FLOOD INSURANCE STUDY

GREEN LAKE COUNTY, WISCONSIN,

AND INCORPORATED AREAS

Community Name	Community Number
Berlin, City of	550166
Green Lake, City of	550167
Green Lake County (Unincorporated Areas)	550165
Kingston, Village of	550168
Markesan, City of	550169
Marquette, Village of	550170
Princeton, City of	550171

Green Lake County

EFFECTIVE:
FEBRUARY 3, 2010

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55047CV000A

Green Lake County, Wisconsin
And Incorporated Areas

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 (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this Preliminary FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Selected Flood Insurance Rate Map panels for this community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

Old Zone(s)	New Zone
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: February 3, 2010

TABLE OF CONTENTS

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY
GREEN LAKE COUNTY, WISCONSIN AND INCORPORATED AREAS

1.0   **INTRODUCTION**

1.1   Purpose of Study

This countywide Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Green Lake County, including the Cities of Berlin, Green Lake, Markesan, and Princeton; the Villages of Kingston and Marquette; and the unincorporated areas of Green Lake County (referred to collectively herein as Green Lake County).

For flood-hazard information in Fond du Lac, Winnebago, Waushara, Marquette, Columbia, and Dodge Counties, see separately published FIS reports and Flood Insurance Rate Maps (FIRM).

Also, the City of Green Lake and Villages of Kingston and Marquette did not have previous FIS text.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the county that will be used to establish actuarial flood insurance rates. This information will also be used by the communities of Green Lake County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and 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 NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2   Authority and Acknowledgments

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

This FIS was prepared to include the unincorporated areas of, and incorporated communities within, Green Lake County in a countywide format. Information on the authority and acknowledgment for each jurisdiction included in this countywide FIS, as compiled from previously printed FIS reports, is shown below.

Berlin, City of:	The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (USACE), Chicago District, under Inter-Agency Agreement No. H-16-75 and H-7-76, Project Order No. 20 and 1, respectively. This work was completed in April 1976.
Green Lake, Unincorporated Areas:	The hydrologic and hydraulic analyses for this study were performed by Owen Ayres and Associates, Inc., for the Federal Insurance Administration, under Contract No. H-3705. This work was completed in May 1975.
Markesan, City of:	The hydrologic and hydraulic analyses for the Grand River, East Tributary, and West Tributary were obtained from the State of Wisconsin / Department of Natural Resources. This work was completed in December 1994. Planimetric base map files were derived by digitizing the City of Markesan, Wisconsin, Flood Insurance Rate Map. These files were compiled at a scale of 1:4800.
Princeton, City of:	The hydrologic and hydraulic analyses for this study were performed by the United States Geological Survey (USGS) for the Federal Emergency Management Agency, under Inter-Agency Agreement No. EMW-85-E-1823. This study was completed in June 1986.

For this countywide FIS, digital conversion of special flood hazard areas was performed by CDM Federal Programs Corporation (CDM), under contract HSFE05-05-D-0027/006. This work was completed July 13, 2007. The digital base mapping information was provided in digital format by Green Lake County, Wisconsin. This information was derived from data compiled in 2000 and updated in April 2005. These data meet or exceed National Mapping Accuracy Standards. Users of this FIS should be aware that minor adjustments may have been made to specific FIRM base map features.

The coordinate system used for the production of the FIRMs is Universal Transverse Mercator (UTM), North American Datum of 1983 (NAD 83), GRS 80 spheroid. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRMs.

1.3   Coordination

An initial Consultation Coordination Officer (CCO) meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the FIS.

The dates of the initial and final CCO meetings held for previous FIS for jurisdictions within Green Lake County are shown in Table 1, "Initial and Final CCO Meetings."

TABLE 1 – INITIAL AND FINAL CCO MEETINGS

Community	Initial CCO Date	Final CCO Date
City of Berlin	January 1975	May 12, 1976
Green Lake County, Unincorporated areas	*	July 16, 1975
City of Markesan	*	April 16, 2002
City of Princeton	December 1984	July 14, 1987

*Information not available

For this countywide FIS, the initial CCO meeting was held September 12, 2006, and was attended by representatives of CDM, Wisconsin Department of Natural Resources (WDNR), FEMA and the communities. The results of the study were reviewed at the final CCO meeting held on February 5, 2008 and attended by representatives of CDM, WDNR, FEMA and the communities. All problems raised at that meeting have been addressed in this study.

2.0   **AREA STUDIED**

2.1   Scope of Study

This FIS report covers the geographic area of Green Lake County, Wisconsin including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were previously studied by detailed methods. The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRMs (Exhibit 2).

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Stream	Limits of Detailed Study
Barnes Creek	From its confluence with the Fox River to Hunter Street
East Tributary	From its confluence with the Grand River to approximately 3,100 ft upstream of John Street
Fox River	Approximately 7,600 ft downstream of the confluence with Barnes Creek to the Green Lake / Marquette County Line
Grand River	From the Village of Kingston corporate limit to approximately 1,500 ft upstream of County Trunk Highway A
Puchyan River	From County Trunk Highway J to approximately 1,500 ft upstream of Interstate Highway 23
Silver Creek	From County Trunk Highway A to the Green Lake / Fond du Lac County Line
West Tributary	From its confluence with the Grand River to approximately 2,500 ft upstream of State Route 44
Winchell Springs Creek	From its confluence with the Fox River to approximately 2,800 ft upstream of the Chicago, Milwaukee, St. Paul, and Pacific Railroad

As part of this countywide FIS, updated analyses were included for the flooding sources shown in Table 3, "Scope of Revision."

TABLE 3 – SCOPE OF REVISION

Stream	Limits of Revised or New Detailed Study
Silver Creek	From mouth of Green Lake to the Green Lake / Fond du Lac County Line

For this countywide study, the flood boundaries of all flooding sources previous studied by detailed methods were redelineated based on updated topographic information.

All or portions of Belle Fountain Creek, Grand Lake, Grand River, Puchyan River, Snake Creek, Sucker Creek, White Creek, White River and numerous unnamed streams were studied by approximate methods.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The boundaries for the stream Zone A floodplains in Green Lake County were developed using limited detail study techniques and the County's 4-foot terrain data. For Grand Lake, Lake Maria, Little Green Lake, Spring Lake and one unnamed lake the Zone A boundaries were digitized to fit the best available topography. The scope and methods of study were proposed to, and agreed upon, by FEMA and WDNR.

2.2   Community Description

Green Lake County is located in the southeast-central area of Wisconsin, within the geographical provinces of the Central Plain (northwestern half of the county) and the Eastern Ridges and Lowlands (southeastern half of the county). The Central Plain, which is an extinct glacial bed, is characterized by a flat to gently rolling topography. The area is largely covered with wetlands.

The streams in this region, including the Fox River, have low gradients. The Eastern Ridges and Lowlands in the southeast are covered by a glacial outwash plain of irregular topography. Eleven of the twelve named lakes within the county are found in this area. The Grand River is the primary stream in this region. Most of the tributary streams of the Grand River have steep gradients.

The soil in the county fall into three broad categories: loams, sands, and peats. Loams cover two-thirds of the county. An Interim Soil Survey Report (Reference 1) for the county is available. Agricultural land use is prevalent in the county. Approximately 12 percent of the land areas are wooded.

The prevailing winds are westerly in the winter and southerly in the summer. July is normally the warmest month, with an average temperature of 72°F. January is the coldest month, with an average temperature of 18°F. The average annual precipitation is 29 inches and the average annual snowfall is 39 inches. Approximately 60 percent of the normal yearly precipitation falls during the 5-month period from May through September.

The Green Lake County 1960 and 1970 populations were 15,418 and 16,878, respectively. The population in Green Lake County was 18,651 in 1990 and 19,105 in 2000 (Reference 2). Numerous seasonal and permanent residences, as well as commercial and industrial developments, are located in the flood plains of the lakes and streams. County and state roads and railroad lines cross the streams at various locations.

2.3   Principal Flood Problems

The principal flood problems in Green Lake County are due to stream overflow and wave runup. Riverine flooding is due primarily to overflows of the Fox River which has a very wide and flat floodplain. Three locks and dams are located on the Fox River; however, the locks are no longer maintained for navigational purposes.

There have been several significant floods on the Fox River with the highest stage (no discharge available) on record occurring in 1881. The largest recorded discharge at the Berlin gage (records 1898 to date) was 6,900 cubic feet per second (cfs) in March 1946 (Reference 3). In 1973, the recorded discharge was 6,010 cfs which exceeds that of a 10-year frequency flood. Large land areas were flooded, resulting in damage to agricultural, residential, commercial, and industrial buildings and lands. The highest recorded discharge for the Grand River at the U.S. Geological Survey (records 1968 to date) gage near Kingston was 1,540 cfs in March 1973. Flooding in this area affects residential, industrial, and agricultural areas.

Flood hazards on Green Lake include high lake stages, ice buildup, and wave runup. Wind setup on Green Lake is insignificant due to the depth of the lake. Structural damage to buildings and retaining walls caused by erosion and wave action occurred as recently as 1973. Southwesterly or northeasterly winds coupled with high lake levels create the most hazardous conditions.

2.4   Flood Protection Measures

Several small levees exist along the Fox River. These levees provide little flood protection. Lake Puckaway, formed by the Princeton Dam, provides little protection due to the large flood volumes encountered during floods. Dams are located on the Grand River at Kingston and Manchester. Neither structure provides any flood control protection. Green Lake, due to its large storage volume, reduces peak flows from its tributary streams.

There is an abandoned navigational lock and dam in the southwest portion of the City of Berlin, but it does not provide any flood control for the city. The city has adopted a floodplain zoning ordinance to direct the future development of the city's floodplains. This ordinance restricts the type of development which may occur in all lands adjacent to any stream or river within the city, and which are at, or below, the 760-foot contour line as shown on the official city topographic map.

3.0   **ENGINEERING METHODS**

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this FIS. 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 floodplain 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 1-percent annual chance flood (1-percent chance of annual exceedance) 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 county at the time of completion of this FIS. Maps and flood elevations will be amended periodically to reflect future changes.

3.1   Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for the flooding sources studied in detail affecting the county.

Each incorporated community within, and the unincorporated areas of, Green Lake County, with the exception of the City of Green Lake and Villages of Kingston and Marquette have a previously printed FIS report. The hydrologic analysis described in those reports have been compiled and summarized below.

Pre-Countywide Analyses:

For Barnes Creek, Winchell Springs Creek, and its unnamed tributary in the City of Berlin, flood flow frequency data were based on a regional discharge-frequency curve developed by the USACE as part of a previous Flood Plain Information Report for Clintonville, Wisconsin (Reference 4). Drainage area–peak discharge relationships for stream segments in the City of Berlin are illustrated in Figures 1 and 2.

For East and West Tributaries in the City of Markesan, frequency-discharge data were determined using the SCS computer program as outlined in Technical Release No. 20 (Reference 5).

For the Fox River in unincorporated Green Lake County, flood flow frequency data were based on statistical analysis of stage-discharge records covering a 74-year period at the USGS gaging station located near Berlin. The analysis followed the standard log-Pearson Type III method as outlined by the Water Resources Council (Reference 6).

In evaluating the Fox River's storage capacity, flood routing was required. A hydrograph similar to the 1-percent chance recurrence interval flood at the Berlin gage was routed downstream from Lake Puckaway by the average successive log method (Reference 7). The results obtained agreed favorably with the 1973 flood data for the Berlin gage. In simulating the 1973 flood conditions, the majority of the runoff was assumed to be contributed upstream from the county line. Flood
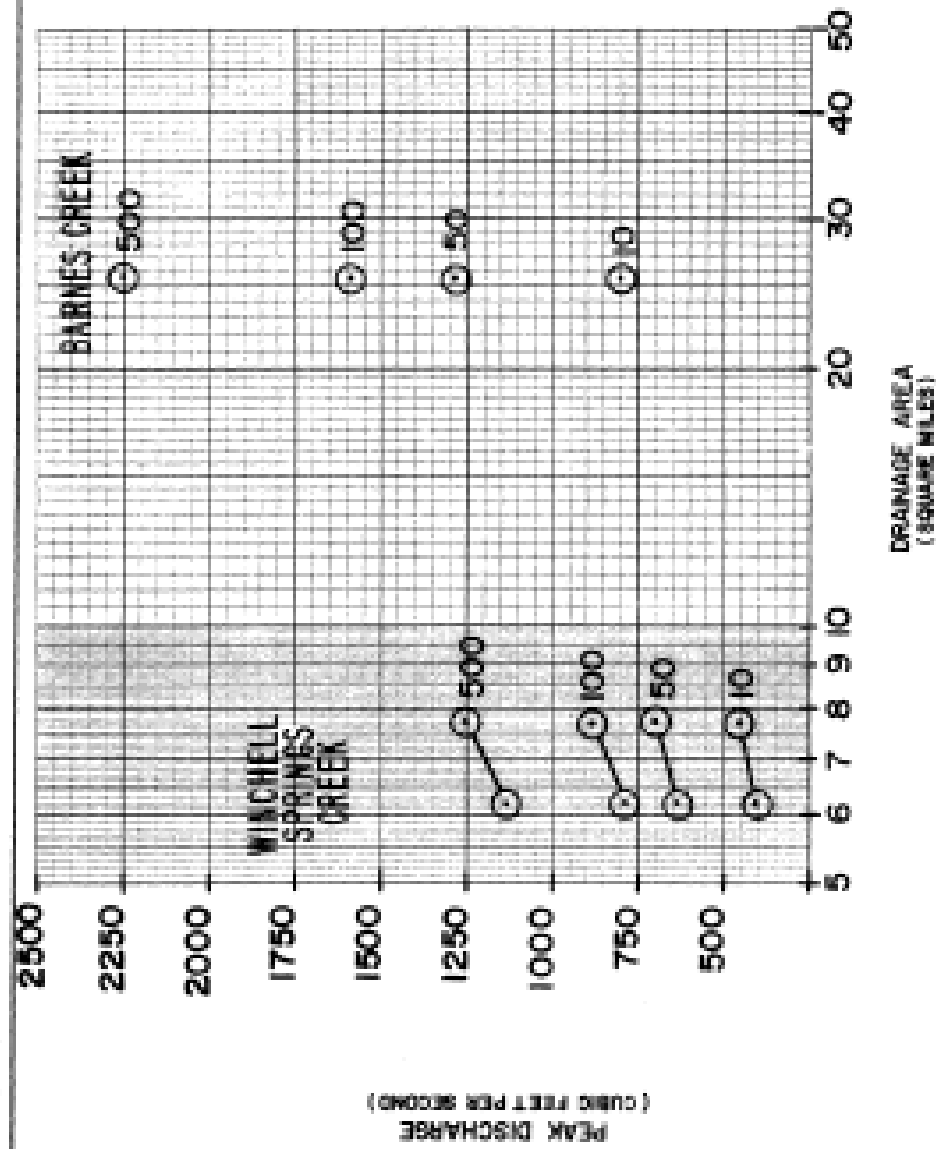
FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES

BARNES CREEK, WINCHELL SPRINGS CREEK
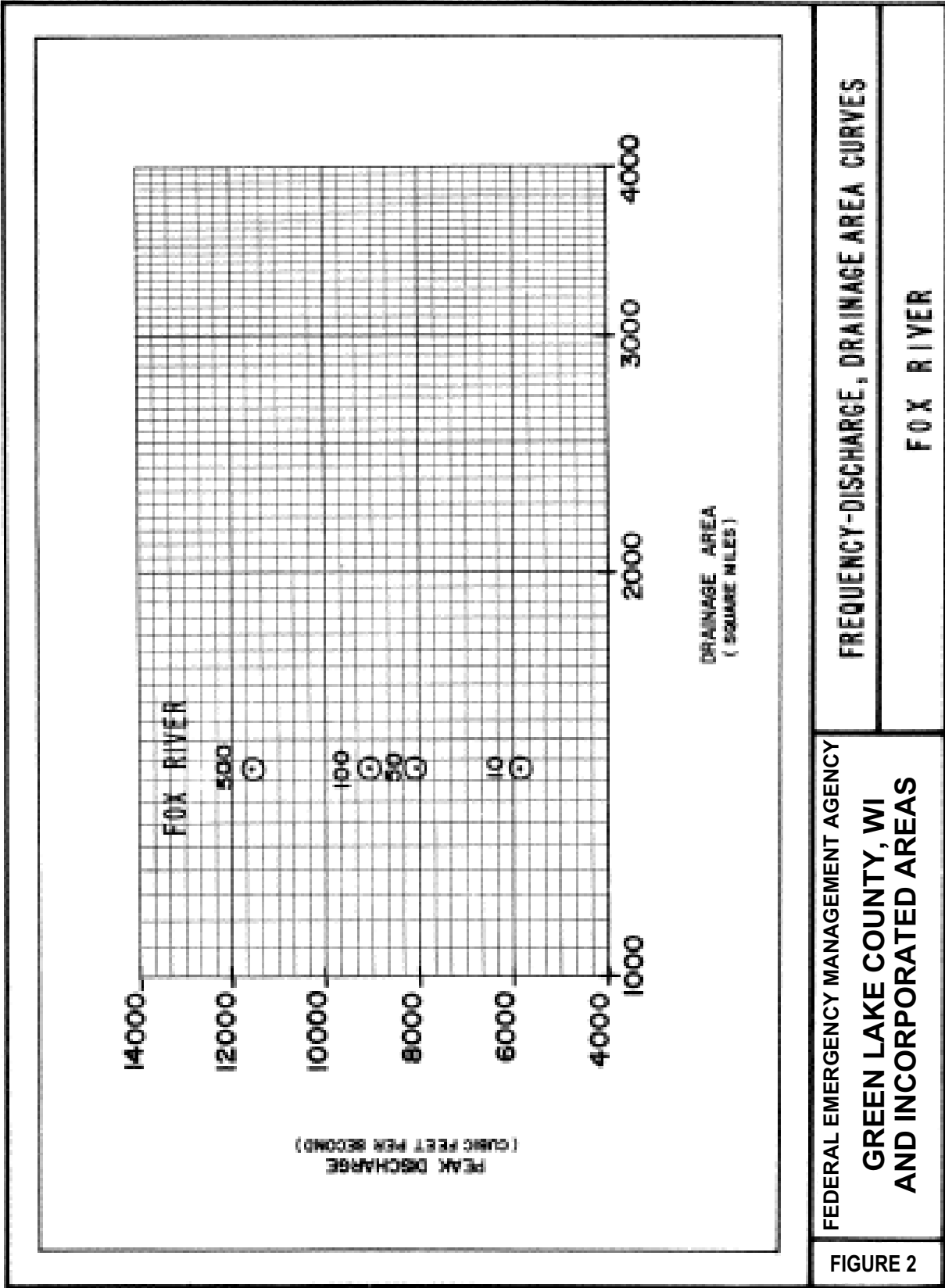
FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

FIGURE 1

8

DRAINAGE AREA
(SQUARE MILES)

PEAK DISCHARGE
(CUBIC FEET PER SECOND)

FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY	FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES
GREEN LAKE COUNTY, WI AND INCORPORATED AREAS	FOX RIVER
FIGURE 2	

routing by this method is limited in that it does not recognize the many factors affecting wave movement. The results obtained by the average successive log method are considered to typify existing floodflow conditions. Other, more exact methods of flood routing such as Muskingum's method (Reference 7) were not utilized due to a lack of data required for deriving storage coefficients and other necessary information.

The drainage area for the Fox River was determined from USGS quadrangle maps (Reference 8), and it compared favorably to known drainage areas (Reference 9).

The 1-percent annual chance recurrence interval discharge for the Fox River at the City of Princeton was determined by the method outlined in the USGS publication "Techniques for Estimating Magnitude and Frequency of Floods for Wisconsin Streams" (Reference 10).

For the Grand River in unincorporated Green Lake County, a statistical analysis approach was not used because of the shortness of the period of record. Therefore, the 1973 flood hydrograph was analyzed and converted to a unit hydrograph developed by utilizing Clark's method (Reference 11). This was supplemented by comparisons to other streams in the vicinity and by regression analysis (Reference 12). Discharges obtained at the gage were transferred to the various locations by drainage area ratios.

For the Grand River in the City of Markesan, a statistical analysis was determined using gaged comparisons between the Kingston Basin and other similar basins. The statistical method compared the two basins on Rock River to the Kingston Basin. Log-Pearson distributions were performed for the two basins and the results of the distribution were transferred to the Kingston basin using the area-transfer method. The transferred basin results were averaged to get flows for the Kingston basin.

For the Puchyan River, peak discharges were determined by flood routing the tributaries through Green Lake. Frequency-discharge data for Silver Creek were determined using Soil Conservation Service hydrologic criteria. Runoff was estimated from the rainfall-runoff characteristics of the watershed.

Discharges for the 0.2-percent annual chance recurrence interval floods of all streams were determined by straight-line interpolation of a single-log graph of flood discharges computed for frequencies up to 100 years.

Drainage area-peak discharge relationships for streams in Green Lake County are compared with other streams in the region and in other parts of Wisconsin in Figure 3.
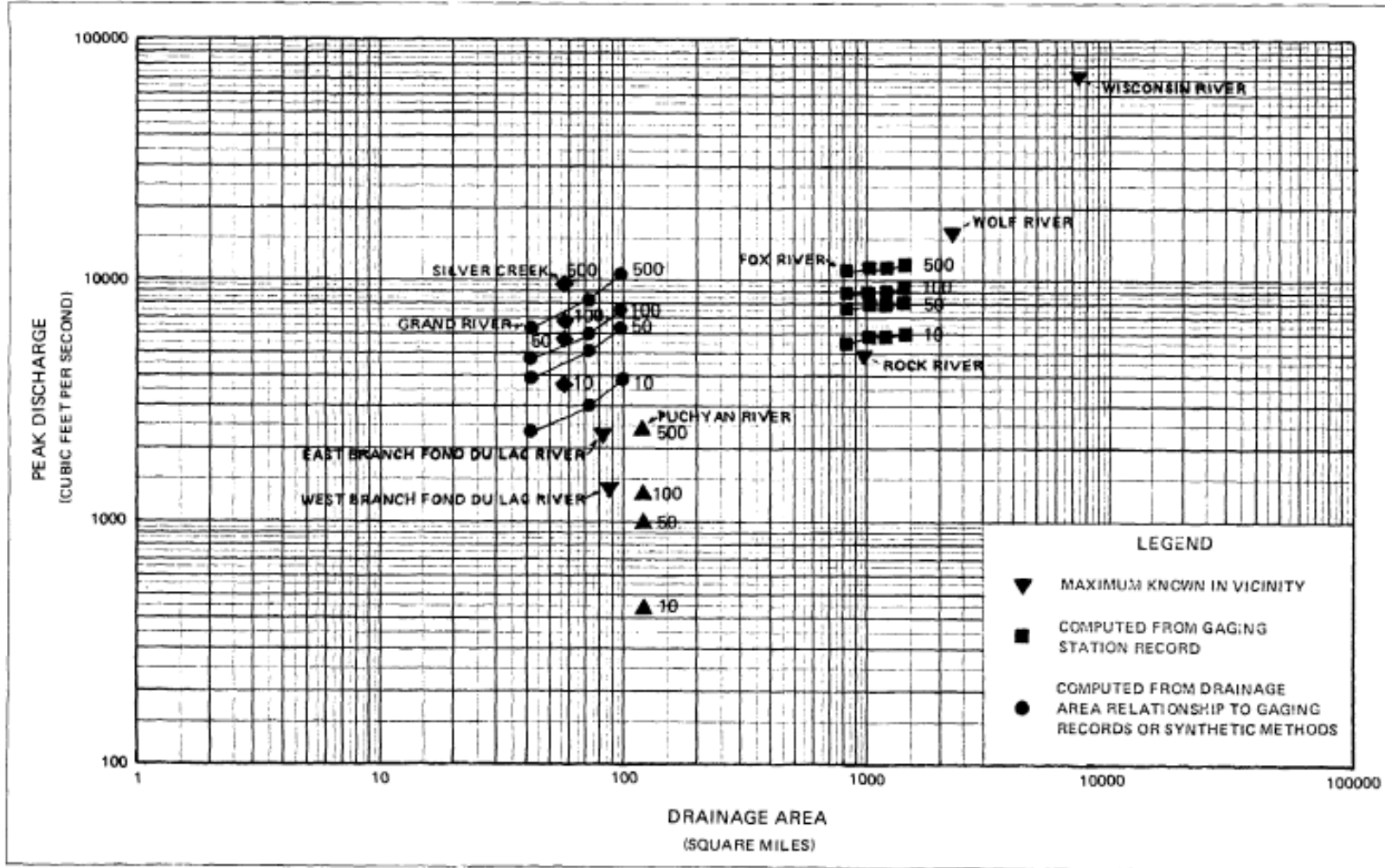
FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI AND INCORPORATED AREAS

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

WISCONSIN RIVER - WOLF RIVER - PUCHYAN RIVER - SILVER RIVER
EAST BRANCH FOND DU LAC RIVER - GRAND RIVER - WEST BRANCH FOND DU LAC RIVER
ROCK RIVER - FOX RIVER

This Countywide Analysis:

A HEC-HMS model was created for Silver Creek by WDNR, splitting the Green Lake County reach into four subbasins. Comparison of HMS results to the 2003 USGS Regional Regression Equations indicated the HMS flows were conservative but realistic. Flows along Silver Creek were significantly reduced from the 1976 values.

A summary of the drainage area-peak discharge relationships for all of the streams studied by detailed methods is shown in Figures 1, 2, and 3 and Table 4, "Summary of Discharges". Note that the countywide Silver Creek flow rates can be found in Table 4.

TABLE 4 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
EAST TRIBUTARY					
At State Route S in City of Markesan	2.9	235	360	425	544
FOX RIVER					
Downstream of abandoned railroad in City of Princeton	963.0	*	*	6,900	*
GRAND RIVER					
At State Route 44 in City of Markesan	58.6	1,730	2,690	3,070	3,850
Approximately 2,800 feet upstream of Bridge Street in City of Markesan	44.7	1,730	2,690	3,070	3,850
SILVER CREEK					
At County Highway A	56.3	1,960	3,218	3,870	5,500
Green Lake / Fond du Lac county line	36.8	1,220	1,925	2,271	3,050
WEST TRIBUTARY					
At John Street in City of Markesan	1.1	350	540	630	820
At State Route 44 in City of Markesan	*	300	460	540	700
Approximately 1,800 feet upstream of State Route 44 in City of Markesan	*	260	400	460	600

* Information not available

Records are available since 1968 for the gage located near the outlet of Green Lake. These records were compared to the lake levels obtained in flood routing the lake for the Puchyan River hydrology. Since there are no long term records, the derived elevation-frequency curves shown in Figure 4 are only approximate and should be used with caution. All elevations shown for Green Lake are based on a dam sill elevation of 796.11 NGVD. Operation of the dam can significantly alter the elevation of the lake during flood conditions.

USGS gage records on Little Green Lake are available from 1936 to 1962 (the gage was removed in 1962). These gage records were statistically analyzed to obtain the elevation-frequency data shown in Figure 5.

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent annual chance floods for the flooding sources studied by detailed methods and are summarized in Table 5, "Summary of Stillwater Elevations."

TABLE 5 - SUMMARY OF STILLWATER ELEVATIONS

	ELEVATION (feet NAVD[1])			
FLOODING SOURCE AND LOCATION	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
Puckaway Lake	767.8	768.9	769.5	770.9

[1] North American Vertical Datum 1988

3.2   Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Each incorporated community within, and the unincorporated areas of, Green Lake County, with the exception of the City of Green Lake and Villages of Kingston and Marquette have a previously printed FIS report. The hydraulic analysis described in those reports have been compiled and summarized below.

Pre-Countywide Analyses:

In the City of Markesan, the WSP-2 computer program was used to compute the water-surface elevations of floods of the selected recurrence intervals for East and West Tributaries (Reference 13). Starting water-surface elevations for East and West Tributaries were taken from known water-surface elevations from the confluence with the Grand River.

The water-surface elevations in unincorporated Green Lake County were computed using the USACE HEC-2 step-backwater computer program (Reference 14). One-hundred and thirty-six stream and lake cross sections were field surveyed. A computer model simulating the 1973 flood on the Fox River was made with the use of high water marks. This model was then utilized in developing the other flood profiles.

Starting elevations for the Fox River were developed by the slope-area method and compared to the rating curve for the Berlin gage. The starting elevations for the Grand River were derived by their flow equations for the Kingston and

Manchester dams and by the slope-area method near Markesan. Starting elevations for the Puchyan River were developed by the slope-area methods and related to the Fox River. Silver Creek starting elevations were correlated with the Green Lake flood elevations.

In developing the water-surface profile for the Fox River, the hydraulic model was developed to match the USGS gage at Berlin for known flows (maximum in recent years was 6,010 cfs in 1973). Stage-discharge relationships for flows in excess were then determined from the hydraulic model. These discharges compared favorably to a synthesized extension of the currently used rating curve for the gage.

In the City of Princeton, topographic data for the Fox River was obtained by field survey. Structural geometry and elevations for two bridges were also obtained from field surveys. Synthesized cross sections were developed based on adjacent surveyed cross sections and from topographic maps. Water surface elevations for the 1-percent chance recurrence interval flood were computed by WSPRO, a step-backwater computer program developed by the USGS for the Federal Highway Administration (Reference 15). The starting water-surface elevation for the Fox River was obtained from the FIS for Green Lake County, Wisconsin (Reference 16).

Wave runup is the vertical distance above the 1-percent annual chance recurrence stillwater elevation that a wave will "run up" the shoreline of a body of water. Wave runup was computed on Green Lake using methods outlined in Reference 12. Figure 6 also depicts the addition of runup to the storm water surface caused by wind generated waves. Transects were taken at selected locations and runup
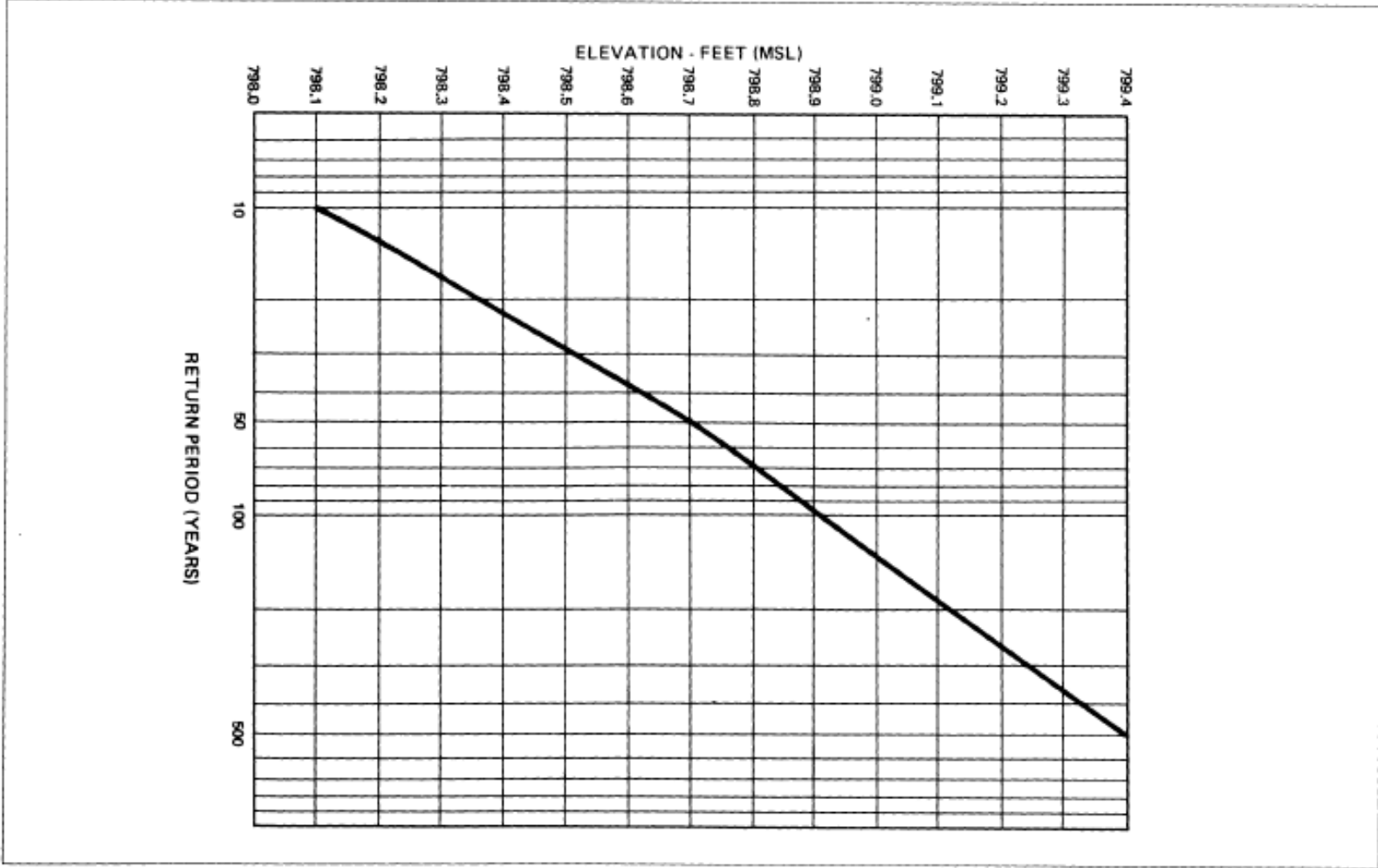
14

ELEVATION-FREQUENCY CURVE

GREEN LAKE - OUTLET DAM
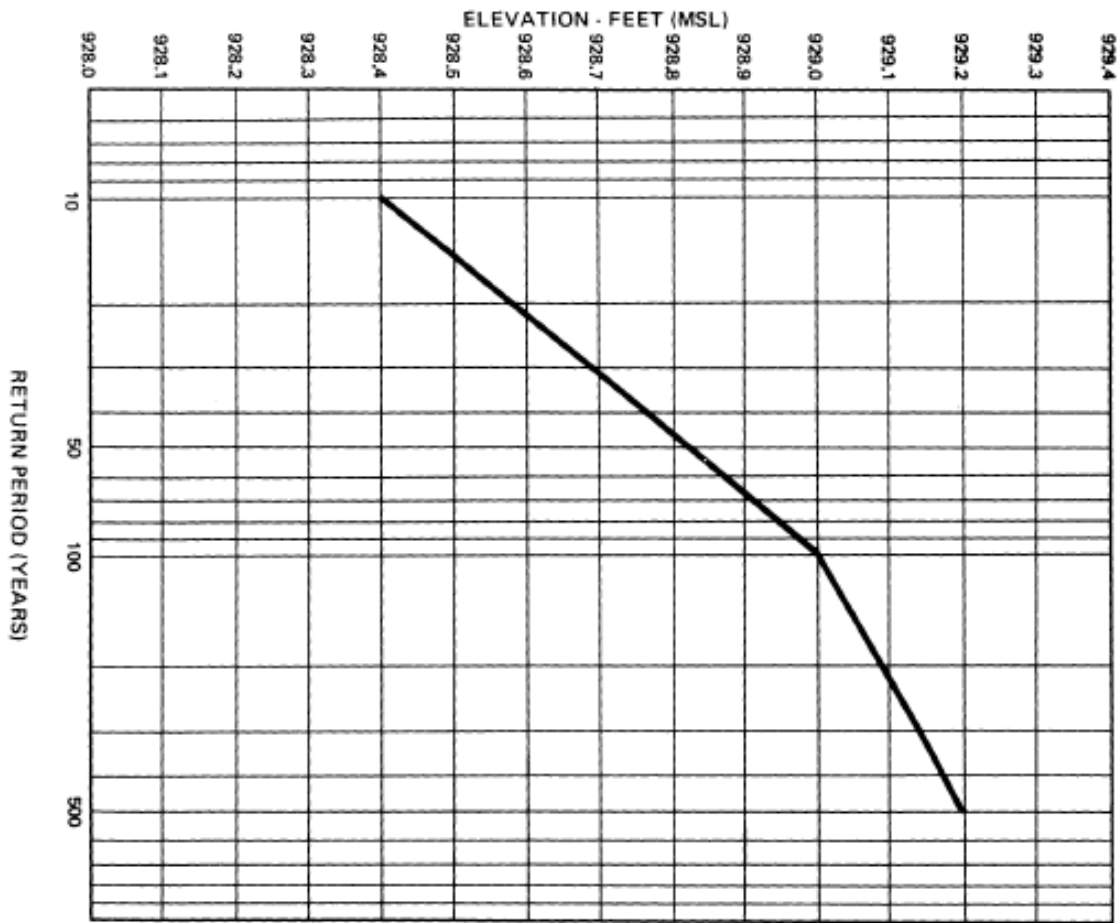
FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI AND INCORPORATED AREAS

FIGURE 4

15

ELEVATION-FREQUENCY CURVE

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

LITTLE GREEN LAKE · U.S.G.S. GAGE NEAR OUTLET

FIGURE 5

16

was computed using the geometry of these cross sections. Runup in areas other than at the transects may vary somewhat from that at the individual transects due to variations in shoreline topography. Riprap or other shoreline protection would cause wave runup to be reduced considerably. Table 6 summarizes wave runup at each transect. It should be noted that floodplain delineation for Green Lake did not include flooding resulting from wave runup.

FIGURE 6 – WIND SETUP, WAVE RUNUP DIAGRAM
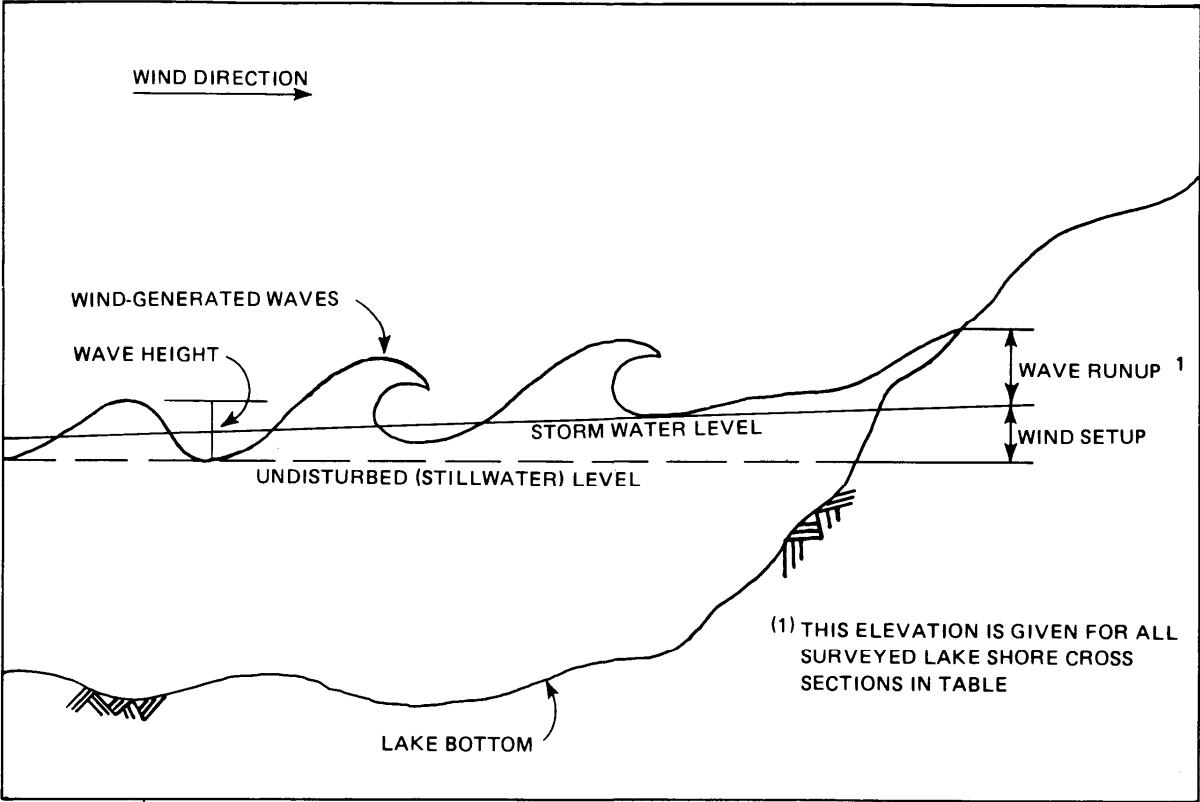
TABLE 6 - WAVE RUNUP DATA

Cross Section Identification	Wave Runup (feet)
1	2.4
2	0.4
3	0.8
4	2.6
5	0.4
6	0.4
7	1.4
8	4.4
9	1.4

17

This Countywide Analysis:

A HEC-RAS model was developed for Silver Creek by the WDNR using previously developed HEC-2 models for the stream. After conversion to HEC-RAS, revisions were made within the model to balance bridges, etc. Starting water surface elevations were estimated based on the same event flooding stage of Green Lake. Multiple profiles were calculated using the HMS model for the 10-, 2-, and 1-percent annual chance recurrence interval events. The 0.2-percent chance annual recurrence event was based on a log plot extension of the other three calculated flows.

Roughness factors (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 7, "Manning's "n" Values."

TABLE 7 – MANNING'S "n" VALUES

Stream	Channel "n"	Overbank "n"
Barnes Creek	0.033 – 0.035	0.075
East Tributary	0.030 – 0.045	0.025 – 0.100
Fox River	0.033 – 0.050	0.035-0.080
Grand River	0.030 – 0.045	0.025 – 0.100
Puchyan River	*	*
Silver Creek	0.030 – 0.033	0.060 – 0.08
West Tributary	0.030 – 0.045	0.025 – 0.100
Winchell Springs Creek	0.033 – 0.035	0.075

* Information not available

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

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.3   Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FISs and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Green Lake County is -0.1 feet.

For additional information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

> Vertical Network Branch, N/CG13
> National Geodetic Survey, NOAA
> Silver Spring Metro Center 3
> 1315 East-West Highway
> Silver Spring, Maryland 20910
> (301) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, descriptions, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0   **FLOODPLAIN MANAGEMENT APPLICATIONS**

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent annual chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent annual chance flood elevations; delineations of the 1-percent annual chance and 0.2-percent annual chance floodplains; and 1-percent annual chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1   Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (1-percent annual chance) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance

floodplain boundaries have been delineated using the flood elevations determined at each cross section.

For the pre-countywide analyses the Green Lake County unincorporated area detailed boundaries between cross sections were interpolated using USGS topographic maps enlarged to a scale of 1:12,000 (Reference 8). For streams within the City of Berlin the boundaries between cross sections were interpolated using topographic maps at a scale of 1:4800, with a contour interval of 2 feet (Reference 17), and a contour map at a scale of 1:6000, with a 1 foot contour interval (Reference 18). For streams within the City of Princeton the boundaries between cross sections were interpolated using topographic maps at a scale of 1:62,500 with a contour interval of 20 feet (Reference 19). Within the City of Markesan the boundaries between cross sections were interpolated using aerial photographs at a scale of 1:2400 with a contour interval of 2 feet, which were verified using USGS topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (References 20, 21).

For this countywide study, the 1- and 0.2-percent annual chance floodplain boundaries were re-delineated using a digital terrain model that meets National Map Accuracy Standards for mapping at a scale of 1:2400 in select urban areas, and 1:4800 elsewhere.

The 1- and 0.2-percent annual chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-perent annual chance floodplain boundaries are close together, only the 1-percent annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2   Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that

hazardous velocities are not produced. However, Wisconsin has established a more strict policy and does not allow any increase in the regional flood height for flood fringe developments (Reference 22). The increase shown in Table 8, "Floodway Data" for certain stream segments were calculated before this policy went into effect, and are shown as the regulatory elevation to remain in compliance with the current regulation. The floodways in this FIS are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. 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 (see Table 8, Floodway Data). The computed floodways are shown on the FIRM (Exhibit 2). In cases where the floodway and 1-percent annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

In the redelineation efforts, the floodways were not recalculated. As a result, there were areas where the previous floodway did not fit within the boundaries of the redelineated 1-percent annual chance floodplain. In these areas, the floodway was reduced. Water surface elevations, with and without a floodway, the mean velocity in the floodway, and the location and area at each surveyed cross section as determined by hydraulic methods can be seen in Table 8, Floodway Data Table. The width of the floodway depicted by the FIRM panels and the amount of reduction to fit the floodway inside the 1-percent annual chance floodplain, if necessary, is also listed.

No portions of the floodways extend beyond the Green Lake County boundary.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 7, "Floodway Schematic."

FIGURE 7 – FLOODWAY SCHEMATIC

LIMIT OF FLOODPLAIN FOR UNENCROACHED 100-YEAR FLOOD

FLOODWAY FRINGE — FLOODWAY — FLOODWAY FRINGE

STREAM CHANNEL

FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY

GROUND SURFACE

ENCROACHMENT

ENCROACHMENT

FILL

C

SURCHARGE*

D

FILL

A

B

FILL

AREA OF ALLOWABLE ENCROACHMENT; RAISING GROUND SURFACE WILL NOT CAUSE A SURCHARGE THAT EXCEEDS THE INDICATED STANDARDS

FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOODPLAIN

LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT

*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEDERAL EMERGENCY MANAGEMENT AGENCY REQUIREMENT) OR LESSER HEIGHT IF SPECIFIED BY STATE.

5.0 **INSURANCE APPLICATIONS**

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent annual chance) flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BARNES CREEK									
A	2,323[1]	135	314	5.0	0	758.0	758.0[4]	758.0[4]	0.0
B	2,481[1]	160	1,142	1.4	0	758.5	758.5	758.5	0.0
C	4,488[1]	240	1,300	1.2	0	759.5	759.5	759.5	0.0
D	7,075[1]	320	1,010	1.6	0	760.3	760.3	760.3	0.0
E	9,609[1]	300	1,209	1.3	0	761.2	761.2	761.3	0.1
F	9,820[1]	70	311	5.1	0	761.9	761.9	762.0	0.1
EAST TRIBUTARY									
A	560[2]	70	66	6.5	0	850.5	850.5	850.5	0.0
B	750[2]	65	322	1.4	0	853.4	853.4	853.4	0.0
C	2,000[2]	365	2,197	0.2	223	853.5	853.5	853.5	0.0
D	3,670[2]	227	1,111	0.4	333	853.8	853.8	853.8	0.0
FOX RIVER									
A	456,297[3]	460	3,884	2.3	0	757.4	757.4	757.8	0.4
B	456,931[3]	588	1,961	4.6	0	757.4	757.4	757.8	0.4
C	459,518[3]	293	2,642	3.4	0	758.7	758.7	759.0	0.3
D	461,419[3]	550	2,764	3.3	0	759.2	759.2	759.4	0.3
E	461,683[3]	130	1,880	4.8	0	759.3	759.3	759.5	0.3
F	461,841[3]	175	3,406	2.6	0	759.9	759.9	760.1	0.2
G	463,900[3]	660	5,440	1.7	0	760.2	760.2	760.4	0.2
H	467,174[3]	2,090	14,067	0.6	0	760.4	760.4	760.7	0.3
I	469,920[3]	1,464	12,701	0.7	0	760.4	760.4	760.7	0.3
J	472,190[3]	1,680	8,005	1.1	0	760.8	760.8	760.5	0.0
K	476,625[3]	3,090	20,015	0.4	0	760.8	760.8	760.8	0.0

[1] Stream distance in feet above confluence with Fox River, [2] Stream distance in feet above confluence with Grand River, [3] Stream distance in feet above mouth, [4] Elevation computed without consideration of backwater effects from Fox River

TABLE 8	FEDERAL EMERGENCY MANAGEMENT AGENCY **GREEN LAKE COUNTY** AND INCORPORATED AREAS	**FLOODWAY DATA**
		BARNES CREEK - EAST TRIBUTARY - FOX RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
FOX RIVER (Continued)									
L	482,011	2,690	17,210	0.5	0	760.9	760.9	760.9	0.0
M	485,284	3,050	12,205	0.7	0	761.0	761.0	761.0	0.0
N	490,353	2,297	12,650	0.7	133	761.2	761.2	761.2	0.0
O	494,683	2,750	13,325	0.7	0	761.3	761.3	761.3	0.0
P[2]									
Q[2]									
R[2]									
S[2]									
T[2]									
U	525,624	3,500	8,450	1.0	0	762.4	762.4	762.4	0.0
V	534,336	2,030	9,820	0.9	0	763.4	763.4	763.4	0.0
W	541,992	920	3,350	2.6	0	764.3	764.3	764.3	0.0
X	546,163	1,200	4,150	2.1	0	765.1	765.1	765.1	0.0
Y	549,700	1,100	6,400	1.4	0	765.8	765.8	765.8	0.0
Z	553,608	938	4,774	1.5	0	766.1	766.1	766.1	0.0
AA	554,083	394	3,435	2.0	130	766.1	766.1	766.1	0.0
AB	554,400	509	2,455	2.8	0	766.3	766.3	766.3	0.0
AC	554,822	480	2,181	3.2	0	766.4	766.4	766.4	0.0
AD	556,195	184	2,140	3.2	127	766.9	766.9	766.9	0.0
AE	556,512	187	2,200	3.1	132	767.1	767.1	767.1	0.0
AF	558,096	2,317	11,850	0.6	0	767.3	767.3	767.3	0.0
AG	559,152	2,576	13,377	0.5	0	767.3	767.3	767.3	0.0
AH	563,798	1,815	9,310	0.9	115	767.6	767.6	767.6	0.0
AI	566,913	2,220	21,090	0.4	170	767.8	767.8	767.8	0.0

[1] Stream distance in feet above mouth, [2] Floodway not shown between cross sections O and U since floodways were not computed for White and Puchyan Rivers in the area of their confluence with Fox River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

FOX RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
FOX RIVER (Continued)									
AJ	570,398	2,230	13,130	0.7	0	767.9	767.9	767.9	0.0
AK	573,936	1,460	3,805	2.3	0	767.9	767.9	767.9	0.0
AL	581,116	2,650	15,600	0.6	0	768.5	768.5	768.5	0.0
AM	585,710	2,330	11,930	0.7	0	768.7	768.7	768.7	0.0
AN	590,198	3,180	11,550	0.7	0	768.8	768.8	768.8	0.0
AO	596,323	2,150	12,350	0.7	0	769.1	769.1	769.1	0.0
AP	599,068	840	6,750	1.3	0	769.1	769.1	769.1	0.0
AQ	604,982	2,382	12,870	0.7	147	769.3	769.3	769.3	0.0
AR	608,784	2,470	15,850	0.5	0	769.3	769.3	769.3	0.0
AS	616,545	2,142	14,220	0.6	388	769.4	769.4	769.4	0.0
AT	621,192	1,730	13,655	0.6	0	769.5	769.5	769.5	0.0
AU	625,416	5,124	31,125	0.3	276	769.5	769.5	769.5	0.0
GRAND RIVER									
A	82,420	3,068	20,355	0.4	232	794.9	794.9	794.9	0.0
B	84,849	190	925	8.1	0	794.9	794.9	794.9	0.0
C	88,862	710	4,960	1.5	0	801.4	801.4	801.4	0.0
D	94,670	449	1,855	3.2	456	802.0	802.0	802.0	0.0
E	98,736	581	3,365	1.8	179	805.7	805.7	805.7	0.0
F	103,065	1,290	2,955	2.0	0	808.7	808.7	808.7	0.0
G	107,448	370	1,040	5.8	0	814.4	814.4	814.4	0.0
H	111,249	420	2,695	2.2	140	821.0	821.0	821.0	0.0
I	113,889	50	360	16.7	0	827.0	827.0	827.0	0.0
J	114,206	CENTERLINE OF DAM				838.3			

[1] Stream distance in feet above mouth

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

FOX RIVER - GRAND RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
GRAND RIVER (Continued)									
K	116,899	400	3,240	1.9	0	838.5	838.5	838.5	0.0
L	119,856	1,342	1,055	5.7	158	838.9	838.9	838.9	0.0
M	132,192	259	860	3.6	0	841.2	841.2	841.2	0.0
N	133,067	325	1,713	1.8	0	843.1	843.1	843.1	0.0
O	133,687	130	1,022	3.0	80	843.4	843.4	843.4	0.0
P	134,637	233	1,654	1.9	30	844.1	844.1	844.1	0.0
Q	135,487	780	2,921	1.1	0	844.6	844.6	844.6	0.0
R	136,367	577	3,118	1.0	113	844.8	844.8	844.8	0.0
S	137,112	235	899	3.4	0	846.8	846.8	846.8	0.0
T	137,412	175	572	5.4	0	846.9	846.9	846.9	0.0
U	137,532	230	687	4.5	0	847.4	847.4	847.4	0.0
V	137,978	90	566	5.4	0	848.1	848.1	848.1	0.0
W	138,518	95	465	6.6	0	849.1	849.1	849.1	0.0
X	138,938	170	1,327	2.3	80	849.9	849.9	849.9	0.0
Y	139,358	260	1,127	2.7	0	850.0	850.0	850.0	0.0
Z	140,698	295	1,125	2.7	0	851.0	851.0	851.0	0.0
AA	141,378	123	716	4.3	55	851.9	851.9	851.9	0.0
AB	142,003	190	1,603	1.9	75	854.3	854.3	854.3	0.0
AC	142,553	505	2,627	1.2	0	854.4	854.4	854.4	0.0
AD	143,193	800	4,244	0.7	0	854.5	854.5	854.5	0.0
AE	144,777	380	2,135	2.2	0	856.0	856.0	856.0	0.0
AF	145,622	320	524	8.9	0	861.7	861.7	861.7	0.0
AG	146,836	250	755	6.2	0	866.6	866.6	866.6	0.0
AH	148,262	190	1,090	4.3	0	874.3	874.3	874.3	0.0

[1] Stream distance in feet above mouth

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY

AND INCORPORATED AREAS

FLOODWAY DATA

GRAND RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
GRAND RIVER (Continued)									
AI	150,163[1]	88	980	4.7	37	882.3	882.3	882.3	0.0
AJ	151,958[1]	940	8,280	0.6	0	882.9	882.9	882.9	0.0
PUCHYAN RIVER									
A	38,755[2]	50	365	3.6	0	773.6	773.6	773.6	0.0
B	43,243[2]	970	2,320	0.6	0	774.5	774.5	774.5	0.0
C	47,097[2]	1,330	2,985	0.4	0	774.7	774.7	774.7	0.0
D	57,974[2]	45	245	5.3	0	777.1	777.1	777.1	0.0
E	62,198[2]	1,350	3,200	0.4	0	778.4	778.4	778.4	0.0
F	70,593[2]	40	170	7.6	0	780.5	780.5	780.5	0.0
G	72,072[2]	60	180	7.2	0	783.2	783.2	783.2	0.0
H	72,336[2]	CENTERLINE OF DAM				792.9			
I	72,441[2]	35	255	5.0	0	793.3	793.3	793.3	0.0
J	73,339[2]	190	1,405	0.9	60	793.8	793.8	793.8	0.0
K	74,976[2]	120	715	1.8	50	794.3	794.3	794.3	0.0
SILVER CREEK									
A	250[2]	3,470	17,255	0.2	0	801.9	801.9	801.9	0.0
B	3,950[2]	921	5,557	0.6	0	801.9	801.9	801.9	0.0
C	7,110[2]	2,200	6,640	0.5	0	802.0	802.0	802.0	0.0
D	9,130[2]	727	3,374	0.7	0	802.2	802.2	802.2	0.0
E	9,900[2]	933	4,237	0.6	0	802.2	802.2	802.2	0.0
F	14,610[2]	530	3,468	0.7	408	802.4	802.4	802.4	0.0
G	17,160[2]	1,093	3,507	0.7	0	802.7	802.7	802.7	0.0

[1] Stream distance in feet above mouth, [2] Stream distance in feet above confluence with Green Lake

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

GRAND RIVER - PUCHYAN RIVER - SILVER CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SILVER CREEK									
H	20,060[1]	501	1,598	1.4	50	803.3	803.3	803.3	0.0
WEST TRIBUTARY									
A	580[2]	150	238	3.2	0	844.8	844.8	844.8	0.0
B	705[2]	130	217	3.2	0	846.3	846.3	846.3	0.0
C	1,225[2]	46	249	2.7	164	848.0	848.0	848.0	0.0
D	1,785[2]	155	255	3.0	62	852.1	852.1	852.1	0.0
E	2,285[2]	41	120	4.5	0	854.9	854.9	854.9	0.0
F	2,545[2]	135	265	2.1	0	856.7	856.7	856.7	0.0
G	4,065[2]	430	253	1.9	0	860.3	860.3	860.3	0.0
H	4,905[2]	33	61	7.8	0	871.3	871.3	871.3	0.0
WINCHELL SPRINGS CREEK									
A	316[3]	104	243	3.3	0	760.4	754.5[4]	754.5[4]	0.0
B	475[3]	110	633	1.3	0	760.4	759.3[4]	759.3[4]	0.0
C	950[3]	690	3,371	0.2	0	760.4	759.3[4]	759.3[4]	0.0
D	1,056[3]	725	3,105	0.3	0	760.4	759.3[4]	759.3[4]	0.0
E	1,847[3]	250	836	0.9	0	760.4	759.3[4]	759.3[4]	0.0
F	1,953[3]	175	742	1.1	0	760.4	759.4[4]	759.4[4]	0.0
G	2,164[3]	50	241	3.3	0	760.4	759.5[4]	759.5[4]	0.0
H	2,323[3]	50	268	3.0	0	761.2	761.2	761.2	0.0
I	2,692[3]	75	379	2.1	0	761.7	761.7	761.7	0.0
J	2,851[3]	780	2,717	0.3	0	762.0	762.0	761.9	0.1
K	3,220[3]	1,204	3,693	0.2	106	762.0	762.0	761.9	0.1

[1] Stream distance in feet above confluence with Green Lake, [2] Stream distance in feet above confluence with Grand River, [3] Stream distance in feet above confluence with Fox River, [4] Elevation computed without consideration of backwater effects from Fox River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

SILVER CREEK - WEST TRIBUTARY - WINCHELL SPRINGS CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
WINCHELL SPRINGS CREEK (Continued)									
L	4,224	1,120	1,584	0.5	0	762.0	762.0	762.0	0.0
M	5,016	950	981	0.8	0	762.2	762.2	762.1	0.1

[1] Stream distance in feet above confluence with Fox River

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY
AND INCORPORATED AREAS

FLOODWAY DATA

WINCHELL SPRINGS CREEK

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent annual chance floodplain, areas within the 0.2-percent annual chance floodplain, and to areas of 1-percent annual chance flooding where average depths are less than 1 foot, areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent annual chance flood by levees. No base flood elevations or depths are shown within this zone.

6.0   **FLOOD INSURANCE RATE MAP**

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent annual chance floodplains that were 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 1- and 0.2-percent annual chance floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The countywide FIRM presents flooding information for the entire geographic area of Green Lake County. Previously, separate FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as floodprone. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community, up to and including this countywide FIS, are presented in Table 9 "Community Map History."

7.0   **OTHER STUDIES**

This FIS 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 NFIP.

The Countywide studies for Columbia, Dodge, Fond du Lac, and Winnebago Counties, Wisconsin, are in progress and might impact the information presented in this countywide FIS report.

8.0   **LOCATION OF DATA**

Information concerning the pertinent data used in preparation of this FIS can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region V, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Berlin, City of	January 16, 1974	None	September 30, 1977	None
Green Lake, City of	October 22, 1976	None	September 27, 1985	None
Kingston, Village of	December 17, 1973	May 14, 1976	September 1, 1986	None
Markesan, City of	May 10, 1974	October 10, 1975	July 2, 2003	None
Marquette, Village of	December 28, 1973	January 2, 1976	February 3, 2010	None
Princeton, City of	December 28, 1973	January 2, 1976	June 15, 1988	None
Green Lake County Unincorporated Areas	January 24, 1975	None	March 1, 1978	February 2, 1990

TABLE 9	FEDERAL EMERGENCY MANAGEMENT AGENCY **GREEN LAKE COUNTY, WI AND INCORPORATED AREAS**	**COMMUNITY MAP HISTORY**

9.0   **BIBLIOGRAPHY AND REFERENCES**

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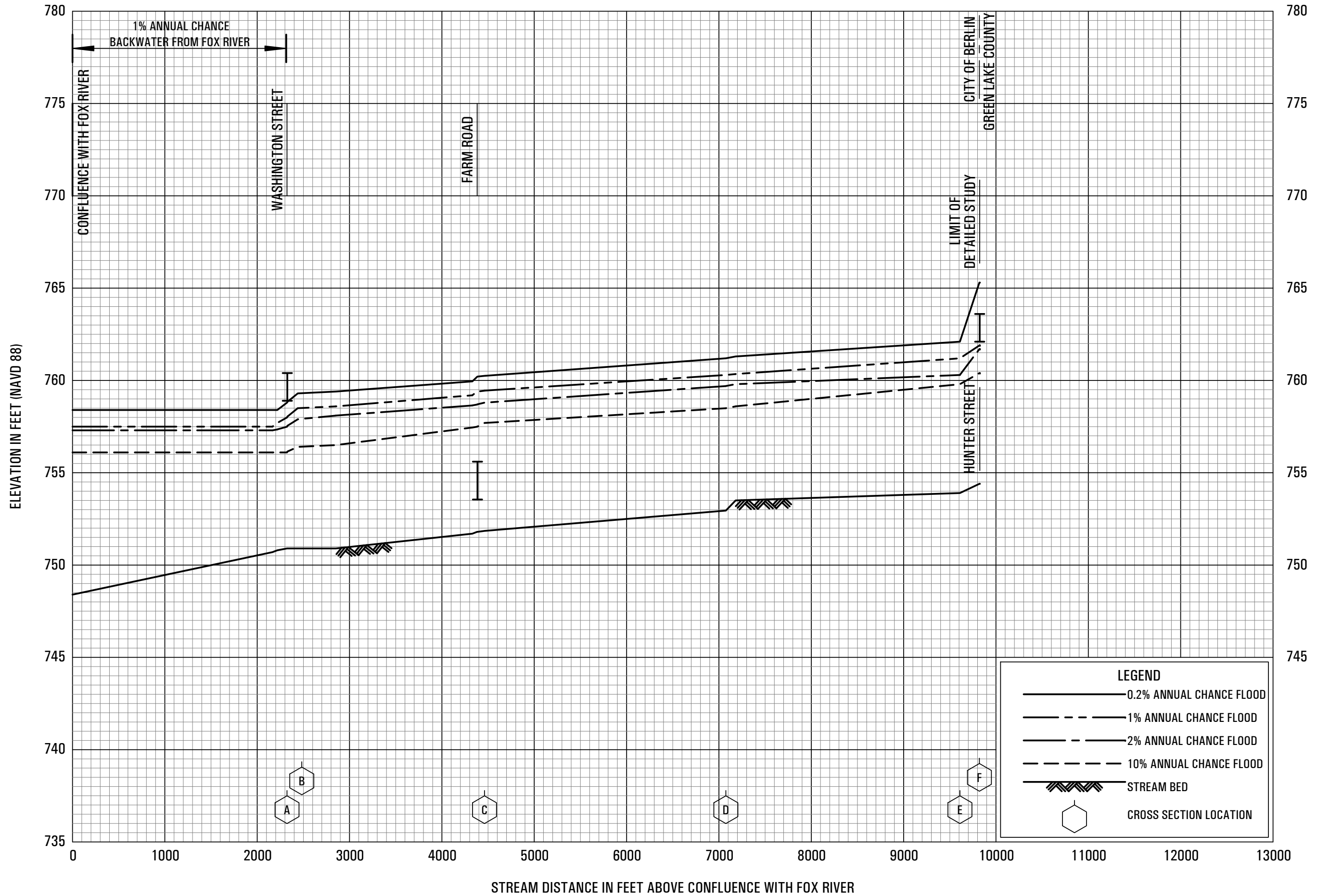
FLOOD PROFILES

BARNES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

01P

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH FOX RIVER

ELEVATION IN FEET (NAVD 88)

LEGEND

0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

1% ANNUAL CHANCE
BACKWATER FROM FOX RIVER

CONFLUENCE WITH FOX RIVER

WASHINGTON STREET

FARM ROAD

CITY OF BERLIN
GREEN LAKE COUNTY

LIMIT OF
DETAILED STUDY

HUNTER STREET
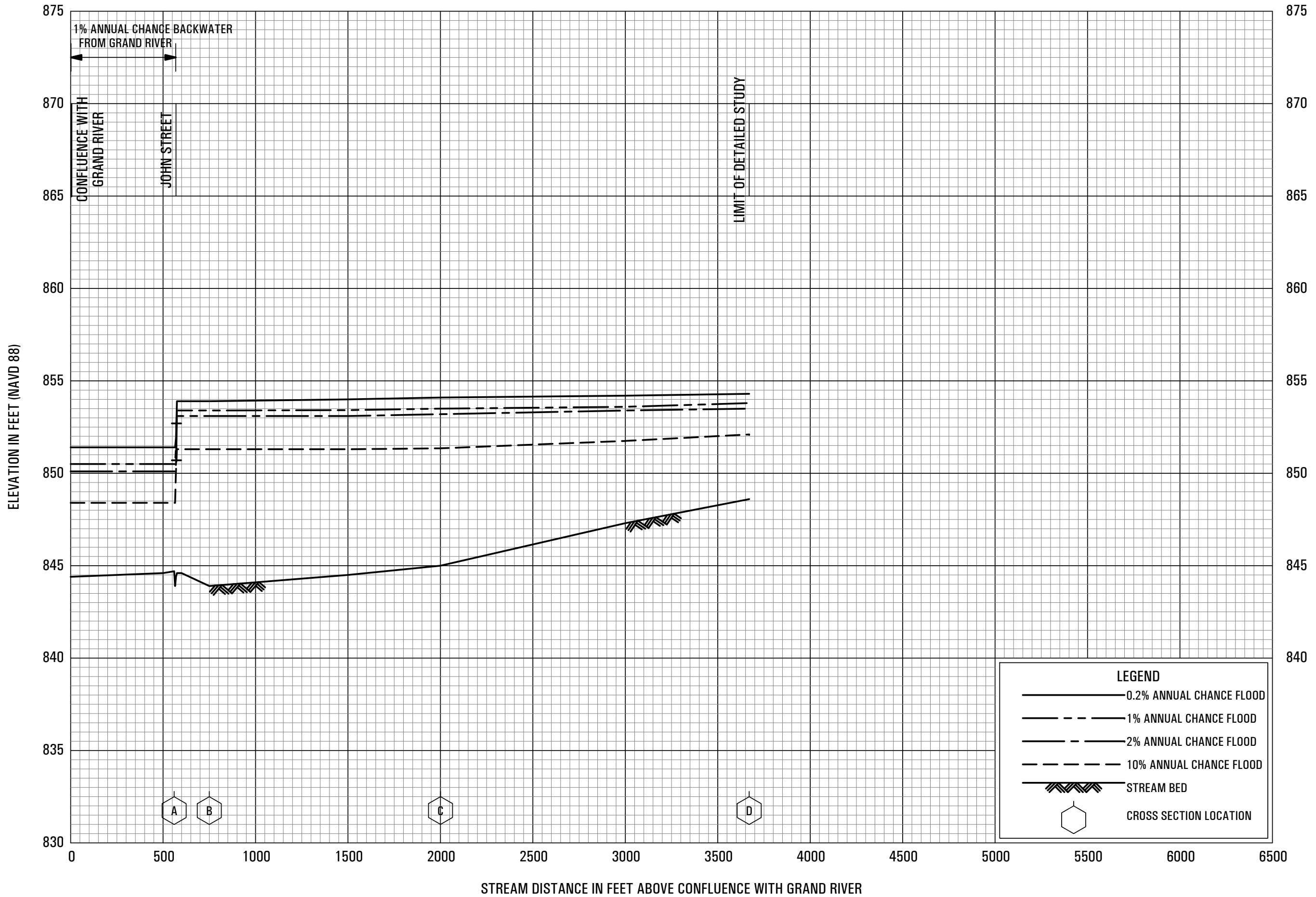
FLOOD PROFILES

EAST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

02P

LEGEND

———————— 0.2% ANNUAL CHANCE FLOOD
— — — — 1% ANNUAL CHANCE FLOOD
—·—·—·— 2% ANNUAL CHANCE FLOOD
– – – – – 10% ANNUAL CHANCE FLOOD
〰〰〰 STREAM BED
⬡ CROSS SECTION LOCATION

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH GRAND RIVER

1% ANNUAL CHANCE BACKWATER
FROM GRAND RIVER

CONFLUENCE WITH GRAND RIVER

JOHN STREET

LIMIT OF DETAILED STUDY

FLOOD PROFILES
FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

03P

FLOOD PROFILES

FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

05P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

CONFLUENCE OF PUCHYAN RIVER

RIVER LOCK AND DAM

LEGEND

0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

FLOOD PROFILES

FOX RIVER

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

GREEN LAKE COUNTY
CITY OF PRINCETON

RAILROAD

MAIN STREET

LEGEND

0.2% ANNUAL CHANCE FLOOD

1% ANNUAL CHANCE FLOOD

2% ANNUAL CHANCE FLOOD

10% ANNUAL CHANCE FLOOD

STREAM BED

CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

06P

FLOOD PROFILES

FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

07P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

CITY OF PRINCETON
GREEN LAKE COUNTY

PRINCETON LOCK AND DAM

LEGEND

0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

FLOOD PROFILES
FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

08P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

FLOOD PROFILES
FOX RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

09P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

LIMIT OF DETAILED STUDY

LEGEND
——————— 0.2% ANNUAL CHANCE FLOOD
— — — 1% ANNUAL CHANCE FLOOD
— · — · 2% ANNUAL CHANCE FLOOD
— — — 10% ANNUAL CHANCE FLOOD
〰〰〰 STREAM BED
⬡ CROSS SECTION LOCATION

AS   AT   AU

FLOOD PROFILES

GRAND RIVER

CITY OF KINGSTON

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND
——————— 0.2% ANNUAL CHANCE FLOOD
—··—··—··— 1% ANNUAL CHANCE FLOOD
—·—·—·—·— 2% ANNUAL CHANCE FLOOD
— — — — — 10% ANNUAL CHANCE FLOOD
⋀⋀⋀⋀⋀⋀ STREAM BED
⬡ CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

10P

FLOOD PROFILES

GRAND RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

11P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

USGS GAGING STATION

LEGEND

———— 0.2% ANNUAL CHANCE FLOOD

—··—··— 1% ANNUAL CHANCE FLOOD

—·—·— 2% ANNUAL CHANCE FLOOD

— — — 10% ANNUAL CHANCE FLOOD

〜〜〜 STREAM BED

⬡ CROSS SECTION LOCATION

FLOOD PROFILES

GRAND RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

12P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

COUNTY HIGHWAY S

MANCHESTER DAM

LEGEND

0.2% ANNUAL CHANCE FLOOD

1% ANNUAL CHANCE FLOOD

2% ANNUAL CHANCE FLOOD

10% ANNUAL CHANCE FLOOD

STREAM BED

CROSS SECTION LOCATION

FLOOD PROFILES

GRAND RIVER

STATE HIGHWAY 73
LIMIT OF DETAILED STUDY

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
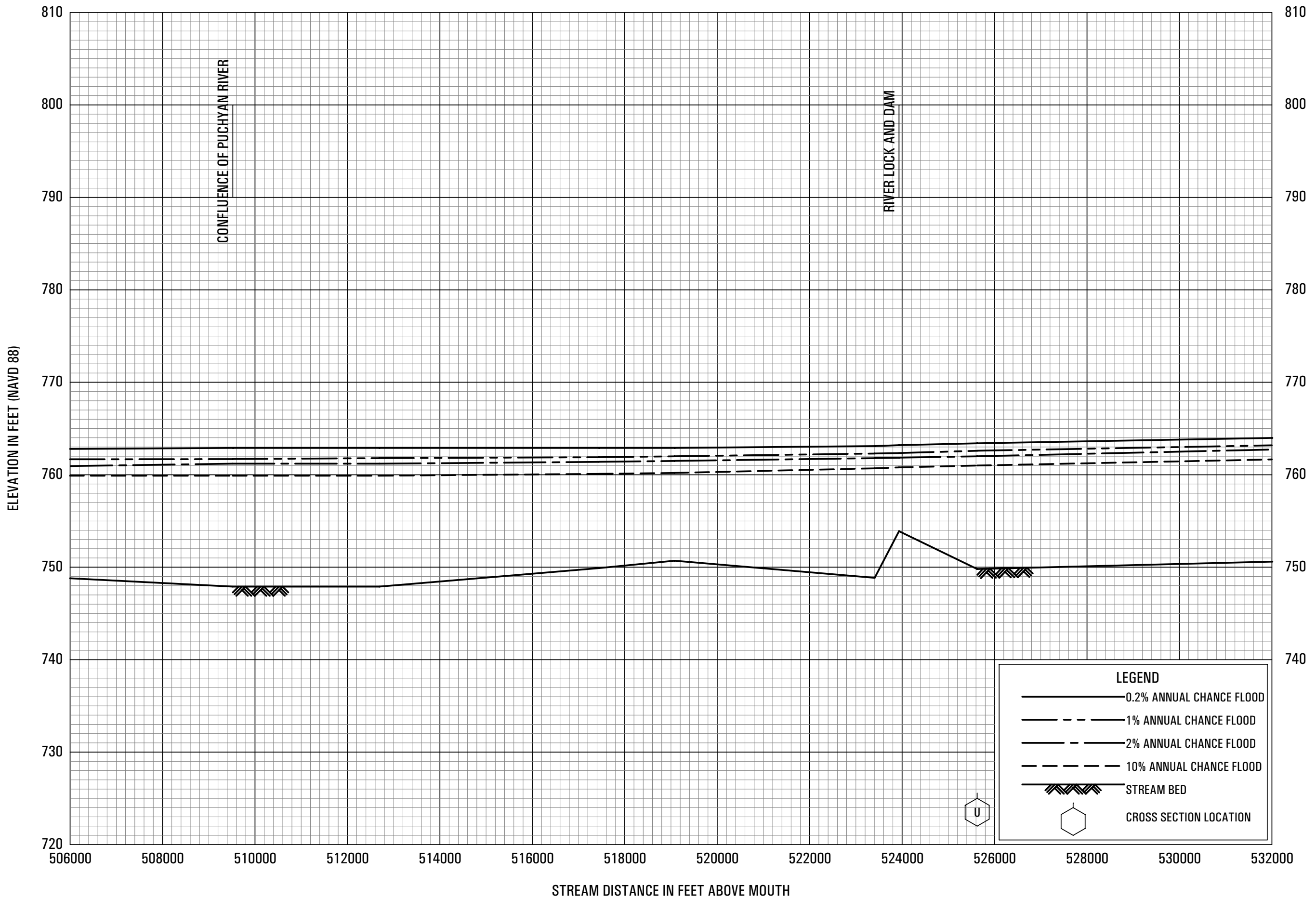10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY
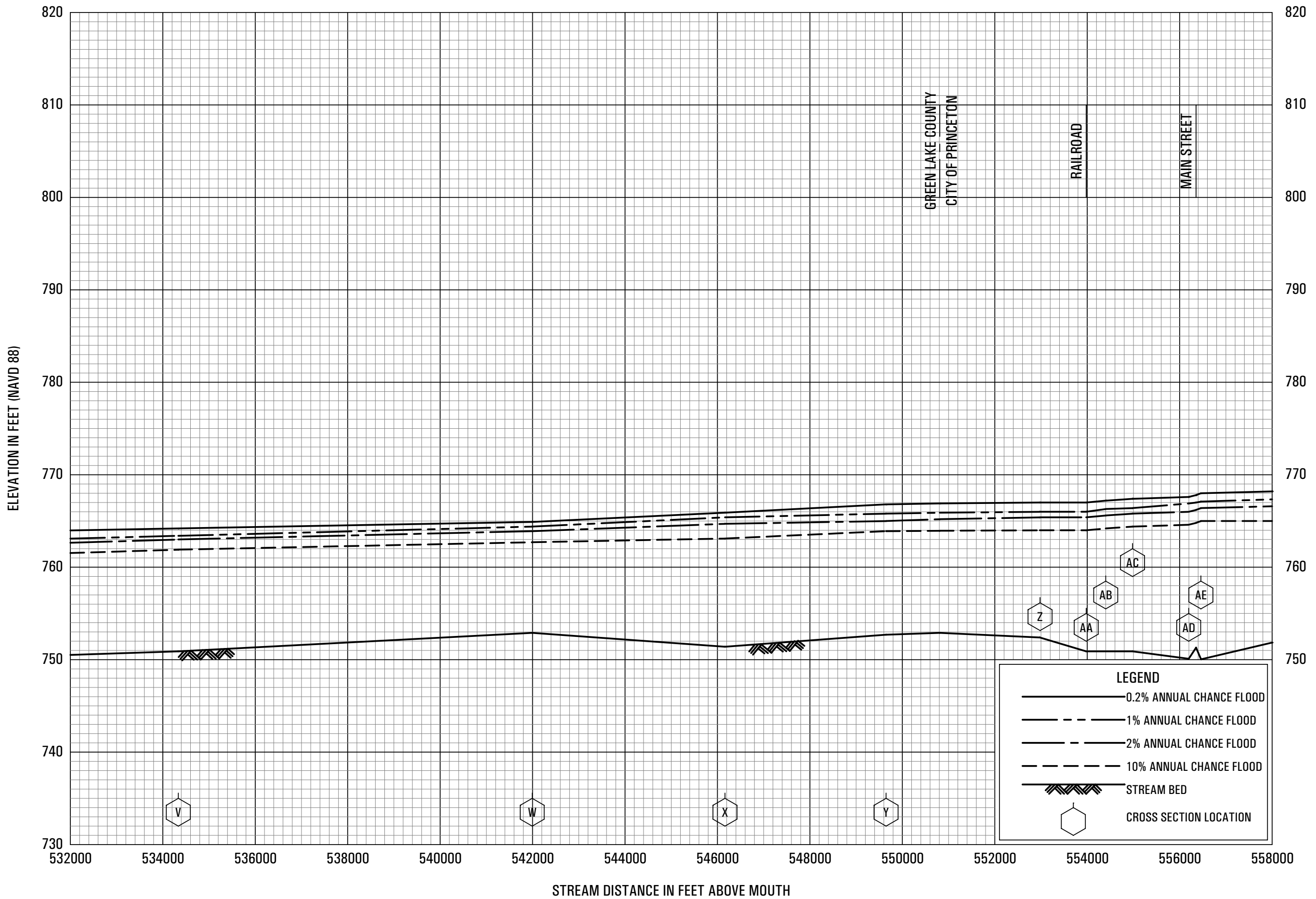GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

13P

FLOOD PROFILES

GRAND RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
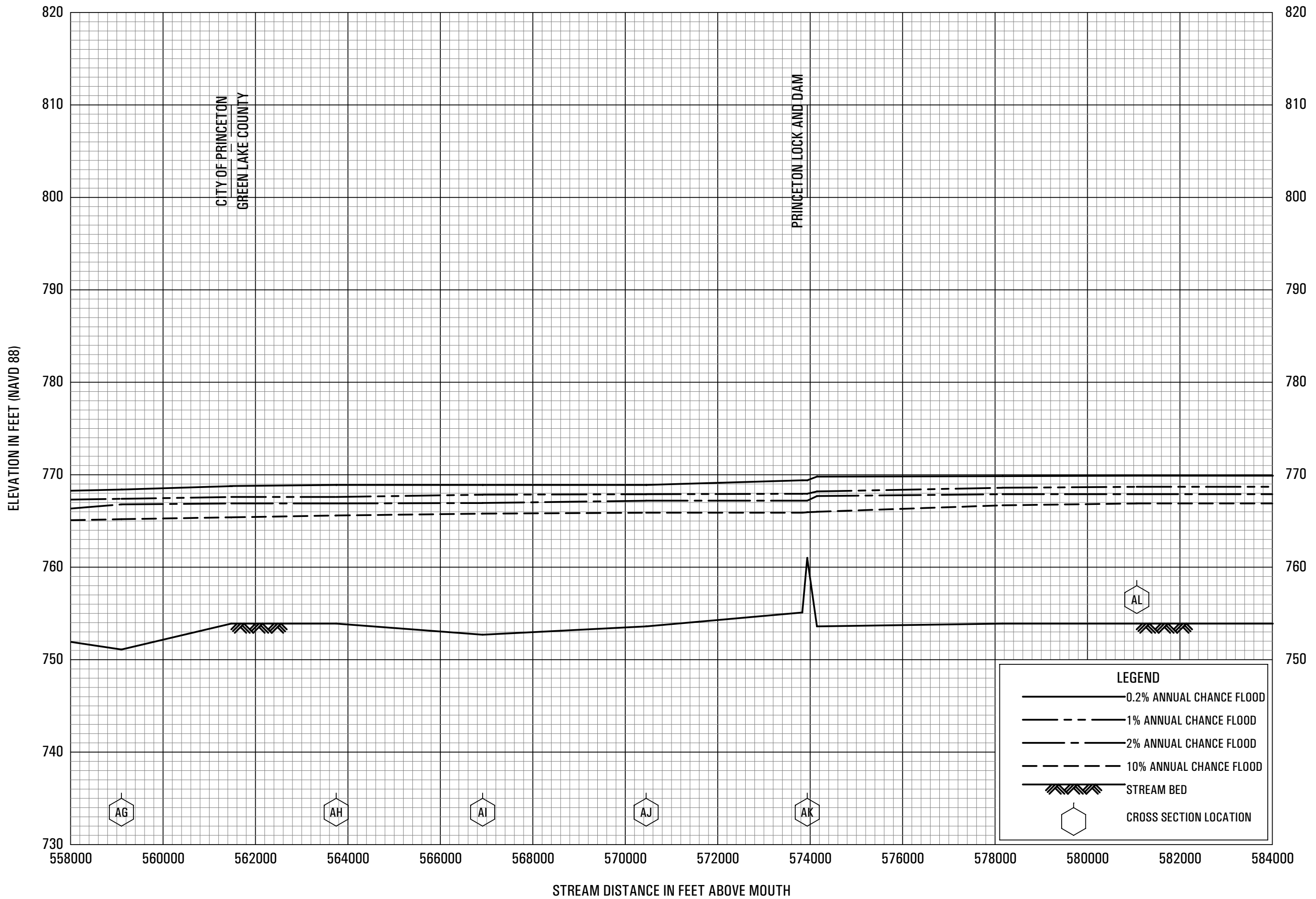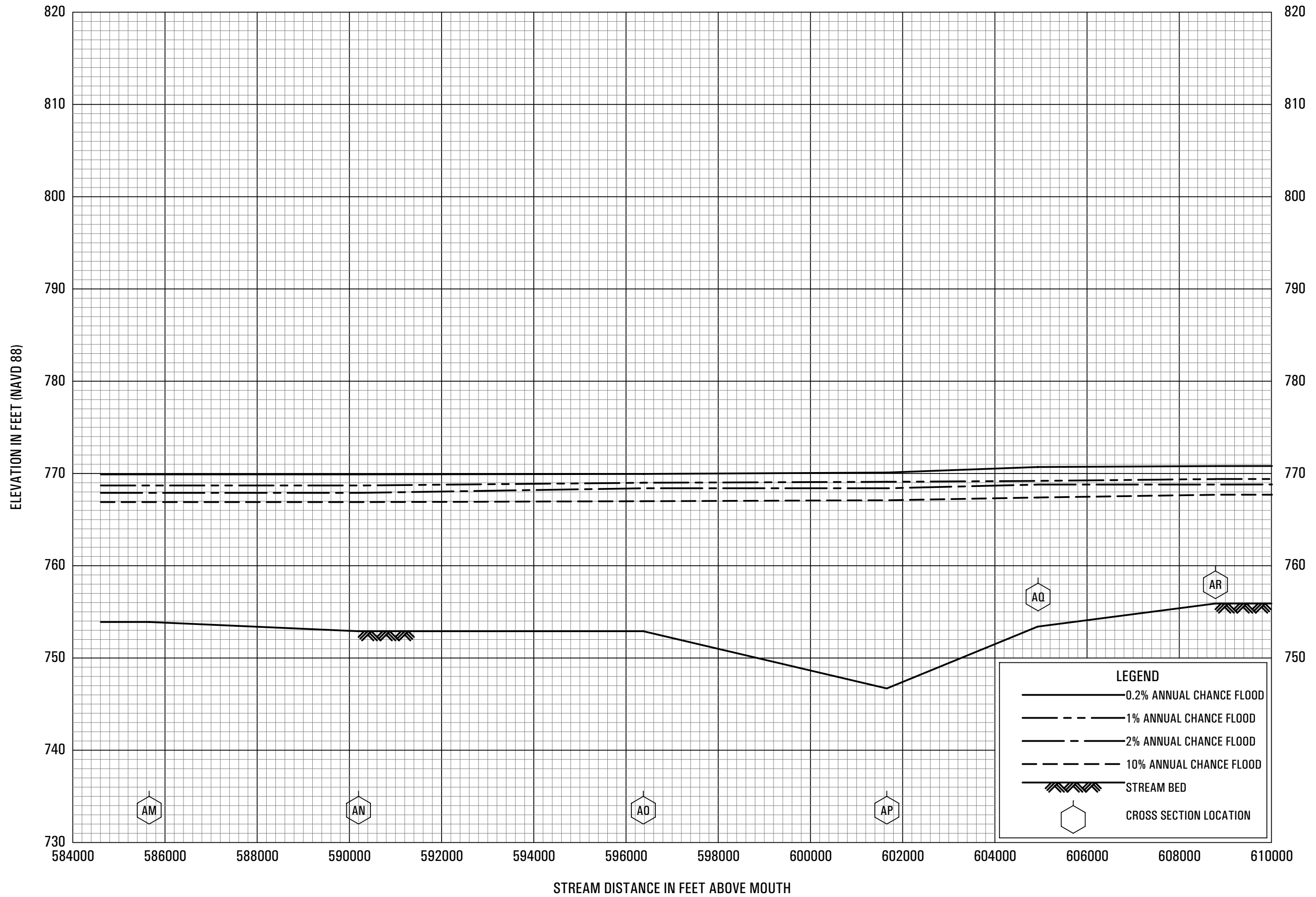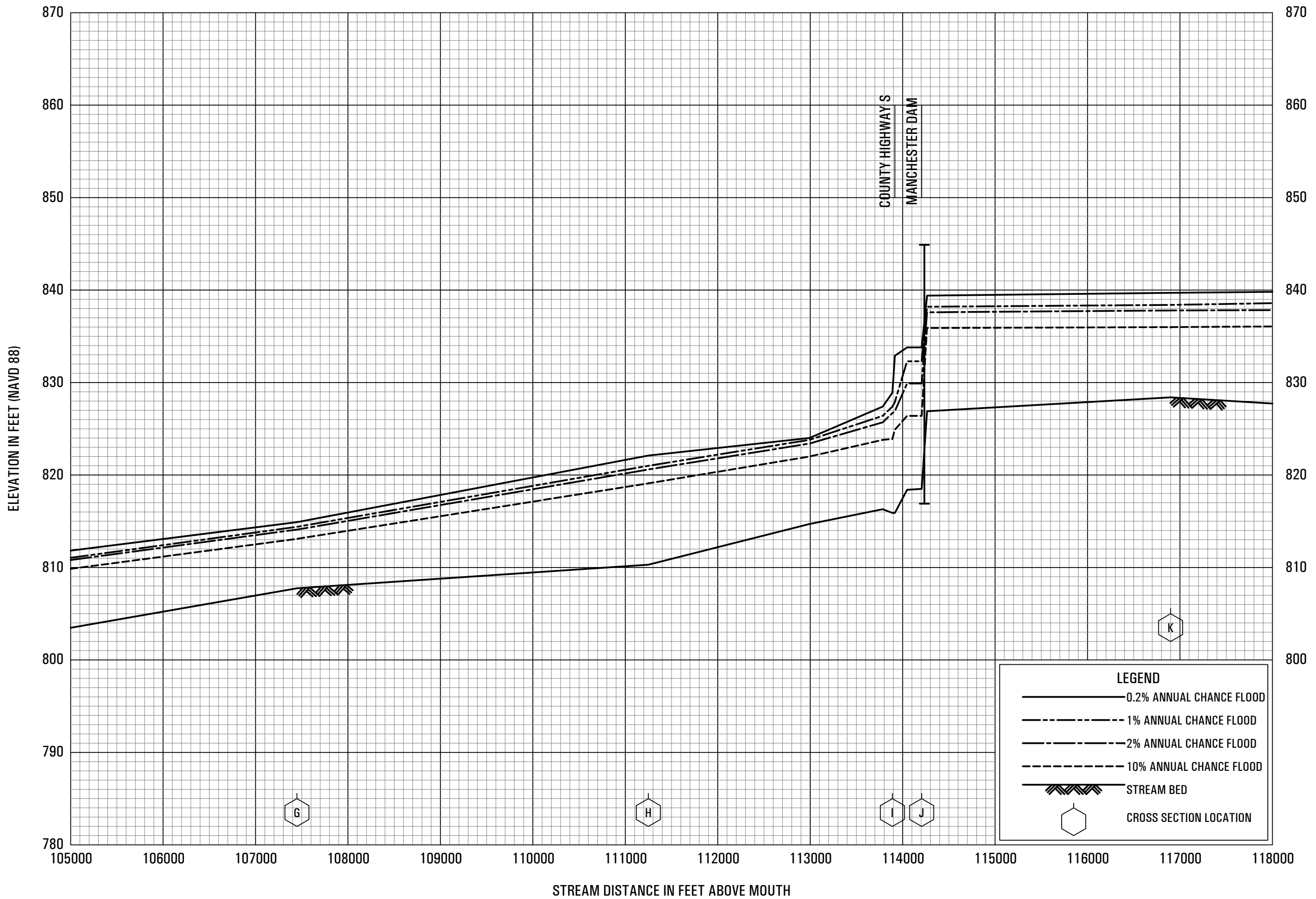
GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

14P

FLOOD PROFILES

GRAND RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

15P

LEGEND

———— 0.2% ANNUAL CHANCE FLOOD
—·—·—· 1% ANNUAL CHANCE FLOOD
—··—··— 2% ANNUAL CHANCE FLOOD
———— 10% ANNUAL CHANCE FLOOD
〰〰〰 STREAM BED
⬡ CROSS SECTION LOCATION

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE MOUTH

VILLAGE ROAD

COUNTY HIGHWAY A

LIMIT OF DETAILED STUDY

FLOOD PROFILES

PUCHYAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

16P

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH GREEN LAKE

COUNTY HIGHWAY J

CONFLUENCE OF SNAKE CREEK

LEGEND

———————— 0.2% ANNUAL CHANCE FLOOD

– – – – – 1% ANNUAL CHANCE FLOOD

–·–·–·– 2% ANNUAL CHANCE FLOOD

– – – – 10% ANNUAL CHANCE FLOOD

〰〰〰 STREAM BED

CROSS SECTION LOCATION

FLOOD PROFILES

PUCHYAN RIVER

ELEVATION IN FEET (NAVD 88)

COUNTY HIGHWAY A

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH GREEN LAKE

LEGEND

———————— 0.2% ANNUAL CHANCE FLOOD

— — — — 1% ANNUAL CHANCE FLOOD

— · — · — 2% ANNUAL CHANCE FLOOD

– – – – 10% ANNUAL CHANCE FLOOD

〰〰〰 STREAM BED
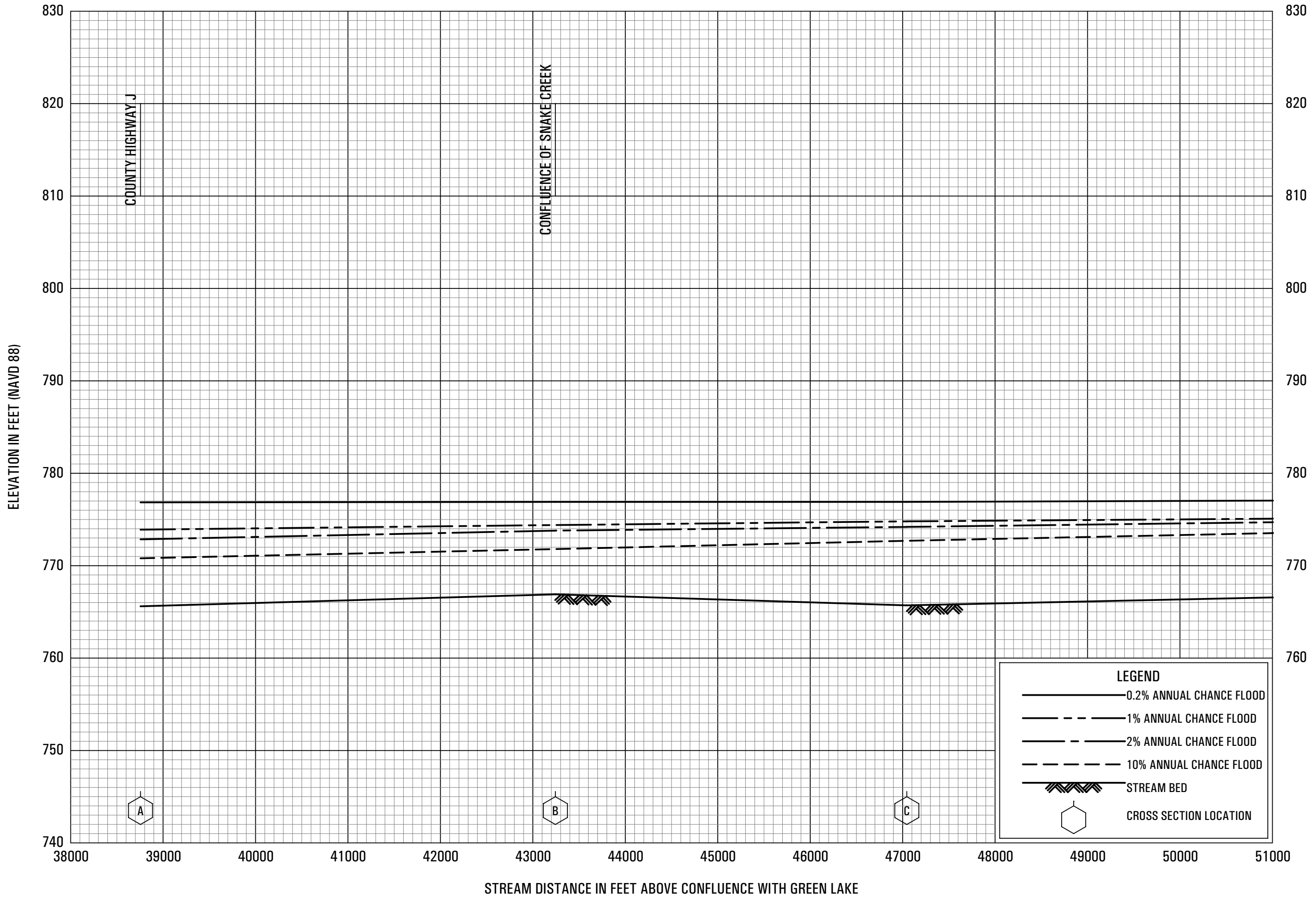
⬡ CROSS SECTION LOCATION

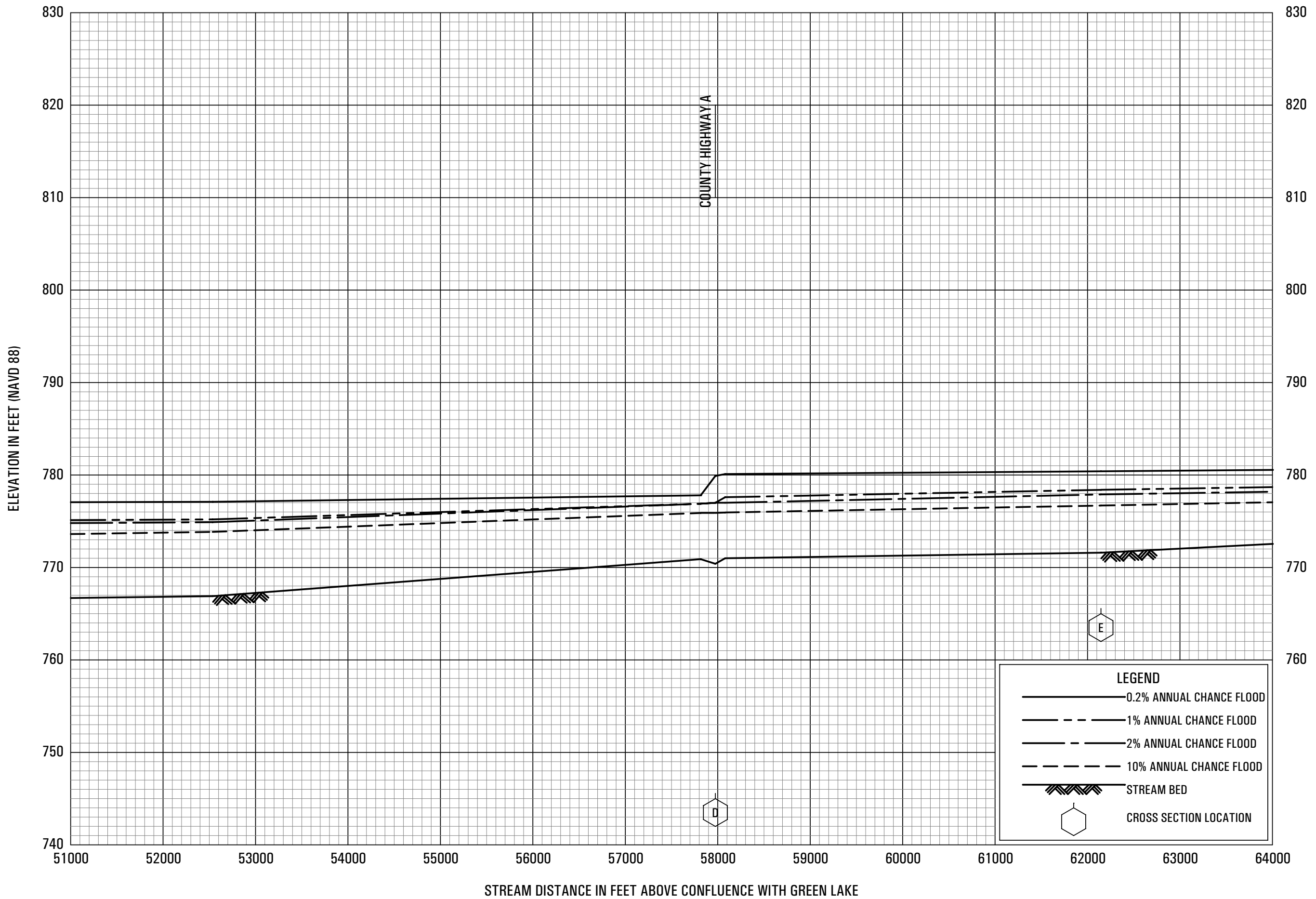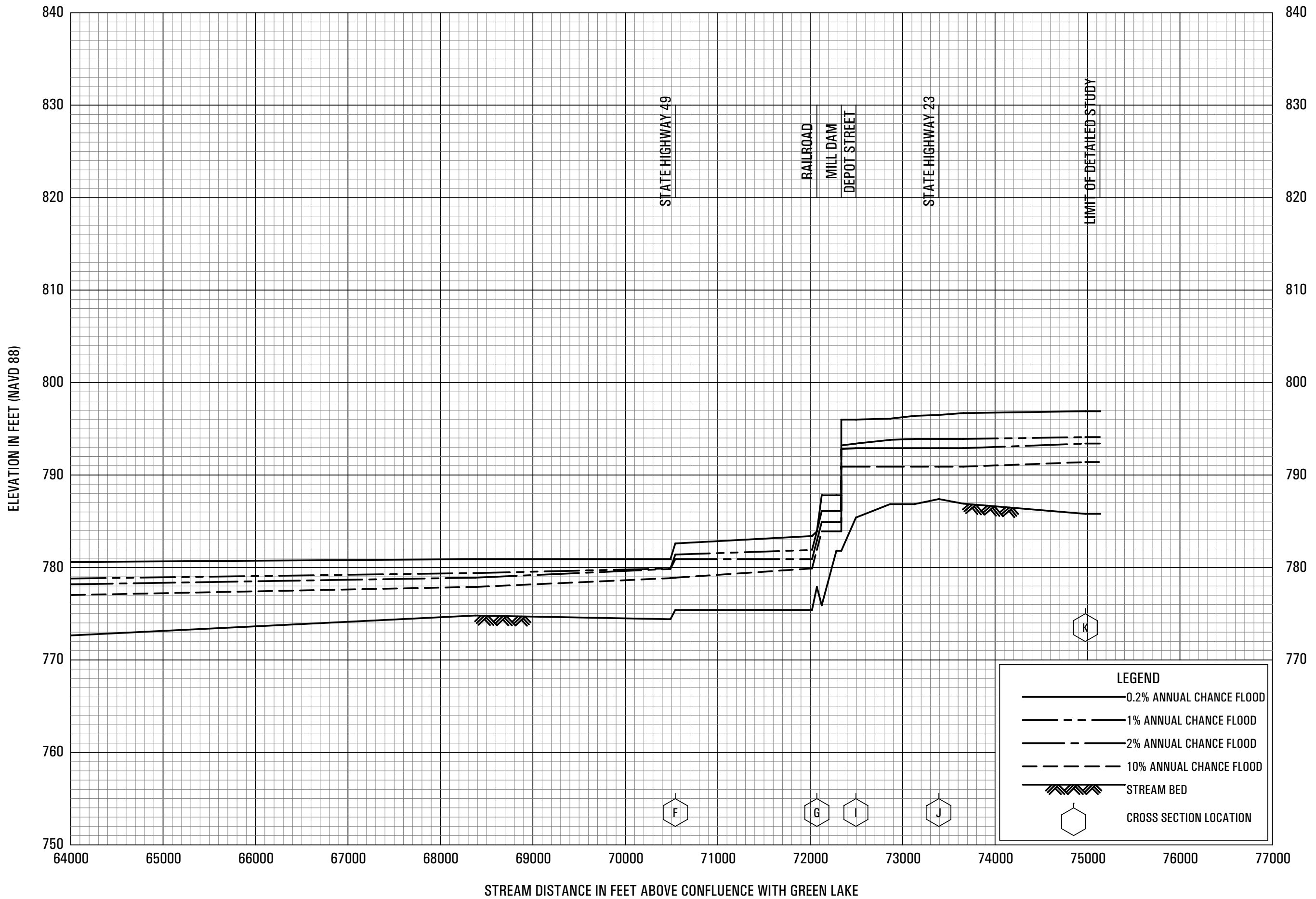FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

17P

FLOOD PROFILES
PUCHYAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS
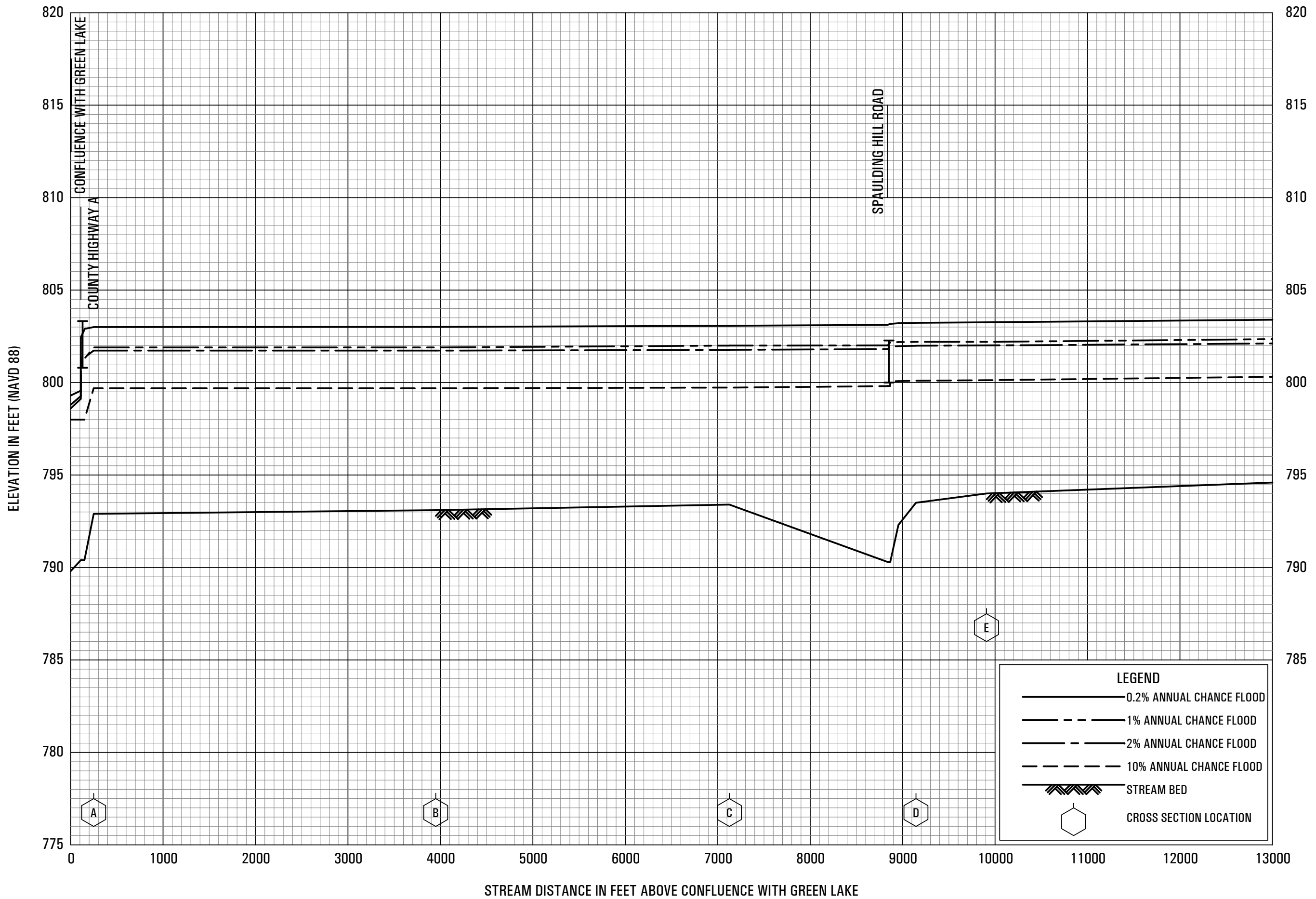
18P

FLOOD PROFILES

SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

19P

FLOOD PROFILES
SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
GREEN LAKE COUNTY, WI
AND INCORPORATED AREAS

20P

FLOOD PROFILES

WEST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI

AND INCORPORATED AREAS

21P

LEGEND

——————— 0.2% ANNUAL CHANCE FLOOD

—··—··— 1% ANNUAL CHANCE FLOOD

—·—·— 2% ANNUAL CHANCE FLOOD

———— 10% ANNUAL CHANCE FLOOD

∧∧∧∧∧∧ STREAM BED

⬡ CROSS SECTION LOCATION

ELEVATION IN FEET (NAVD 88)

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH GRAND RIVER

1% ANNUAL CHANCE BACKWATER
FROM GRAND RIVER

CONFLUENCE WITH GRAND RIVER

JOHN STREET

MARGARET STREET

LIMIT OF DETAILED STUDY

FLOOD PROFILES

WINCHELL SPRINGS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GREEN LAKE COUNTY, WI
AN INCORPORATED AREAS

22P