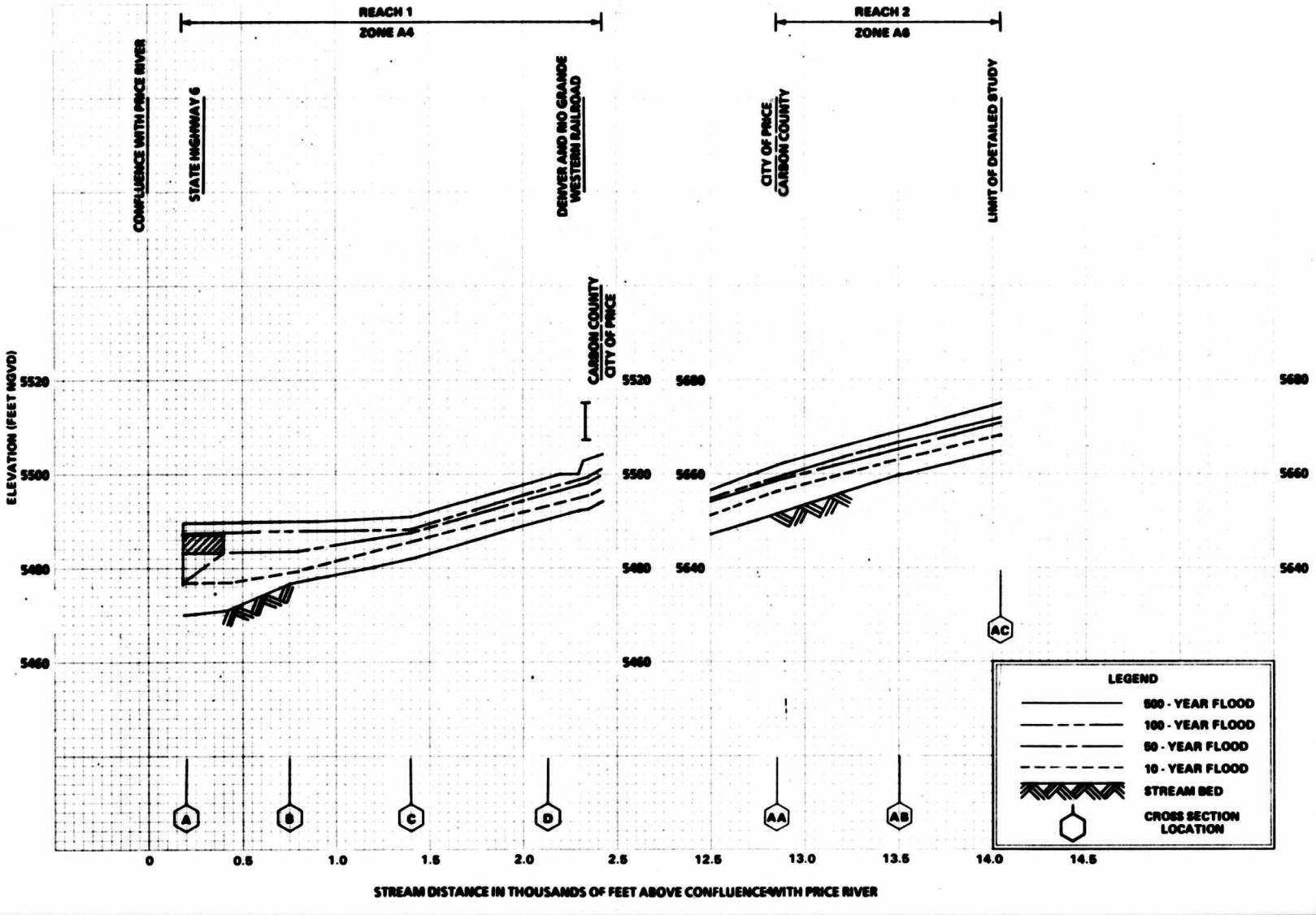

FLOOD PROFILES

MEADS WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

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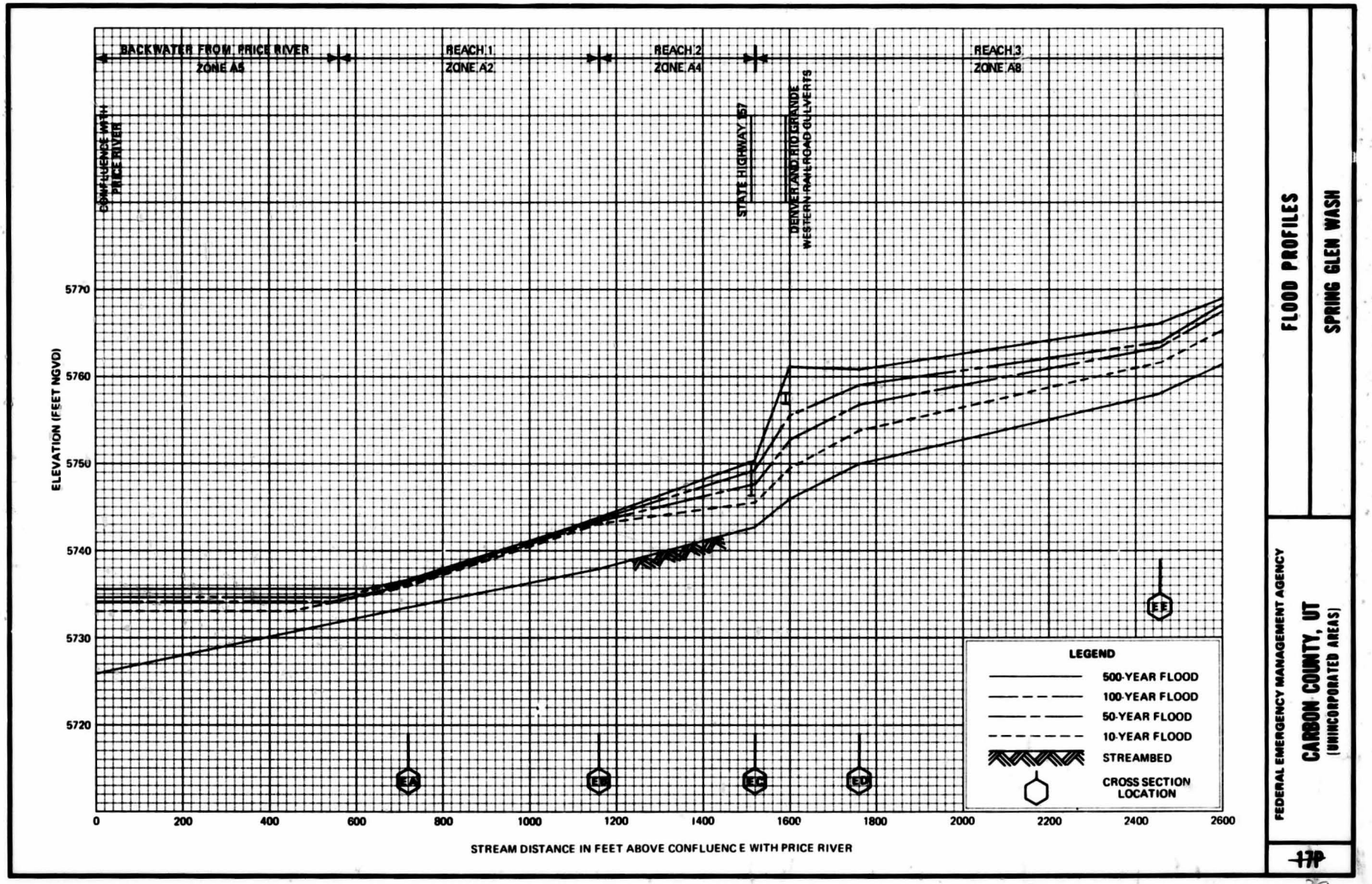
16P



FLOOD PROFILES

SPRING GLEN WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT
(UNINCORPORATED AREAS)

17P

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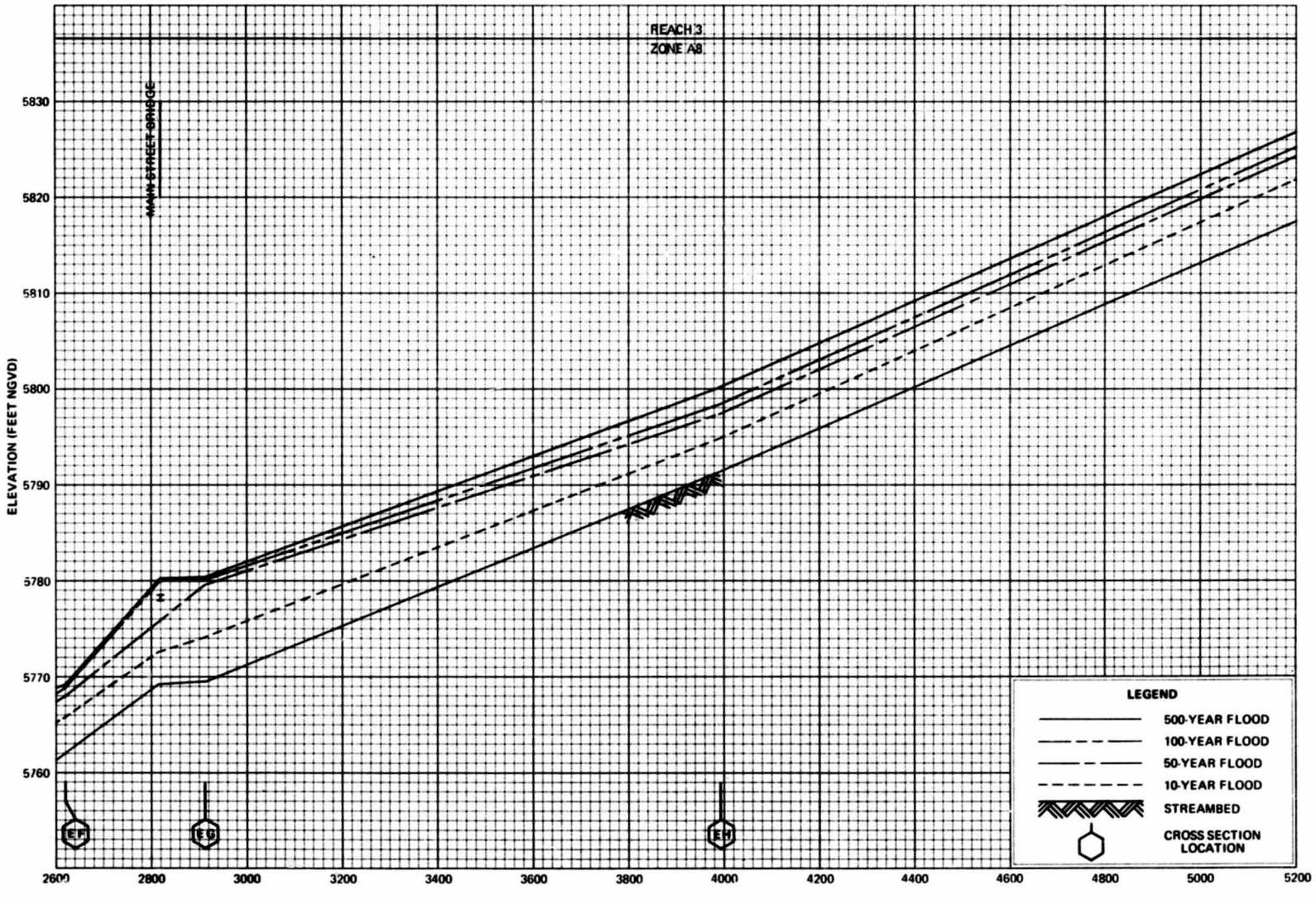

FLOOD PROFILES

SPRING GLEN WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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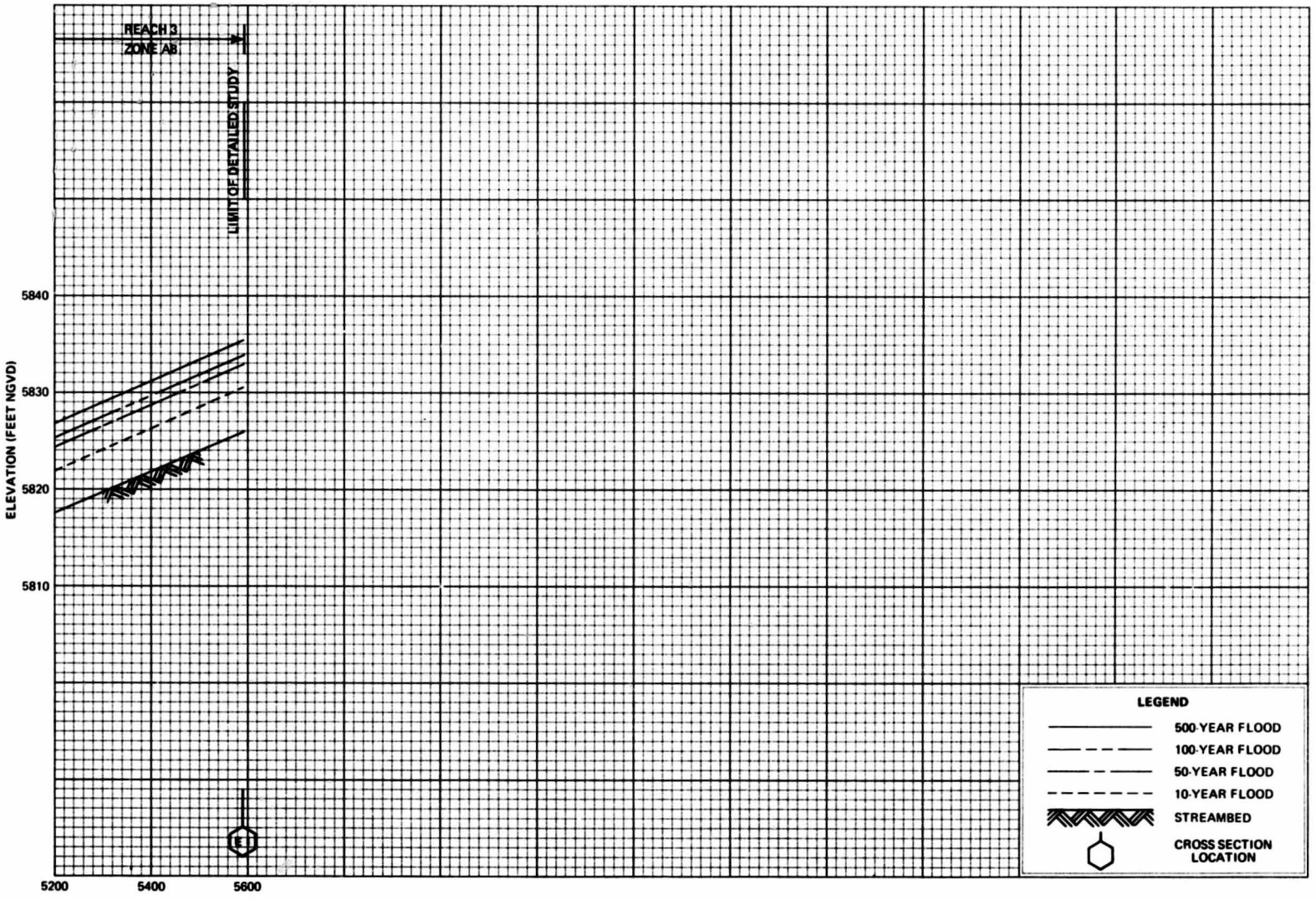

FLOOD PROFILES

SPRING GLEN WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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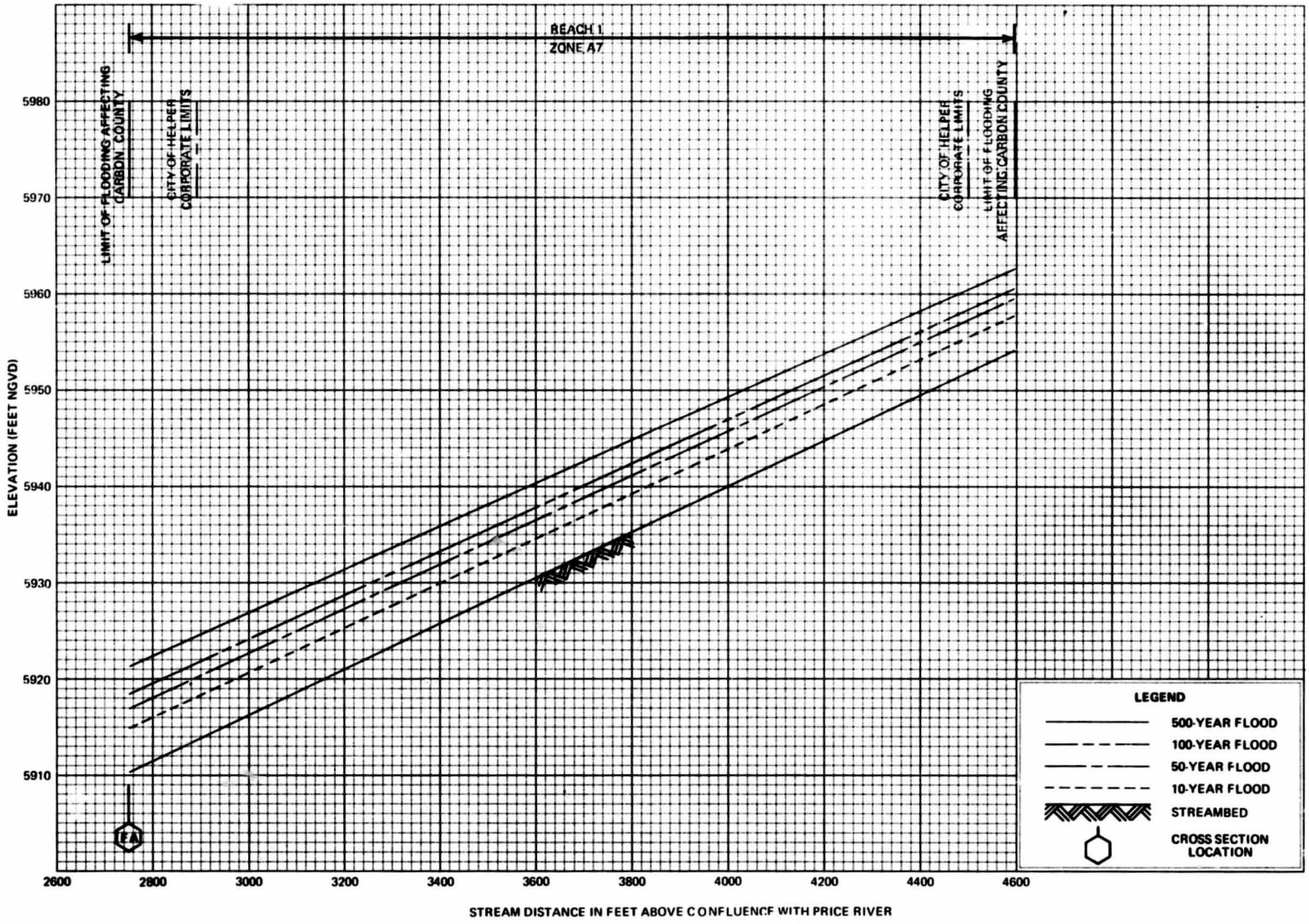

FLOOD PROFILES

SPRING CANYON WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CARBON COUNTY, UT

(UNINCORPORATED AREAS)

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