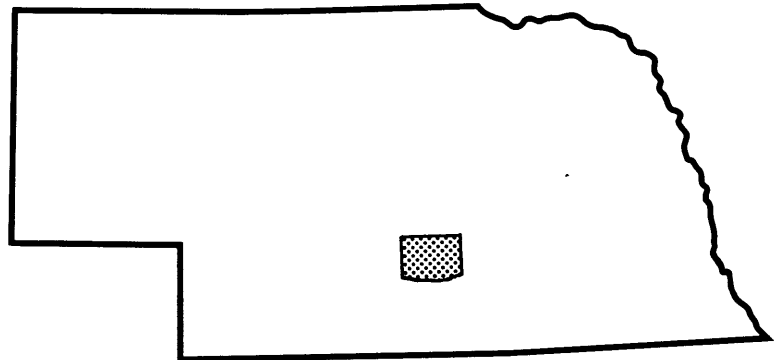


FLOOD INSURANCE STUDY



**CITY OF KEARNEY,
NEBRASKA**
BUFFALO COUNTY



JANUARY 5, 1984



Federal Emergency Management Agency

COMMUNITY NUMBER - 310016

TABLE OF CONTENTS

	<u>Page</u>
1.0 <u>INTRODUCTION</u>	1
1.1 Purpose of Study	1
1.2 Authority and Acknowledgements	1
1.3 Coordination	1
2.0 <u>AREA STUDIED</u>	2
2.1 Scope of Study	2
2.2 Community Description	2
2.3 Principal Flood Problems	5
2.4 Flood Protection Measures	6
3.0 <u>ENGINEERING METHODS</u>	6
3.1 Hydrologic Analyses	7
3.2 Hydraulic Analyses	8
4.0 <u>FLOOD PLAIN MANAGEMENT APPLICATIONS</u>	11
4.1 Flood Boundaries	11
4.2 Floodways	11
5.0 <u>INSURANCE APPLICATION</u>	18
5.1 Reach Determinations	18
5.2 Flood Hazard Factors	18
5.3 Flood Insurance Zones	18
5.4 Flood Insurance Rate Map Description	19

TABLE OF CONTENTS (Continued)

	<u>Page</u>
6.0 <u>OTHER STUDIES</u>	21
7.0 <u>LOCATION OF DATA</u>	21
8.0 <u>REFERENCES AND BIBLIOGRAPHY</u>	21

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	12

TABLES

Table 1 - Summary of Discharges	9
Table 2 - Floodway Data	13
Table 3 - Flood Insurance Zone Data	20

EXHIBITS

Flood Profiles

Platte River	Panels 01P - 03P
North Channel Platte River	Panels 04P - 08P
Wood River	Panels 09P - 10P
Glenwood Park Creek	Panels 11P - 13P
Kearney Canal	Panels 14P - 15P

Flood Boundary and Floodway Map Index

Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF KEARNEY,
BUFFALO COUNTY, NEBRASKA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Kearney, Buffalo County, Nebraska, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Kearney to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), the Study Contractor, for the Federal Emergency Management Agency, under Inter-Agency Agreement No. (IAA)-H-9-79, Project Order No. 38, Amendment No. 3. This study was completed in April 1982.

1.3 Coordination

The identification of streams requiring detailed study was accomplished through joint agreement among personnel of the COE, FEMA, and the City of Kearney. Information necessary for developing a community base map was obtained from the City of Kearney.

The time and cost meeting was held on April 25, 1979 at Kearney City Hall. This meeting also met the requirements of an initial coordination meeting. The meeting outlined the forthcoming study to local officials and provided information to the COE for submitting a time and cost estimate to perform the study. Representatives from the COE, FEMA, and the City of Kearney were in attendance.

On June 14, 1983, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Kearney, Buffalo County, Nebraska and the extraterritorial zoning limits extending outward a distance of 2 miles from the Kearney corporate limits. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through April 1987.

The following flooding sources were studied by detailed methods:

- a. The Platte River, within the corporate limits and its extraterritorial limits, approximately 6.25 miles;
- b. The North Channel Platte River, within the corporate limits and its extraterritorial limits; approximately 9.1 miles;
- c. The Wood River, from about 1.14 miles downstream of County Highway 40-E to about 0.66 mile upstream of State Highway 10;
- d. Glenwood Park Creek, from the extraterritorial limits near its confluence with the Wood River to a point 0.29 mile upstream of 56th Street, approximately 5.9 miles;
- e. Kearney Canal, from its confluence with the North Channel Platte River to a point approximately 1.0 mile downstream of County Road 52-A, approximately 5.9 miles; and,
- f. North Dry Creek Ditch, from its confluence with the Platte River to a point just downstream of the confluence of Whiskey Slough, approximately 0.8 mile.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Kearney.

Airport Draw was studied by approximate methods, from the Kearney Municipal Airport to its most downstream crossing of 56th Street, a distance of about 5.0 miles.

2.2 Community Description

The City of Kearney is located in southern Buffalo County in central Nebraska. Kearney is completely surrounded by unincorporated Buffalo County with a portion of the extraterritorial limits located in Kearney County. Kearney, which had a 1980 population of 21,158, is the county seat of Buffalo County (Reference 1). Kearney is heavily irrigated with many

irrigation wells and several irrigation canals. Industries include cattle feeding, irrigation products, grain drying equipment, alfalfa processing, pharmaceutical products, and other various manufactured goods. Recreational facilities such as a fairground, a golf course, parks, tennis courts, a swimming pool, and baseball and horseshoe playfields are available. Educational facilities in Kearney include Kearney State College and elementary and high schools. Kearney is served by newspaper, radio, and commercial television facilities. Major thoroughfares are Interstate Highway 80, U.S. Highway 30, and State Highways 10 and 44. The main line of the Union Pacific Railroad and an airport also serve the community.

The climate in the Kearney area is subhumid and continental, with cold winters and hot summers. The mean annual rainfall is 24.6 inches. The mean January temperature is 22.8 degrees Fahrenheit (F.) and the mean July temperature is 76.3 degrees F. (Reference 2). Topography in the area ranges from the flat Platte River valley in the Kearney vicinity to steep rolling hills in the upstream portion of Glenwood Park Creek and the Wood River watersheds. Vegetation ranges from trees and brush along the streams to cultivated crops in level areas and grassland in hilly areas.

Surface soils range from clays to loam to gravels in the Platte River valley to silt loam in the upstream portion of the tributary watersheds. The soils are generally moderately slowly permeable and the hilly area is highly erodible (Reference 3).

Airport Draw begins in the northern part of Kearney and flows in an easterly direction past the Kearney Municipal Airport to its confluence with the Wood River five miles northeast of Kearney. It has a drainage area of about 5.3 square miles, and elevations in the basin range from about 2,250 feet to 2,115 feet. Flood plain uses in the study area are primarily agricultural, except for the area near the Kearney Municipal Airport.

Glenwood Park Creek, a right bank tributary of the Wood River, has a drainage area of about 5.3 square miles. Its headwaters adjoin the City of Kearney along the north and west city limits, and it flows in a northeasterly direction. Its confluence with the Wood River is located approximately 4 miles north of Kearney. Elevations in the basin range from about 2,300 feet to 2,140 feet. Flood plain uses in the study area are primarily agricultural, except for some residential development near State Highway 10.

Kearney Canal begins approximately 2 miles southeast of the City of Elm Creek where a dam on the Platte River diverts water into Kearney Canal. It flows in an easterly direction and is used to supply water for irrigation, power production, and to maintain pool levels at Cottonmill Lake and Lake Kearney. From Lake Kearney, Kearney Canal flows in a southerly direction to its confluence with the North Channel Platte River at a location 1 mile southwest of Kearney. There is an area of about 3.3 square miles in the Cottonmill Lake Area which contributes runoff to a flood on Kearney Canal. Elevations in this area range from about 2,350 feet to 2,150 feet. Flood plain uses in the study area are primarily agricultural, except for residential and commercial development near Kearney.

The North Channel Platte River is a former side channel of the Platte River. The Interstate Highway 80 embankment has eliminated the connection with the Platte River at the upstream end of the North Channel Platte River. The North Channel Platte River now begins 2 miles southwest of Odessa and flows in an easterly direction to its confluence with the Platte River at a location 4 miles east of Kearney. Elevations in the study reach range from about 2,215 feet to 2,110 feet. Flood plain uses in the study area are primarily agricultural, with some intensive commercial development near State Highway 44 at Kearney.

North Dry Creek Ditch is a right bank tributary of the Platte River and has a contributing drainage area of about 40 square miles. It begins 20 miles southwest of Kearney and flows northeasterly to its confluence with the Platte River 1 mile upstream of State Highway 44. Elevations in the basin range from about 2,300 feet to 2,150 feet. Flood plain uses in the study area are primarily agricultural.

The Platte River begins in west-central Nebraska just east of the City of North Platte at the junction of the North and South Platte Rivers. From that point the Platte River flows southeastward approximately 95 miles to Kearney on the way to its confluence with the Missouri River south of Omaha. Elevations in the basin range from over 14,000 feet at the headwaters in the Rocky Mountains to approximately 2,140 feet near Kearney. The drainage area of the Platte River at Kearney is approximately 62,100 square miles. The Platte River flood plain near Kearney is utilized primarily for agricultural activities, with some commercial development near State Highway 44.

The Wood River, a left bank tributary of the Platte River, has a drainage area of about 466 square miles at Kearney. It begins in Custer County, Nebraska and flows in a southeasterly direction to its confluence with the Platte River near Grand Island. Elevations in the basin range from about 2,800 feet to 2,120 feet near Kearney. Flood plain uses in the study area are primarily agricultural with scattered residential development.

2.3 Principal Flood Problems

Kearney lies along the edge of the Platte River valley. Flooding along this reach of the Platte River occurs predominately as a result of heavy snowmelt, major heavy rainstorms in the west, or a combination of both. Ice effects can also aggravate the flood problem. Flooding along the Platte River is normally of long duration with ample warning prior to the peak. Flooding on Airport Draw, Glenwood Park Creek, Kearney Canal, the North Channel Platte River, North Dry Creek Ditch, and the Wood River can result from heavy rainfall on a relatively local basis, creating short duration flooding with relatively little warning.

Historical floods occurred on the Platte River in this reach in June 1935, May 1947, June 1949, June 1965, June 1971, and May 1973. The maximum flood discharge at the U.S. Geological Survey (USGS) stream gage at Odessa, Nebraska, west of Kearney, was 22,700 cubic feet per second (cfs) on June 24, 1947. The second highest discharge occurred on May 31, 1973, with a

discharge of 18,500 cfs at Odessa. Historically, upstream flood runoff from the North and South Platte Rivers has been attenuated considerably as it travels downstream. USGS stream gaging records at Odessa indicate several years in which the Platte River stages were affected by ice. Floods along the Platte River in central Nebraska have not caused significant damages as the channel is wide and can accommodate most high flows with moderate increases in stage (Reference 4).

On the Wood River, the only major flood of record occurred on June 21 to 22, 1947. Over 53,000 acres were flooded following a heavy rainstorm over the watershed (Reference 5). Crops, livestock, and transportation facilities were damaged.

There are few flood records for Airport Draw, Glenwood Park Creek, Kearney Canal, the North Channel Platte River, and North Dry Creek Ditch. On these streams, flood discharges decrease as floodwaters leave the hills and uplands and enter the flat Platte River valley. Flood drainage is slow in the Platte valley due to the flat terrain.

2.4 Flood Protection Measures

Several dams and reservoirs are located on the North Platte River and South Platte River basins. Of these, the major reservoirs in the North Platte River basin contributing to flood peak reduction to some extent on the Platte River at Kearney are Seminoe near St. Clair, Wyoming; Pathfinder near Alcova, Wyoming; Alcova at Alcova, Wyoming; Glendo near Glendo, Wyoming; Guernsey near Guernsey, Wyoming; and, Lake McConaughy near Keystone, Nebraska. The major reservoirs in the South Platte River basin contributing flood peak reduction to some extent on the Platte River at Kearney are Elevenmile Canyon near Lake George, Colorado; Cheesman Lake near Deckers, Colorado; Cherry Creek near Denver, Colorado; Chatfield near Denver, Colorado; and, Bear Creek near Morrison, Colorado. In addition to these reservoirs, irrigation diversions on the North Platte River, the South Platte River, and the Platte River contribute to flood peak reduction to some extent. Small reservoirs have been constructed by the U.S. Department of Agriculture, Soil Conservation Service (SCS) and Central Platte Natural Resources Division in the Glenwood Park Creek, North Dry Creek Ditch, Kearney Canal and the Wood River basins. Only Cottonmill Lake, located along Kearney Canal, provides significant reduction of flood flows on those streams in the Kearney study reach.

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 equaled 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 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 equaled 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 exceedence) 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 herein 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 flooding source studied in detail affecting the community.

The discharge-probability relationships for the Platte River and Wood River at Kearney are based on the report entitled, "Report on the Platte River Basin, Nebraska, Level B Study, Flood Damage and Control Technical Paper" (Reference 4). Six gaging stations on the upper Platte River with more than 15 years of record each were the principal sources of data for defining these relationships. The gaging records were analyzed statistically utilizing procedures in "A Uniform Technique for Determining Flood Flow Frequencies" (Reference 6). The flood peak discharge-frequency relationships at any given point on the upper Platte River were interpolated between the gaging stations on the basis of river mileage. The 500-year flood discharge was extrapolated from the 10-, 50-, and 100-year flood discharges developed in the Level B study.

The discharge-probability relationships for Airport Draw, Glenwood Park Creek, Kearney Canal, and North Dry Creek Ditch were developed using the Environmental Protection Agency's Storm Water Management Model (SWMM) (Reference 7). Rainfall data were selected using the National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NWS HYDRO-35 (Reference 8). A soil infiltration rate of 0.2 inch per hour was used for pervious areas. Impervious areas and surface storage values were left at the default values in the SWMM program. On Kearney Canal, SWMM was used in combination with reservoir flood routing methods to determine the outflow from Cottonmill Lake for the various flood events.

Since flow from the Platte River into the North Channel Platte River has been blocked by the Interstate Highway 80 embankment, the discharge-probability relationships for the North Channel Platte River were based upon the assumption that peak discharges on the North Channel Platte River would result from runoff from the 74 square mile Elm Creek basin that is a tributary to the Platte River approximately 14 miles upstream from Kearney. The 100-year hydrograph for Elm Creek at the mouth was developed from the hydrologic studies done on the Buffalo Creek and Spring Creek basins as part of the Flood Insurance Study for Lexington, Nebraska (Reference 9). The hydrograph was routed downstream to the study reach of the North Channel Platte River near Kearney.

Discharges decrease going downstream on the North Channel Platte River, the Wood River, and Glenwood Park Creek due to storage in the flood plain. On Kearney Canal, discharges decrease downstream of Cottonmill Lake due to storage in the lake.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Topographic data used in the approximate analysis for Airport Draw were obtained from USGS 7.5 minute quadrangle mapping at a scale of 1:24000 and contour intervals of 5 and 10 feet (Reference 10). Additional topographic mapping covering the remainder of the study area was obtained at a scale of 1:4800 with a contour interval of 4 feet (Reference 11). Aerial photography for these maps was taken in May and June 1980. Cross section data were determined from this mapping by photogrammetric methods. The streambed is actually the low water profile on the date of photography. The hydraulic computations for the Platte River considered this fact. USGS 7.5 minute quadrangle mapping at a scale of 1:24000 with contour intervals of 5 and 10 feet was also available for all streams in the study area (Reference 10).

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

Roughness coefficients (Manning's "n") for the streams were determined by field inspection, aerial photographs, and ground photographs. Manning's "n" values for the Platte River channel were verified by matching the computed water-surface elevations with high water marks of the May-June 1973 flood and the June 1971 flood. The general shape of the elevation-discharge relationship for the Platte River was verified by comparing it with data collected at the USGS stream gaging station on the Platte River at Odessa. Data were not available for calibration of roughness values on the other streams studied. The following table lists the roughness values used for all streams.

Manning's "n" Values

<u>Stream</u>	<u>"n" Values</u>	
	<u>Channel</u>	<u>Overbank</u>
Glenwood Park Creek	0.045 - 0.65	0.05 - 0.10
Kearney Canal	0.025 - 0.035	0.06
North Channel Platte River	0.04 - 0.045	0.065 - 0.12
North Dry Creek Ditch	0.025 - 0.03	0.06
Platte River	0.035	0.065 - 0.10
Wood River	0.07	0.10

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u>	<u>PEAK DISCHARGES (CFS)</u>			
	<u>SQ MILES</u>	<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
GLENWOOD PARK CREEK					
At mouth	5.3	1,700	2,900	3,700	5,200
State Highway 10	4.6	1,750	3,050	3,850	5,400
Upstream Limit	2.3	1,500	2,650	3,350	4,600
KEARNEY CANAL					
At mouth	N/A	700	700	700	700
Downstream of Cottonmill Lake	N/A	700	700	700	700
At Cottonmill Lake	N/A	700	1,270	2,010	3,420
Upstream of Cottonmill Lake	N/A	700	700	700	700
Upstream Limit	N/A	700	700	700	700
NORTH CHANNEL PLATTE RIVER					
At mouth	N/A	1,500	2,000	2,300	3,500
At mouth of Kearney Canal	N/A	1,500	2,000	2,500	3,800
Upstream Limit	N/A	1,800	2,400	3,000	4,600
NORTH DRY CREEK DITCH					
Study Reach	40	1,850	3,150	3,800	5,500
PLATTE RIVER					
At Kearney	62,100	15,200	26,700	32,200	50,000
WOOD RIVER					
Downstream Limit	466	2,600	5,650	7,500	13,000
Upstream Limit	415	2,670	6,150	8,300	14,000

Water-surface profiles for streams studied by detailed methods were developed using the COE back-water computer program, HEC-2 (Reference 12). Starting water-surface elevations for the Platte River and the Wood River were based on normal depth. Starting water-surface elevations on Glenwood Park Creek, Kearney Canal, the North Channel Platte River, and North Dry Creek Ditch were based on rating curves developed at the mouth of these streams. Bridge sections were field surveyed. Bridge head losses on all streams were determined using the normal bridge routine in HEC-2.

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

The 100-year flood from the Platte River does not overtop Interstate Highway 80 within the study reach of this Flood Insurance Study. However, because of drainage structures through the Interstate Highway 80 embankment, some 100-year floodwater will be able to pass through the embankment to the north side of the highway. Because the flood plain north of the highway embankment is relatively wide and flat, the assumption was made that any 100-year floodwater from the Platte River in this area would be less than 1 foot in depth. This area was designated as Zone B unless it was flooded by the North Channel Platte River. On the North Channel Platte River, upstream from County Road X, there is no well-defined channel area and the 100-year flood in this wide and flat area will cause shallow flooding. This area was therefore designated as Zone AH, with base flood elevation lines showing elevations of the 100-year flood.

Kearney Canal and North Dry Creek Ditch within the Kearney area are streams in which the flood plain adjacent to the creeks is higher than at distances farther from the creeks. Because of this and the broad, flat flood plain, floodflows which escape the creek channel flow at shallow depths and at elevations which are independent of those in the creek channel. The HEC-2 computer model was used to determine the channel capacities and to determine flood depths and flood elevations on the overbanks of these streams. Channel capacity on Kearney Canal ranges from 400 to 700 cfs. The channel capacity on North Dry Creek Ditch ranges from 1,500 to 2,000 cfs. Flood zones adjacent to the channel area were designated as Zone A1 for Kearney Canal and Zone AH for North Dry Creek Ditch with base flood elevation lines showing elevations of the 100-year flood. Flood zones away from the channel areas for these two streams for the 100-year flood were designated as Zone AO if flood depths were between 1 and 3 feet deep and Zone B if less than 1 foot in depth.

On Kearney Canal, there are two outlet channels which extend from Kearney Canal southward to the North Channel Platte River. These outlet channels capture most of the floodwaters that would overflow from Kearney Canal. This area was designated as Zone A.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from 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

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study 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 FEMA 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 the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:4800 with a contour interval of 4 feet (Reference 11).

For Airport Draw, which was studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations and USGS 7.5 minute quadrangle maps at a scale of 1:24000 (Reference 10).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, 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 may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

Floodways were not determined for the North Channel Platte River (upstream of County Highway X), Kearney Canal, and North Dry Creek Ditch because of the irregularity of the flood plains (see section 3.2). The floodways delineated for other streams were computed by specifying left and right bank encroachment stations (HEC-2, Method 1). The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed and are presented in Table 2, Floodway Data.

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, 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 2.

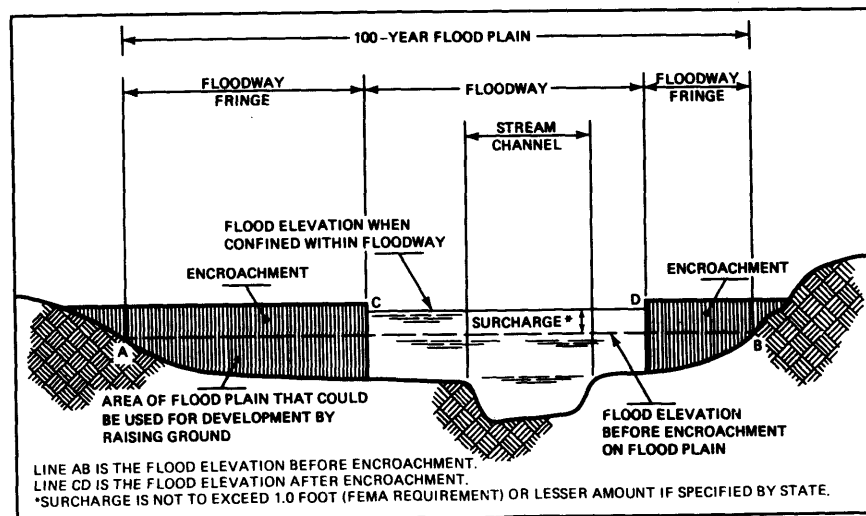


FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (FEET)	INCREASE
PLATTE RIVER								
A	22,520	3670 ²	9585	2.6	2121.2	2121.2	2121.3	0.1
B	23,810	3430	8249	3.1	2123.4	2123.4	2123.4	0.0
C	25,020	3427	10,722	2.4	2125.2	2125.2	2125.3	0.1
D	27,290	3422	8995	2.8	2127.3	2127.3	2127.4	0.1
E	28,560	3486	8839	2.9	2128.9	2128.9	2129.1	0.2
F	29,640	3063	8294	3.0	2130.3	2130.3	2130.5	0.2
G	30,910	3037	8413	3.0	2132.0	2132.0	2132.3	0.3
H	32,180	3080	9092	2.8	2133.5	2133.5	2133.8	0.3
I	33,400	2720	7099	3.6	2135.6	2135.6	2135.7	0.1
J	34,790	2279	7767	3.2	2137.9	2137.9	2138.1	0.2
K	36,090	1940	4833	5.2	2140.3	2140.3	2140.4	0.1
L	37,470	1080	5664	4.4	2142.9	2142.9	2142.9	0.0
M	37,970	1170	6118	4.1	2143.7	2143.7	2143.7	0.0
N	39,060	2470	11,780	2.1	2144.3	2144.3	2144.5	0.2
O	40,240	2872	10,639	2.4	2144.7	2144.7	2145.0	0.3
P	41,520	3216	7713	3.3	2145.5	2145.5	2145.7	0.2
Q	42,830	3234	4816	5.2	2147.3	2147.3	2147.3	0.0
R	43,890	3588	9149	2.8	2149.1	2149.1	2149.1	0.0
S	45,200	3656	10,472	2.4	2150.3	2150.3	2150.5	0.2
T	46,520	4018	8358	3.0	2152.4	2152.4	2152.5	0.1
U	48,270	4395/3820 ³	12,786	2.0	2154.9	2154.9	2155.0	0.1
V	49,850	4394/1900 ³	9582	2.6	2157.1	2157.1	2157.1	0.0
W	50,940	4306/1750 ³	11,851	2.1	2158.9	2158.9	2158.9	0.0
X	51,960	4309/1600 ³	10,238	2.5	2160.4	2160.4	2160.4	0.0
Y	53,570	4434/1025 ³	12,541	2.0	2162.7	2162.7	2162.7	0.0
Z	54,720	4419/400 ³	13,119	1.9	2163.8	2163.8	2163.8	0.0

¹FEET ABOVE STATE HIGHWAY 10

²THIS WIDTH IS BEYOND EXTRATERRITORIAL LIMITS

³TOTAL WIDTH / WIDTH WITHIN EXTRATERRITORIAL LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOODWAY DATA

PLATTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (FEET)	INCREASE
NORTH CHANNEL PLATTE RIVER								
A	4950	300 ²	1101	2.1	2113.0	2113.0	2113.5	0.5
B	6500	219 ²	795	2.9	2113.7	2113.7	2114.5	0.8
C	7690	151 ²	623	3.8	2115.0	2115.0	2115.7	0.7
D	8940	160/130 ³	606	3.9	2116.7	2116.7	2116.9	0.2
E	9340	180	546	4.3	2118.2	2118.2	2118.3	0.1
F	10,320	220	1000	2.4	2118.9	2118.9	2119.1	0.2
G	11,650	210	1125	2.1	2119.4	2119.4	2119.5	0.1
H	12,690	210	689	3.4	2120.0	2120.0	2120.1	0.1
I	14,050	210	601	4.0	2122.0	2122.0	2122.0	0.0
J	15,270	220	705	3.4	2123.7	2123.7	2123.7	0.0
K	16,520	200	553	4.3	2125.5	2125.5	2125.5	0.0
L	17,930	215	617	3.9	2127.9	2127.9	2128.0	0.1
M	19,130	200	665	3.7	2129.5	2129.5	2129.7	0.2
N	19,880	197	699	3.5	2130.2	2130.2	2130.7	0.5
O	20,700	190	546	4.4	2131.2	2131.2	2131.6	0.4
P	21,170	230	458	5.3	2133.2	2133.2	2133.2	0.0
Q	22,320	280	949	2.6	2134.4	2134.4	2135.4	1.0
R	23,670	184	584	4.2	2136.2	2136.2	2136.8	0.6
S	24,580	210	486	5.0	2137.8	2137.8	2138.2	0.4
T	25,330	133	718	3.4	2138.8	2138.8	2139.3	0.5
U	25,950	160	864	2.8	2140.0	2140.0	2140.5	0.5
V	27,170	220	1015	2.4	2141.9	2141.9	2142.3	0.4
W	28,350	390	1855	1.3	2142.3	2142.3	2142.7	0.4
X	31,140	410	1158	2.1	2143.1	2143.1	2143.5	0.4
Y	32,870	333	947	2.6	2144.6	2144.6	2144.9	0.3
Z	34,530	450	954	2.6	2146.3	2146.3	2146.5	0.2
AA	36,230	320	668	3.8	2148.7	2148.7	2149.5	0.8

¹STREAM DISTANCE IN FEET ABOVE MOUTH

²THIS WIDTH IS BEYOND EXTRATERRITORIAL LIMITS

³TOTAL WIDTH / WIDTH WITHIN EXTRATERRITORIAL LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOODWAY DATA

NORTH CHANNEL PLATTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (FEET)	INCREASE
GLENWOOD PARK CREEK								
A	1210	187	993	3.7	2138.5	2135.4 ²	2135.4	0.0
B	4200	223	1581	2.4	2140.1	2140.1	2140.4	0.3
C	6550	208	1104	3.4	2143.9	2143.9	2144.4	0.5
D	8200	204	855	4.4	2149.0	2149.0	2149.2	0.2
E	8330	330	2918	1.3	2151.5	2151.5	2152.4	0.9
F	9800	350	1196	3.2	2152.5	2152.5	2153.5	1.0
G	10,940	267	1243	3.1	2156.5	2156.5	2156.5	0.0
H	11,140	310	1504	2.6	2159.2	2159.2	2159.2	0.0
I	11,230	350	1337	2.9	2159.3	2159.3	2159.3	0.0
J	12,240	350	1658	2.3	2160.1	2160.1	2160.3	0.2
K	14,310	320	2033	1.9	2162.3	2162.3	2163.0	0.7
L	15,120	290	1513	2.6	2163.3	2163.3	2163.9	0.6
M	16,730	390	1827	2.2	2165.7	2165.7	2165.9	0.2
N	19,830	360	1505	2.7	2170.3	2170.3	2170.7	0.4
O	22,495	360	1535	2.7	2175.7	2175.7	2176.0	0.3
P	24,030	550	2331	1.8	2178.0	2178.0	2178.4	0.4
Q	24,890	320	964	3.3	2179.7	2179.7	2180.5	0.8
R	25,810	290	829	3.9	2183.2	2183.2	2183.4	0.2
S	26,590	400	730	4.4	2187.0	2187.0	2187.5	0.5
T	26,930	410	3173	1.0	2194.9	2194.9	2195.9	1.0
U	27,800	390	2907	1.1	2195.0	2195.0	2196.0	1.0
V	28,670	370	1660	2.0	2195.2	2195.2	2196.2	1.0
W	29,250	420	1273	2.6	2196.1	2196.1	2196.7	0.6
X	30,020	330	720	4.6	2198.8	2198.8	2199.2	0.4
Y	30,390	400	1201	2.8	2202.6	2202.6	2202.7	0.1
Z	30,630	350	640	5.2	2203.4	2203.4	2203.7	0.3

¹FEET ABOVE CONFLUENCE WITH WOOD RIVER

²ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECTS FROM WOOD RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOODWAY DATA

GLENWOOD PARK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (FEET)	INCREASE
WOOD RIVER								
A	26,150	660	5461	1.4	2140.4	2140.4	2140.6	0.2
B	29,320	416	3757	2.1	2141.6	2141.6	2141.7	0.1
C	31,870	588 ²	5666	1.4	2142.6	2142.6	2142.8	0.2
D	33,440	250	3015	2.6	2144.1	2144.1	2144.3	0.2

¹FEET ABOVE COUNTY HIGHWAY 36-E

²THIS WIDTH IS BEYOND EXTRATERRITORIAL LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOODWAY DATA

WOOD RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (FEET)	INCREASE
GLENWOOD PARK CREEK AA	31,680	250	945	3.5	2208.6	2208.6	2208.6	0.0

¹FEET ABOVE CONFLUENCE WITH WOOD RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOODWAY DATA

GLENWOOD PARK CREEK

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA 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 (FHF), and flood insurance zone designations for each flooding source affecting the City of Kearney.

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 per cent of the reach.

<u>Average Difference Between 10- and 100-year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Kearney are shown on the Flood Profiles and are summarized in Table 3, Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's 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 0.5 foot, and shown as a 3-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 flood 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 FHF's, the entire incorporated area of the City of Kearney and its extraterritorial limits 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 are shown or FHF's determined.
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 FHF's are determined.
Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHF's are determined.
Zones A1, A3 -A5, A12:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area 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; or 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.

Table 3, Flood Insurance Zone Data, summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Kearney 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 FEMA.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
PLATTE RIVER REACH 1	0015,0020	-1.8	-0.5	1.1	020	A4	VARIES-SEE MAP
NORTH CHANNEL PLATTE RIVER REACH 1	0020	-1.3	-0.5	1.2	015	A3	VARIES-SEE MAP
WOOD RIVER REACH 1	0010	-5.9	-1.7	3.2	060	A12	VARIES-SEE MAP
GLENWOOD PARK CREEK REACH 1	0010	-2.5	-0.9	1.4	025	A5	VARIES-SEE MAP
REACH 2	0010	-1.8	-0.6	1.3	020	A4	VARIES-SEE MAP
REACH 3	0010	-0.7	-0.3	0.4	005	A1	VARIES-SEE MAP
KEARNEY CANAL REACH 1	0005,0010,0015 0020	-0.6	-0.1	0.1	005	A1	VARIES-SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

FLOOD INSURANCE ZONE DATA

**PLATTE RIVER — NORTH CHANNEL PLATTE RIVER — WOOD RIVER —
GLENWOOD PARK CREEK — KEARNEY CANAL**

6.0 OTHER STUDIES

The Missouri River Basin Commission has published two reports on the Platte River basin (References 3 and 4) which agree with this study.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Kearney (Reference 13).

7.0 LOCATION OF DATA

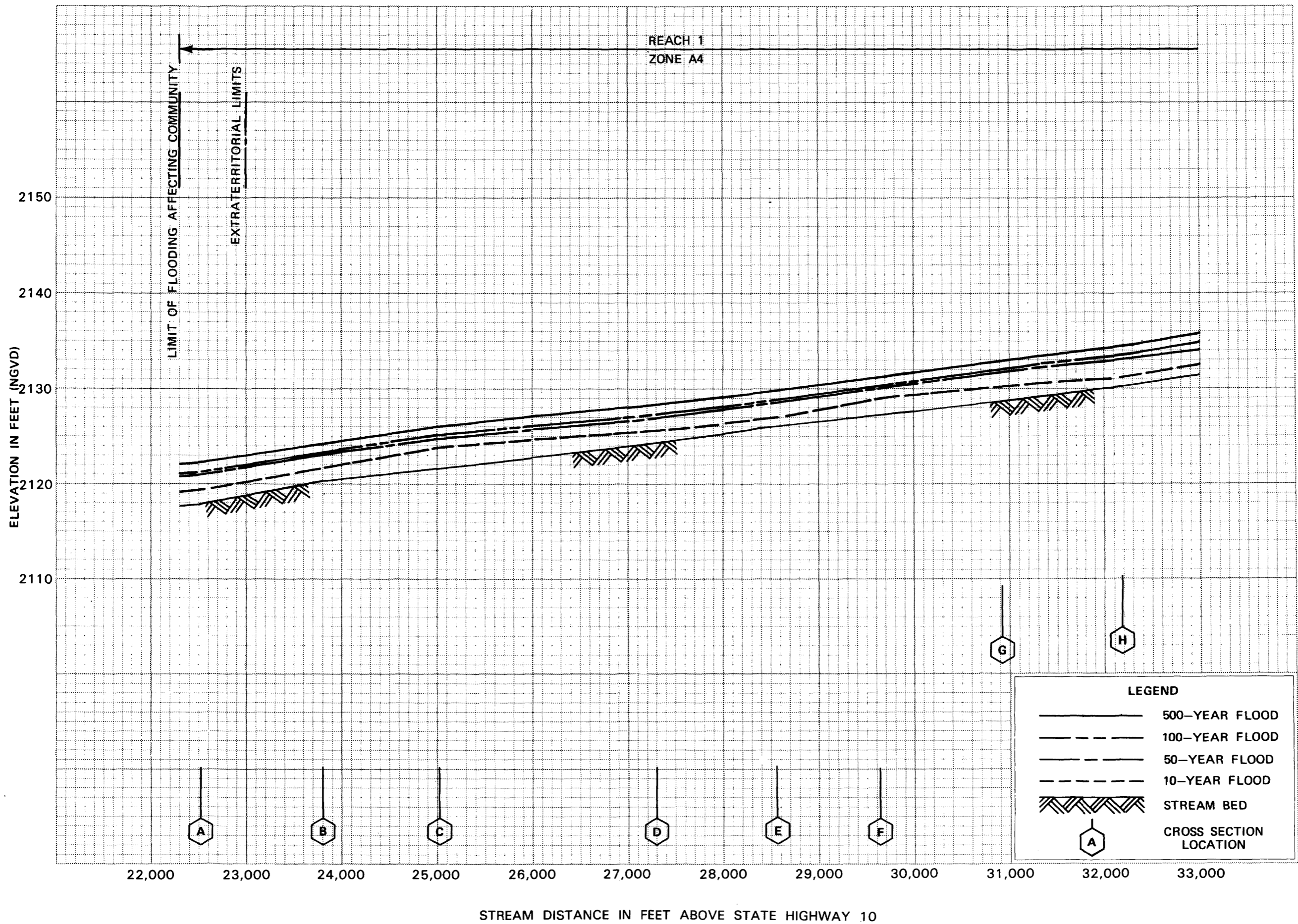
Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 911 Walnut Street, Kansas City, Missouri 64106.

8.0 REFERENCES AND BIBLIOGRAPHY

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U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, County of Buffalo, Unincorporated Areas, Nebraska, April 1979.

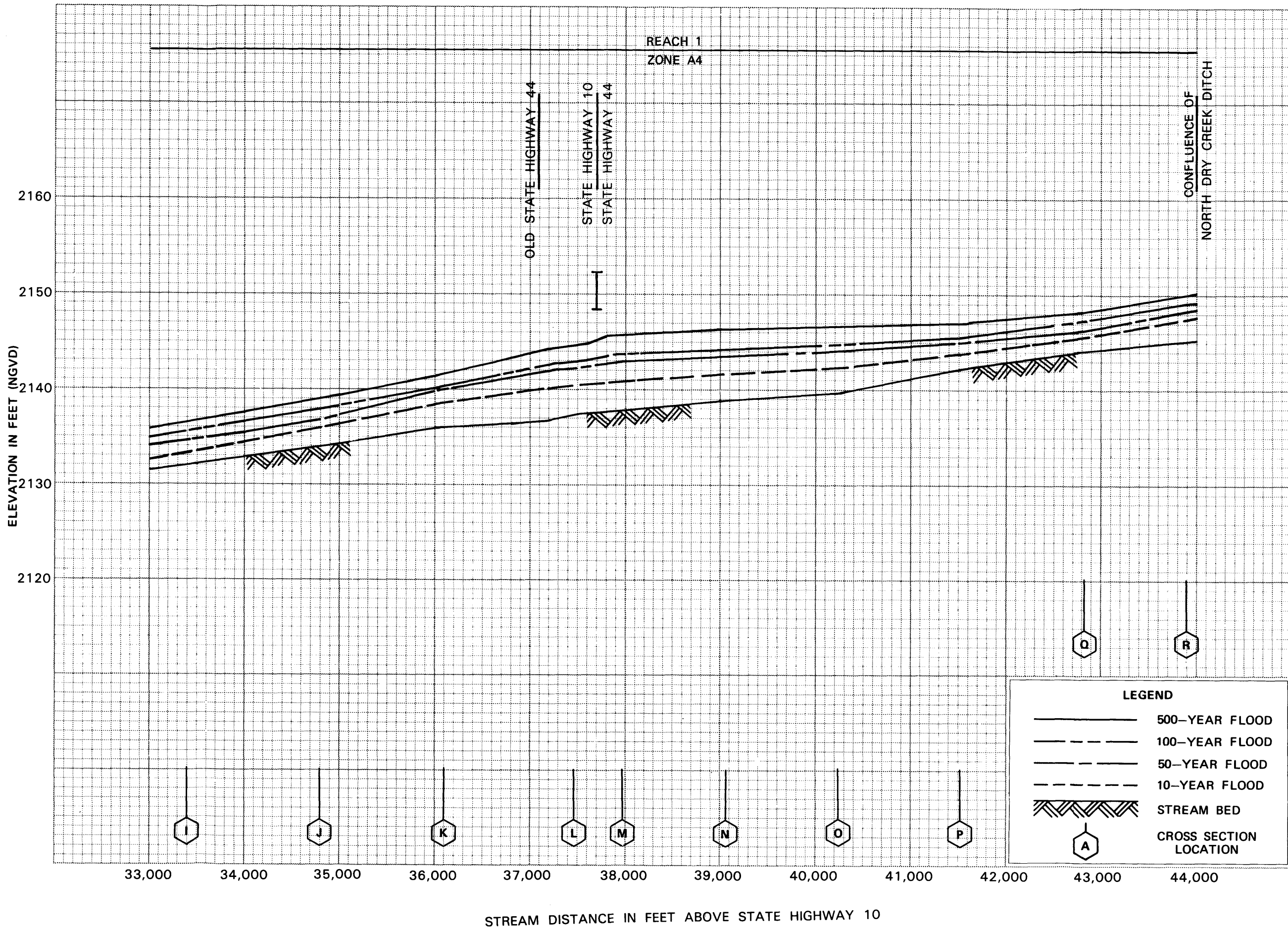


FLOOD PROFILES

PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)

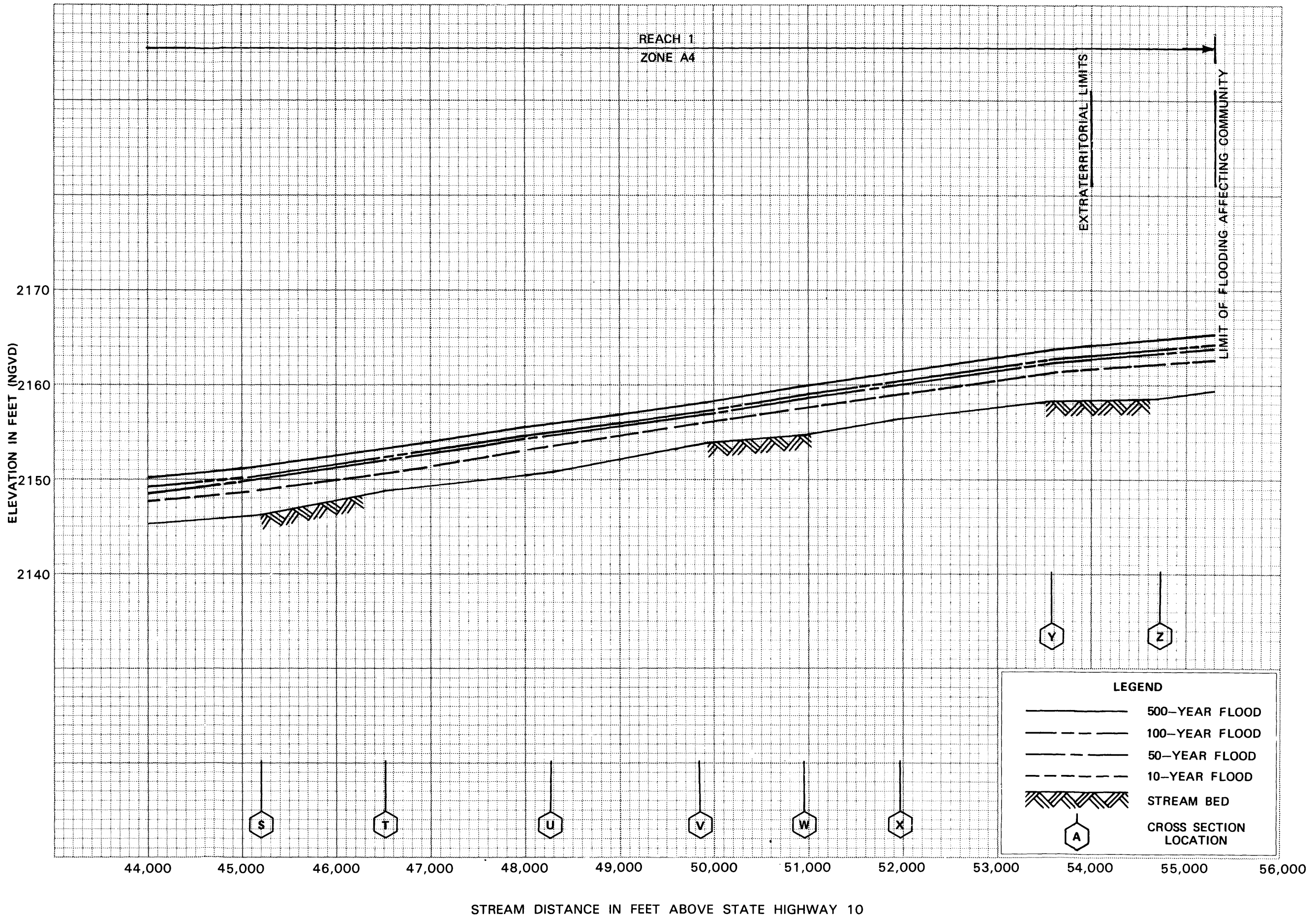


FLOOD PROFILES

PLATTE RIVER

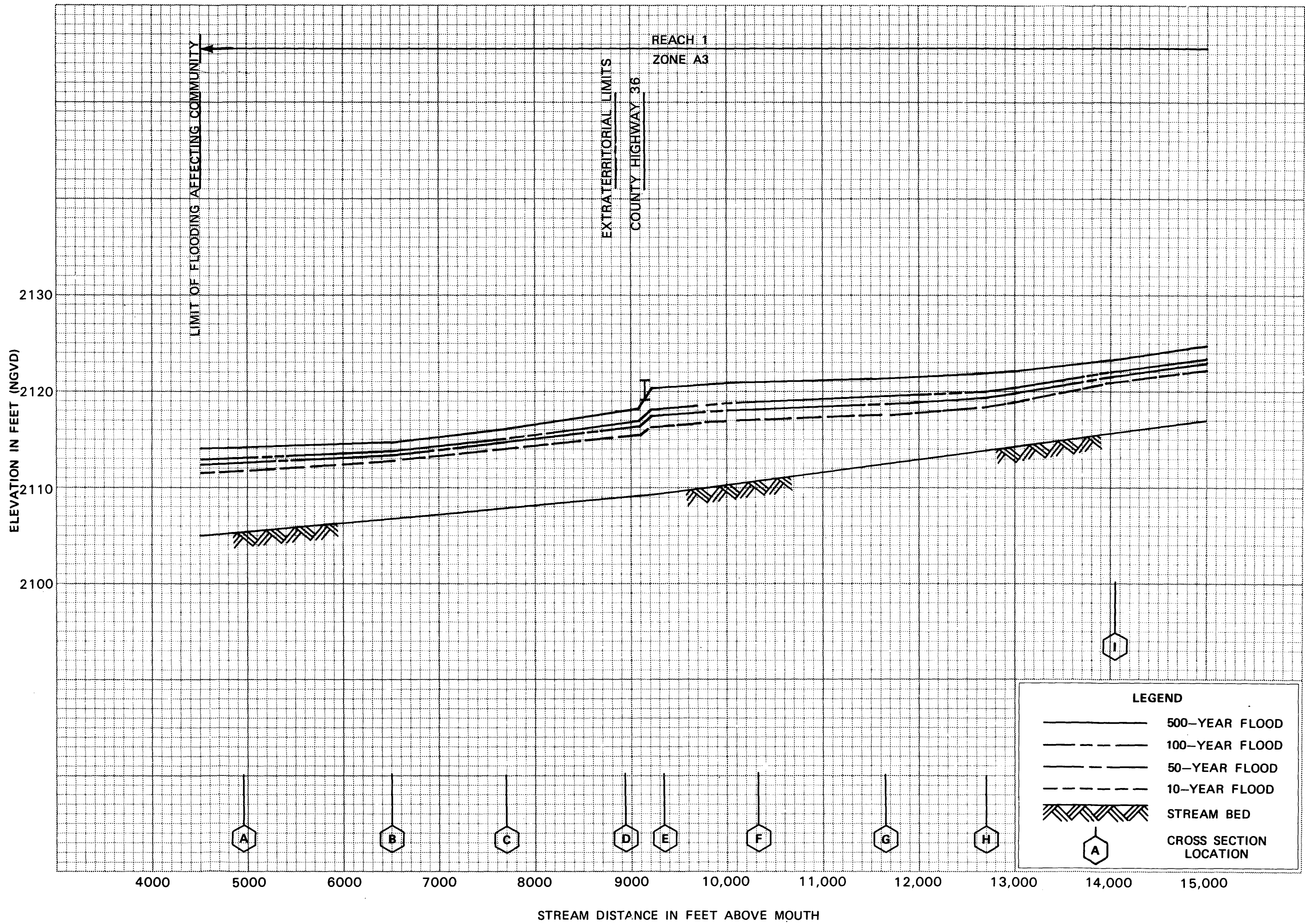
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)



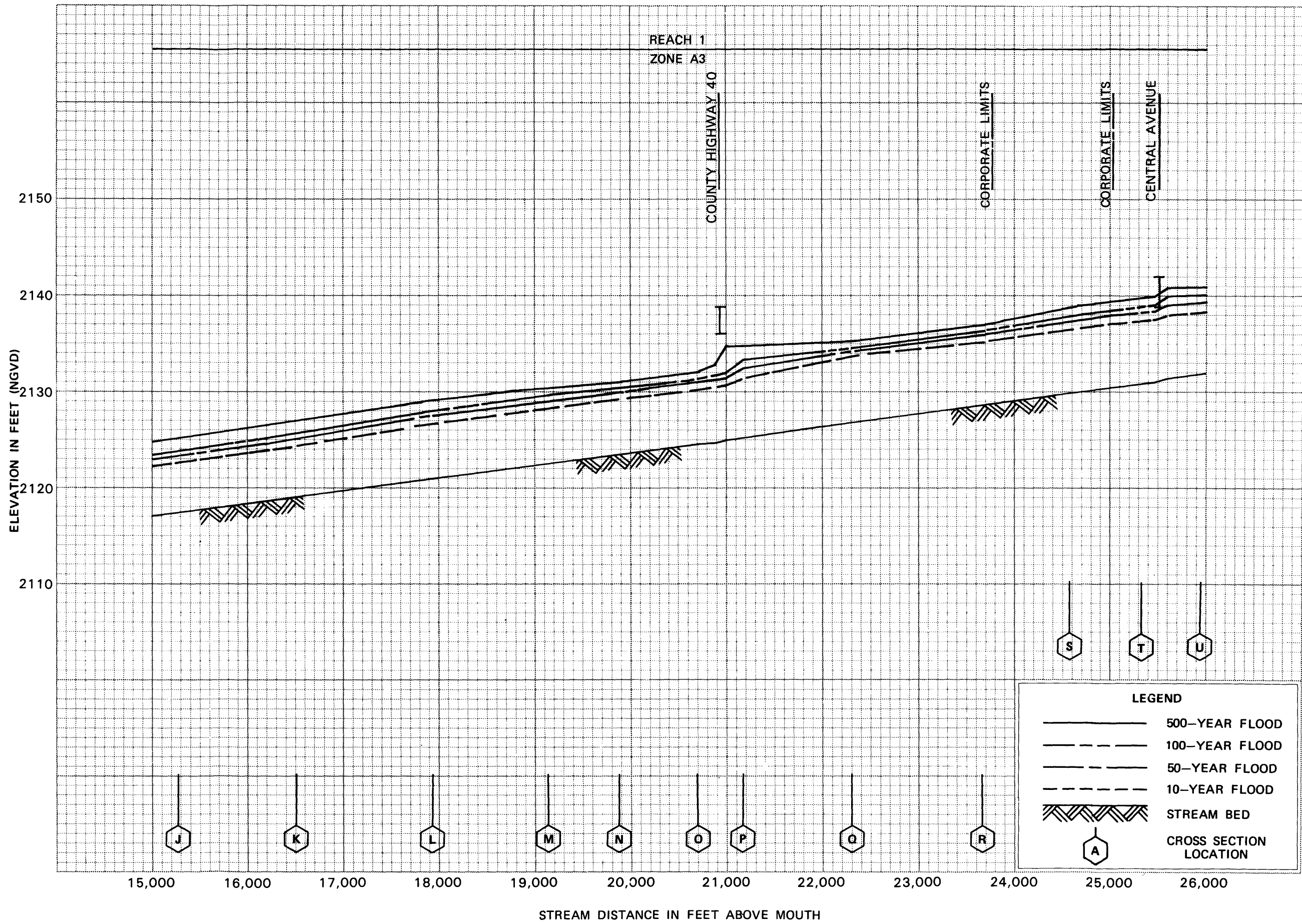
**FLOOD PROFILES
PLATTE RIVER**

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



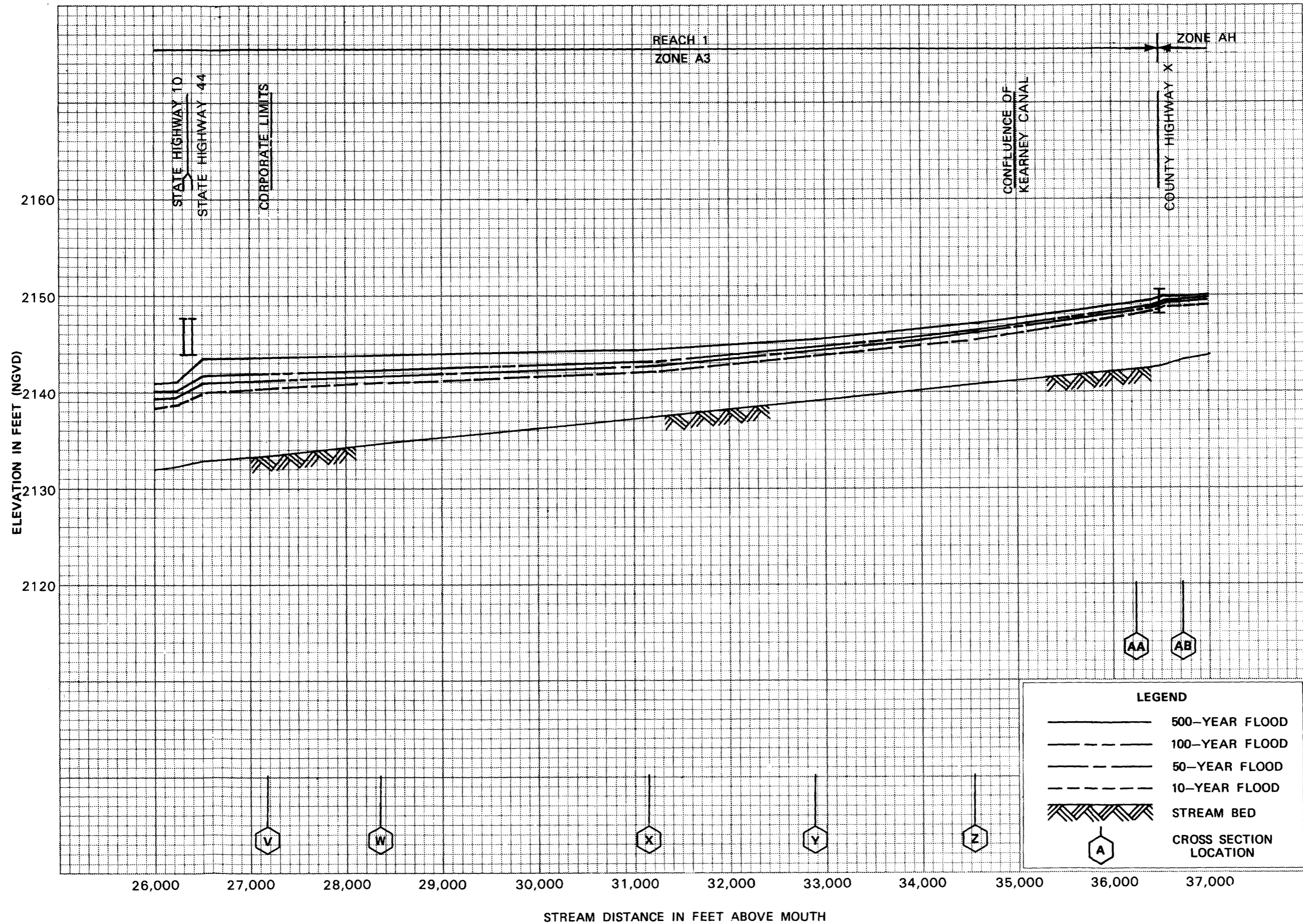
**FLOOD PROFILES
NORTH CHANNEL PLATTE RIVER**

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



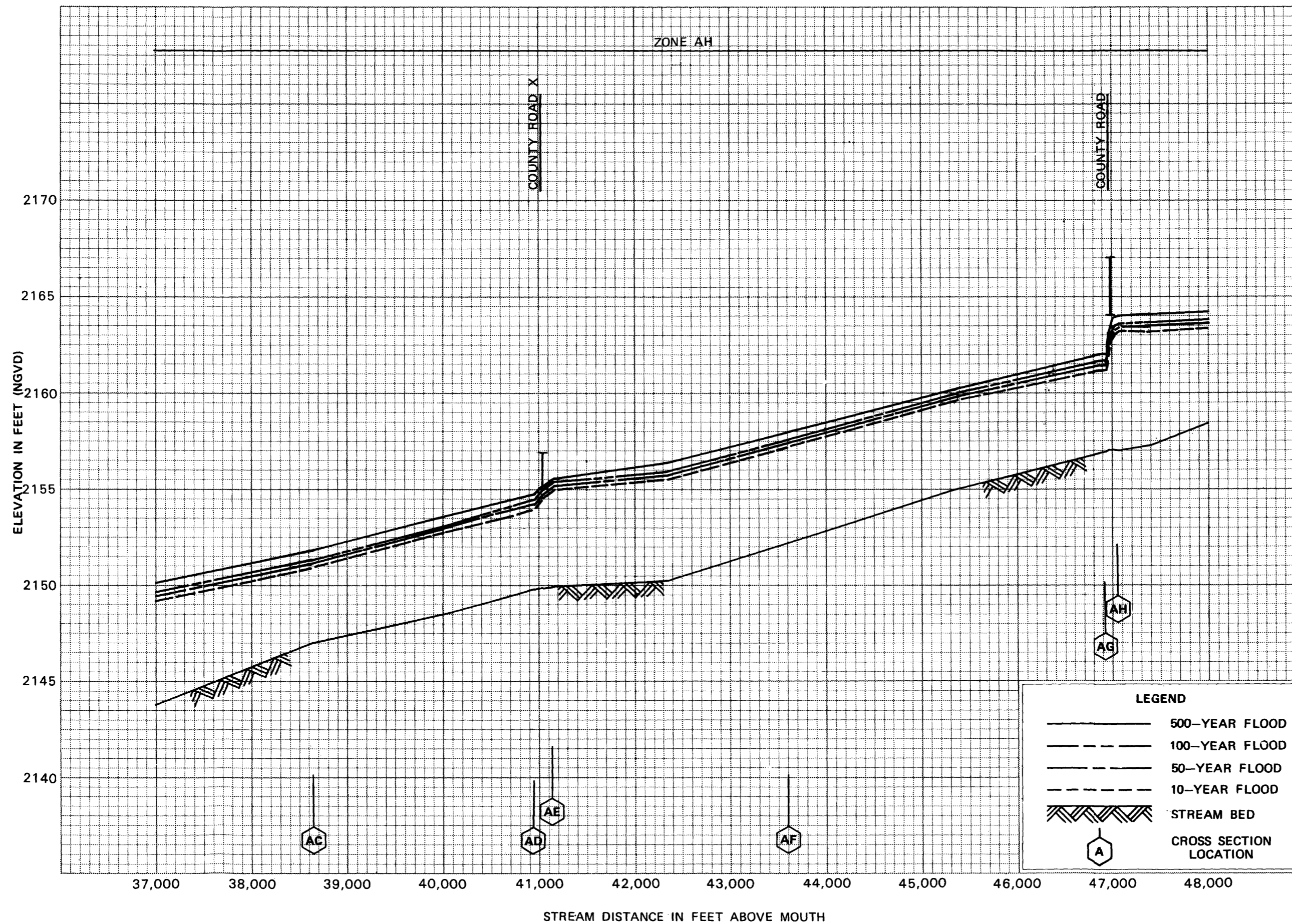
FLOOD PROFILES
NORTH CHANNEL PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



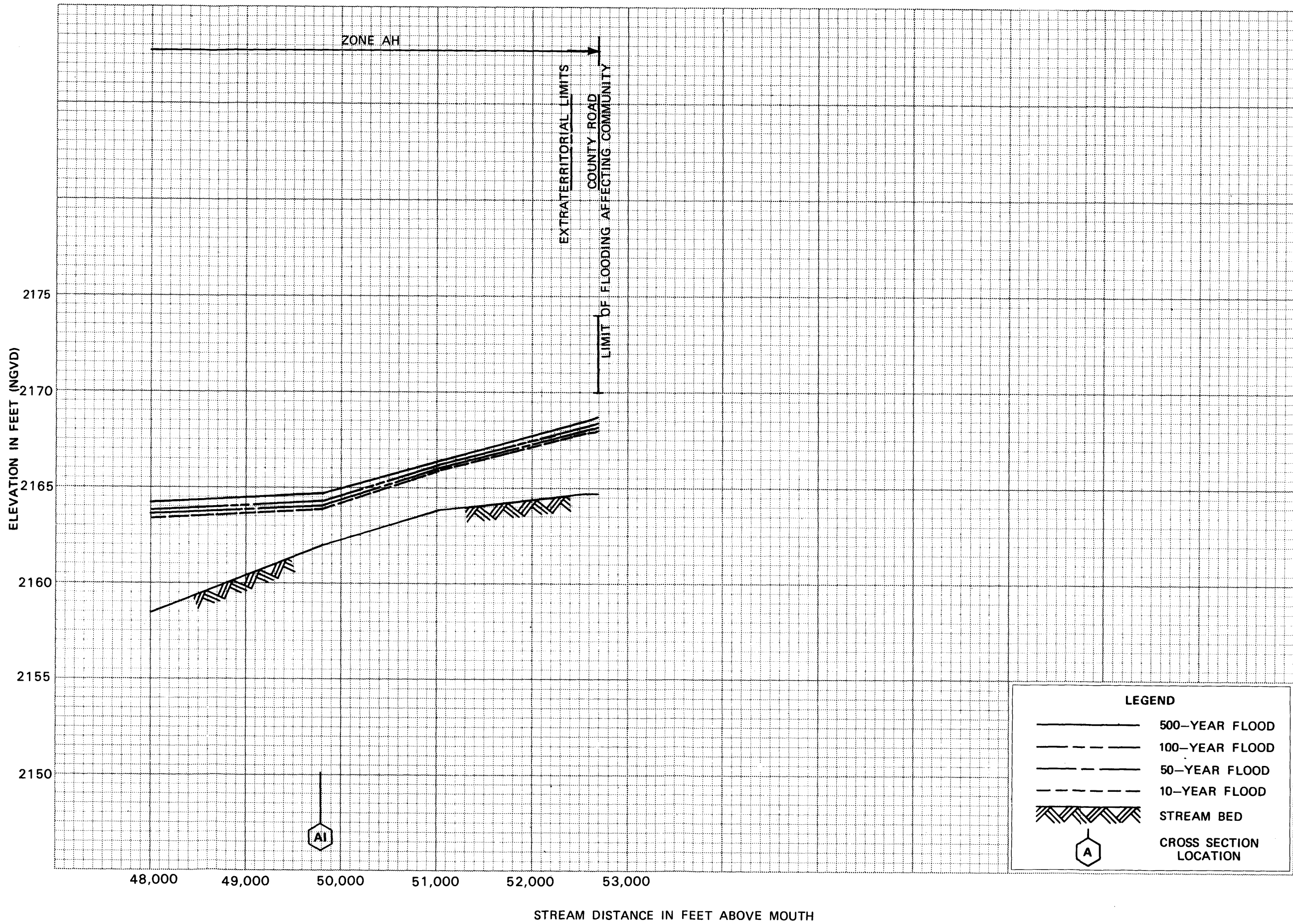
FLOOD PROFILES
NORTH CHANNEL PLATTE RIVER

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CITY OF KEARNEY, NE
(BUFFALO CO.)



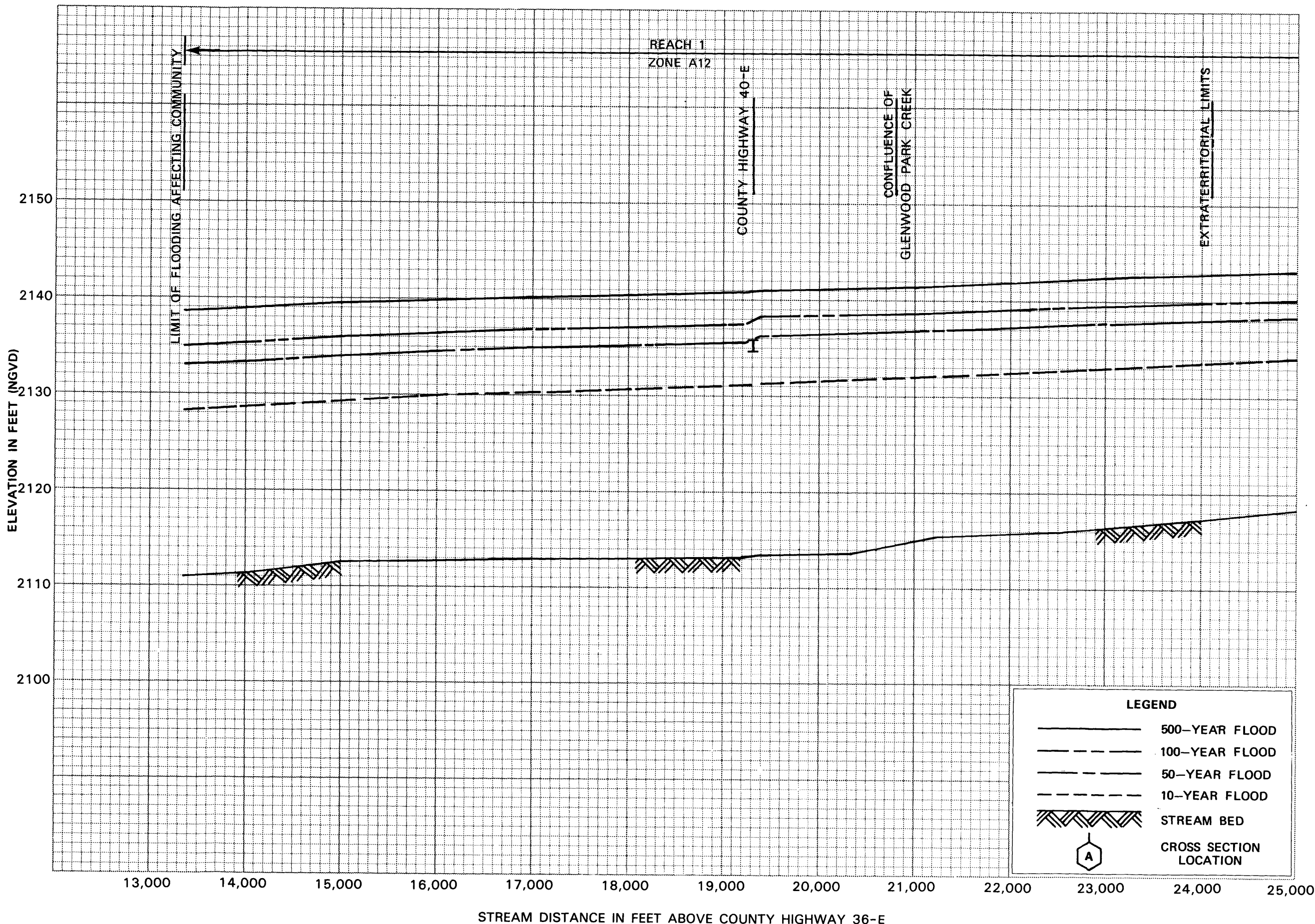
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NORTH CHANNEL PLATTE RIVER

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CITY OF KEARNEY, NE
 (BUFFALO CO.)



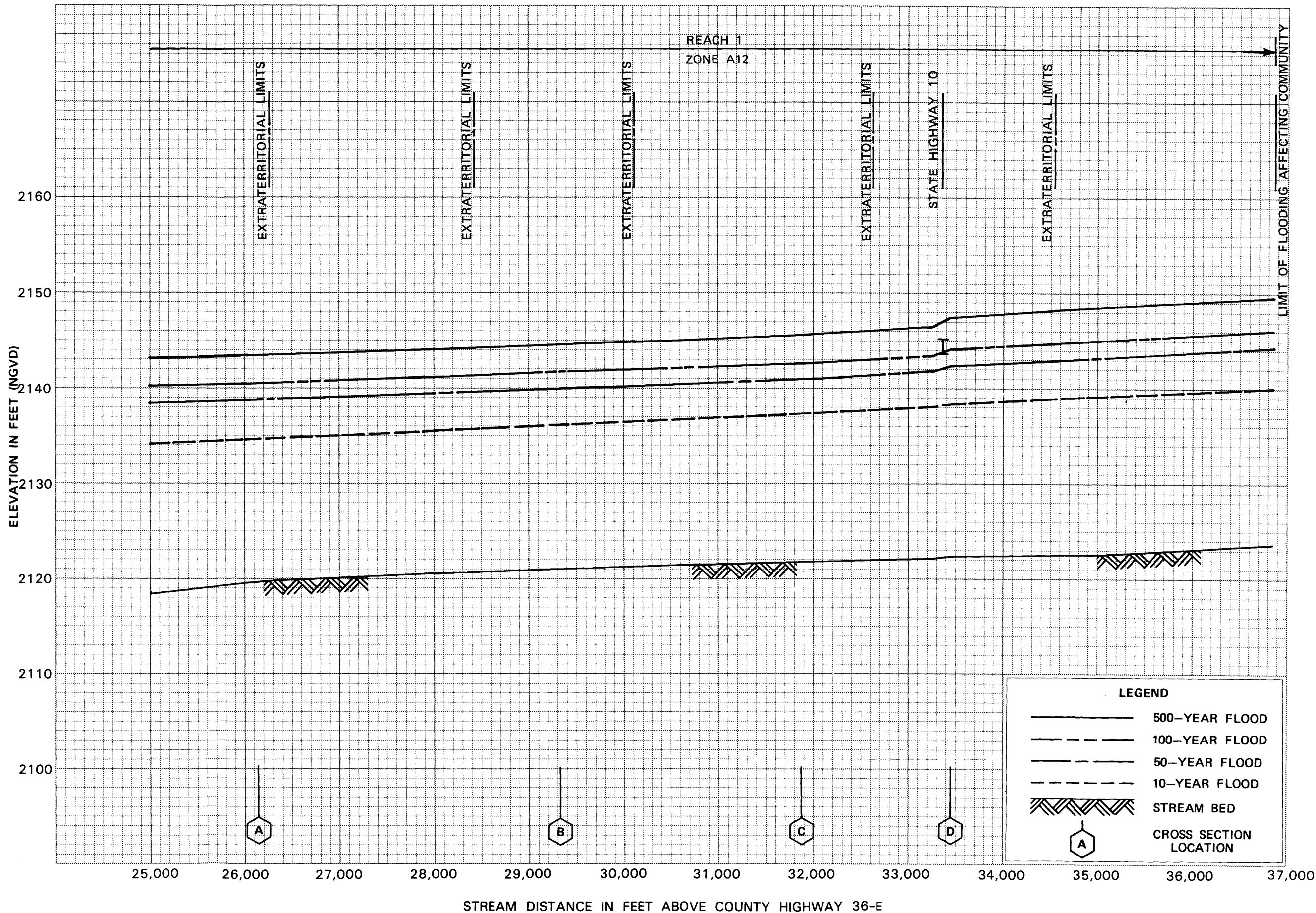
FLOOD PROFILES
NORTH CHANNEL PLATTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



**FLOOD PROFILES
WOOD RIVER**

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)

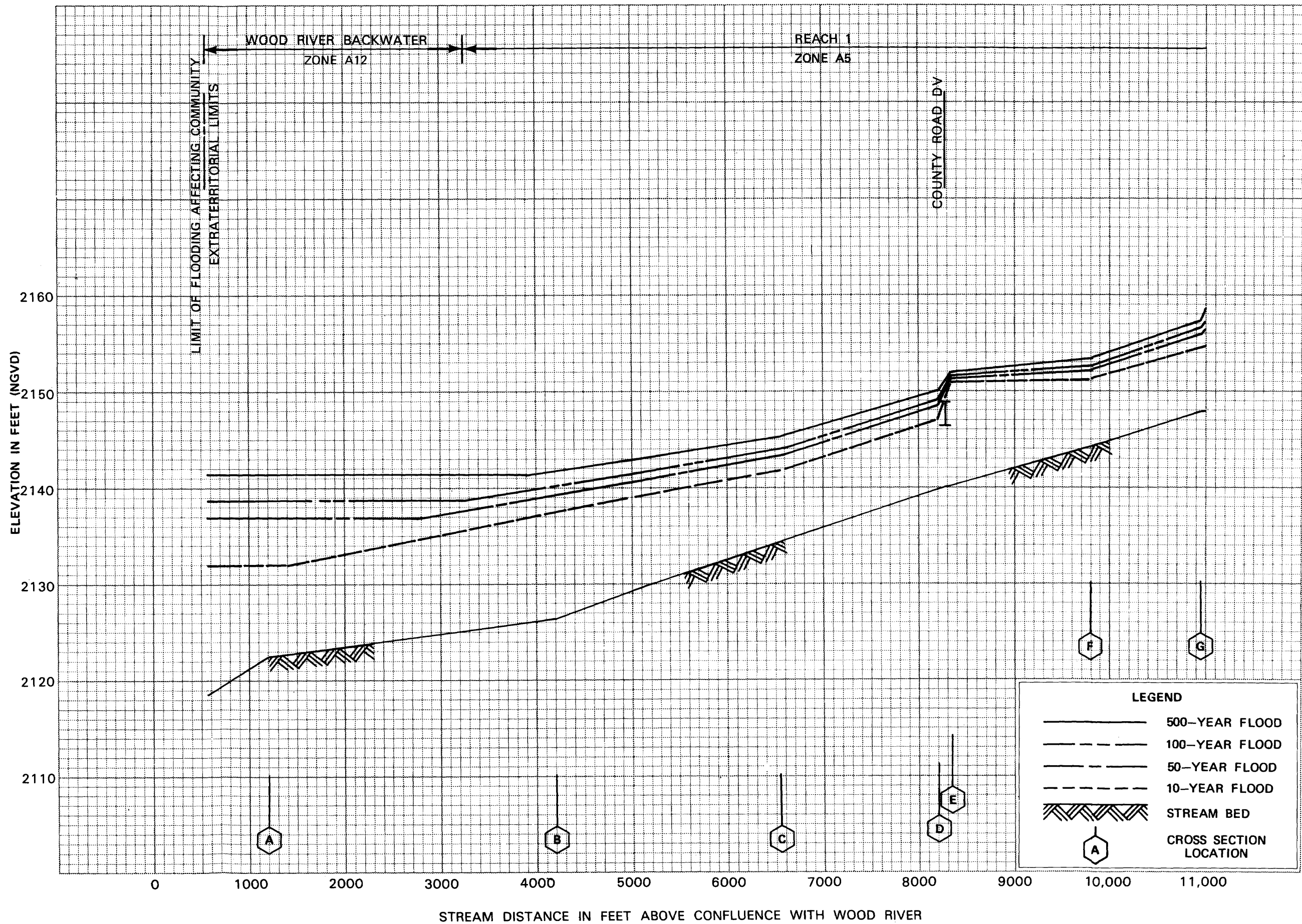


FLOOD PROFILES

WOOD RIVER

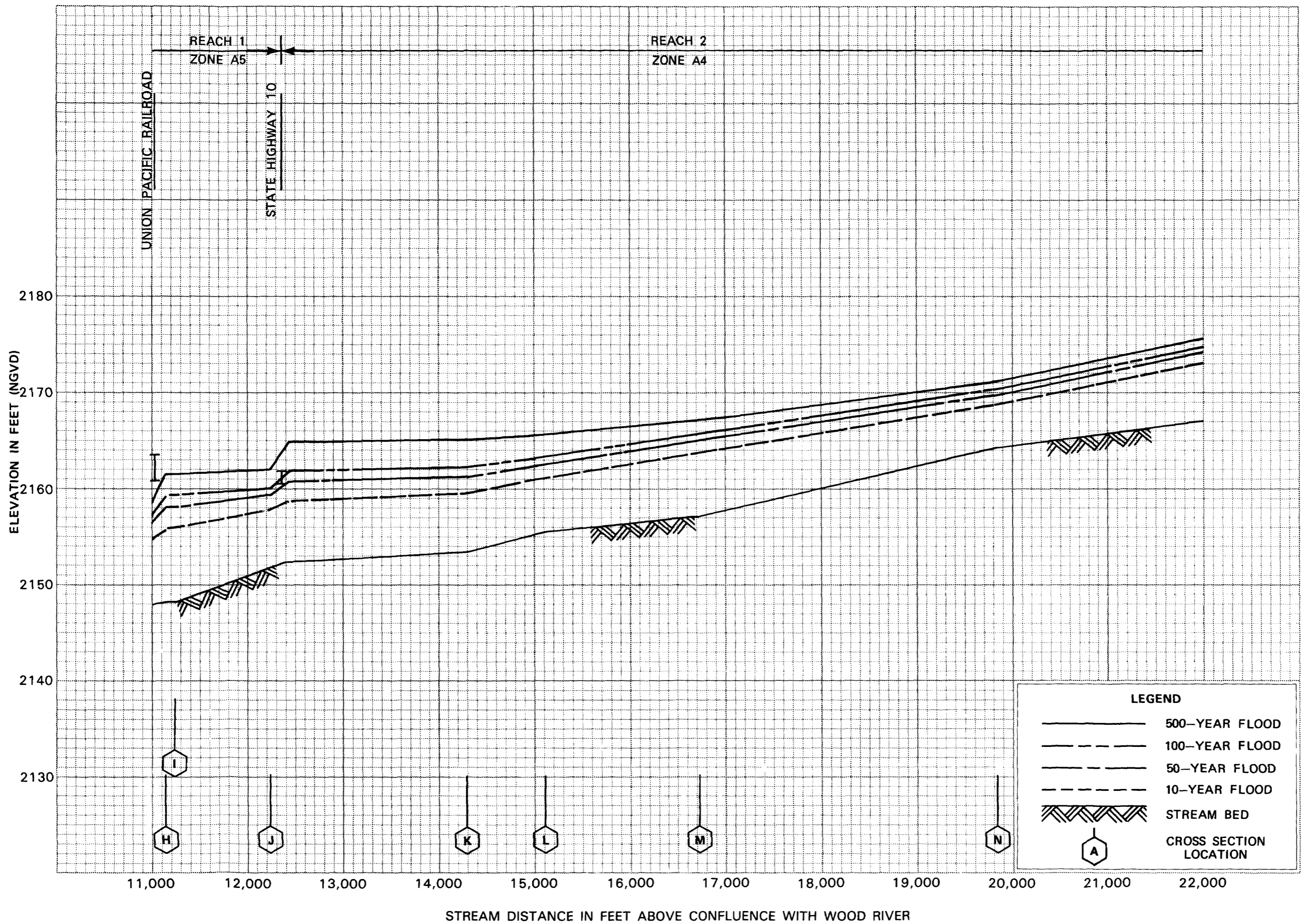
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)



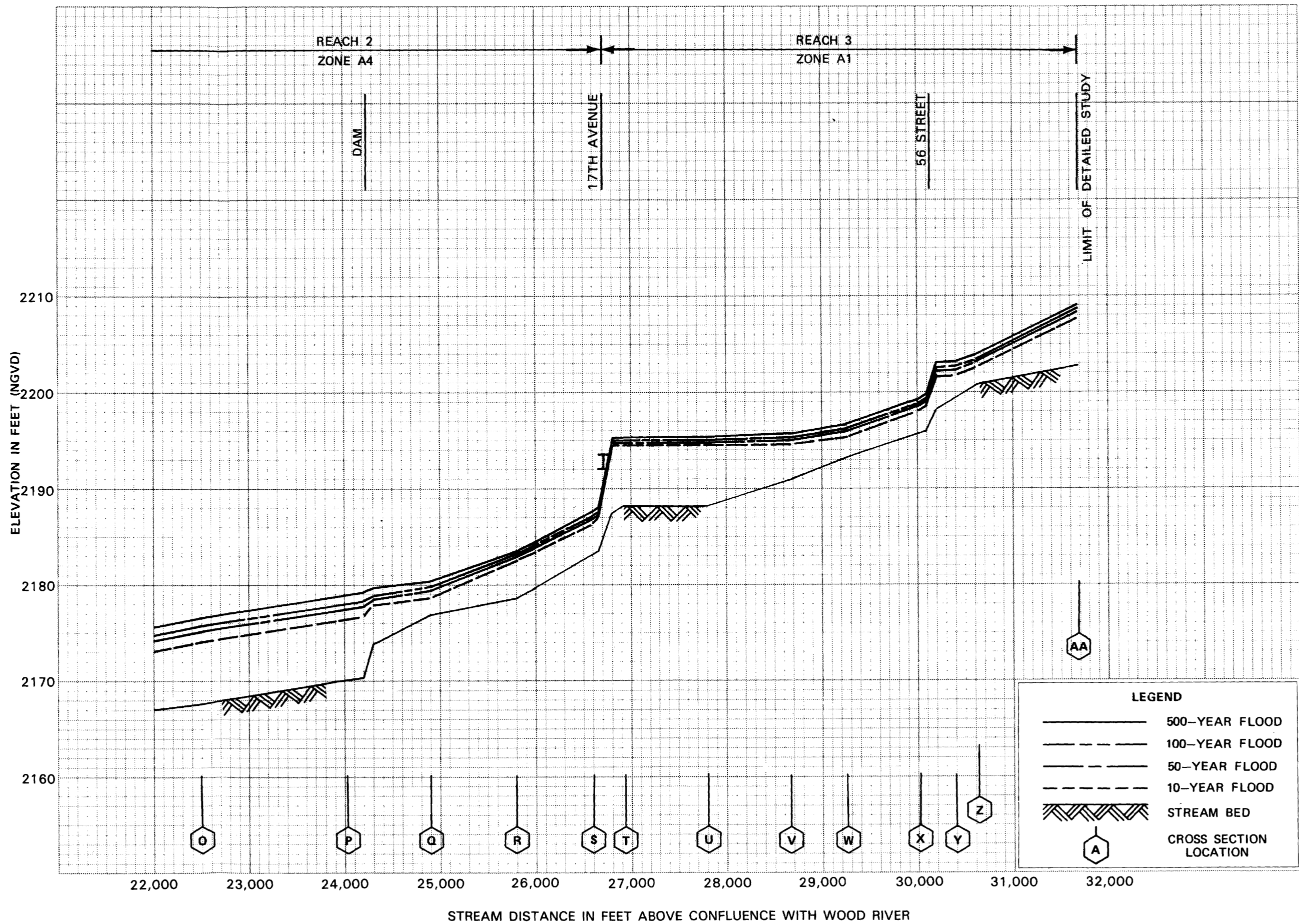
FLOOD PROFILES
GLENWOOD PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



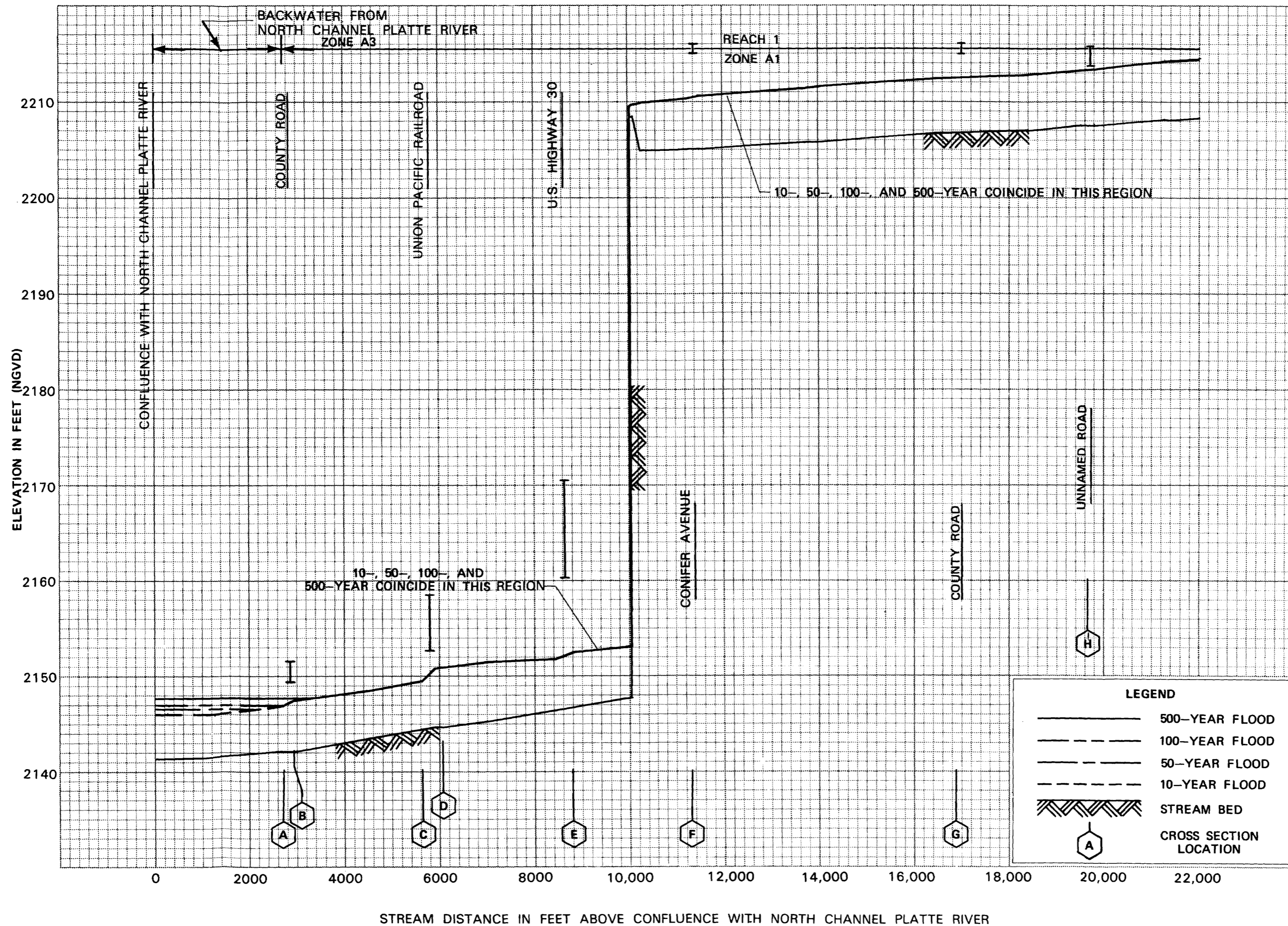
FLOOD PROFILES
GLENWOOD PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)



FLOOD PROFILES
GLENWOOD PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)

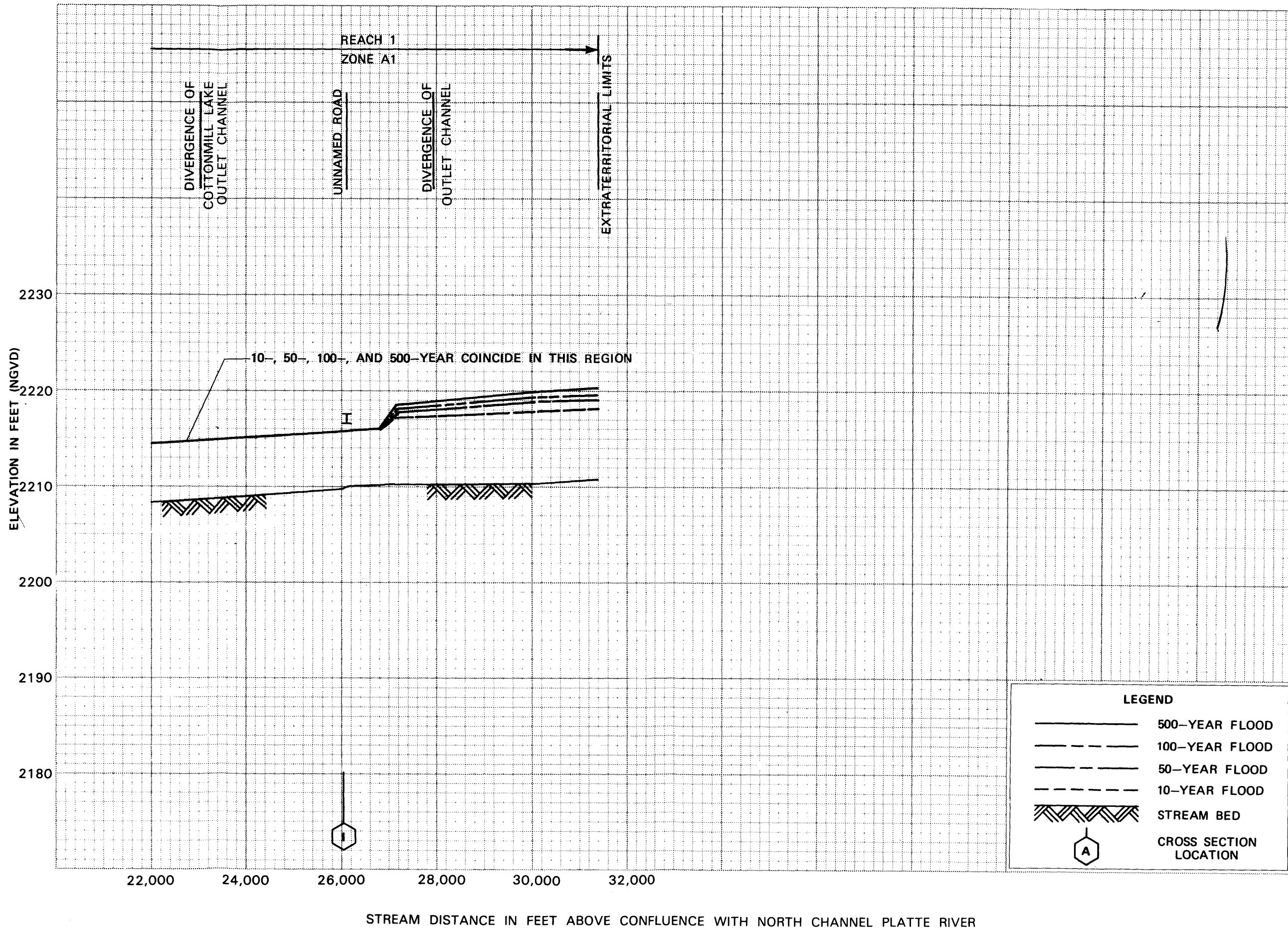


FLOOD PROFILES

KEARNEY CANAL

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF KEARNEY, NE
(BUFFALO CO.)



**FLOOD PROFILES
KEARNEY CANAL**

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF KEARNEY, NE
(BUFFALO CO.)