Utah State University

DigitalCommons@USU

2002

Flood Insurance Study, City of Lehi, Utah, Utah County

Federal Emergency Management Agency

Utah State University
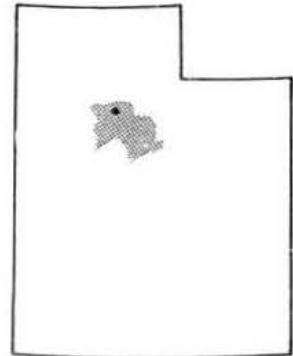MERRILL-CAZIER LIBRARY

FEM 1.209/44:490209 V000

FLOOD INSURANCE STUDY

0594C-44

CITY OF LEHI, UTAH

UTAH COUNTY

REVISED: JULY 17, 2002

Federal Emergency Management Agency

COMMUNITY NUMBER · 490209 V000

BEST COPY AVAILABLE   COMPLETED

GA 2002 C19792

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont=d)

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

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 City of Lehi, Utah 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 Lehi 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

Procurement of community information, such as zoning maps, flood problems, and selection and identification of flooding sources requiring detailed study were accomplished through an initial meeting on April 12, 1976, attended by personnel of the U.S. Bureau of Reclamation, Federal Insurance Administration, and Lehi city board members.

Coordination and contacts during this study included exchange of data and review with the Utah County Flood Action Committee, the U.S. Army Corps of Engineers, the U.S. Soil Conservation Service, and the U.S. Geological Survey. Data were also accumulated through interviews with local residents and a newspaper search concerning flood problems and past flood events.

The results of this study were reviewed at a final community coordination meeting held on September 19, 1978. Attending the meeting were representatives of the Federal Insurance Administration, the study contractor, and the city. No problems were raised 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 the U.S. Bureau of Reclamation for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-12-76, Project Order No. 2. This work, which was completed in April 1978, covered all significant flooding sources affecting the City of Lehi, Utah.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Lehi, Utah County, Utah. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by the overflow of Dry Creek was studied in detail. Included in the detailed study is the Wastewater Ditch Diversion which diverts floodflows from Dry Creek below the Union Pacific Railroad tracks, runs south to 600 North, and then west to the corporate limits of Lehi.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1983.

2.2 Community Description

The City of Lehi is located in east-central Utah County, approximately 32 miles south of Salt Lake City, in central Utah. It has a present population estimated at 6000. The adjacent areas are unincorporated land areas in Utah County. The economy of the area is quite diversified, including agriculture and industry.

Dry Creek, which flows through the center of Lehi, is a small perennial stream that originates in the Wasatch Front to the northeast and flows approximately 16 miles before emptying into Utah Lake, southwest of town. Dry Creek Basin rises from 4,560 feet at the City of Lehi to an elevation of 11,300 feet in the headwater area. Commercial areas and older residential structures are located along Dry Creek. The upper reaches of the creek exist in a confined flood plain, whereas the lower area of commercial and residential development is located on a relatively broad flood plain that slopes gently to the southwest to Utah Lake. Developing residential areas are located chiefly in the northeast section of town. Part of the developments are approximately 20 feet above the affected flood area, and some land is being developed within the flood plain.

Average annual precipitation in the basin ranges from approximately 12 inches in the valley floor to approximately 30 inches in the high headwater areas. The climate ranges from semi-arid in the lower elevations to dry-subhumid in the mountainous areas.

2.3 Principal Flood Problems

Low-lying areas of Lehi are subject to periodic flooding caused by overflow of Dry Creek. The most severe flooding occurs in the summer as a result of convective-type thunderstorms. These larger summer storms, while occurring infrequently, cause the major propor-

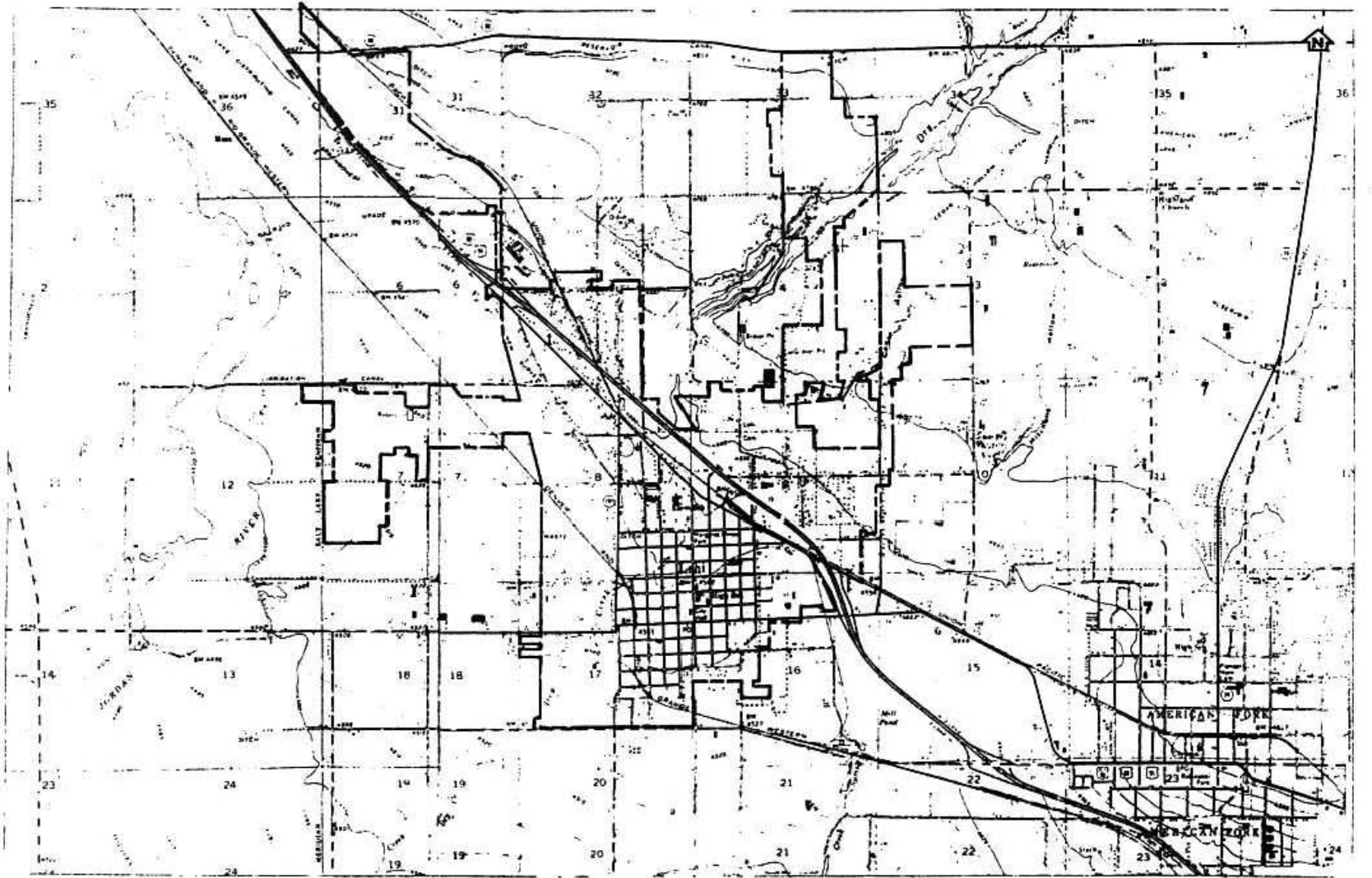| FEDERAL EMERGENCY MANAGEMENT AGENCY	APPROXIMATE SCALE
CITY OF LEHI, UT (UTAH CO.)	4000 0 4000 8000 12000 FEET
	VICINITY MAP

FIGURE 1

tion of all downstream flood damages. Some of the larger floods occurred before streamflow or precipitation records were kept. Sketchy accounts from early settlers, brief newspaper articles, and official records indicate that flooding occurred on Dry Creek in 1869, 1876, 1878, 1880, 1881, 1885, 1890, 1896, 1909, 1919, 1921, 1923, 1930, 1934, 1935, 1938, and 1946. Because of the nature of the documentary evidence, however, it is difficult to determine where flood damage occurred in Lehi, or if damage was limited to the canyon reaches.

The maximum estimated flood peak of 750 cubic feet per second (cfs) at the Dry Creek gage occurred in August 1951. A flow of 1150 cfs was estimated for Fort Creek in July 1965; however, this flood dissipated in the Dry Creek Dam debris basin, completed by the U.S. Soil Conservation Service in 1962. Major and minor flooding is known to have occurred in Lehi in May 1950, August 1951, May 1952, June 1953, May 1964, and July 1967.

2.4 Flood Protection Measures

Dry Creek Dam and its debris basin, located approximately 2 miles upstream from the Lehi corporate limits, significantly reduce the thunderstorm flood peaks (26 percent for the 100-year flood). The dam and debris basin have a capacity of 270 acre-feet. However, there is no significant reduction in peak snowmelt flow. A waste-water ditch diversion has been constructed in Lehi which routes part of the excess flows to the west of the city and into the Jordan River. These two flood protection measures have been used to reduce the 100-year flood.

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. 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.

4

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.

The Dry Creek drainage area consists of 22 square miles of mountain drainage and 15 square miles of bench area for a total of 37 square miles. It varies in altitude from 10,500 feet at the divide to 4,700 feet at Dry Creek Dam. Dry Creek Dam is a flood control structure located on Dry Creek 2 miles above the corporate limits. It was built by the U.S. Soil Conservation Service in 1962 to alleviate floodwater and sediment damages caused by summer rainstorms, and sediment damages from spring snowmelt flows. It was not designed to control snowmelt floodwater.

Discharge records are available for two drainage tributaries above Lehi. They are Fort Creek at Alpine (U.S. Geological Survey Gage No. 1660), and Dry Creek near Alpine (U.S. Geological Survey Gage No. 1655). The two gages together provide flow data for 16.4 square miles. The Fort Creek gage has 8 years of record and the Dry Creek gage has 24 years of record. In addition to the record data, the U.S. Soil Conservation Service estimated peak flows of two extreme flood events. In August 1951, the Dry Creek gage was washed out by flooding estimated at 750 cfs. A flow of 1150 cfs was estimated for Fort Creek in July 1965. Both floods resulted from thunderstorm runoff (References 1 and 2).

Snowmelt flood peaks were determined from a log-Pearson Type III analysis of spring runoff data at Fort Creek and Dry Creek gages (Reference 3).

A computer program (Reference 4) with generalized skew input of -0.26 was used to analyze the data and determine the 10-, 50-, 100-, and 500-year flood peaks at each gage. The respective peak flows were then added to obtain a combined peak for the two gages. These peaks were then increased by the square root of drainage area ratios to reflect total runoff for the 22 square miles of mountainous drainage.

Thunderstorm hydrographs were developed for the total 37-square mile drainage above Dry Creek Dam. Precipitation data was taken from National Oceanic and Atmospheric Administration, Atlas 2 and run on a precipitation frequency-duration computer program (Reference 5) to establish the 1-hour rain depths for each required flood frequency. The 1-hour depths were then reduced by an areal reduction factor of 0.64. Excess rainfall was determined by subtracting an initial infiltration loss of 0.5 inch and 0.2 inch per hour thereafter. Basin runoff characteristics were simulated by use of the Buckhorn Creek Unitgraph. A computer program (Reference 6) was then used to calculate runoff hydrographs.

5

The thunderstorm hydrographs developed were routed through Dry Creek Dam by use of a computer program which uses the modified Puls method (Reference 7). The present sediment content in the retarding basin was determined to be 90 acre-feet (Reference 8). Routing significantly reduced the thunderstorm flood peaks; however, thunderstorm runoff remains the critical source of flooding for the 50-, 100-, and 500-year floods. The Dry Creek Dam is successful in retarding the 10-year thunderstorm to the extent that snowmelt becomes dominant at that frequency.

Historical accounts of past flooding also indicate that thunderstorm runoff is the prominent source of flooding in Lehi. The 100-year and 500-year flood peaks derived are nearly the same as the U.S. Army Corps of Engineers Intermediate and Standard Project floods in their 1969 Flood Plain Information report (Reference 9).

Peak discharge-drainage area relationships for Dry Creek are shown in Figure 2. This figure also shows a comparison of derived flood peaks (computed by the Rational Method) to historical peaks (computed from gaging station records) in the vicinity.

3.2   Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the backwater analysis of Dry Creek were obtained from aerial photo maps at a scale of 1:2400, with a contour interval of 2 feet (Reference 10) and from data used in the Flood Plain Information report for Dry Creek (Reference 9).

The reach of stream that presents flood hazards to Lehi extends from the northern corporate limits near Interstate Highway 15 approximately 2.0 miles downstream to the southwest corporate limits. Encroachment on the flood plain and numerous obstructions along the stream cause minimal flow capacity in the main channel. The stream flows in a confined flood plain from where it enters the city near Interstate Highway 15 downstream to 400 West. The carrying capacity of the channel is small and overbank flows are confined.

At 400 West, overbank flows fan out in a shallow sheet across gently sloping terrain. For the shallow overflow conditions that exist, only a minimum quantity of peak flow will reenter the main channel. The remaining overbank flow will dissipate over the outwash fan allowing for surface detention, retention, and ponding in areas of low relief.

PEAK DISCHARGE
(CUBIC FEET PER SECOND)

DRAINAGE AREA
(SQUARE MILES)

DRY CREEK

LEGEND
△ MAXIMUM KNOWN IN VICINITY
⊙ COMPUTED FROM GAGING STATION RECORD
⊙ COMPUED BY RATIONAL METHODS
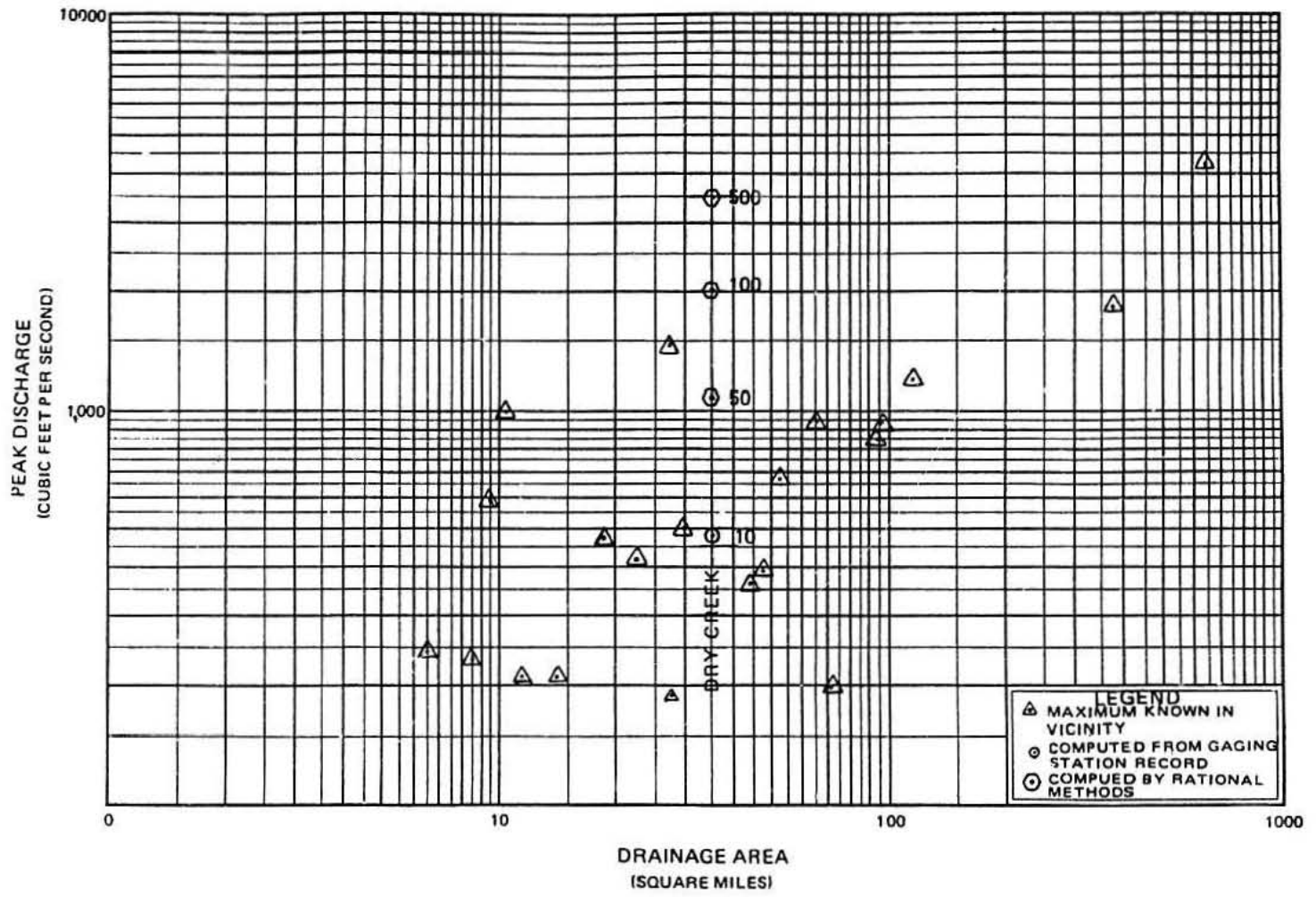
FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
(UTAH CO.)

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

DRY CREEK

(1)

Cross sections were located at regular intervals along the stream from 400 West to the upstream corporate limits. An on-site inspection indicates that the stream is capable of carrying only low flows from the elementary school downstream to the southern corporate limits. High floodflows are conveyed over bridge structures and in overbank areas. Channel cross section data was ignored for this reach of study area when analyzing the hydraulic effects of peak flows. Ground elevations for the cross sections were photogrammetrically obtained as the 1:2400 scale topographic were compiled (Reference 10). Thalweg elevations for Dry Creek from the elementary school to the upstream corporate limits were obtained from existing profiles.

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 Insurance Rate Map.

Hydraulic analyses for both Dry Creek and the Wastewater Ditch Diversion were performed using the HEC-2 step-backwater computer program (Reference 11).

The backwater computations for Dry Creek were started using the slope-area method located at the first cross section. The starting elevation compares favorably with the shallow flooding conditions that existed during past flood events.

Reach lengths for the channel were measured along the centerline of channel between sections as scaled from 1:2400 scale mapping or stream bottom profiles. The overbank reach lengths were scaled from the 1:2400 maps measured along the approximate centerline of effective area.

Roughness coefficients (Manning's "n") were evaluated from aerial photographs (Reference 9), topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (Reference 12), and on-site field examinations. The "n" value was selected from tables published by the U.S. Geological Survey (Reference 13), based on channel conditions and overbank vegetation or land use. Within the Lehi corporate limits, the channel "n" values ranged between 0.030 and 0.045, and overbank "n" values ranged between 0.060 and 0.100.

The Interstate Highway 15 culvert bridge and the adjacent Frontage Road embankment are major obstructions to floodflow of Dry Creek. A modified Puls method of routing was employed for determining flow rates that affect Lehi downstream from the area. Floodflows are greatly reduced as a backwater effect, and resulting ponding conditions are caused by the roadway embankments. As ponded water overflows a drainage divide, a shallow flooding condition is created north of the freeway embankment. Dry Creek separates into two channels

downstream of the Union Pacific Railroad. One of these is the Wastewater Ditch Diversion. The quantity of water flowing in each drainage was determined using a divided flow approach. Water flows at the railroad embankment as a combination of pressure and weir flow. The water does not flow over the railroad embankment in the immediate area of the culvert, but over the railroad culvert approach. The computed pressure flow was used to determine the divided flow caused by the Wastewater Ditch Diversion structure. The Wastewater Ditch Diversion is a perched channel with a low left overbank. The total discharge under the railroad bridge was proportioned between the Wastewater Ditch Diversion and the main channel, with a resulting maximum flow in the ditch of 175 cfs. The water-surface elevation for the total flow was determined for cross section M and a water-surface profile was calculated for each assumed discharge through the two channels. A "total" discharge was obtained at the diversion by summing both main channel and Wastewater Ditch Diversion discharges for common water-surface elevations.

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).

Profiles are shown for the restricted area of Dry Creek from 300 North to the upstream corporate limits. The 10-year and 50-year profiles are similar, and water-surface elevations are not significantly different. The same is true for the 100- and 500-year floods.

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.

Average floodwater depths were estimated to an accuracy of 1.0 foot in areas affected by shallow flooding. For purposes of applying study methods to shallow flooding, an average depth of 1.0 foot was given to inundated areas of shallow overflow designated as AO Zones.

Flood elevations in shallow flooding areas from Dry Creek were determined by appropriate methods including field reconnaisance, engineering judgment, reports of local citizens, local newspaper reports, and review with Lehi city officals.

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 discrimina-
tion, the 100-year flood has been adopted by the Federal Emergency
Management Agency 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-year 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 1:2400, with a
contour interval of 2 feet (Reference 10).

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

Flood boundaries in shallow flooding areas from Dry Creek were
determined by appropriate methods including field reconnaissance,
engineering judgment, reports of local citizens, local newspaper
reports, and review with Lehi city officials.

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, increase the flood heights, and increases
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. Minimum standards of the Federal Emergency
Management Agency limit such increases in flood heights to 1.0 foot,
provided that hazardous velocities are not produced.

The floodways for the confined reach of Dry Creek was computed on
the basis of equal conveyance reduction from each side of the flood
plain without permitting encroachment of the channel. The results
of these computations are tabulated at selected cross sections for
each stream segment for which a floodway was computed (Table 1).

Development of a floodway in the shallow flooding areas is not
feasible.

14

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 (FEET NGVD)	WITH FLOODWAY	INCREASE
Dry Creek								
A	0	162	321	3.7	4,557.0	4,557.0	4,558.0	1.0
B	420	129	319	3.4	4,559.8	4,559.8	4,560.8	1.0
C	850	139	296	4.8	4,562.8	4,562.8	4,563.8	1.0
D	1,050	218	490	2.7	4,563.6	4,563.6	4,563.8	0.2
E	1,275	195	332	4.1	4,564.9	4,564.9	4,565.7	0.8
F	1,440	134	292	4.7	4,566.2	4,566.2	4,567.2	1.0
G	1,885	216	372	2.9	4,568.2	4,568.2	4,569.1	0.9
H	2,050	167	316	3.5	4,569.4	4,569.4	4,570.3	0.9
I	2,425	170	339	3.7	4,572.3	4,572.3	4,573.2	0.9
J	2,625	102	209	6.2	4,574.6	4,574.6	4,575.5	0.9
K	2,845	183	371	3.5	4,576.9	4,576.9	4,577.9	1.0
L	3,040	210	555	1.7	4,577.9	4,577.9	4,578.7	0.8
M	3,090	232	660	2.4	4,577.9	4,577.9	4,578.8	0.9
N	3,250	52	168	7.7	4,579.0	4,579.0	4,580.0	1.0
O	5,300	124	421	3.6	4,595.0	4,595.0	4,595.6	0.6
AD[2]	12,550	36	157	11.7	4,664.4	4,664.4	4,664.4	0.0
AE[2]	13,250	39	202	9.1	4,674.3	4,674.3	4,675.3	1.0
AF[2]	14,100	63	271	6.8	4,682.9	4,682.9	4,683.2	0.3
AG[2]	15,100	66	285	6.5	4,689.7	4,689.7	4,690.6	0.9

[1]Feet above Cross Section 'A'   [2]Cross sections P-AC and AH-AY are located in Utah County (Unincorporated Areas)

TABLE 1	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	CITY OF LEHI, UT (UTAH CO.)	DRY CREEK

15

A floodway was not computed above U.S. Highway 91 because confining the floodwaters to a floodway would create a hazardous, high velocity flood in the residential and commercial developments located in the immediate vicinity. In this area the floodway for Dry Creek will be considered the same as the 100-year flood plain.

As shown on the Flood Insurance Rate Map, 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 Emergency Management Agency 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 City of Lehi.

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

Three reaches meeting the above criteria were required for the flooding sources of the City of Lehi. These included two on Dry Creek and one on Wastewater Ditch Diversion. 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 Emergency Management Agency 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 incorporated area of Lehi 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 A0:   Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no Flood Hazard Factors are determined.

Zones A1 and A5:   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 a 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.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Lehi 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 Emergency Management Agency.

6.0 OTHER STUDIES

The U.S. Army Corps of Engineers published a Flood Plain Information report for American Fork and Dry Creek in November 1969 (Reference 9). They derived the Intermediate Regional Flood and Standard Project Flood by routing synthetic thunderstorm hydrographs for these floods through the Dry Creek Dam.

A similar derivation for this study resulted in nearly identical flood peak values. This would be expected because there have been no significant additions to the hydrologic data available for Lehi since the U.S. Army Corps of Engineers report was completed in 1969.

Differences in computed depths of flooding are noted when compared with water-surface profiles in the Flood Plain Information report (Reference 9). In the area of the elementary school, depths of flooding differ as much as 2.9 feet. At cross section K, for example, the Flood Plain Information report gives a 100-year floodwater elevation of 4574. But as noted from aerial topographic maps (Reference 10), the minimum ground elevation at this section is approximately 4575. Computed profiles for this study show a depth of flooding in this area ranging from approximately 1.0 foot to 2.0 feet deep. Differences are also noted in reach length determinations. Due to the availability and use of recent topographic maps with scales of 1:2400 and 2-foot contour intervals (Reference 10), the computed profiles and depths of flooding for this study are more accurate than those used in the previously completed Flood Plain Information report.

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

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Emergency Management Agency, Regional Director, Insurance & Mitigation Division, Denver Federal Center, Building 710, Lakewood, Colorado 80225.

8.0 BIBLIOGRAPHY AND REFERENCES

1.   U.S. Department of Agriculture, Soil Conservation Service, Report on Floods in Dry Creek and Box Elder Canyons, Utah County, Utah, August 9, 1951

2.   ----------, American Fork-Dry Creek Watershed Flood Report, Flood of July 18, 1965, August 4, 1965

3. U.S. Water Resources Council, Hydrology Committee, Guidelines for Determining Flood Flow Frequency, Bulletin 17, March 1976

4. U.S. Department of the Interior, Bureau of Reclamation, Engineering and Research Center, Flood Flow Frequency Analysis Program Users Manual, February 1977

5. U.S. Department of the Interior, Bureau of Reclamation, Engineering and Research Center, Computation of Precipitation Frequency-Duration Values in the Western United States, March 1976

6. ------------, Engineering and Research Center, Flood Hydrograph by Unitgraph Procedure, November, 1975

7. ------------, Engineering and Research Center, Reservoir Routing by the Modified Puls Method, May 1977

8. Saxon, Fred C., "Sedimentation Study - Dry Creek Debris Basin," December 1969

9. U.S. Department of the Army, Corps of Engineers, Sacramento District, Flood Plain Information, American Fork and Dry Creek, American Fork and Lehi, Utah, November 1969

10. U.S. Department of the Interior, Bureau of Reclamation, Aerial Photographs: City of Lehi, Scale 1:2,400, Contour Interval 2 feet: Provo, Utah, November 1977

11. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, October 1973

12. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Map, Scale 1:24,000, Contour Interval 10 feet: Lehi, Utah (1951), Photorevised (1969)

13. ------------, Water-Supply Paper No. 1849, Roughness Characteristics of Natural Channels, 1967

U.S. Department of Agriculture, Soil Conservation Service, Rainfall Runoff Relations for Utah, Colorado, New Mexico, and Arizona

------------, Watershed Work Plan, American Fork-Dry Creek Watershed, Utah County, Utah, June 1958

U.S. Department of Commerce, National Weather Service, National Oceanic and Atmospheric Administration, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Vol. VI - Utah, 1973

U.S. Department of the Interior, Geological Survey, Computer Data File Printout, (Annual Flood Peak Records)

------------, Water Resources Data for Utah, Part 1, published annually

------------, Water Supply Paper No. 1684, Magnitude and Frequency of Floods in the United States, Part 10, the Great Basin, 1966

------------, Water Supply Paper Nos. 1927 and 2127, Surface-Water Supply of the United States, Part 10, The Great Basin

9.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original FIS was printed. Future revisions may be made that do not result in the republishing of the FIS report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Building and Planning Department, 99 West Main Street, Lehi City, Utah 84043.

9.1 First Revision

This study was revised on July 17, 2002, to incorporate new detailed flood hazard information for the Jordan River within the City of Lehi. It was also revised to incorporate updated corporate limits. The City of Lehi's annexation of land from Utah County is represented in this study, and was prepared in a quasi-countywide format. In this format, all flood hazard information for the City of Lehi, the City of Saratoga Springs, and the unincorporated areas of Utah County will be shown on the revised FIRM. The title block of the FIRM will indicate your community name, but the areas outside the corporate limits of your community will be shown for informational purposes only. The City of Saratoga Springs and the unincorporated areas of Utah County will receive their own separately published FIRMs.

Hydraulic analyses for the restudy of the Jordan River were carried out by Montgomery Watson for FEMA under Contract Number EMD-96-CO-0037.

The results of the restudy were reviewed at the final CCO meeting held on August 2, 2001. All problems raised at that meeting have been addressed in this restudy.

This quasi-countywide study involves the detailed study of the Jordan River, which flows through the unincorporated areas of Utah County and through the incorporated City of Lehi. This study also depicts the large amount of land area annexed by the City of Lehi from Utah County. These corporate limit changes are represented on the new FIRM panels.

As part of this quasi-countywide study, the profile panels for Dry Creek were re-lettered to provide a continuous flow as Dry Creek flows from within the City of Lehi, to the unincorporated areas of Utah County, again into the City of Lehi, and also again

into the unincorporated areas of Utah County. These profile panels are included with this FIS.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks (ERMs) and their descriptions are shown on the maps. ERMs shown on the FIRM represent those used during the preparation of this and previous Flood Insurance Studies. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and flood plain boundaries shown on the FIRM. Users should be aware that these ERM elevations may have changed since the publication of this FIS. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or flood plain management purposes.

Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

The NFIP encourages State and local governments to adopt sound flood plain management programs. To assist in this endeavor, each FIS provides 100-year flood plain data, which may include a combination of the following: 10-, 50-,100-, and 500-year flood elevations; delineations of the 100-year and 500-year flood plains; and 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or flood plain boundary determinations.

As part of this revision, the format of the map panels has changed. Previously, flood-hazard information was shown on both the Flood Insurance Rate Map and Flood Boundary and Floodway Map. In the new format, all base flood elevations, cross sections, zone designations, and flood plain and floodway boundary delineations are shown on the Flood Insurance Rate Map and the Flood Boundary and Floodway Map has been eliminated. Some of the flood insurance zone designations were changed to reflect the new format. Areas previously shown as numbered Zone A were changed to Zone AE. Areas previously shown as Zone B were changed to Zone X (shaded). Areas previously shown as Zone C were changed to Zone X (unshaded). In addition, all Flood Insurance Zone Data Tables were removed from the Flood Insurance Study report and all zone designations and reach determinations were removed from the profile panels.
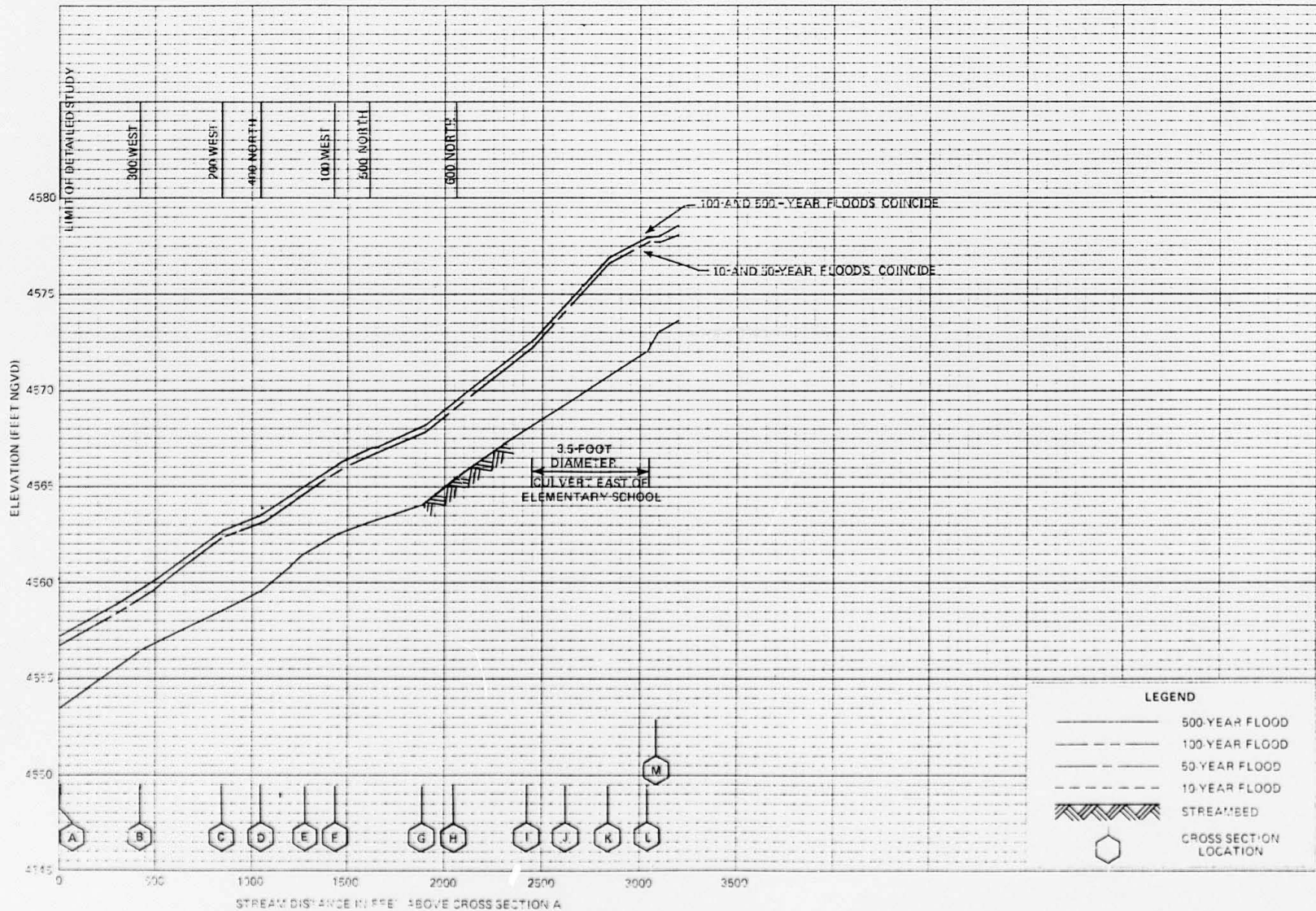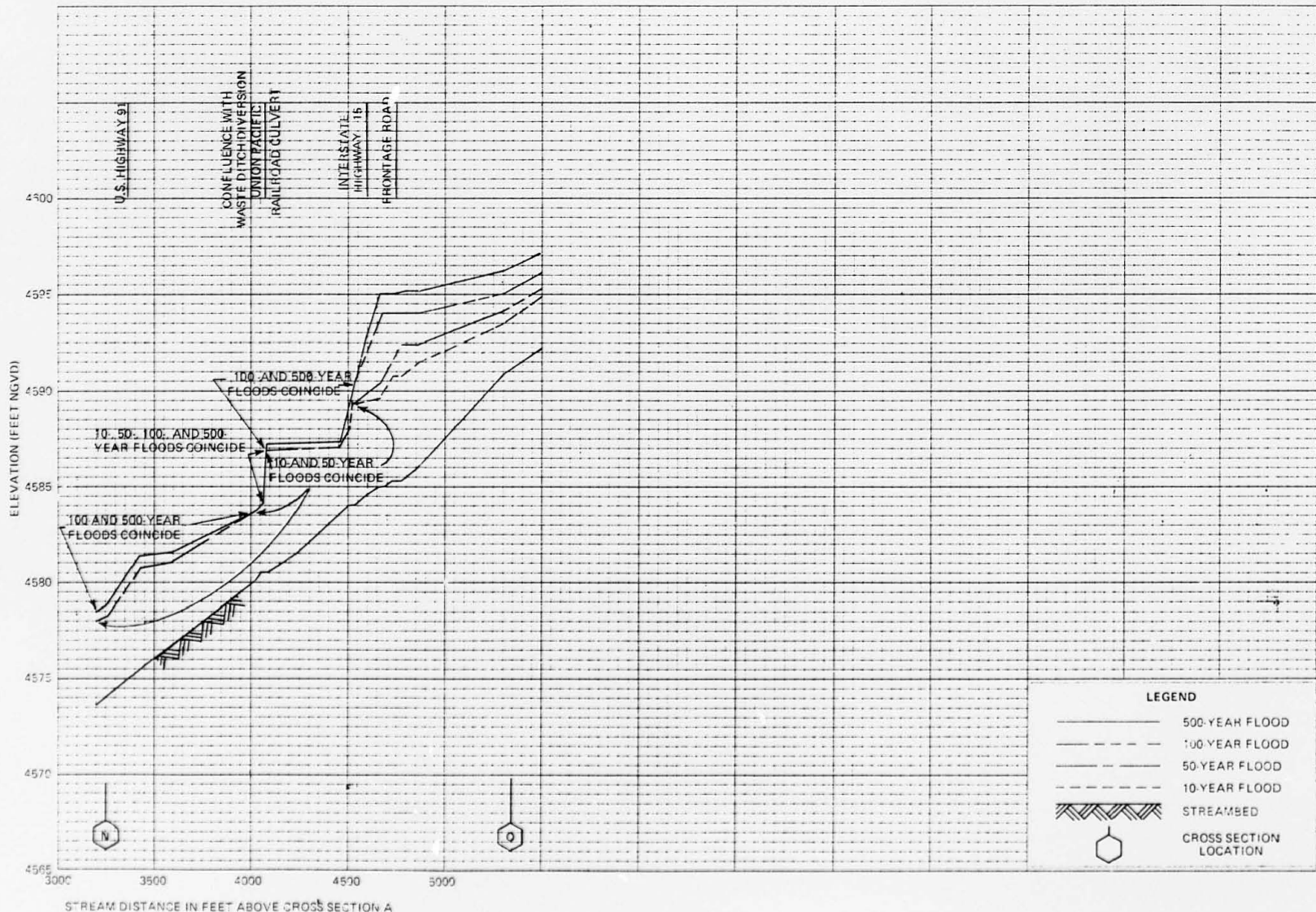
18

22

FLOOD PROFILES

DRY CREEK

CITY OF LEHI, UT
(UTAH CO.)

FEDERAL EMERGENCY MANAGEMENT AGENCY

01P

Flood Profiles — Dry Creek, City of Lehi, UT (Utah Co.)

ELEVATION (FEET NGVD)

Labels on profile:
- U.S. HIGHWAY 91
- CONFLUENCE WITH WASTE DITCH DIVERSION
- UNION PACIFIC RAILROAD CULVERT
- INTERSTATE HIGHWAY 15
- FRONTAGE ROAD
- 100- AND 500-YEAR FLOODS COINCIDE
- 10-, 50-, 100-, AND 500-YEAR FLOODS COINCIDE
- 10- AND 50-YEAR FLOODS COINCIDE
- 100- AND 500-YEAR FLOODS COINCIDE

STREAM DISTANCE IN FEET ABOVE CROSS SECTION A

LEGEND

——————	500-YEAR FLOOD
– – – –	100-YEAR FLOOD
————	50-YEAR FLOOD
– – – –	10-YEAR FLOOD
∿∿∿∿	STREAMBED
⬡	CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
(UTAH CO.)

FLOOD PROFILES

DRY CREEK

02P

FLOOD PROFILES

DRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
(UTAH CO.)

03P

3

FLOOD PROFILES

DRY CREEK

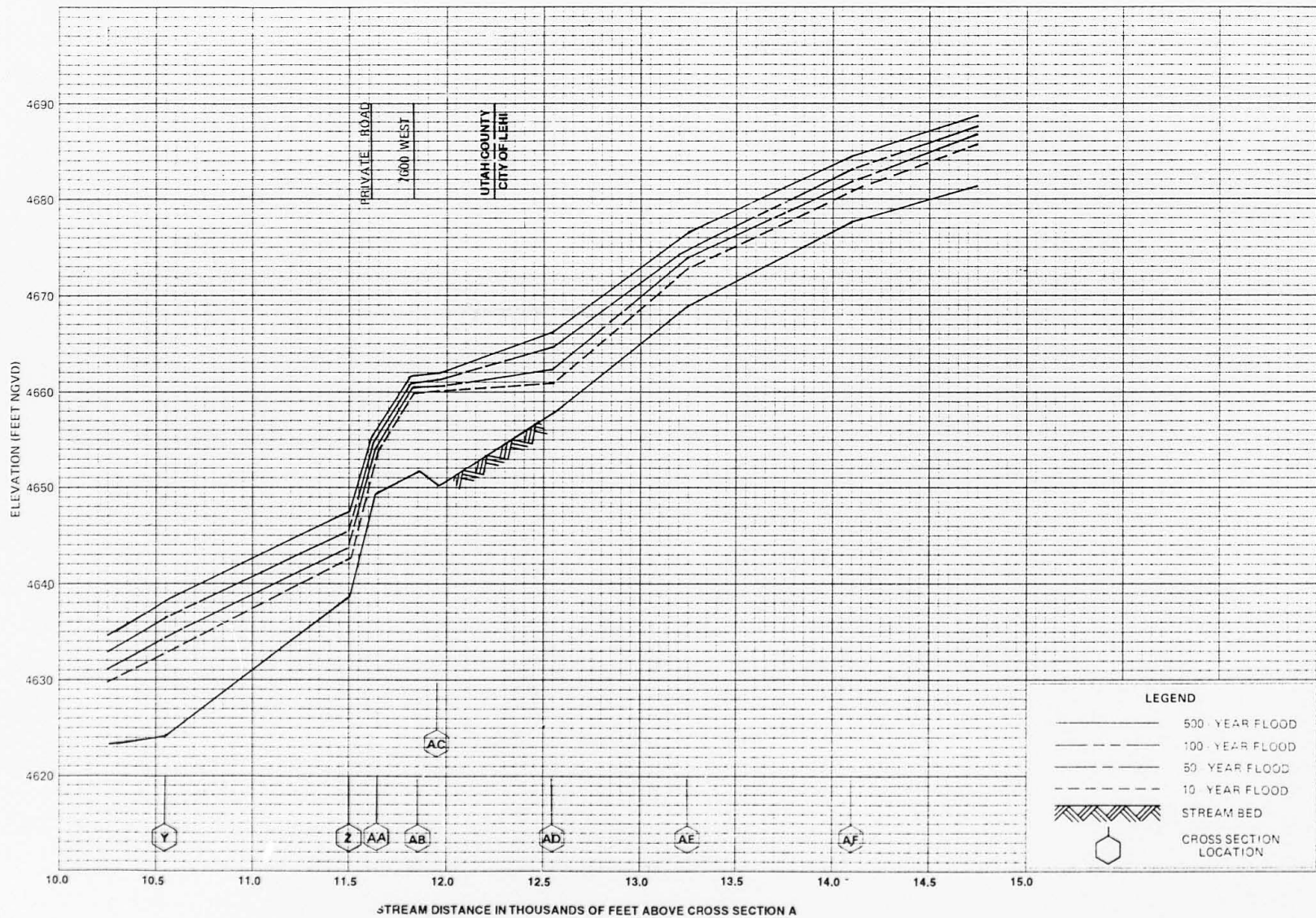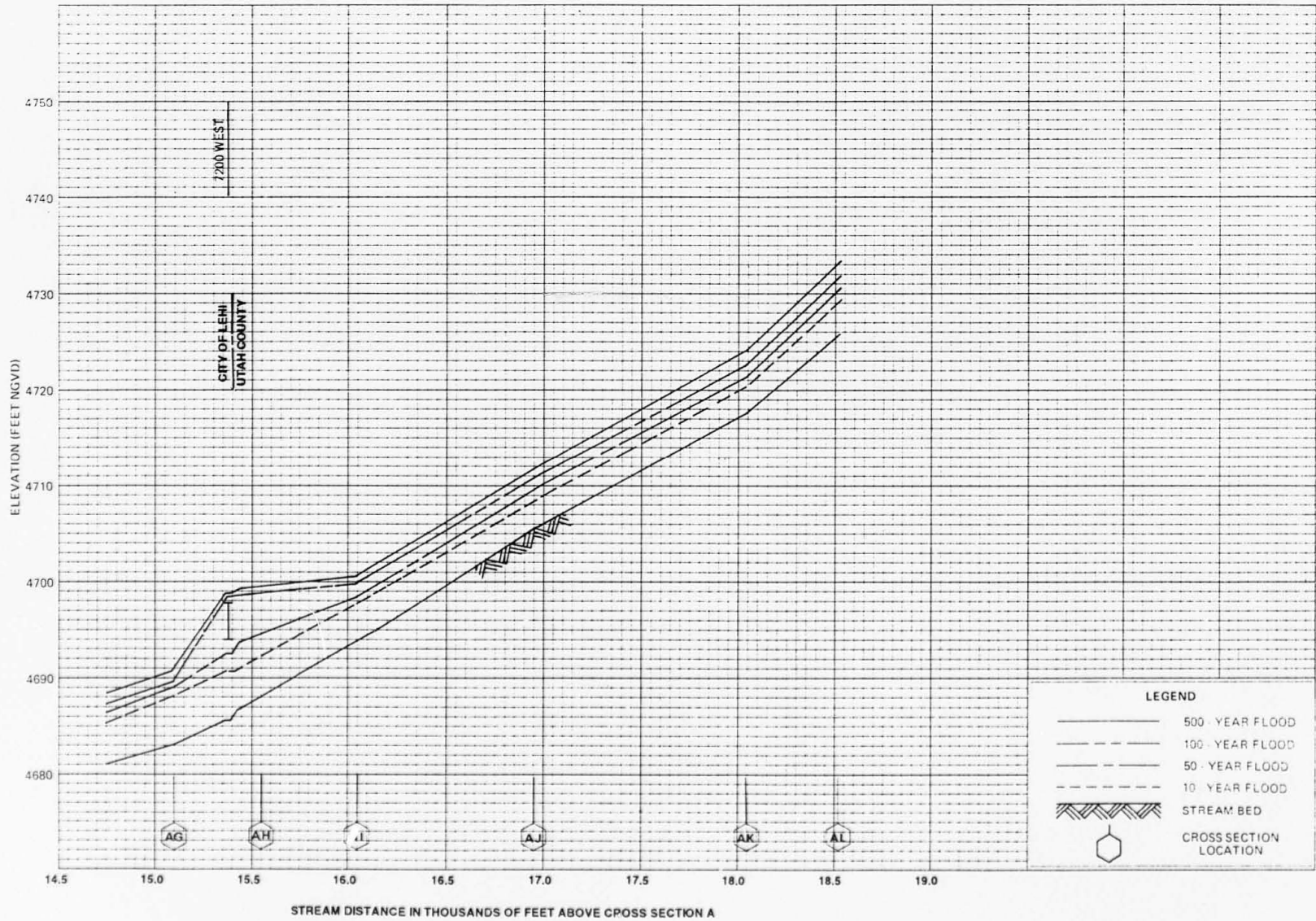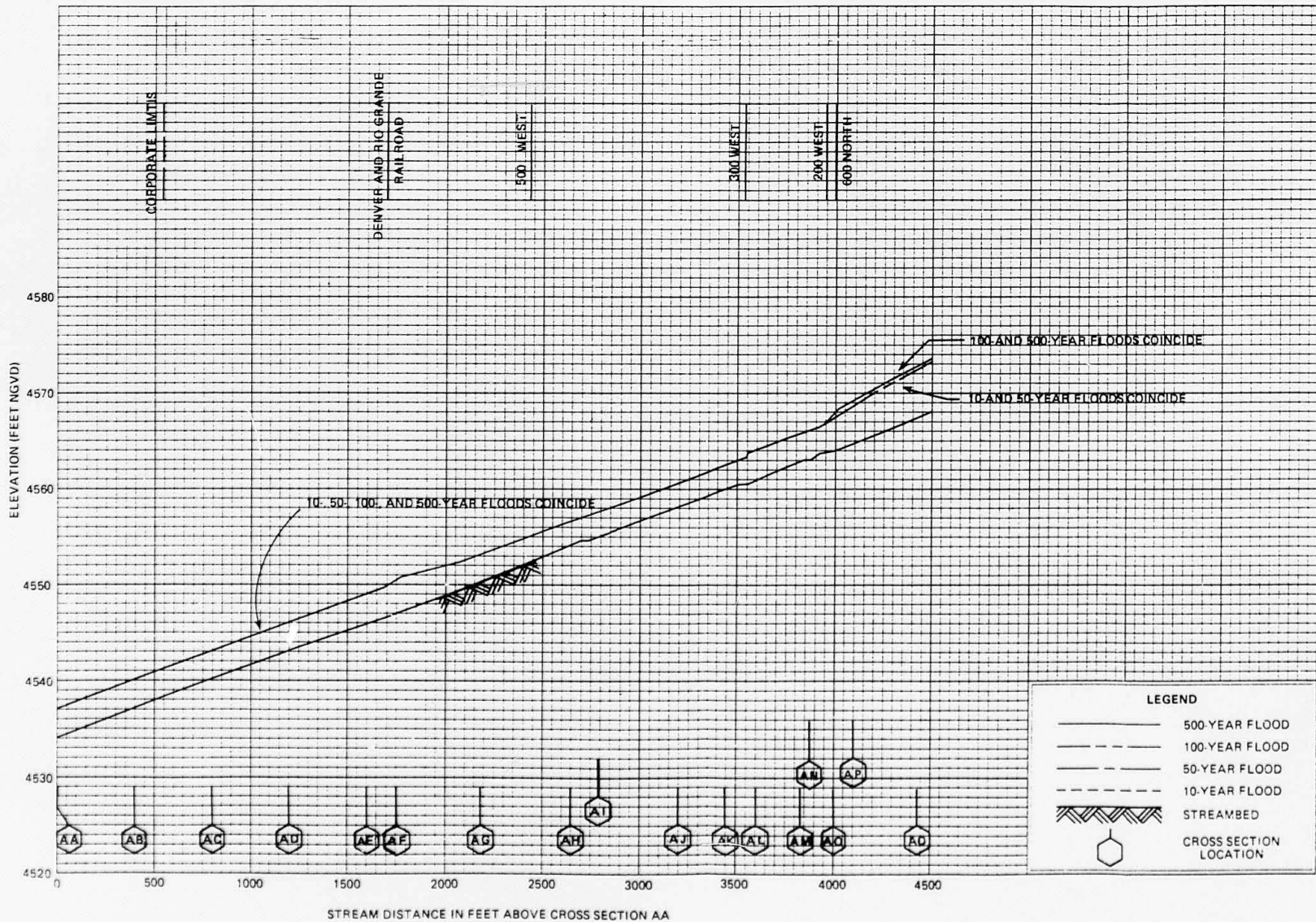FEDERAL EMERGENCY MANAGEMENT AGENCY
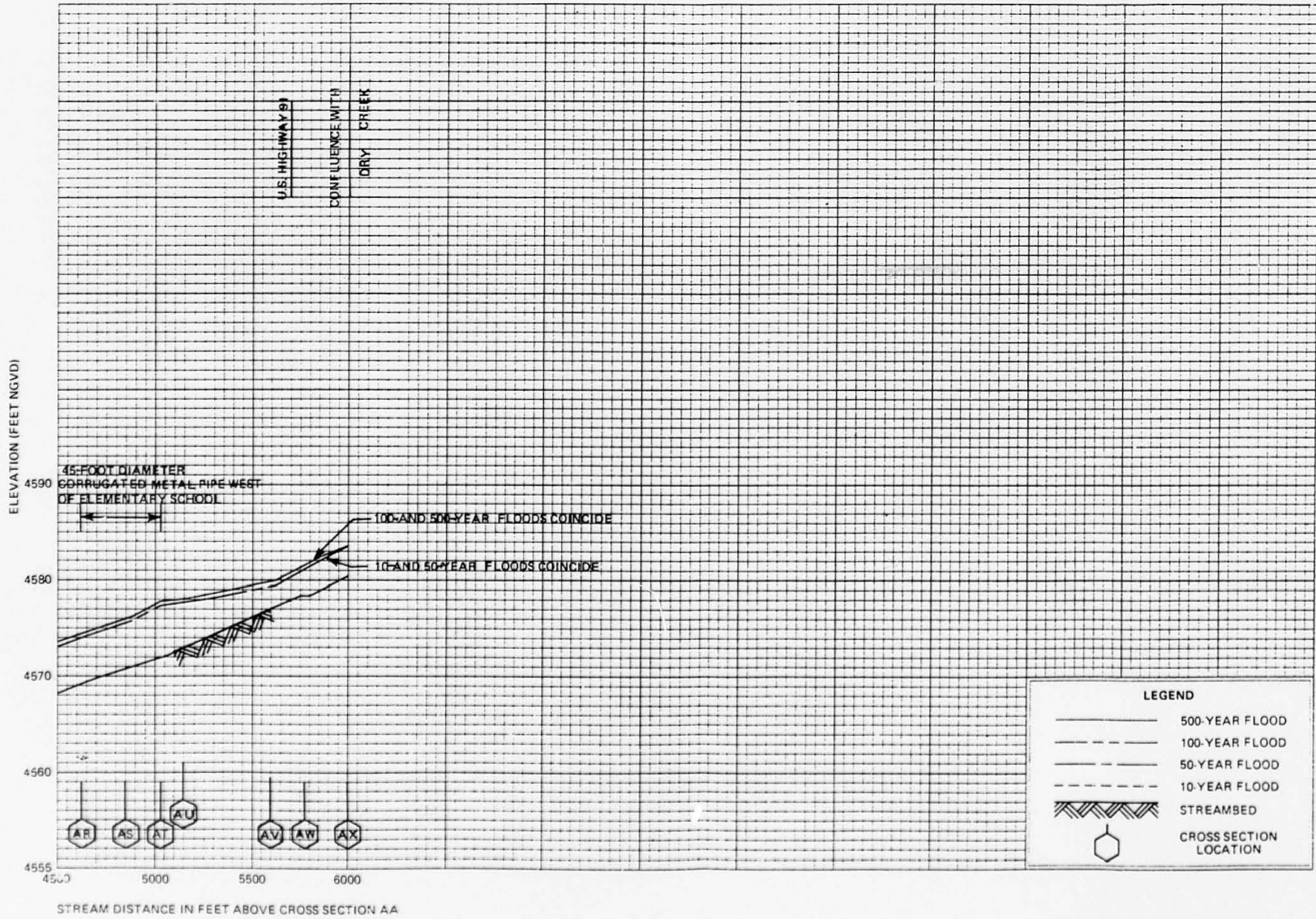
CITY OF LEHI, UT
(UTAH CO.)

04P

BEST COPY AVAILABLE

4

FLOOD PROFILES

DRY CREEK

ELEVATION (FEET NGVD)

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CROSS SECTION A

2200 WEST

CITY OF LEHI
UTAH COUNTY

LEGEND

——————— 500 - YEAR FLOOD
— — — — — 100 - YEAR FLOOD
————— 50 - YEAR FLOOD
– – – – – 10 - YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
(UTAH CO.)

05P

FLOOD PROFILES

WASTEWATER DITCH DIVERSION

FEDERAL EMERGENCY MANAGEMENT AGENCY
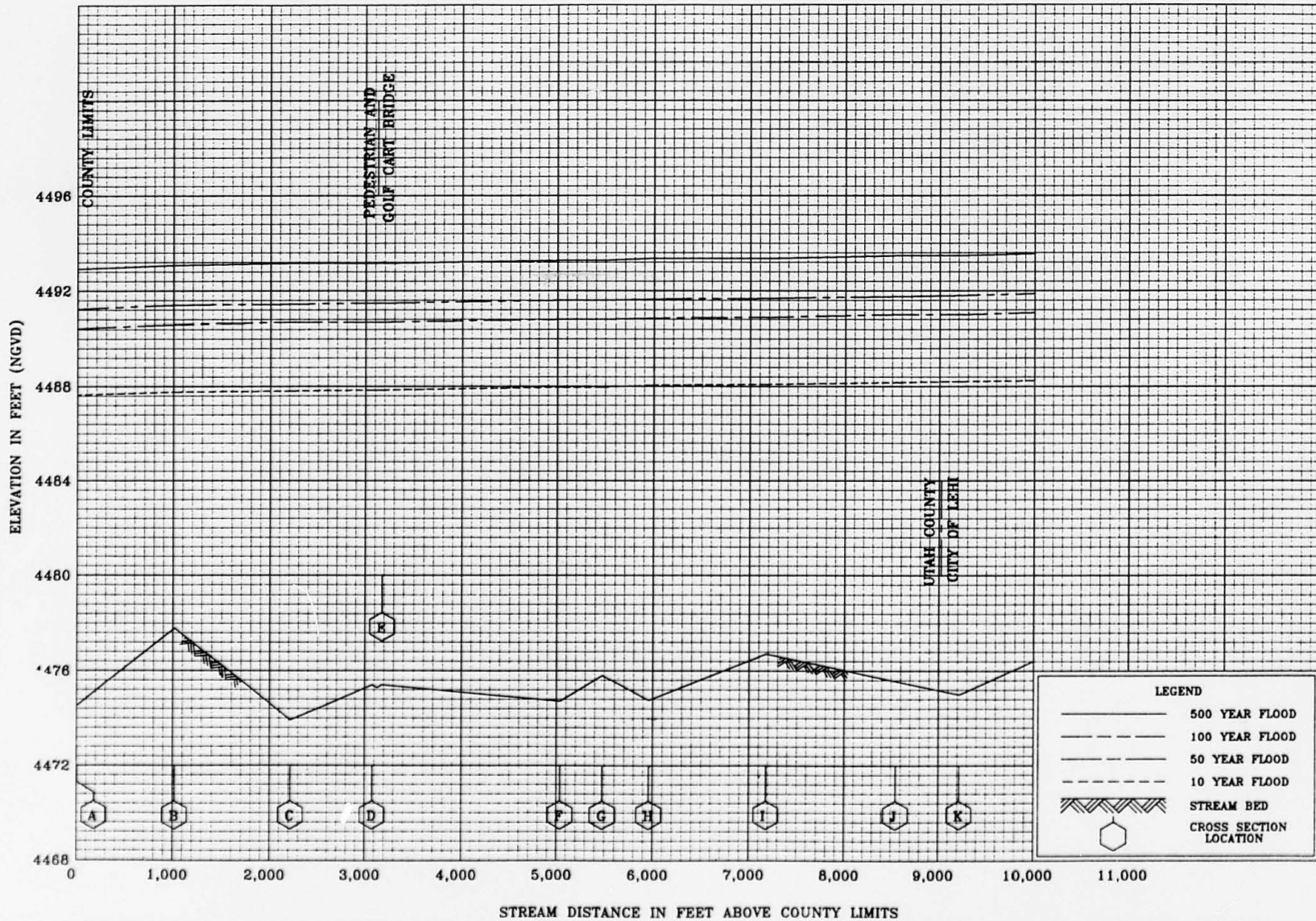
CITY OF LEHI, UT
(UTAH CO.)

06P

CORPORATE LIMITS

DENVER AND RIO GRANDE RAIL ROAD

500 WEST

300 WEST

200 WEST

600 NORTH

100 AND 500-YEAR FLOODS COINCIDE

10 AND 50-YEAR FLOODS COINCIDE

10-, 50-, 100-, AND 500-YEAR FLOODS COINCIDE

ELEVATION (FEET NGVD)

STREAM DISTANCE IN FEET ABOVE CROSS SECTION AA

LEGEND

500-YEAR FLOOD
100-YEAR FLOOD
50-YEAR FLOOD
10-YEAR FLOOD
STREAMBED
CROSS SECTION LOCATION

FLOOD PROFILES

WASTE WATER DITCH DIVERSION

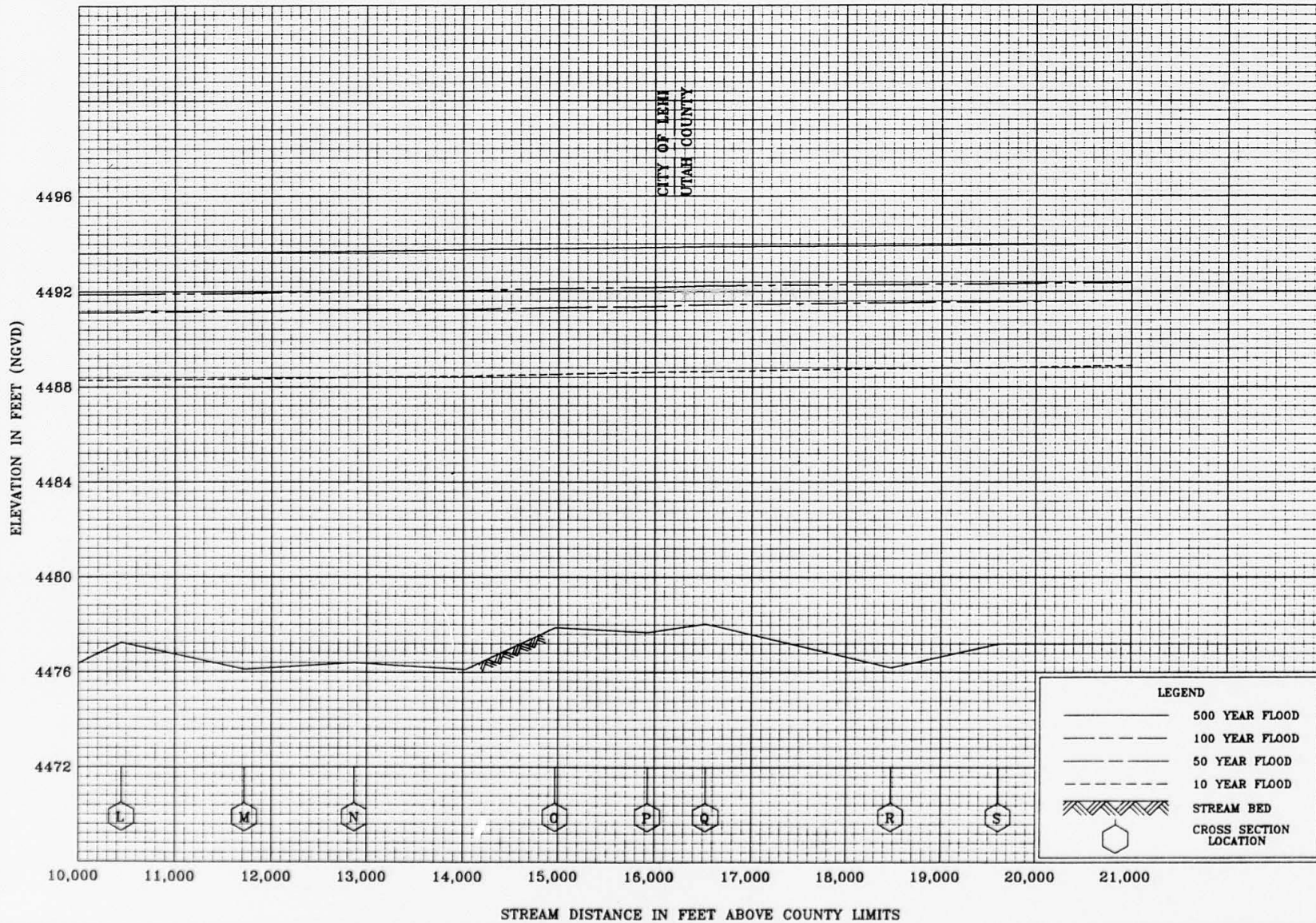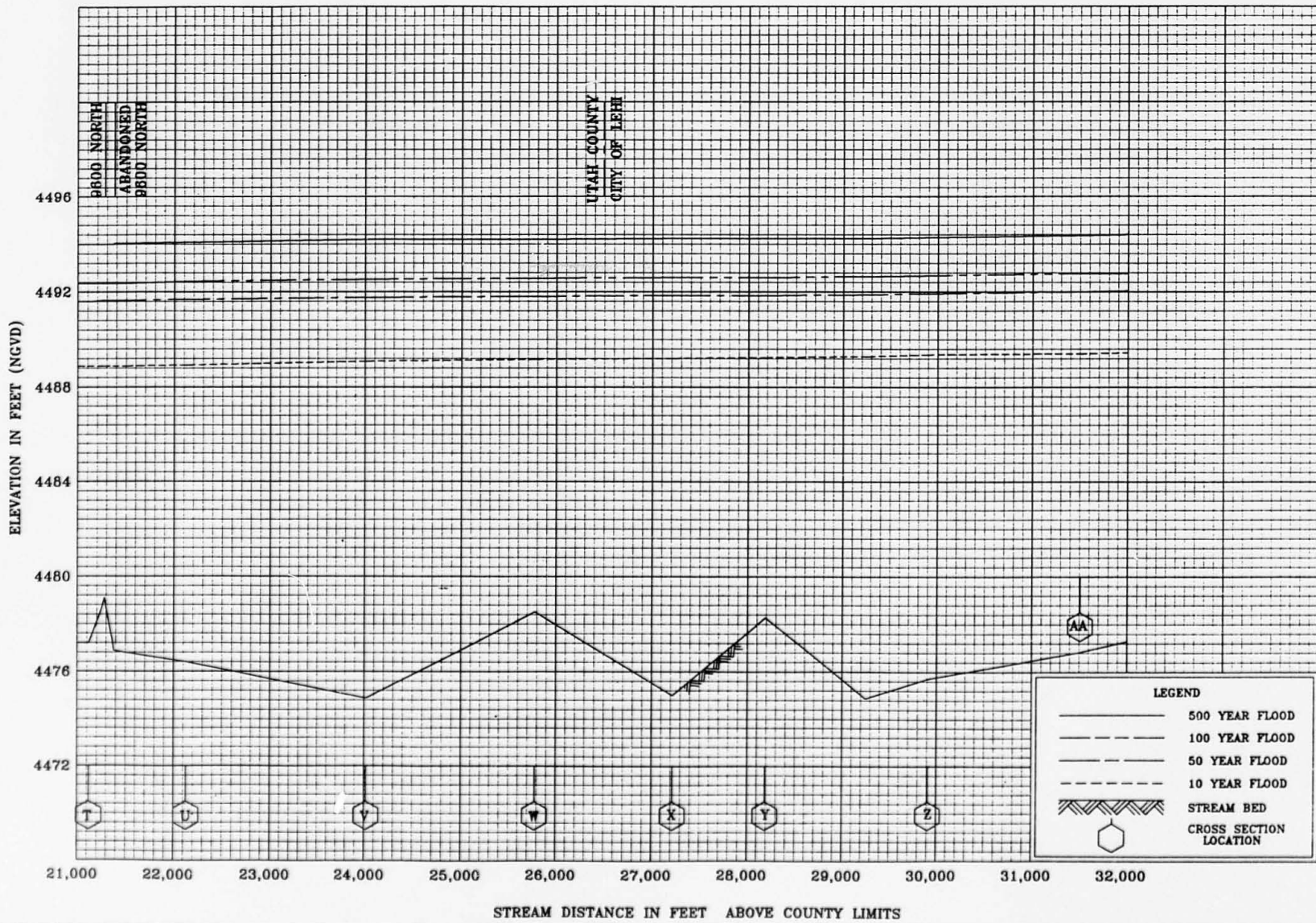FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
(UTAH CO.)

07P

FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT

(UTAH CO.)

08P

FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT
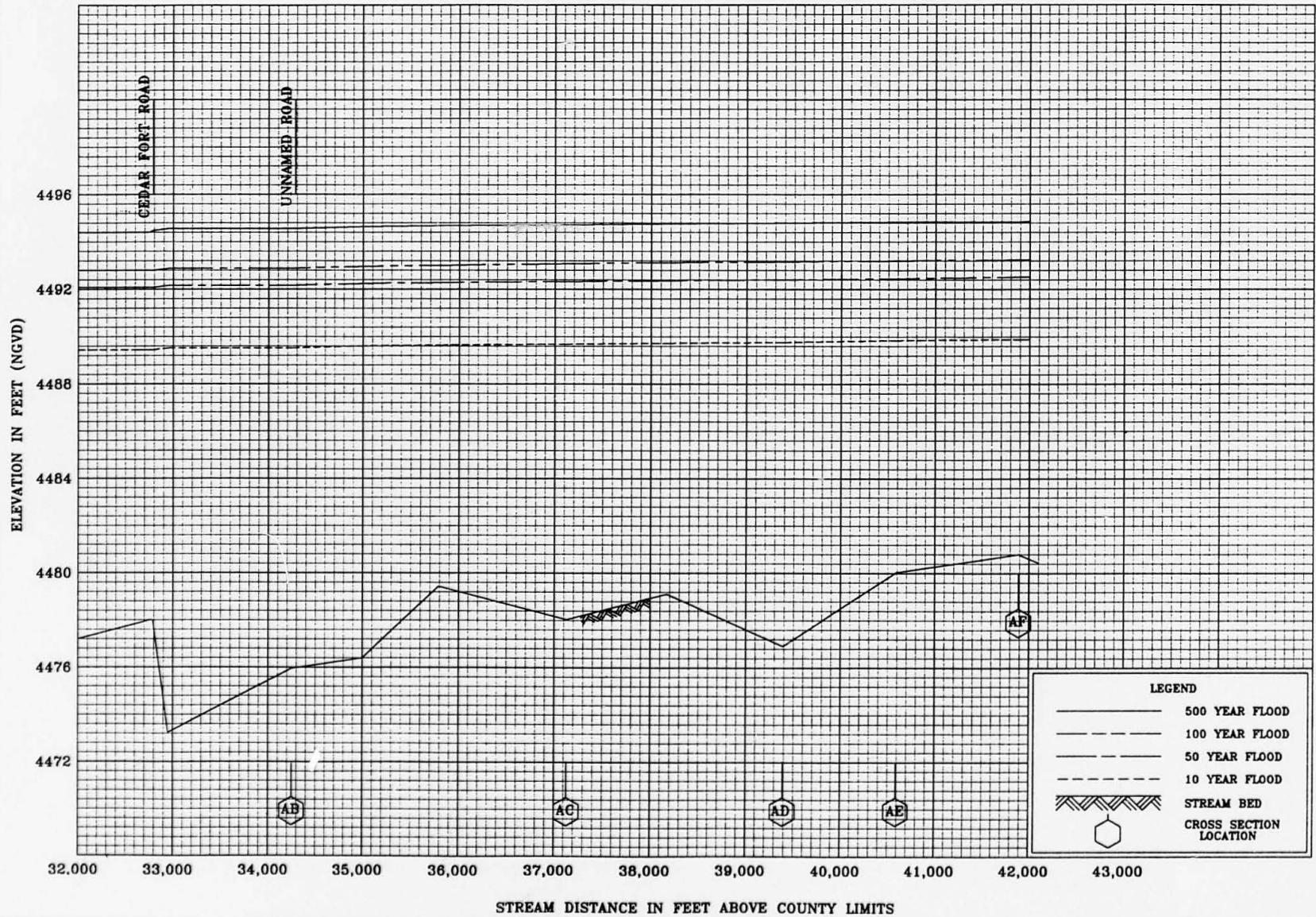
(UTAH CO.)

09P

FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
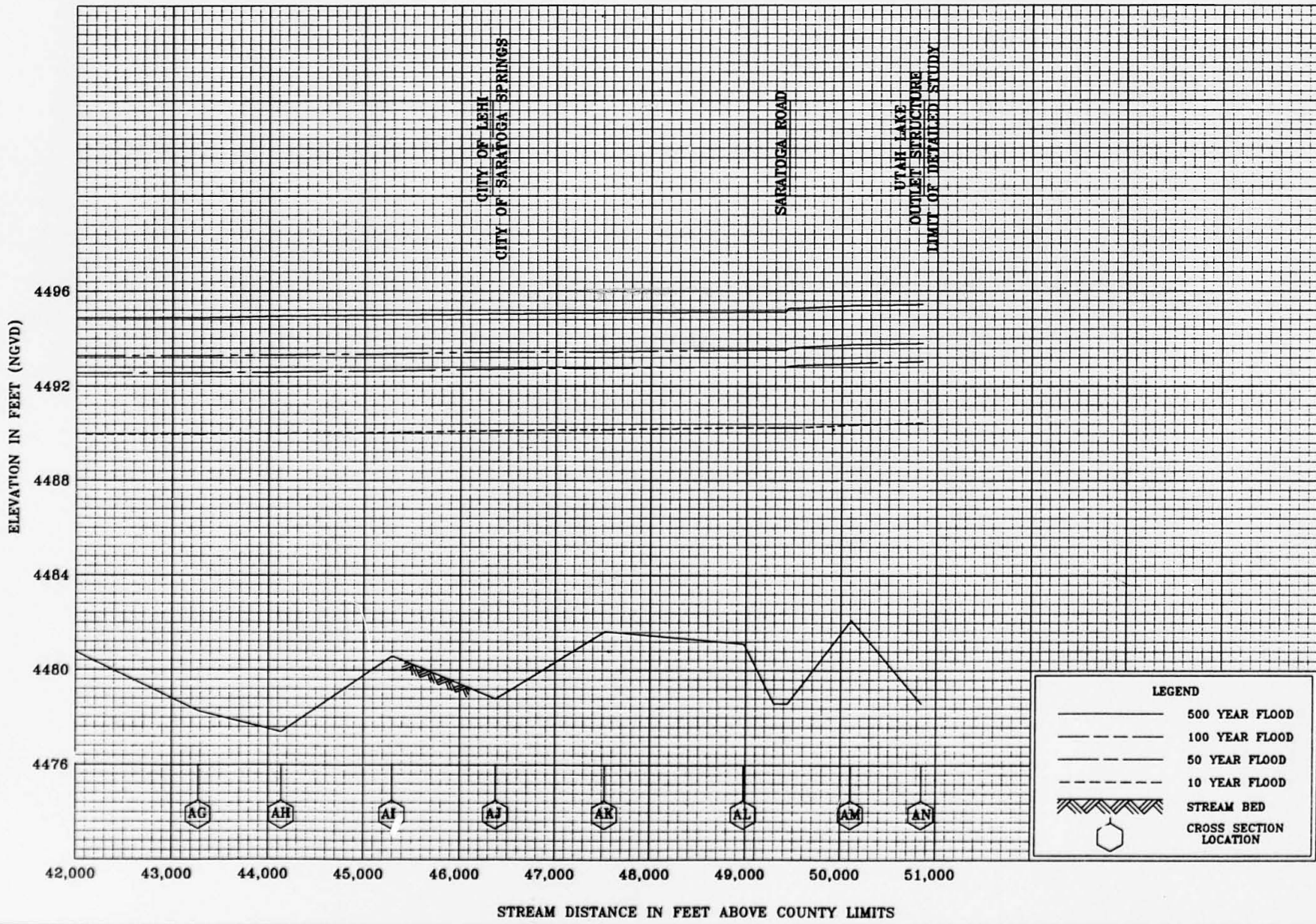
CITY OF LEHI, UT

(UTAH CO.)

10P

FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT

(UTAH CO.)

LEGEND

——————— 500 YEAR FLOOD

– – – – 100 YEAR FLOOD

——— — 50 YEAR FLOOD

- - - - - 10 YEAR FLOOD

WWWWW STREAM BED

⬡ CROSS SECTION LOCATION

ELEVATION IN FEET (NGVD)

STREAM DISTANCE IN FEET ABOVE COUNTY LIMITS

CEDAR FORT ROAD

UNNAMED ROAD

11P

FLOOD PROFILES

JORDAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LEHI, UT

(UTAH CO.)

12P

BEST COPY AVAILABLE