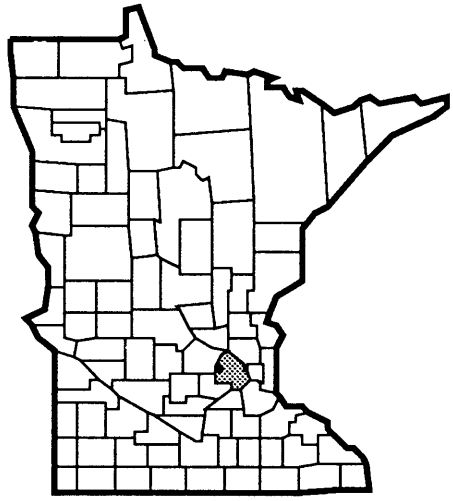
FLOOD INSURANCE STUDY

CITY OF INDEPENDENCE, MINNESOTA

HENNEPIN COUNTY



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Federal Emergency Management Agency

COMMUNITY NUMBER - 270167

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.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY

CITY OF INDEPENDENCE

HENNEPIN COUNTY, MINNESOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Independence, Hennepin County, Minnesota, 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 Independence to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will also 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(d). 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 source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Hydrologic and hydraulic analyses for this study were performed by Edwards and Kelcey, Inc. for the Federal Emergency Management Agency, under Contract No. EMW-C-0322. This study was completed in September 1980.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, FEMA, the Minnesota Department of Natural Resources (Mn/DNR) and representatives of the City of Independence in June 1979.

On January 26, 1982, 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.

Results of the hydrologic analyses were coordinated with the City of Independence, the Mn/DNR, and the Hennepin Soil and Water Conservation District.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Independence, Hennepin County, Minnesota. 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 for the next five years, through September 1985.

Areas studied by approximate methods were selected due to their low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by FEMA and the City of Independence.

Lake Robina Tributary and Lake Robina were studied in detail. Pioneer Creek, Lake Sarah, South Fork Crow River and Lake Independence within the corporate limits were studied in detail. Ox Yoke Lake, which is located outside of Independence was studied in detail as it is a flooding source for portions of Independence. Haughey Lake, Fox Lake and Painter Creek within the corporate limits were studied by approximate methods.

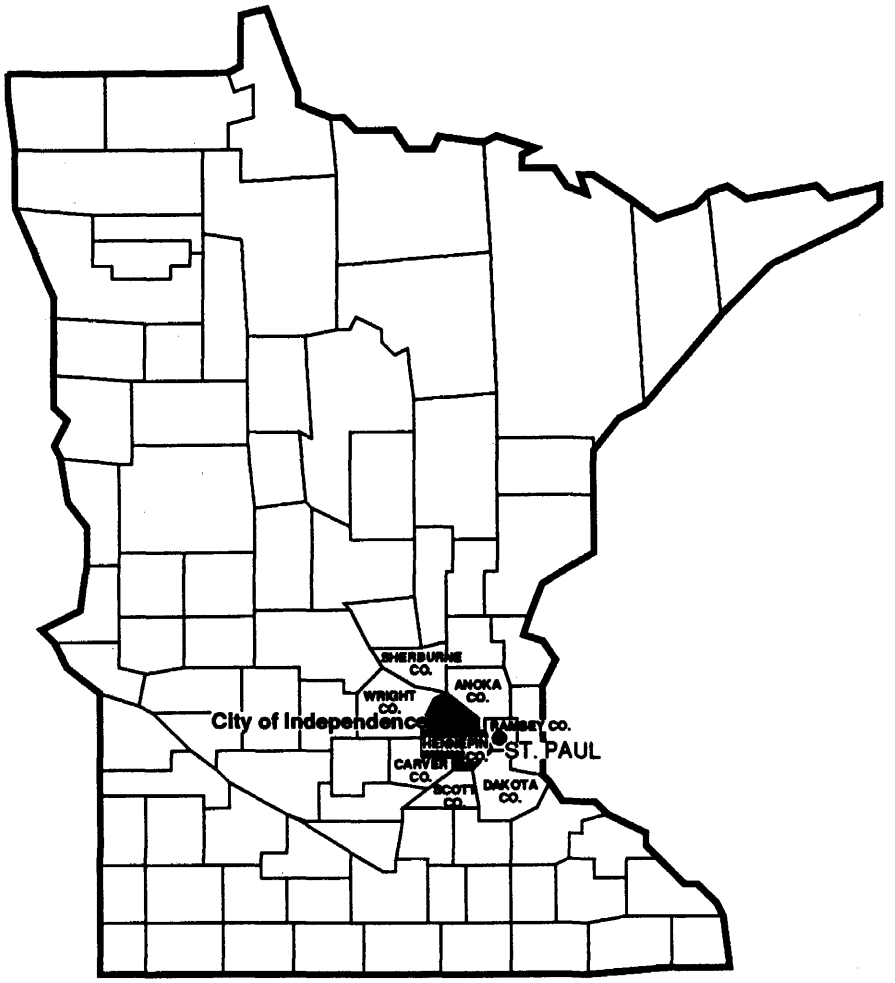


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN

(HENNEPIN CO.)

VICINITY MAP

2.2 Community Description

The City of Independence is located in the northwestern portion of the seven-county metropolitan area of Minneapolis and St. Paul, on the western boundary of Hennepin County. Adjacent communities to Independence include Greenfield to the north, unincorporated areas of Wright County and Delano to the west, Maple Plain, Orono and Medina to the east, and Minnetrista to the south. The 1980 population is 2576 (Reference 1). Independence was first organized as a township in 1858; the township took its name from Lake Independence which was named on the Fourth of July four years earlier. The community had its beginnings as a farming community; the economy of the area is still primarily agriculture-oriented though residential development is gradually occurring. The greatest population growth in Independence has occurred since 1950, most of it being non-farm rural and suburban.

The climate classification in Hennepin County is predominantly continental, with wide variations in temperature ranging from an average of approximately 15 degrees Fahrenheit for the winter months to approximately 70 degrees Fahrenheit in the summer months. The normal annual precipitation is about 28 inches and the normal annual snowfall is approximately 43 inches (Reference 2).

The topography of Independence can be described as gently rolling, with elevations varying from 920 to 1040 feet. The predominant soil type in the study area is a medium to fine textured Grantsburg till. Vegetation types in Independence are primarily agricultural cropland and meadows, with scattered woodlands and numerous wetlands throughout the area.

The flood plains throughout Independence are generally lightly developed, consisting of pasture and cropland and scattered farmsteads and lake cottages. However, the proximity to the Minneapolis-St. Paul metropolitan area has resulted in increasing development pressure in recent years.

2.3 Principal Flood Problems

There is very limited knowledge of past floods in Independence. There has never been a flood that has caused any significant damage. The largest flood on Pioneer Creek occurred in April 1986, as

a result of backwater from the South Fork of the Crow River. That event had an approximate recurrence interval of 50 years and was caused by snowmelt coupled with spring rains.

Highwater on Sarah Lake occurred in July of 1975; that event corresponds approximately to a 100-year recurrence interval and was caused by intense rainfall.

The combination of conditions that cause flooding in Independence in 1965 are the most apt to cause flooding again. Floods of large magnitude are likely to occur when snowmelt from heavy snow cover is followed by intense spring rains.

The same hydrologic effect is achieved when long periods of rain are accompanied by an intense rain. Floods on the lower portion of Pioneer Creek in Independence are more apt to occur as a result of high flood stages on the South Fork Crow River.

2.4 Flood Protection Measures

No flood control projects exist within Independence and there are no known plans for structural flood control works to protect existing development in the study area. This report will provide the information necessary for Independence to adopt appropriate flood plain regulations in place of structural flood control measures.

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 one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one

percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and for any 90-year period, the risk increases to about 60 percent (six in ten). 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 the flooding source studied in detail affecting the community.

The hydrology for Pioneer Creek, Lake Robina and Lake Robina Tributary was examined in a report titled Flood Hazard Study, Pioneer Creek, Spurzem Creek and Lake Robina Tributary, Hennepin County Minnesota, prepared by the SCS and the Hennepin County Soil and Water Conservation District (Reference 3). Since no stream gage data is available for the study area of Pioneer Creek and Lake Robina Tributary, discharges for the selected frequency floods were estimated through the use of the SCS TR-20 computer program (Reference 4). By applying this program, the physical characteristics of the basin were used to predict the discharge that will occur from a rainfall event of a given frequency. Runoff depths for a given rainfall depth was determined by the soil types, land use, and hydrologic condition of the basin.

Discharge hydrographs were developed for the 10-day duration runoff and the 1-day duration rainfall. Because of the numerous storage areas within the watershed, the 10-day duration runoff, as expected, was found to be the critical storm event.

Graphs of the routed peak outflow from the reservoirs versus their respective drainage areas were used to estimate the discharge at other locations in the study area. The reservoir outflow values were used since these values best account for the total natural storage in the basin.

Pioneer Creek joins the South Fork Crow River about three miles south of Delano. Since the drainage area of Pioneer Creek is less than 5% of that of the South Fork Crow River at the conflu-

ence, it was assumed for the floods considered in this study that the peak flow from Pioneer Creek would occur sooner than the peak flow from the South Fork Crow River.

The discharge-frequency relationship for the South Fork Crow River was statistically correlated from 41 years of discharge records from the South Fork Crow River near Mayer and 53 years of record from Rockford. This resulted in an adjusted record of 52 years of record near Mayer. The discharge-frequency relationship for the South Fork Crow River near Mayer was transferred downstream from Mayer using the drainage area ratio to the 0.4 power.

Peak stages were determined for Lake Independence for the City of Medina Flood Insurance Study (Reference 5). A statistical analysis of 19 years of peak elevations was performed by methods outlined in the Water Resoures Bulletin No. 17A (Reference 6).

Peak discharges for the 10-, 50-, 100- and 500-year floods for Pioneer Creek, Lake Robina Tributary and South Fork Crow River are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

Flooding Source & Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10-Year	50-Year	100-Year	500-Year
PIONEER CREEK					
Downstream of County Road 157	37.6	400	585	650	790
Downstream of Copeland Road	27.3	370	555	620	740
Upstream of Robina Tributary	21.5	320	400	430	485
Downsteam of County Road 92	20.5	310	375	395	440
Downsteam of U.S. Highway 12	18.7	170	240	270	340
Downstream of County Road 90	16.5	115	190	220	290

TABLE 1 - SUMMARY OF DISCHARGES (Continued)

Flooding Source & Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10-Year	50-Year	100-Year	500-Year
LAKE ROBINA TRIBUTARY					
0.2 Mile Upstream of Confluence with Pioneer Creek	5.0	160	240	255	305
Downstream of County Road 92	3.3	13	40	55	80
Downstream of U.S. Highway 12	2.5	8	18	22	33
SOUTH FORK CROW RIVER	1,145	7,200	16,700	23,200	40,800

The peak elevations for Lake Sarah were obtained by Edwards and Kelcey using the SCS TR-20 Computer Program. Storms of 6-hour and 1-day duration were analyzed along with the 10-day runoff volume. The 10-day runoff was the critical event for all recurrence intervals. Rainfall amounts for the 6-hour and 1-day storms were taken from the National Weather Service Technical Papers No. 40 and No. 49, and the 10-day runoff volume was taken from the SCS Hydrology Guide for Minnesota (References 7, 8, and 9). The starting lake elevation was chosen at the invert of the outlet channel at the abandoned railroad grade. The rating curve for the outlet of Lake Sarah was derived using the U.S. Army Corps of Engineers (COE's) HEC-2 computer program (Reference 10). The starting elevations for the HEC-2 program were developed from a rating curve of the 60-inch pipe culvert at the Soo Line Railroad crossing of Sarah Creek which is 400' downstream of the abandoned railroad grade. The cross section and geometric information for the HEC-2 program was obtained from survey data of Sarah Creek between the abandoned railroad grade and the Soo Line Railroad. This data was surveyed by Hennepin County and is contained in the Mn/DNR Lakes Files. Storage elevation curves were determined from a USGS 7.5 minute advanced map with a contour interval of 10 feet (Reference 11).

Table 2 shows the peak stages of Lake Independence, Lake Sarah and Lake Robina for the selected recurrence intervals.

TABLE 2 - SUMMARY OF ELEVATIONS

LOCATION	ELEVATIONS (NGVD) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Lake Independnece	958.3	959.2	959.5	960.1
Lake Sarah	980.1	980.9	981.2	981.8
Lake Robina	955.2	955.7	955.8	956.3

The hydrology of Independence was coordinated with the Hydrologic Interagency Review Committee, consisting of members from the U.S. Army Corps of Engineers (COE), the Soil Conservation Service (SCS), Mn/DNR, the U.S. Geological Survey (USGS), and the Minnesota Department of Transportation (Mn/DOT), to eliminate the possibility of future conflicts. Interagency approval was received September 8, 1980.

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.

Cross sections for the backwater analyses of Pioneer Creek and Lake Robina Tributary were obtained from the Flood Hazard Study of Pioneer Creek (Reference 3). The profiles generated by the FIS contractor were found to be within 0.5 foot of the Flood Hazard Study Profile, therefore the profiles reported in the Flood Hazard Study, Pioneer Creek, Spurzem Creek and Lake Robina Tributary were used for this report. The overbank portions of the cross sections were obtained from the 1:6000 scale, 2-foot contour interval, topographic maps prepared for the Flood Hazard Study by the SCS (Reference 12). The channel portions of the cross sections were obtained by field surveys.

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.

The channel and overbank roughness coefficients (Manning's "n") for the HEC-2 step-backwater analyses were assigned after examination of aerial

photos and field inspection. The range in "n" values used varied from 0.035 to 0.08 for the channel and 0.05 to 0.12 for the overbank.

The step-backwater computations were started downstream of the confluence of Pioneer Creek and the South Fork Crow River. The starting elevations and additional cross sections for the South Fork Crow River were obtained from the adjoining Wright County Flood Insurance Study (Reference 13).

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 FIRM and FBFM mapping.

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 at each cross section.

Flooding sources studied by approximate methods were delineated on guadrangle maps with a contour interval of 10 feet and at an enlarged scale of 1:6000 (References 14, 15, 16). Painter Creek was delineated using the Flood Hazard Boundary Map (Reference 17). This delineation was checked by field inspection of the area.

The boundaries of 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 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 height to 1.0 foot, provided that hazardous velocities are not produced. In Minnesota, however, flood plain encroachment is limited by Minnesota Regulations to that which would cause a 0.5 foot increase in flood heights above pre-floodway conditions at any point (Reference 18).

The commmunity has selected the 0.0 foot rise floodway which is more restrictive than the 0.5 foot rise floodway. The limits of the 0.0 foot rise floodway are the boundaries of the 100-year flood.

Results of floodway profile computations are listed for selected cross-sections on Pioneer Creek and Lake Robina Tributary in Table 3.

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 boundaries of the floodway and the 100-year

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 (FEET)
PIONEER CREEK								
A	24430	440/350 [2]	190	3.4	930.1	925.0 [3]	925.0	0.0
B	25850	250	489	1.3	930.1	926.3 [3]	926.3	0.0
C	27450	150	284	2.3	930.1	927.1 [3]	927.1	0.0
D	29200	135	305	2.1	930.3	929.5 [3]	929.5	0.0
E	31260	145	365	1.8	932.4	932.4	932.4	0.0
F	32100	137	332	2.0	933.3	933.3	933.3	0.0
G	35260	345	1492	0.4	935.8	935.8	935.8	0.0
H	35700	295	1179	0.6	935.9	935.9	935.9	0.0
I	37000	40	171	3.8	936.7	936.7	936.7	0.0
J	37700	176	499	1.3	938.5	938.5	938.5	0.0
K	39465	397	762	0.9	939.1	939.1	939.1	0.0
L	40400	507	1192	0.6	939.3	939.3	939.3	0.0
M	44100	115	166	2.6	939.4	939.4	939.4	0.0
N	45360	140	321	1.3	940.3	940.3	940.3	0.0
O	45900	163	227	1.7	940.9	940.9	940.9	0.0
P	47370	56	325	1.2	943.5	943.5	943.5	0.0
Q	49600	550	3073	0.1	943.6	943.6	943.6	0.0
R	50700	60	77	5.1	943.6	943.6	943.6	0.0
S	51180	64	170	2.3	945.1	945.1	945.1	0.0
T	53800	55	190	2.1	947.5	947.5	947.5	0.0
U	56575	735	1523	0.2	949.9	949.9	949.9	0.0
V	59200	65	37	7.3	949.9	949.9	949.9	0.0
W	60400	200	121	2.2	955.7	955.7	955.7	0.0

[1] Feet above confluence with South Fork Crow River.

[2] Total width/width within Corporate Limits.

[3] Those elevations computed without consideration of backwater from the South Fork Crow River.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN

(HENNEPIN CO.)

FLOODWAY DATA

PIONEER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1,3]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE (FEET)
PIONEER CREEK								
X	61980[1]	100	271	0.8	957.9	957.9	957.9	0.0
Y	63000[1]	800	4979	0.04	957.9	957.9	957.9	0.0
Z	67500[1]	1563/770[2]	5325	0.04	957.9	957.9	957.9	0.0
AA	70170[1]	86	178	1.2	958.8	958.8	958.8	0.0
AB	72050[1]	315	768	0.3	959.4	959.4	959.4	0.0
LAKE ROBINA TRIBUTARY								
A	1,050[3]	291	277	0.9	939.6	939.6	939.6	0.0
B	1,800[3]	100	864	0.3	941.7	941.7	941.7	0.0
C	3,000[3]	23	46	5.5	941.7	941.7	941.7	0.0
D	4,500[3]	260	436	0.6	943.8	943.8	943.8	0.0
E	8,855[3]	436	717	0.1	945.7	945.7	945.7	0.0
F	9,850[3]	29	40	1.4	946.5	946.5	946.5	0.0
G	11,250[3]	22	24	2.3	947.6	947.6	947.6	0.0
H	12,300[3]	30	16	3.4	949.2	949.2	949.2	0.0
I	13,165[3]	42	32	1.7	953.1	953.1	953.1	0.0
J	13,940[3]	50	36	1.5	954.1	954.1	954.1	0.0
K	14,200[3]	35	107	0.2	955.8	955.8	955.8	0.0

[1]Feet above confluence with South Fork Crow River [3]In feet above confluence with Pioneer Creek.
[2]Total width/width within Corporate Limits.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOODWAY DATA

PIONEER CREEK, LAKE ROBINA TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SOUTH FORK CROW RIVER								
A	12,635	1330[2]	9220	3.0	915.3	915.3	915.4	0.1

[1]FEET ABOVE CONFLUENCE WITH CROW RIVER
[2]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOODWAY DATA

SOUTH FORK CROW RIVER

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 that portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.5 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.

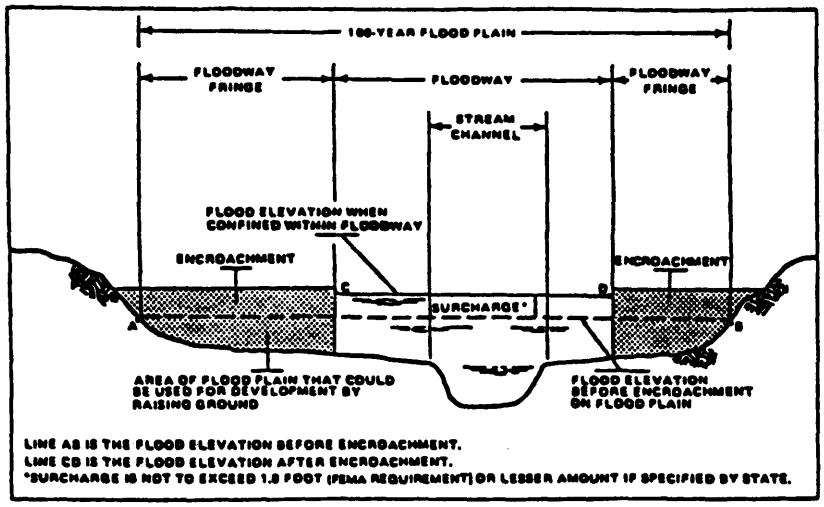


FIGURE 2 - Floodway Schematic

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 (FHF), and flood insurance zone designations for each flooding source studied in detail affecting the City of Independence.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference of 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
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Independence are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 4).

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Emergency Management Agency 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 017 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 area of the City of Independence 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.

Zone A1, A2, A15, A16: 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 100-year flood, including areas of the 500-year floodplain 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. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 4, "Flood Insurance Zone Data", summarizes the flood elevation differences, Flood Hazard Factors, 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 Independence is, for insurance purposes, the 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 Hennepin Soil and Water Conservation District published the Flood Hazard Study, Pioneer Creek, Spurzem Creek, and Lake Robina Tributary (Reference 3). For Pioneer Creek and Lake Robina Tributary the flood profiles and flood boundaries are in complete agreement with those reported in this study.

Flood Insurance Studies have been prepared for Medina, Wright County, Greenfield, Orono, and Delano (References 5, 13, 19, 20 and 21). The Independence Flood

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Pioneer Creek Backwater from South Fork Crow River	0005	-8.0	-3.0	5.5	080	A16	Varies - See Map
Reach 1	0003,0005	-1.2	-0.4	0.9	010	A2	Varies - See Map
Reach 2	0003,0004	-0.7	-0.2	0.3	005	A1	Varies - See Map
Reach 3	0004	-1.1	-0.4	0.5	010	A2	Varies - See Map
Lake Robina Tributary Reach 1	0003	-0.7	-0.5	0.5	005	A1	Varies - See Map
Lake Independence	0002,0004	-1.2	-0.3	0.6	010	A2	960
Lake Sarah	0002	-1.1	-0.3	0.6	010	A2	981
Lake Robina	0001,0003	-0.6	-0.1	0.5	005	A1	956
South Fork Crow River	0001	-7.6	-2.4	5.2	075	A15	919

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD INSURANCE ZONE DATA

PIONEER CREEK - LAKE ROBINA TRIBUTARY - LAKE INDEPENDENCE - LAKE SARAH - LAKE ROBINA - SOUTH FORK CROW RIVER

Insurance Study is in agreement with these previously published studies.

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration for Independence and Minnetrista (References 17 and 22). The differences between the Flood Hazard Boundary Maps and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

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, 300 South Wacker Drive, Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Commerce, Bureau of the Census, 1980 Preliminary Census Figures.

2. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey Hennepin County, Minnesota, April 1974.

3. U.S. Department of Agriculture, Soil Conservation Service, Flood Hazard Study, Pioneer Creek, Spurzem Creek, and Lake Robina Tributary, January 1979.

4. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Project Formulation for Hydrology, May 1965.

5. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Medina, Minnesota, 1979.

6. U.S. Water Resources Council, Hydrology Committee, Bulletin No. 17A, Guidelines for Determining Flood Flow Frequency, March 1976.

7. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Technical Paper No. 40, May 1964.

8. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Technical Paper No. 49, 1964.

9. U.S. Department of Agriculture, Soil Conserviation Service, Hydrology Guide for Minnesota, 1966.

10. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, August 1979.

11. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Advanced Mapping Rockford SW Quadrangel, Minnesota, 1979.

12. Mark Hurd Aerial Surveys, Inc., Topographic Maps, Scale 1:6000, Contour Interval 2 feet: Pioneer Creek, Hennepin County, Minnesota, 1977.

13. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Wright County, Minnesota, November 1977.

14. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Advanced Mapping Buffalo SE Quadrangle, Minnesota, 1979.

15. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Advanced Mapping Waconia NE Quadrangle, Minnesota, 1979.

16. U.S. Geologial Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Mound, Minnesota Quadrangle, 1958.

17. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Independence, Minnesota, June 1974.

18. Minnesota Department of Natural Resources, Division of Waters, Technical Report No. 6, The Regulatory Floodway in Flood Plain Management, September 1977.

19. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Greenfield, Minnesota, April 1981.

20. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Orono, October 1978.

21. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Delano, April 1980.

22. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Minnetrista, Minnesota, January 1978.

9.0 REVISIONS DESCRIPTION

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 ensure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

The data presented will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

9.1 First Revision (Revised September 17, 1992)

a. Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were performed by the U.S. Army Corps of Engineers (COE), St. Paul District, under Interagency Agreement No. EMW-89-E-2978, Project Order No. 5. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

b. Scope

Flooding of South Fork Crow River was restudied in detail.

c. Hydrologic and Hydraulic Analyses

The hydrologic analysis of South Fork Crow River was based on U.S. Geological Survey (USGS) gage no. 05279000 near the City of Mayer, Minnesota. The discharge-frequency curve for this station was adopted from the Unincorporated Areas of Wright County, Minnesota, Flood Insurance Study (Reference 23).

Mayer's gage record includes 50 years of data (1934 through 1983). To improve the short-term statistics of the Mayer gage, a correlation was done with the longer historic record of Rockford's gage according to USGS Bulletin 17B two-station comparison criteria (Reference 24). The skew for the City of Rockford was adopted at the City of Mayer, as it is more representative of the region due to longer historical record for the Rockford gage (Reference 23).

The discharge-frequency curve near the City of Mayer was transferred downstream to the study location by the drainage area ratio transfer method using an exponent of 0.4

Water-surface profiles for the 10-, 50-, 100-, and 500-year floods were computed using the HEC-2 step-backwater computer program (Reference 25). The HEC-2 model was developed for South Fork Crow River from the confluence of North and South Forks to the upstream corporate limits of the City of Watertown, Minnesota. This model is based on an existing model developed for the Unincorporated Areas of Wright County, Minnesota, Flood Insurance Study (Reference 23). Starting water-surface elevations were taken from elevations computed at the confluence of North and South Forks for the City of Greenfield, Minnesota, Flood Insurance Study (Reference 26).

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 5.

TABLE 5 - REVISED SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SOUTH FORK CROW RIVER					
just upstream of confluence with main stem Crow River	1,134	6,380	11,840	14,420	21,110
at county boundary	1,080	6,260	11,600	14,100	20,700

For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000, with a contour interval of 10 feet (Reference 27).

Floodplain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE, numbered A, and numbered V Zones), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B and Zone X shaded).

d. Floodways

The floodplain boundaries previously determined for South Fork Crow River (Reference 28) were reviewed and are considered valid for this revision. This was agreed upon by the community, the state, and FEMA. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause an increase in the base flood elevations greater than the community's allowable surcharge at any point within the community.

e. Insurance Application

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The detailed data included the determination of reaches and Flood Hazard Factors (FHFs) and numbered flood insurance zone designations. The reach determinations and FHFs are no longer applicable. The Flood Insurance Zones have been redesignated and are described as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE (includes Zones A1 through A30)

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

Zone X (includes Zone B and Zone C)

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

f. Flood Insurance Rate Map

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as previously described and, in the cases involving the 100-year floodplains studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For some map panels, the floodways and selected cross sections are shown on the Flood Boundary and Floodway Map.

g. Other Studies

The published Flood Insurance Study for the Unincorporated Areas of Wright County, Minnesota (Reference 23), agrees with this study.

This Flood Insurance Study supersedes the previously published Flood Insurance Study for the City of Independence, Minnesota (Reference 28).

h. References and Bibliography

23. Federal Emergency Management Agency, Flood Insurance Study, Wright County, Unincorporated Areas, Minnesota, August 1988, revised August 1992.

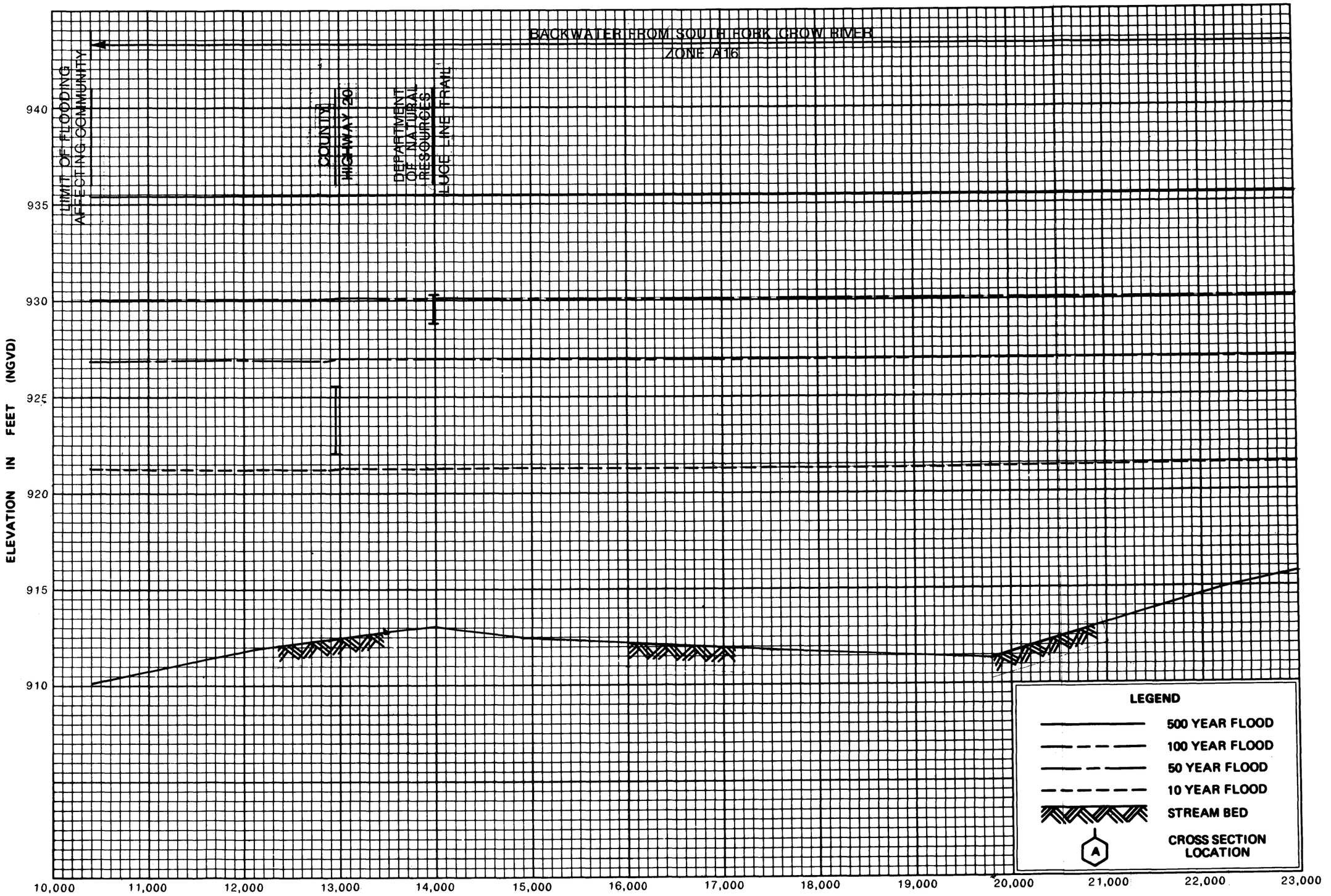
24. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

25. U.S. Army Corps of Engineers, St. Paul District, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Computer Program, Davis, California, September 1989.

26. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Greenfield, Hennepin County, Minnesota, October 1980, revised August 1992.

27. U.S. Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Delano, Minnesota, 1981.

28. Federal Emergency Management Agency, Flood Insurance Study, City of Independence, Minnesota, January 1983.



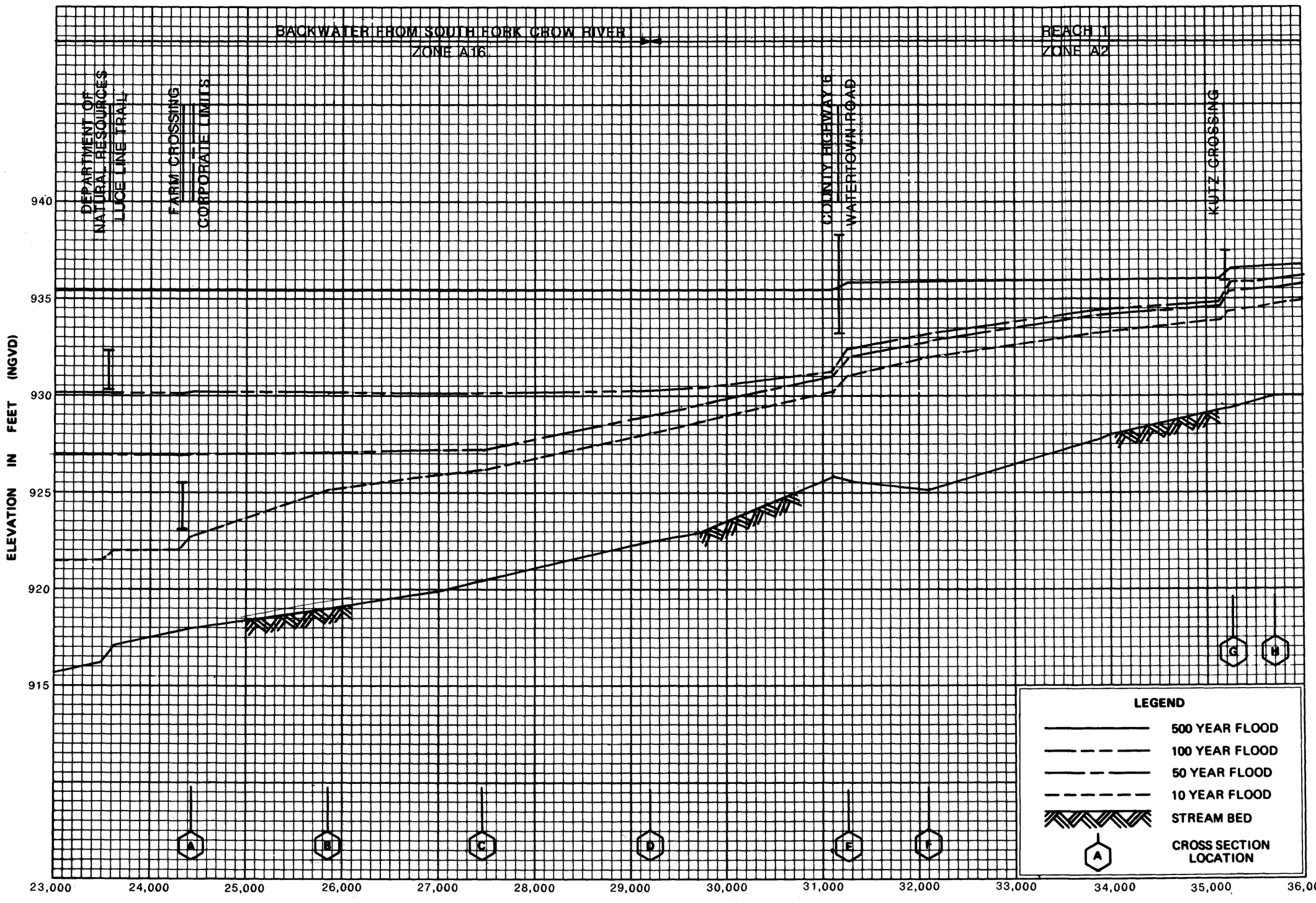
FLOOD PROFILES

PIONEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

01P



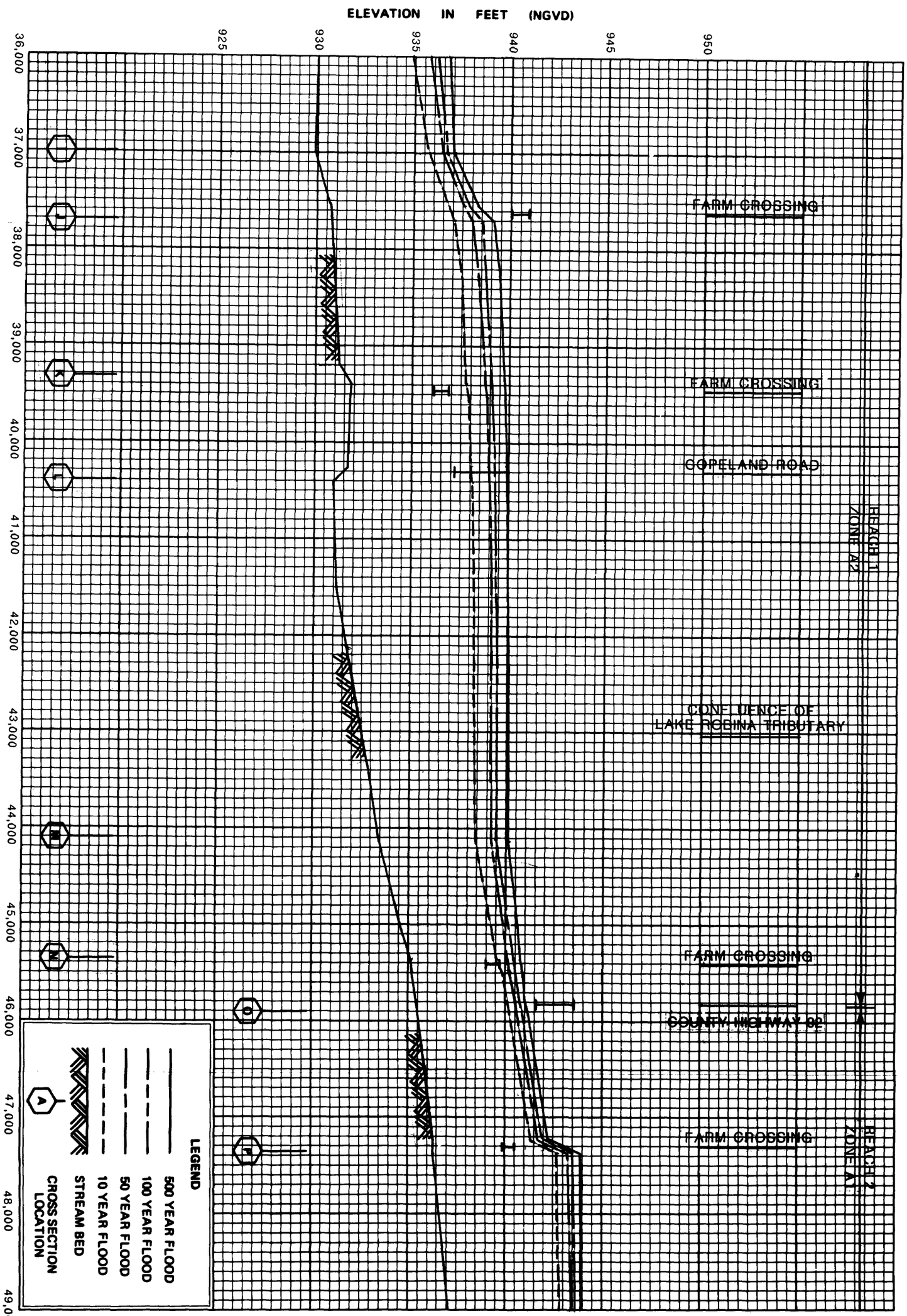
FLOOD PROFILES

PIONEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

02P



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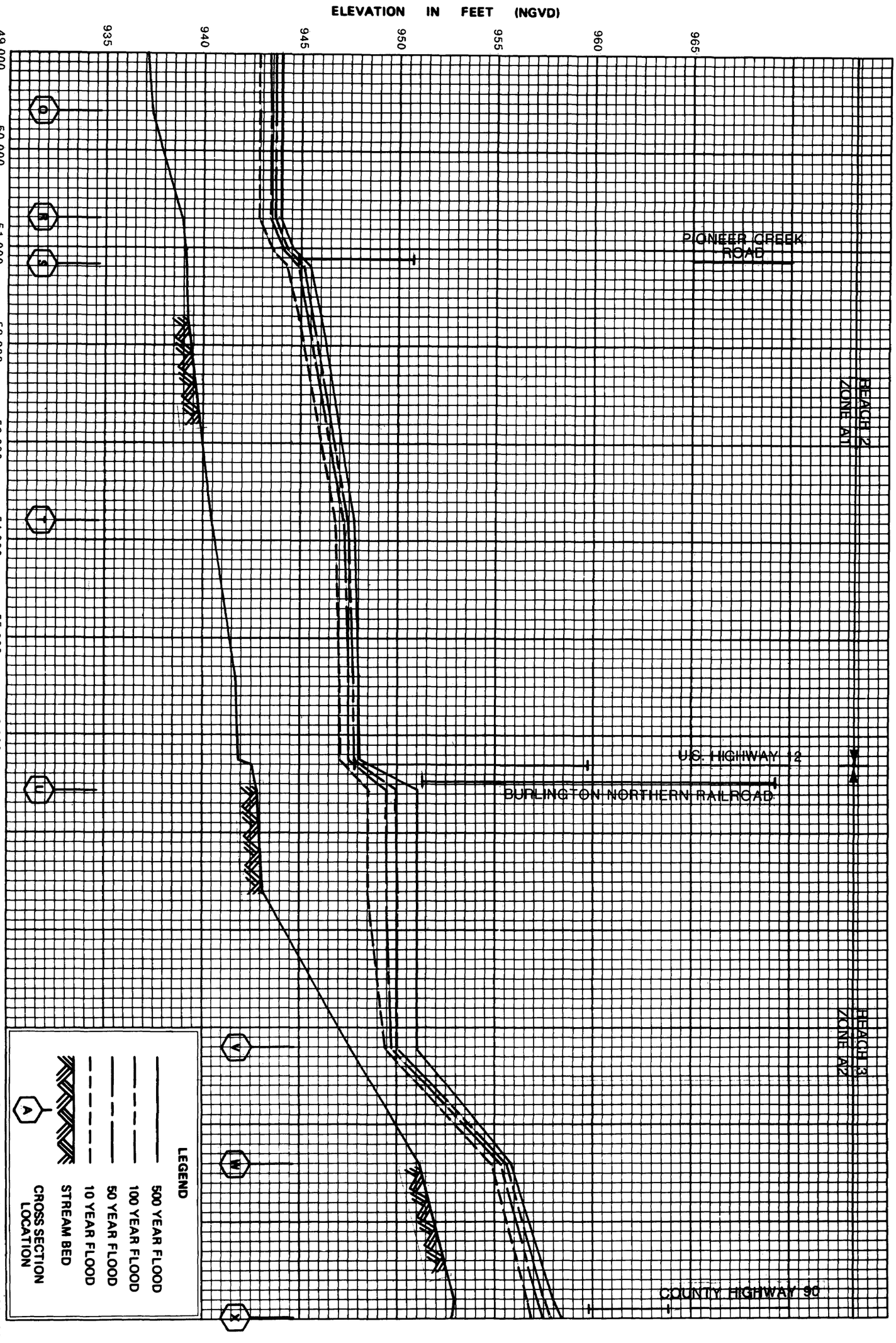
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

PIONEER CREEK



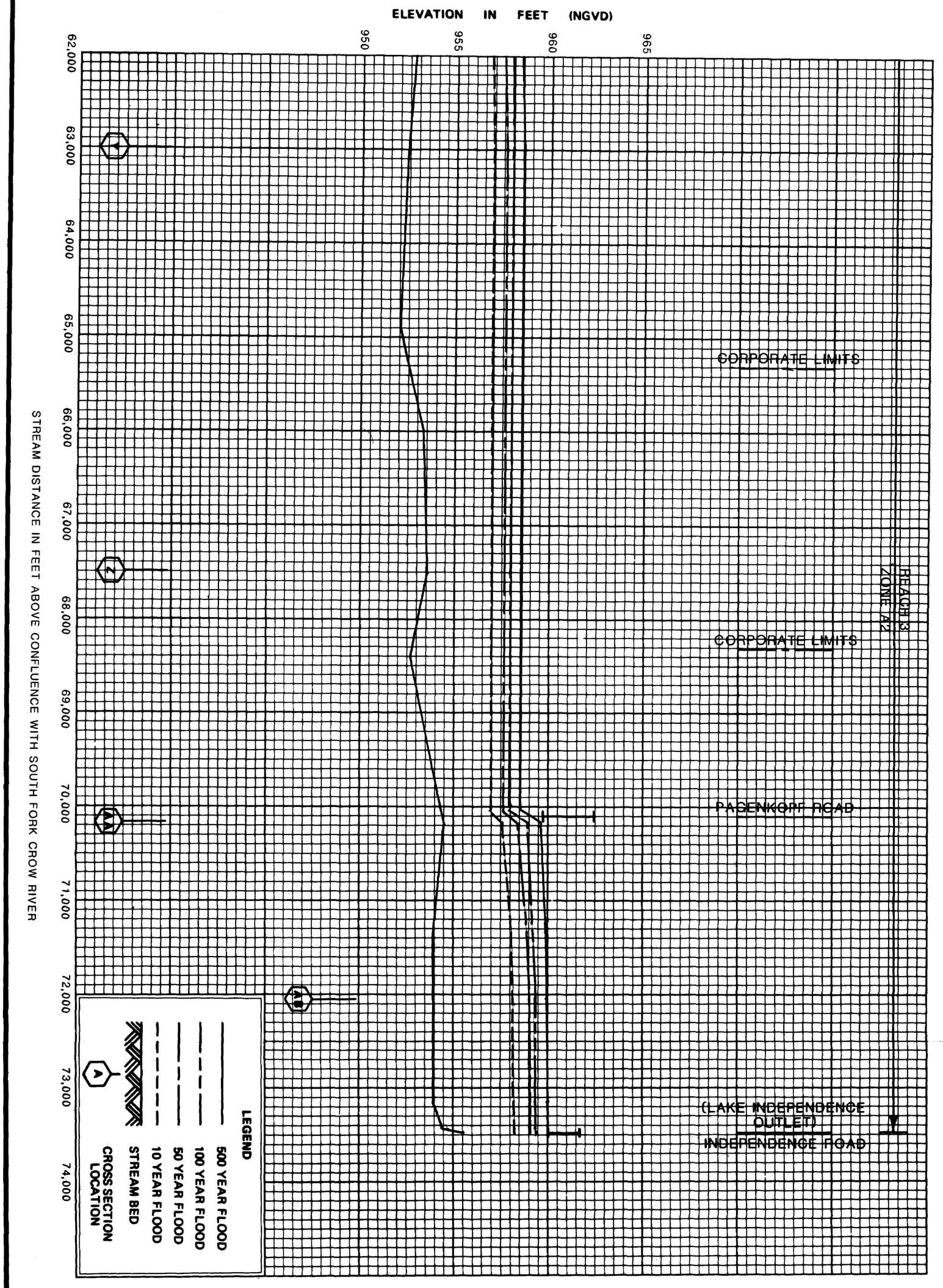
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

PIONEER CREEK

04P



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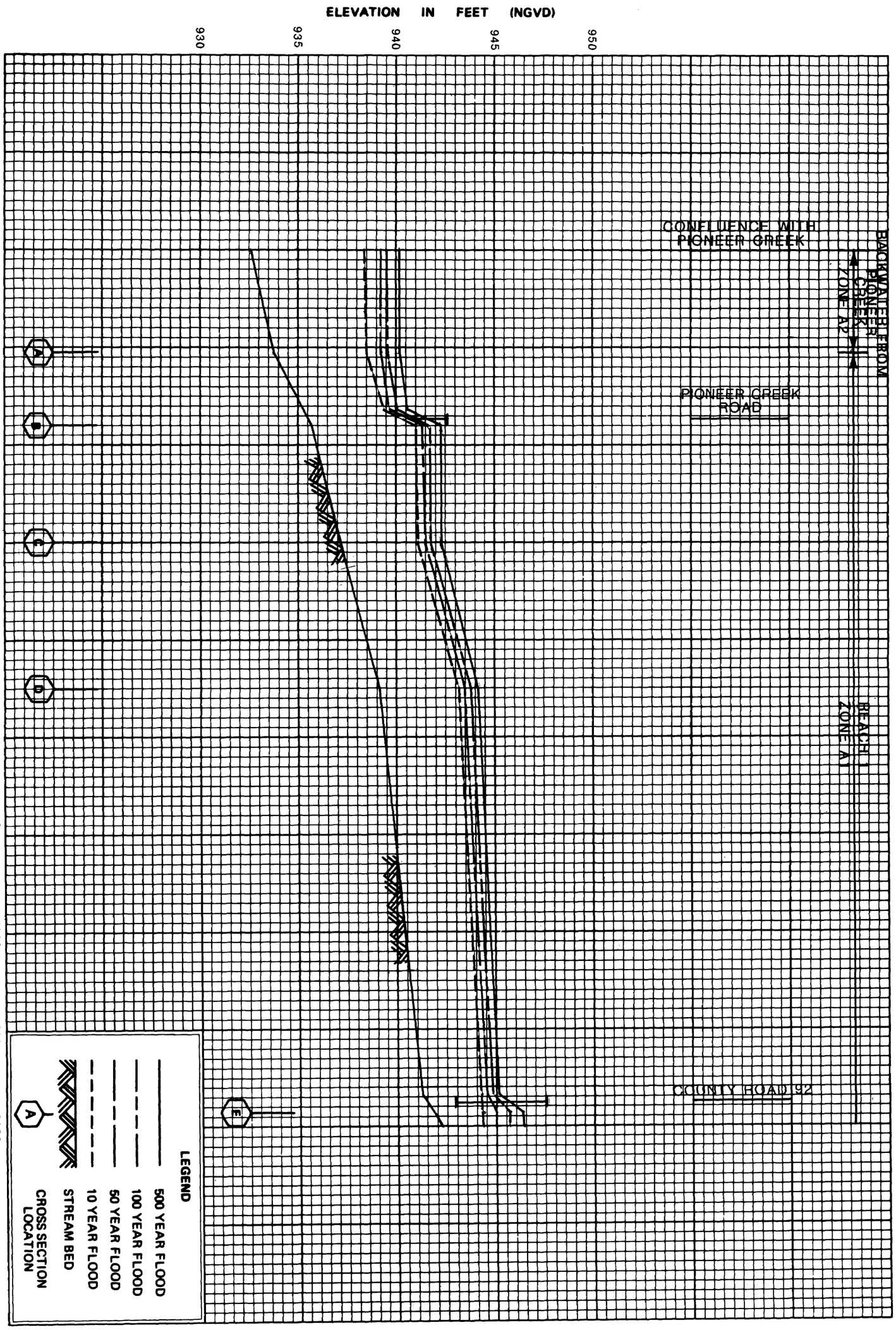
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

PIONEER CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

LAKE ROBINA TRIBUTARY

06P

ELEVATION IN FEET (NGVD)

940 945 950 955 960 965

9000 10,000 11,000 12,000 13,000 14,000 15,000

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH PIONEER CREEK

FARM CROSSING

REACH 1
ZONE AH

U. S. HIGHWAY 12

BURLINGTON NORTHERN RAILROAD

LAKE ROBINA OUTLET

F G H I J K

LEGEND

500 YEAR FLOOD

100 YEAR FLOOD

50 YEAR FLOOD

10 YEAR FLOOD

STREAM BED

A CROSS SECTION LOCATION

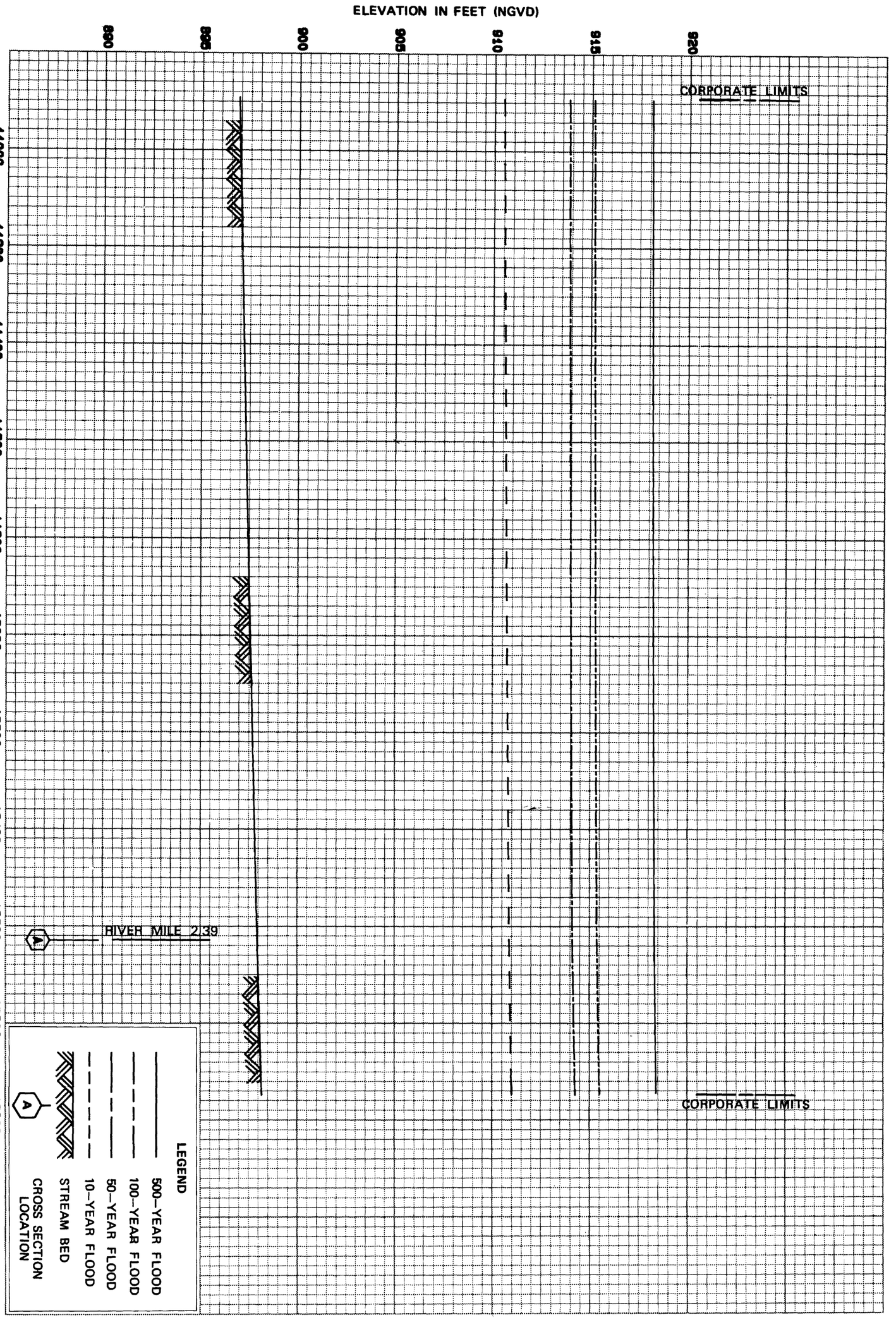
07P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

LAKE ROBINA TRIBUTARY



08P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF INDEPENDENCE, MN
(HENNEPIN CO.)

FLOOD PROFILES

SOUTH FORK CROW RIVER