FLOOD INSURANCE STUDY

DOOR COUNTY, WISCONSIN,
AND INCORPORATED AREAS

Community Name	Community Number
Door County, Unincorporated Areas	550109
Egg Harbor, Village of	550029
Ephraim, Village of	550611
Forestville, Village of	550110
Sister Bay, Village of	550030
Sturgeon Bay, City of	550111

PRELIMINARY

JAN 31, 2007

REVISED:

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
55029CV000A

Door 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:

This Preliminary Flood Insurance Study contains all profiles presented in a reduced scale to minimize reproduction costs. All profiles will be included and printed at full scale in the final published report.

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FLOOD INSURANCE STUDY
DOOR COUNTY, WISCONSIN AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and updates previous FISs/Flood Insurance Rate Maps (FIRMs), Flood Boundary Floodway Maps (FBFMs) and Flood Hazard Boundary Maps (FHBMs) for the geographic area of Door County, including: the City of Sturgeon Bay, the Village of Ephraim, and the unincorporated areas of Door County (hereinafter referred to collectively as Door County). Please note that the Village of Forestville did not have previous FIS text, and the Villages of Sister Bay and Egg Harbor had no previously identified Special Flood Hazard Areas (SFHAs).

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 Door 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.

Information on the authority and acknowledgments for each jurisdiction and all unincorporated areas included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

City of Sturgeon Bay: The hydrologic and hydraulic analyses from the FIS report dated August 5, 1991, were prepared by the U.S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No.

City of Sturgeon Bay (continued)	EMW-88-E-2738, Project Order No. 1. That work was completed in December 1988. Additional data for Sturgeon Bay was obtained from the Flood Insurance Study for Brown County (Reference 1).
Village of Ephraim:	The hydrologic analysis for Green Bay was taken from a flood levels report, which was prepared by the U.S. Army Corps of Engineers (COE), Detroit District, and completed in April 1988. The hydraulic analysis for Green Bay was taken from a flood levels report, which was prepared by the COE, Detroit District, and completed in February 1990 (Reference 2).
Door County (Unincorporated Areas)	The hydrologic and hydraulic analyses from the FIS report dated June 1977 were prepared by Owen Ayres and Associates, Inc., for FEMA, under Contract No. H-3805. That work was completed in October 1976 (Reference 3).

For this countywide FIS, redelineation of SFHAs was performed by Camp Dresser & McKee Federal Programs (CDM), under contract HSFE05-05-D-0027/ 002. This work was completed July 28, 2006. On selected FIRM panels, planimetric base map information was provided in digital format. Information was also derived from USGS Digital Line Graphs. Additional information may have been derived from other sources. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), referenced to the North American Datum of 1983 (NAD 83), GRS80 spheroid.

1.3 Coordination

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

The dates of the initial and final CCO meetings held for Door County and the incorporated communities within its boundaries 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 Sturgeon Bay	*	August 23, 1990
Village of Ephraim	*	October 13, 1994
Unincorporated Areas	*	December 14, 1976

*Data not available

For this countywide FIS, a pre-scoping report was prepared by Michael Baker Jr. dated March 2005 (Reference 4). This report described work performed by WDNR to assemble the necessary information to perform the redelineation of the special flood hazard areas based on improved topographic information. The initial coordination meeting was held July, 2005 and was attended by CDM, WDNR, FEMA and members of the community.

The results of the study were reviewed at the final CCO meetings held on _____. These meetings were attended by representatives of the CDM, the State of Wisconsin, 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 countywide FIS covers the geographic area of Door County, Wisconsin. 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 studied by detailed methods. The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRMs (Exhibit 2).

Green Bay was studied by detailed methods for its entire shoreline within the community. Frequency-elevation relationships and wave runup were studied in detail for Green Bay and Lake Michigan (Reference 2 and 3).

Flooding caused by overflow of Little Creek and Sturgeon Bay was studied in detail (Reference 1).

TABLE 2 - FLOODING SOURCES STUDIED BY DETAILED METHODS

Flooding Source	Limits of Detailed Study
Ahnapee River	From the Door-Kewaunee county line to a point approximately 5.6 miles upstream.
Fish Creek	From its mouth at Green Bay to approximately 2,680 feet upstream of Stone Dam.
Keyes Creek	From its mouth at Green Bay to just downstream of Fox Lane.
Little Creek	From its mouth at Sturgeon Bay to approximately 100 feet upstream of Michigan Street.
Maple Creek (Shivering Sands Creek)	From County Trunk Highway J to a point approximately 0.86 mile upstream. Also from its mouth at Lake Michigan to Haberli Road.
Mink River	from its mouth at Lake Michigan to a point approximately 1.2 miles upstream.
Stony River	From County Trunk Highway J to approximately 1,300 feet upstream Carnot Road.

All or portions of numerous flooding sources in the county were studied by approximate methods. Portions of the Mink River, Keyes Creek, Stony Creek, Ahnapee River, Logan Creek, Whitefish Bay Creek, Heins Creek, Hibbard Creek, Lilly Bay Creek, Renard Creek, a tributary to Renard Creek, Bear Creek, Schuyler Creek, Woodard Creek, Sugar Creek, a tributary to Sugar Creek, Three Springs Creek, Riebolt's Creek, a tributary to Sturgeon Bay Canal, an unnamed tributary to Kangaroo Lake, Kangaroo Lake, Schmoke Lake, Europe Lake, Clark Lake, and Lost Lake were studied by approximate methods.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Door County.

2.2 Community Description

Door County is a peninsula in northeastern Wisconsin, bordered by Lake Michigan on the east and Green Bay on the west, with several islands located off its northern tip. The entire county lies with the Lake Michigan drainage basin. Due to the narrowness of the peninsula, the streams have short, small runs and flow in well-defined dendritic patterns. One major stream is the Ahnapee River, which drains southern Door County and flows south to the City of Algoma before emptying into Lake Michigan. Topographic features are very low. The eastern shoreline of Door County is low-lying and extremely marshy. Moving from east to west, elevations

increase, with bluffs lining Green Bay and western Lake Michigan. Wooded areas exist along the coasts while agricultural land can be found inland. Door County is located in the Eastern Ridges and Lowlands geographical province of Wisconsin, primarily in the Northern Lake Michigan Coastal ecological landscape, with a small section in the southwest lying in the Central Lake Michigan Coastal ecological landscape (Reference 4). The population of Door County in the year 2000 was reported to be 27,961 (Reference 5).

Lake Michigan, including Green Bay, provides over 247 miles of shoreline in Door County. There are 93 miles of streams, none of which are more than 15 miles long, originating in the county.

The landscape of Door County is dominated by Niagara dolomite. An escarpment of Niagara dolomite forms an almost continuous bluff along the Green Bay shoreline. The Maquoketa shale underlies the Niagara formation and is exposed in many places along the Green Bay shoreline to the south. Important soils of the county include stony loams and red clays derived from the calcareous bedrock and material transported from the north in glaciation. Parts of Door County have a unique soil type, the raw humus rendzina, found only in a few other places in the world.

The climate of Door County is tempered by Green Bay and Lake Michigan. There are fewer extremely cold days and fewer hot days than are common to the mainland on the west. Lake waters delay the coming of spring as well as extend mild temperatures in the fall. A little more than 50 percent of the average annual precipitation falls between May and September. The average rainfall recorded at Sturgeon Bay is 27.2 inches a year.

Lumbering, fishing, and shipbuilding became big business in Door County during the last half of the 19th century. Production in the cherry and apple orchards began approximately at the turn of the century and provided a very important farm income. Today the peninsula's leading industrial enterprise is shipbuilding which is centered in the county seat of Sturgeon Bay. Agriculture is an important source of income for the county, especially the cherry and apple harvests. Far surpassing these as a source of income for Door County today, however, is the multi-million dollar tourist industry.

The largest watershed is that of the Ahnapee River, which drains 36 square miles in the southern half of the county. A dam at Forestville impounds 8 miles of the Ahnapee River. There are 25 inland lakes totaling approximately 3,250 acres. Nearly 60 percent of the lake acreage is accounted for by Kangaroo and Clark Lakes.

Commercial and residential developments occur in the flood plain of the lake and streams. Developments, particularly those associated with tourism, continue to be built in the flood plain, increasing the amount of damage due to flooding.

2.3 Principal Flood Problems

The City of Sturgeon Bay's flooding problems are due to the high water levels on Sturgeon Bay and the overflow of Little Creek. Since the areas adjacent to Sturgeon Bay are well developed, the flood potential is significant. A large number of residences and other structures along the shoreline will be inundated.

Little Creek flows in the eastern portion of the City from north to south in a relatively undeveloped portion of the community. The overflow of Little Creek will overtop all the bridges crossing it, but will affect only a small number of buildings.

Most water damage in the Village of Ephraim is associated with storms and occurs along the shoreline of Lake Michigan. Little damage has occurred along inland streams.

The early 1950s (particularly 1952 and 1953), 1985, and 1986 were high water years on Lake Michigan. Higher lake levels had been experienced, especially in the 1880s. Erosion and flooding of shore property along the east shore of Green Bay is not considered a major problem, even during periods of high lake stages. The vast proportion of the shoreline has rock bluffs or protected bays, and is not subject to damage. However, there are some isolated reaches of shore that are subject to significant erosion and flooding damage when extreme high lake stages are accompanied by strong north and northeast winds.

The following is a list of gaging stations that are located along Lake Michigan and Green Bay:

Gaging Station	Gage Number	Period of Record
Ludington	7023	1951-1986
Holland	7031	1960-1986
Calumet Harbor	7044	1903-1986
Milwaukee	7057	1906-1986
Green Bay	7079	1954-1986
Sturgeon Bay	7072	1946-1986
Mackinaw City	5080	1900-1986
Port Inland	7096	1965-1986

Most water damage in Door County is associated with storms and occurs along the shoreline of Lake Michigan. Little damage has occurred along inland streams. The most recent riverine flood on record occurred on the Ahnapee River in September 1975 and had a recurrence interval of approximately 30 years, or an approximate 3-percent annual chance flood

Damage to shore property is caused by wave action and currents. Low-lying areas are also inundated by high water stages. Flooding in many cases is entirely due to temporary local rises in lake levels and waves caused by storms.

Throughout the years, damage and destruction of piers, wharves, boat houses, and boats have been reported routinely. Also breakwaters, retaining walls, and sidewalks have been washed out. All such losses were associated with storms on the Great Lakes. Erosion along the lake shores is also a problem, but is not covered in this study.

2.4 Flood Protection Measures

Breakwaters and forms of shoreline protection against wave action are scattered throughout the county on Lake Michigan. The breakwaters are particularly constructed for the Sturgeon Bay shipping canal. There are no flood protection works on streams in the county.

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-, 2-, 1-, or 0.2-percent annual chance flood (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 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the 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 the peak discharge-frequency relationships for the flooding sources studied in detail affecting the county.

Pre-Countywide Analyses

There were no gaging stations available for streams in the unincorporated areas of the county at the time of the study. Several methods of analysis were used, which included the Soil Conservation Service (SCS) method (Reference 6), the regional

empirical equation method for Wisconsin by Conger (Reference 7), and Snyder's synthetic hydrograph development (Reference 8).

Discharges for the Ahnapee River were computed by Conger's, SCS, and Snyder's methods. A synthetic hydrograph developed by Snyder's method was routed through the small dam on the Ahnapee River to determine floodflows downstream.

Due to the slope of the Fish Creek Basin, it was analyzed using Conger's method with and without the slope parameter.

Design discharges for Keyes Creek, Maple Creek (Shivering Sands Creek), Mink River and Stony Creek were based on the SCS and Conger's methods.

For Little Creek and Sturgeon Bay, the 1-percent annual chance flood discharge was obtained by averaging the results of a regional regression equation (Reference 9), and an urbanized area technique (Reference 10). The peak 1-percent annual chance discharge for Little Creek is shown in Table 3, Summary of Discharges.

TABLE 3 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	PEAK DISCHARGES (cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
LITTLE CREEK				
At mouth	N/A	N/A	400	N/A

Drainage Area-Peak Discharge relationships for the Ahnapee River, Fish Creek, Keyes Creek, Maple Creek, Mink River and Stony River are shown on the next page in Figure 1, Frequency-Discharge, Drainage Area Curves.

The analysis of Green Bay was carried out using the gage data taken from the Green Bay gaging station No. 7079 and the “Revised Report on Great Lakes-Open Coast Flood Levels: Phase I” (Reference 11). Both the log-Pearson Type III and the Pearson Type III distributions were investigated, and comparison of the two methods, when applied to the adjusted data, showed that the skew coefficients were almost identical. It was concluded that the long record gages gave the same flood levels for given return periods using either method. Therefore, the logarithmic transformation was deemed unnecessary, and the Pearson Type III frequency distribution was adopted to determine the 100-year flood elevation at the mouth of Green Bay (Reference 12). Adjustments made to account for then-present conditions were derived from monthly mean lake levels obtained by routing the 1946-1986 net basin supplies through the Great Lakes under present diversion and outlet conditions.

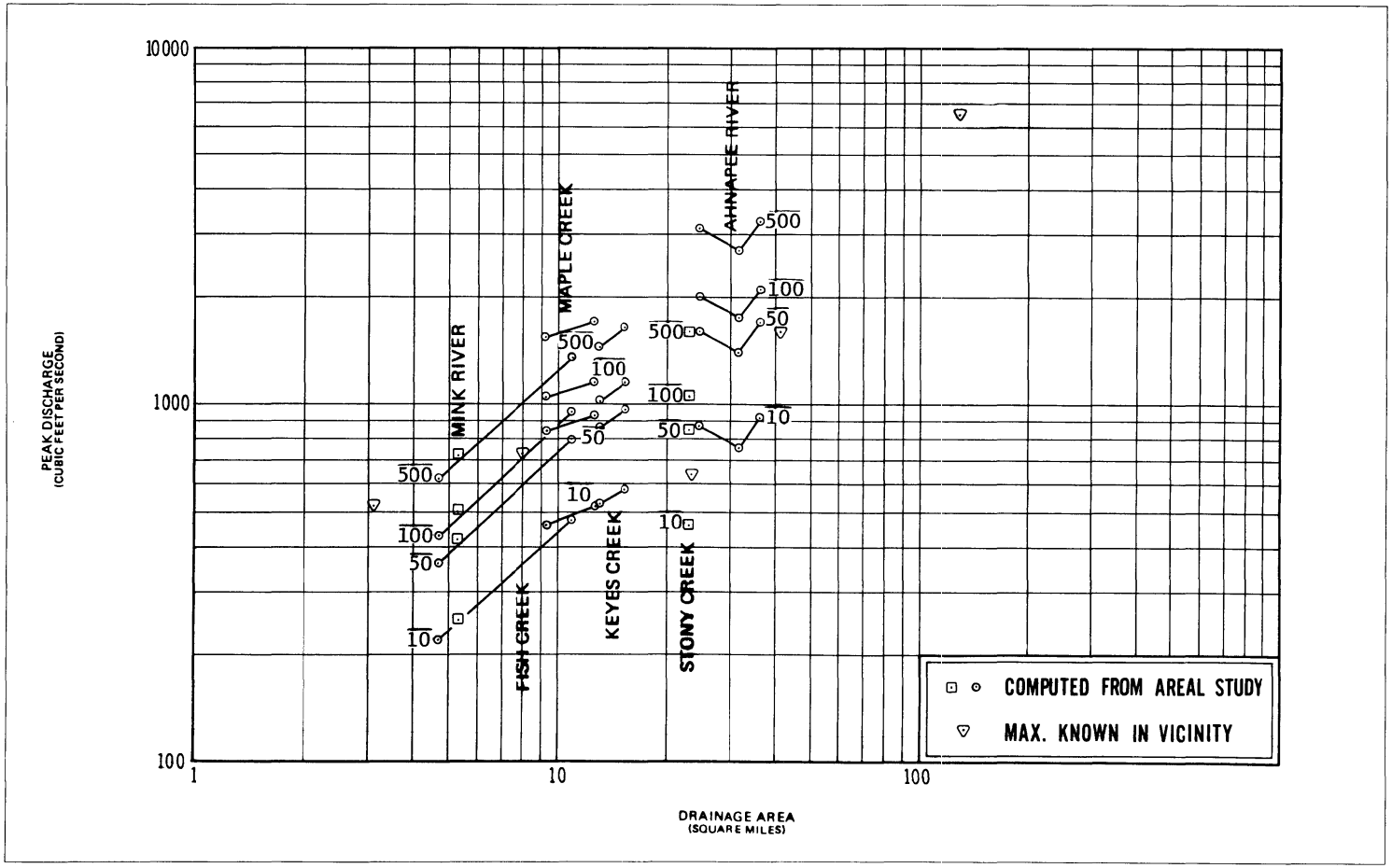

FIGURE 1

DOOR COUNTY, WI

FREQUENCY - DISCHARGE, DRAINAGE AREA CURVES

**AHNAPEE RIVER-MAPLE CREEK -FISH CREEK-
KEYES CREEK-STONY CREEK-MINK RIVER**

The COE performed an extensive analysis on the regional skew characteristics of the gage data and a skew value of 0.2 for Lake Michigan was adopted.

Elevations published in the COE's Revised Great Lakes Open-Coast Flood Elevations report (Reference 11) were used to re-delineate the flood hazard boundary for Door County's coast along Lake Michigan. The elevations, which were published using Mean Sea Level (MSL) 1929, which is equivalent to NGVD 29, were converted to NAVD 88. The open coast flood elevations for the 10-, 2-, 1- and 0.2-percent annual chance floods have been determined for Lake Michigan are summarized in Table 4, "Summary of Open-Coast Flood Elevations."

TABLE 4 – SUMMARY OF OPEN-COAST FLOOD ELEVATIONS

REACH	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
H	582.7	583.8	584.2	585.1
J	582.8	583.9	584.3	585.2

Data used to determine open-coast elevations along Sturgeon Bay within the City of Sturgeon Bay has been superseded (Reference 11), so the elevations previously determined for the bay are not provided.

This Countywide Analysis

There were no hydrologic analyses performed for this revision.

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 this FIS report. For construction and/or floodplain management purposes, users are encouraged to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross sections were determined from topographic maps and field surveys. All topographic mapping used to determine cross sections is referenced in Section 4.1.

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 (Exhibit 2). There were 116 field surveyed cross sections (both riverine

and tidal) for the unincorporated areas of the county study. The distances between cross sections were obtained from enlarged USGS quadrangle maps (Reference 13).

Each incorporated community within, and the unincorporated areas of, Door County, with the exception of The Villages of Egg Harbor, Forestville and Sister Bay, has a previously printed FIS report. The hydraulic analyses described in those reports have been combined and are summarized on the following pages.

Pre-Countywide Analyses

The main and auxiliary spillways at the Forestville Dam were analyzed to determine headwater elevations for the upper reach of the Ahnapee River. This analysis was made assuming all gates in the spillways are removed, no scour or sandbagging of the earthen dam occurs during overflow, and flood elevations do not result in failure of the structure. Operation of the dam does have an impact on the water surface due to the significant channel elevation differences. A dual profile was computed downstream of the Forestville Dam to account for both the main and auxiliary spillway channels. Separation of the total discharge for these channels was based on elevation-discharge curves developed for these spillways. Resulting profiles on the Ahnapee River were compared to historical high water marks for the September 1975 flood which nearly resulted in the failure of the Forestville Dam. Analysis of precipitation measurements taken by nearby residences indicated that the storm was approximately a 3.3-percent annual chance event. This was hydraulically verified by comparison of high water marks at three locations.

Water-surface elevations for Little Creek's 1-percent annual chance flood were computed by WSPRO, a step-backwater computer program (Reference 14). The starting water-surface elevation for Little Creek was taken as the 10-year monthly mean maximum water level of 582 feet (NAVD) for Green Bay (Reference 15).

Water-surface elevations for streams studied in the unincorporated areas of the county were computed using the COE's HEC-2 step-backwater computer program (Reference 16). Water-surface profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for the 10, 2-, 1- and 0.2-percent annual chance floods. In accordance with state guidelines, the backwater computations for the rivers were started at the mean lake level of 580 feet (NAVD). The elevations due to Lake Michigan and Green Bay flooding were then superimposed onto the riverine profiles, resulting in the water-surface profiles shown in Exhibit 1. No profiles were shown for the Mink River because the segment studied in detail was completely influenced by Lake Michigan.

Analysis of flooding caused by Lake Michigan was based on published elevation data in 1975 for open-coast conditions (Reference 17). Lake levels may vary significantly in the enclosed and protected harbors and bays along the county's coast. Figure 2 depicts the relationship between short term stillwater levels,

differential elevations due to wind setup, and wave runup. 1-percent annual chance flood lake elevations were published for Lake Michigan and the City of Green Bay (Reference 17). Estimated lake levels along the western side of the county were based on a linear interpolation of the water-surface from Washington Island to Green Bay, with elevations selected at 0.5 foot intervals. The variation of lake level with location was shown on an Elevation-Frequency Location Map in the Door County unincorporated area study (Reference 3), with associated Elevation-Frequency Curves in the same report. Since this data has been superseded by a revised report prepared by the COE (Reference 11), those figures are not presented in this section of the pre-countywide data.

Figure 2 also depicts the addition of runup to the storm water surface caused by wind generated waves. This simultaneous occurrence of storm water lake levels and wind wave action was used for all runup computations but is unlikely for

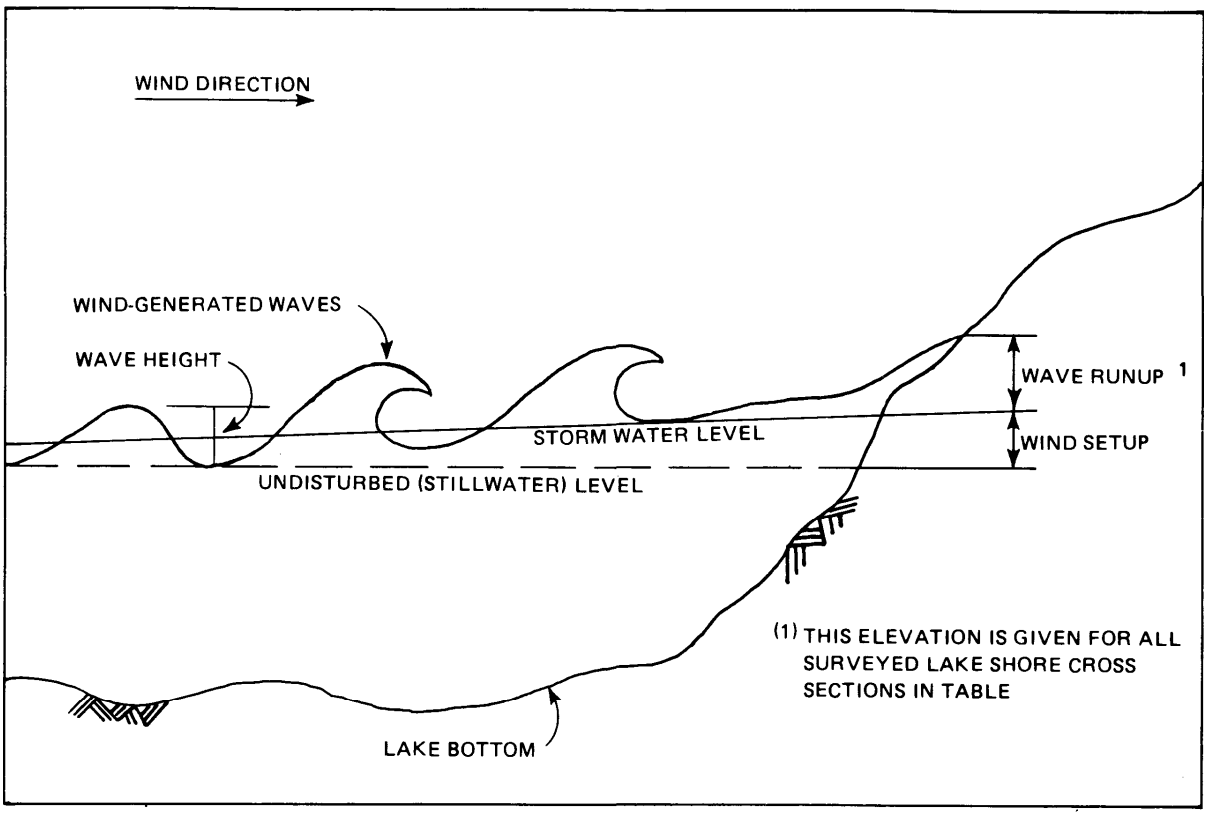

Figure 2 Wind Setup, Wave Runup Diagram

some segments along the western side of Door County, as different winds would be required to produce each effect. It should be noted that floodplain delineation for Lake Michigan did not include flooding resulting from wave runup.

Due to the various wind speeds and directions associated with large storms, open coast lake levels cannot be directly used within Green Bay.

A storm surge analysis was performed using the Great Lakes Storm Surge Planning Program computer program developed by the Great Lakes Environmental Research Laboratory (Reference 18). Data consisting of mean lake water levels, wind speeds, and wind directions were used as input parameters for estimating storm surge elevations. Various wind speeds and directions were input into the computer program to match estimated storm surge elevation with the calculated mean water levels at the Green Bay gage site and open-coast reach "J." Once a match was made, the interpolation of the storm surge elevations between Green Bay and open-coast reach "J" was performed to determine the l0-, 2-, l-, and 0.2-percent annual chance flood levels.

A design wind of 40 knots was selected for calculation of wind generated waves on Green Bay and Lake Michigan. This wind was assumed to be of sufficient duration to produce design waves that are only fetch limited. Computation of wave heights and runup along the Door County coastline was based on procedures set forth in a COE's Manual (Reference 19). Wave heights and runups had no frequency of recurrence attached to them.

The storm surge elevations for the 10-, 2-, 1- and 0.2-percent annual chance flood elevations for Green Bay in the City of Ephraim are shown in Table 5, "Summary of Storm Surge Elevations."

TABLE 5 – SUMMARY OF STORM SURGE ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (FEET NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
GREEN BAY				
At Ephraim	583.1	584.1	584.6	585.5

The prediction of significant wave heights and runup along the Green Bay side of Door County was based on deepwater waves without consideration of energy lost due to bottom friction as the wave approaches the shore. This is generally accepted under conditions of large depths and steep shoreline as found along the Green Bay side. Various wind directions were analyzed, where necessary, to determine the maximum equivalent deepwater wave. Refraction analyses were utilized where contours indicated that it was needed to achieve an accurate description of the wave activity. Prediction of wave heights and runup along the Lake Michigan side of Door County was based on deepwater waves generated in Lake Michigan. Bottom friction was considered along the eastern coast of Door County due to the gradual decreases in lake depth towards the shoreline. Refraction analyses were also made where they were required. Table 6 contains a summary of these wave calculations.

TABLE 6 - WAVE RUNUP DATA

Cross Section	Panel	Effective Fetch (Nautical Miles)	Equivalent Deepwater Wave Height (Feet)	Wave Periods (Second)	Wave Runup (Feet)	Comments
1[1]		11.5	5	3.9	2	Runup over cliff and centerline of town
2[1]		11.5	5	3.9	5	Wave dissipated on rocky cliff face
3	0430C	16.7	8	6.0	9	Wave dissipated on rocky cliff face
4	0345C	17.6	8	6.1	7	Wave dissipated on rocky cliff face
5	0345C	11.0	7	5.5	4	Runup over rocky ledge dissipated along cliff face
6[1]		17.8	7	5.6	8	Runup over top of lower cliff
7	0260C	13.5	8	5.7	10	Runup almost to edge of house
8	0064C	15.3	8	5.8	5	Wave dissipated along stepped face
9	0066C	27.4	10	6.7	7	Runup over centerline of town road
10	0067C	27.4	10	6.7	11	Wave dissipated along vertical cliff face
11[1]		24.0	9	6.6	8	Wave dissipated along slope
12[1]		24.0	9	6.6	17	Runup over cliff dissipates along slope
13[1]		20.6	9	6.3	4	Runup dissipated along slope
14[1]		48.0	9	6.5	8	Runup dissipated along slope
15	0208C	48.0	7	5.6	2	Runup into Sand Bay Park
16	0305C	199.0	8	6.3	1	Runup over berm to centerline of road
17[1]		199.0	11	7.2	7	Wave dissipated along bank
18	0501C	199.0	11	7.0	10	Wave dissipated along bank
19	0491C	199.0	9	6.5	6	Runup over top of bank
20	0605C	199.0	5	4.7	4	Wave dissipated along slope

[1]The location of these transect cross sections is unknown.

Computed runup for locations given in Table 6 is dependent on cross sections taken along the shoreline. Runup in areas other than those indicated will differ due to varying beach cross section and lake bottom topography.

Obstructions due to floating debris or ice at manmade structures such as bridges can result in higher than normal water-surface elevations as evidenced by past floods. The hydraulic analyses of this study, however, did not consider ice or debris effects. Thus, the flood elevations shown on the profiles are considered valid only if hydraulic structures and waterways remain unobstructed.

Flood elevations of stream segments studied by approximate methods were determined by normal depth analysis and flood-prone soils (Reference 20).

Roughness factors (Manning's "n") 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	"n" value
Ahnapee River	0.025 – 0.120
Ahnapee River Auxiliary Spillway	0.025 – 0.120
Fish Creek	0.025 – 0.120
Keyes Creek	0.025 – 0.120
Little Creek	0.035 – 0.080
Maple Creek	0.025 – 0.120
Mink River	0.025 – 0.120
Stony River	0.025 – 0.120

The hydraulic analyses were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

This Countywide Analysis

There were no hydraulic models developed for this countywide study. Flood hazard boundaries for flooding sources studied by detailed and approximate methods were revised based on improved topographic information.

Revised flood profiles were drawn showing the computed water surface elevations for floods of selected recurrence intervals. In cases where the 2- and 1-percent annual chance flood elevations are close together, only the 1-percent annual chance profile was shown.

The following transect cross sections listed in Table 6, Wave Runup Data, are provided for historical purposes only, and are not indicated on the revised FIRMs; 1, 2, 6, 11, 12, 13, 14, 17. The location of these transects could not be verified at the time of this Preliminary FIS text issuance. Should this information become available before this countywide revision is finalized, we will incorporate the data into the revised FIS text and FIRMs before final issuance.

The COE and FEMA collaborated on a report issued by the Detroit District of the COE titled, "Flood Levels of Green Bay," (Reference 21). This report updated the methodology used to determine storm surge elevations for Green Bay. The revised storm surge elevations developed the report were used to re-delineate the flood hazard boundary for Door County along the coast of Green Bay. Table 8, "Flood Levels of Green Bay," summarizes the elevations for townships in Door County where storm surge elevations were determined.

TABLE 8 - FLOOD LEVELS OF GREEN BAY (Feet NAVD)

TOWNSHIP	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
Union	583.6	584.6	585.1	586.1
Gardner	583.5	584.5	585.1	586.0
Nasewaupee	583.4	584.4	584.9	585.8
Sevastopol	583.2	584.2	584.6	585.6
Egg Harbor	583.1	584.2	584.6	585.6
Gibraltar	583.1	584.1	584.6	585.5
Liberty Grove	583.0	584.1	584.6	585.4
Washington Island	582.8	583.9	584.3	585.2

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 29). With the finalization of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD 29 and NAVD 88, visit the Nation 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 (TSDN) associated with the FIS report and FIRM for the community. Interested individual may contact FEMA to access these data.

For this revision, the vertical datum shift in Door County was calculated to be **-0.1 feet NGVD 29 to NAVD 88**. All elevation values were edited to reflect these changes. Structure and ground elevations in the community must therefore be referenced to NAVD 88.

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- 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 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 county. For the streams studied in detail, the 1- and 0.2-percent annual chance 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 1:2400 with a contour interval of 2 feet (Reference 22), 1:24,000 with a contour interval of 10 feet (Reference 9), and 1:12,000 with contour intervals of 10 to 20 feet (Reference 13).

For the flooding sources studied by approximate methods, the boundaries of the 1-percent annual chance floodplains were delineated using topographic maps taken

from the previously printed FIS reports, FBFMs, FHBMs, and/or FIRMs for all of the incorporated and unincorporated jurisdictions within Door County with the exception of the Villages of Egg Harbor and Sister Bay.

For this countywide study, the 1- and 0.2-percent annual chance floodplain boundaries have been delineated using digital base map information provided by the Door County Land Information Office. This data includes 2002 orthophotography and contours at two foot intervals; referenced to the Wisconsin State Plane coordinate system, NAD83 horizontal datum, and NGVD 29 vertical datum.

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-percent 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 floodfringe developments (Reference 23). 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 floodway for Little Creek presented in this FIS was computed on the basis of the natural conveyance of the floodplain. The floodway widths were computed at selected cross sections. Floodways determined for Ahnapee River, Fish Creek, Keyes Creek, Maple Creek (Shivering Sands Creek) and Stony Creek were based on the existing hydraulic conveyance characteristics of the surveyed cross

sections, removing areas of non-conveyance. The effect of a structure, such as a bridge, is reflected in the hydraulic computations. On Mink River, the hydraulic floodway was determined by using Green Bay's mean lake level of 580 feet (NGVD). All floodways between the field measured cross sections were determined by engineering judgment using the available topographic maps. Floodway locations were computed with no consideration given to economic, legal, or political factors.

The results of the floodway computations are tabulated for selected cross sections in Table 9. 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.

For selected streams in Table 9, the 1-percent annual chance floodplain and floodway were redelineated due to improved topographic data. As a result, there were areas where, based on the previous hydraulic analyses, the floodway would not fit within the redelineated boundaries of the 1-percent annual chance floodplain. In these areas, the floodway was also reduced to fit within the 1-percent annual chance floodplain boundary. The data provided in Table 9 lists the width of the floodway based on the hydraulic analyses previously done, as well as the amount of reduction needed to fit the redelineated floodway inside the redelineated 1-percent annual chance floodplain boundary. The redelineated floodways are shown on the FIRM (Exhibit 2).

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 9 for certain downstream cross sections of Fish Creek, Keyes Creek, Little Creek, Maple Creek (Shivering Sands Creek) and Mink River are lower than the regulatory flood elevations in that area, which must take into account the 1-percent annual chance flooding due to backwater from other sources.

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 of the 1-percent annual chance 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 5.

A floodway generally is not appropriate in areas such as those that may be inundated by floodwaters from Lake Michigan and Green Bay. Thus no floodway was prepared near the mouths of streams which flow into Lake Michigan or Green Bay, or along the lakeshore. A floodway is also not appropriate in areas of impoundment created by a dam and, therefore, is not shown on that segment of the Ahnapee River which is influenced by the Forestville Dam. Floodways were not calculated for the Green Bay, Lake Michigan and Sturgeon Bay due to the inapplicability of the floodway concept regarding lacustrine flooding sources.

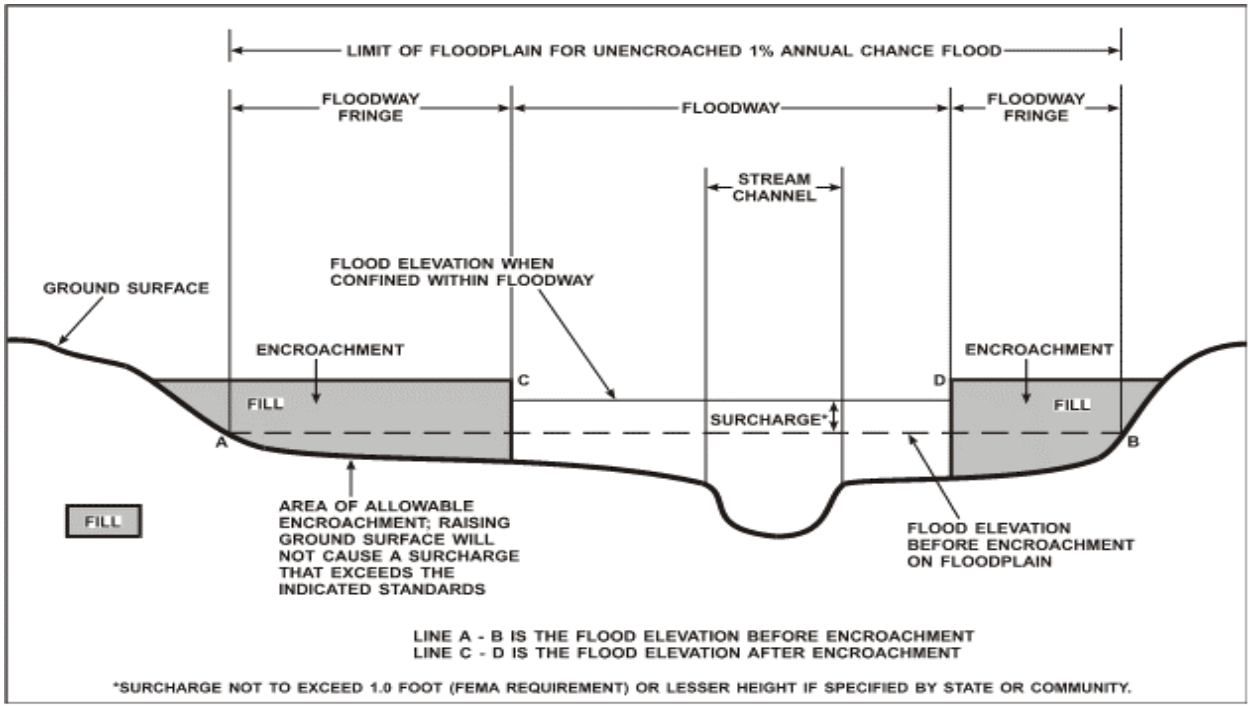

FIGURE 3 - FLOODWAY SCHEMATIC

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[2](FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AHNAPEE RIVER									
A	6.04	760	4,900	0.4	0	587.3	587.3	587.3	0.0
B	6.44	1,720	9,160	0.2	90	587.3	587.3	587.3	0.0
C	7.07	1,370	3,200	0.5	0	587.4	587.4	587.4	0.0
D	7.28	870	3,110	0.6	0	587.4	587.4	587.4	0.0
E	7.31	870	3,060	0.6	0	589.9	589.9	589.9	0.0
F[3]	7.57	400	1,870	0.8	0	589.9	589.9	589.9	0.0
F[4]	7.57	460	1,660	0.2	0	589.9	589.9	589.9	0.0
G[5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
H	8.45	700	3,340	0.6	0	593.9	593.9	593.9	0.0
I	9.03	470	1,600	1.2	0	594.0	594.0	594.0	0.0
J	9.31	310	770	2.6	0	595.2	595.2	595.2	0.0
K	9.70	400	830	2.4	0	598.8	598.8	598.8	0.0
L	10.46	450	1,690	1.2	0	605.1	605.1	605.1	0.0
M	11.01	490	820	2.4	0	609.7	609.7	609.7	0.0
N	11.56	640	2,340	0.9	0	614.2	614.2	614.2	0.0
FISH CREEK									
A	0.01	150	100	9.3	40	584.6	581.9[6]	581.9	0.0
B	0.19	210	710	1.3	0	584.6	584.5[6]	584.5	0.0
C	0.24	60	100	7.3	0	584.6	584.5[6]	584.5	0.0
D	0.45	230	670	1.1	0	594.4	594.4	594.4	0.0
E	0.76	500	680	1.0	0	595.9	595.9	595.9	0.0
F	1.27	730	2,290	0.3	0	596.3	596.3	596.3	0.0

[1]Miles above mouth [2]A reduced floodway width resulting from topographic redelineation is shown on the FIRM for informational purposes only. Actual floodway width should be used for regulatory purposes [3]Main Channel [4]Auxiliary Spillway Channel [5]Floodway not computed
[6]Elevation computed without consideration of backwater effects from Green Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

AHNAPEE RIVER-FISH 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[1] (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
KEYES CREEK									
A	0.09[2]	470	920	1.2	0	585.1	579.8[4]	579.8	0.0
B	0.35[2]	110	200	5.6	0	585.1	581.7[4]	581.7	0.0
C	0.42[2]	110	200	5.6	0	588.5	588.5	588.5	0.0
D	0.64[2]	940	1,360	0.8	0	591.6	591.6	591.6	0.0
E	0.80[2]	550	2,690	0.4	0	593.0	593.0	593.0	0.0
F	0.98[2]	1,190	2,520	0.4	200	593.1	593.1	593.1	0.0
G	1.28[2]	810	2,300	0.4	0	593.2	593.2	593.2	0.0
H	1.66[2]	420	1,790	0.6	0	604.1	604.1	604.1	0.0
I	2.08[2]	340	750	1.4	0	604.6	604.6	604.6	0.0
J	2.37[2]	700	1,330	0.8	0	606.1	606.1	606.1	0.0
LITTLE CREEK									
A	260[3]	70	107	3.8	0	584.9	584.8[4]	584.8	0.0
B	460[3]	133	219	1.8	0	585.6	585.6	585.6	0.0
C	750[3]	142	163	2.5	0	587.0	587.0	587.0	0.0
D	1,161[3]	88	76	5.3	0	587.6	587.6	587.6	0.0
E	1,450[3]	104	286	1.4	0	590.7	590.7	590.7	0.0
F	1,970[3]	177	532	0.8	0	591.7	591.7	591.7	0.0
G	2,430[3]	352	463	0.9	0	592.0	592.0	592.0	0.0
H	2,688[3]	162	178	2.3	0	592.8	592.8	592.8	0.0
I	2,990[3]	140	182	2.2	0	595.8	595.8	595.8	0.0
J	3,210[3]	140	204	2.0	0	597.2	597.2	597.2	0.0
K	3,650[3]	48	104	3.9	0	599.7	599.7	599.7	0.0
L	3,800[3]	44	105	3.8	0	601.0	601.0	601.0	0.0
M	4,126[3]	54	113	3.5	0	602.4	602.4	602.4	0.0

[1]A reduced floodway width resulting from topographic redelineation is shown on the FIRM for informational purposes only. Actual floodway width should be used for regulatory purposes [2]Miles above mouth [3]Feet above mouth [4]Elevation computed without consideration of backwater effects from Green Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

KEYES CREEK-LITTLE 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[2](FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MAPLE CREEK (SHIVERING SANDS CREEK)									
A	0.14	150	170	6.9	0	584.2	581.4[3]	581.4	0.0
B	0.22	110	310	3.7	0	588.6	588.6	588.6	0.0
C	0.52	170	460	2.4	76	599.6	599.6	599.6	0.0
D	0.67	490	1,520	0.8	0	600.8	600.8	600.8	0.0
E	2.85	1,050	5,010	0.2	0	603.9	603.9	603.9	0.0
MINK RIVER									
A	0.27	320	1,190	0.4	0	584.3	579.9[3]	579.9	0.0
B	0.69	300	1,420	0.4	0	584.3	579.9[3]	579.9	0.0
C	1.20	620	2,270	0.2	0	584.3	579.9[3]	579.9	0.0
STONY CREEK									
A	3.33	30	240	4.3	0	661.9	661.9	661.9	0.0
B	3.61	1,030	1,760	0.6	0	662.4	662.4	662.4	0.0
C	3.89	360	1,750	0.6	0	664.1	664.1	664.1	0.0
D	4.13	820	4,870	0.2	0	664.2	664.2	664.2	0.0

[1]Miles above mouth [2]A reduced floodway width resulting from topographic redelineation is shown on the FIRM for informational purposes only. Actual floodway width should be used for regulatory purposes [3]Elevation computed without consideration of backwater effects from Lake Michigan

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

MAPLE CREEK (SHIVERING SANDS CREEK)-MINK RIVER-STONY CREEK

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 annual chance floodplains that are determined in the FIS 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

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.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Area of special flood hazard formerly protected from the 1-percent annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1-percent annual chance or greater flood event.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 1-percent annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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.

Zone D

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

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 current FIRM presents flooding information for the entire geographic area of Door County. Previously, separate FHBMs and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on 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

A Flood Insurance Study was prepared for the City of Algoma, Wisconsin, approximately 4 miles downstream of the Door County line by the USGS (Reference 24). The Ahnapee River discharges and profiles presented in the 1977 Door County study agreed with those published in the City of Algoma's study. Water-surface elevations and cross sections for the Algoma study, supplied by the USGS, were combined with intermediate field-surveyed cross sections to integrate the two studies.

A report entitled Revised Report on Great Lakes Open-Coast Flood Levels: Phase 1, was prepared by the COE, Detroit District (Reference 8). In addition, the COE, Detroit District, prepared a report entitled Great Lakes Wave Runup Study for Brown County, City of Green Bay and Village of Howard, Wisconsin Flood Levels of Green Bay: Flood Levels Report (Reference 25).

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Door County has been compiled into this FIS. Therefore, this FIS supersedes all previously printed FIS Reports, FHBMs, FBFMs, and FIRMs for all of the incorporated and unincorporated jurisdictions within Door County.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the 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)
Ephraim, Village of	December 5, 1995	None	December 5, 1995	None
Forestville, Village of	November 30, 1973	April 23, 1976	N/A	None
Sturgeon Bay, City of	June 7 , 1974	April 16, 1976	August 5, 1991	None
Door County (Unincorporated Areas)	December 13, 1974	None	April 3, 1978	None

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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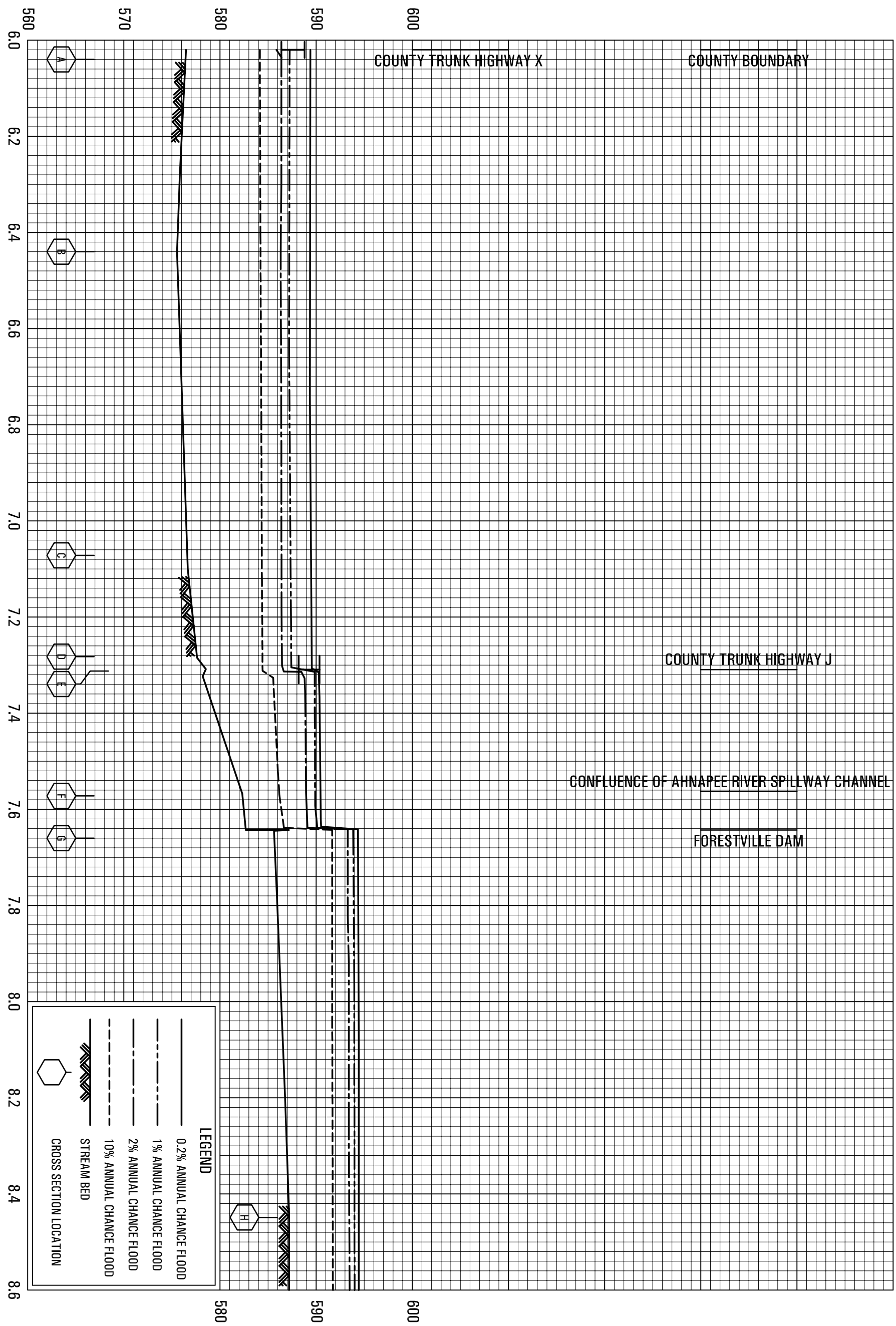


01P

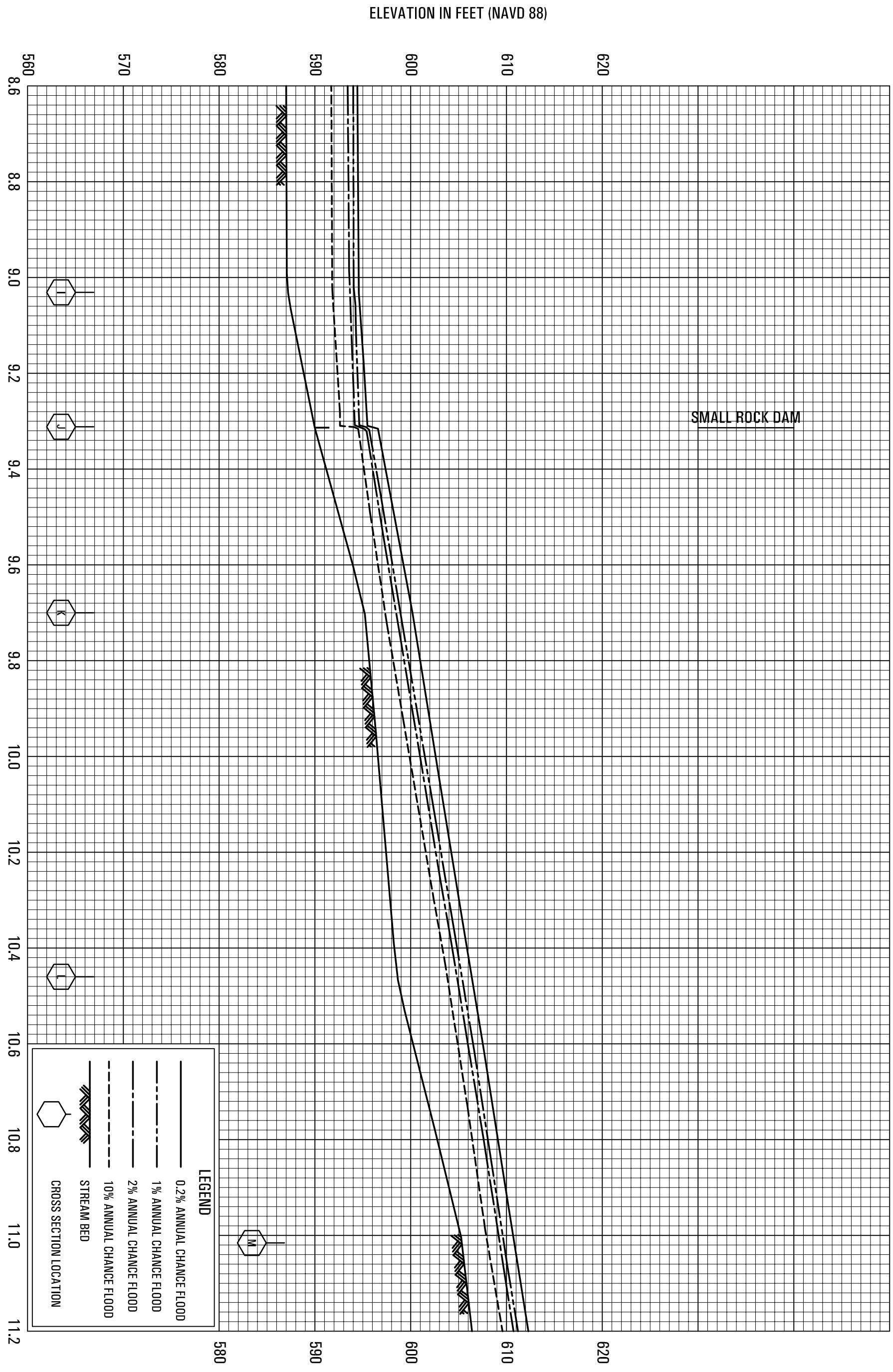
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

AHNAPEE RIVER



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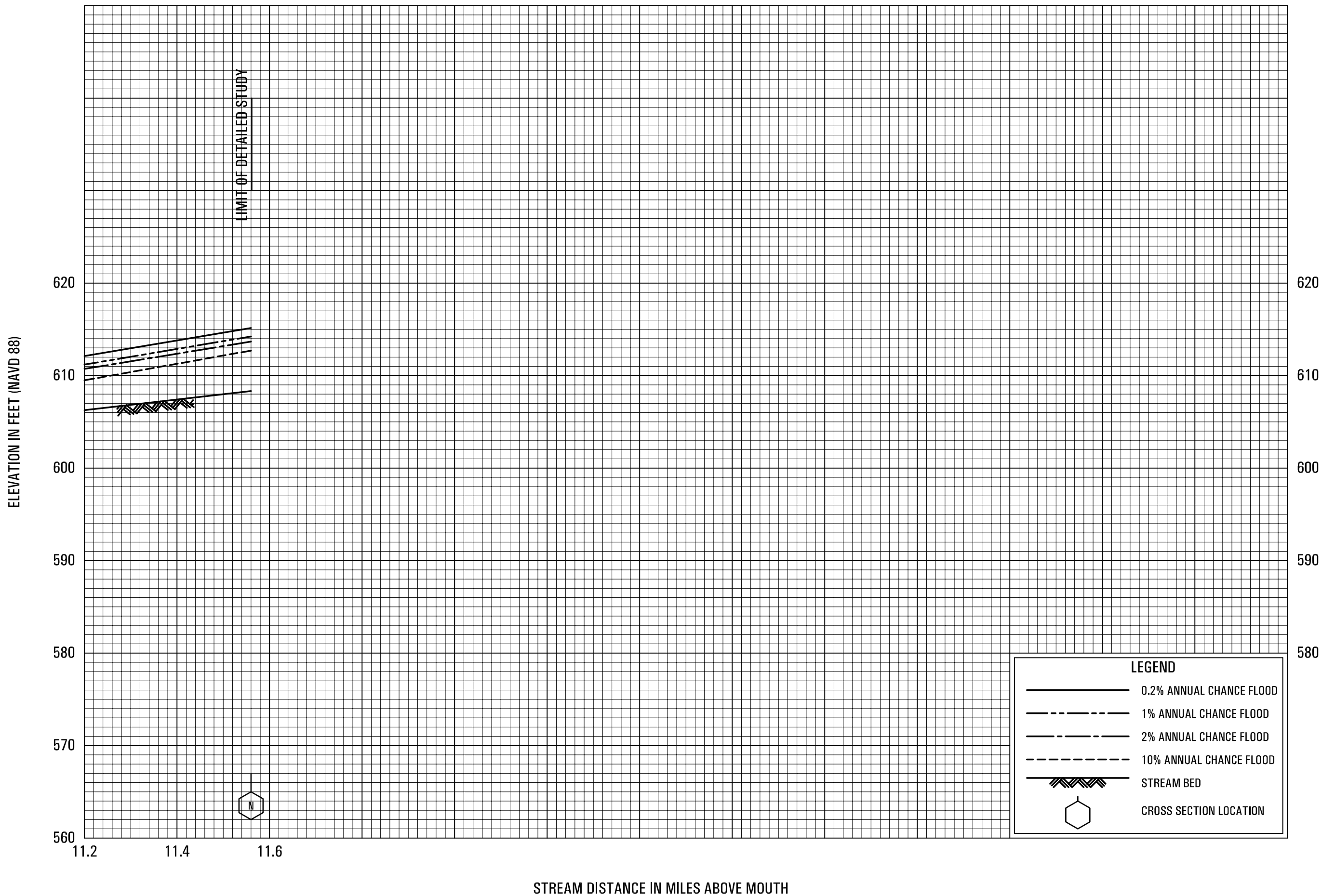
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

AHNAPEE RIVER



FLOOD PROFILES

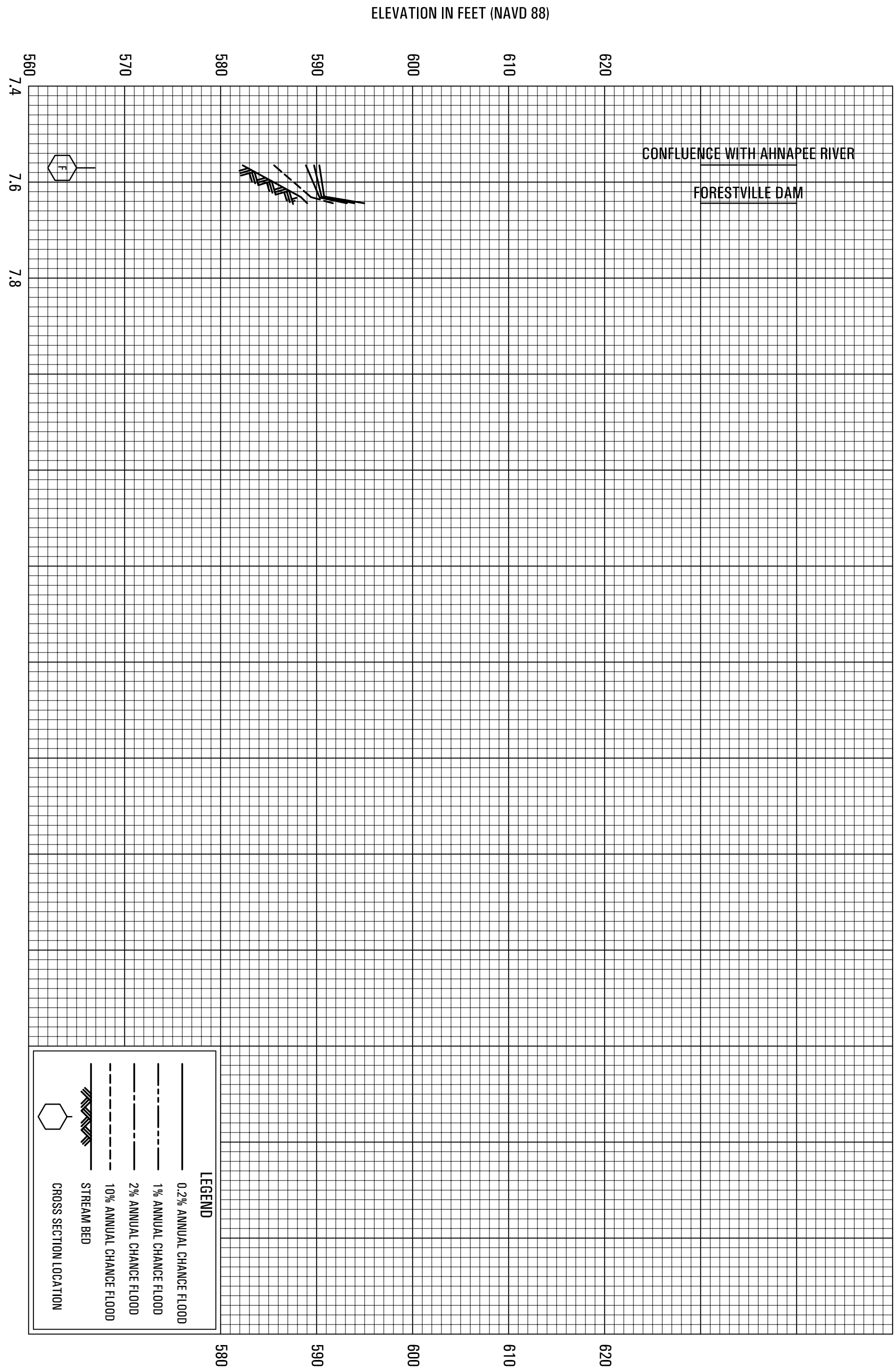
AHNAPEE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

03P



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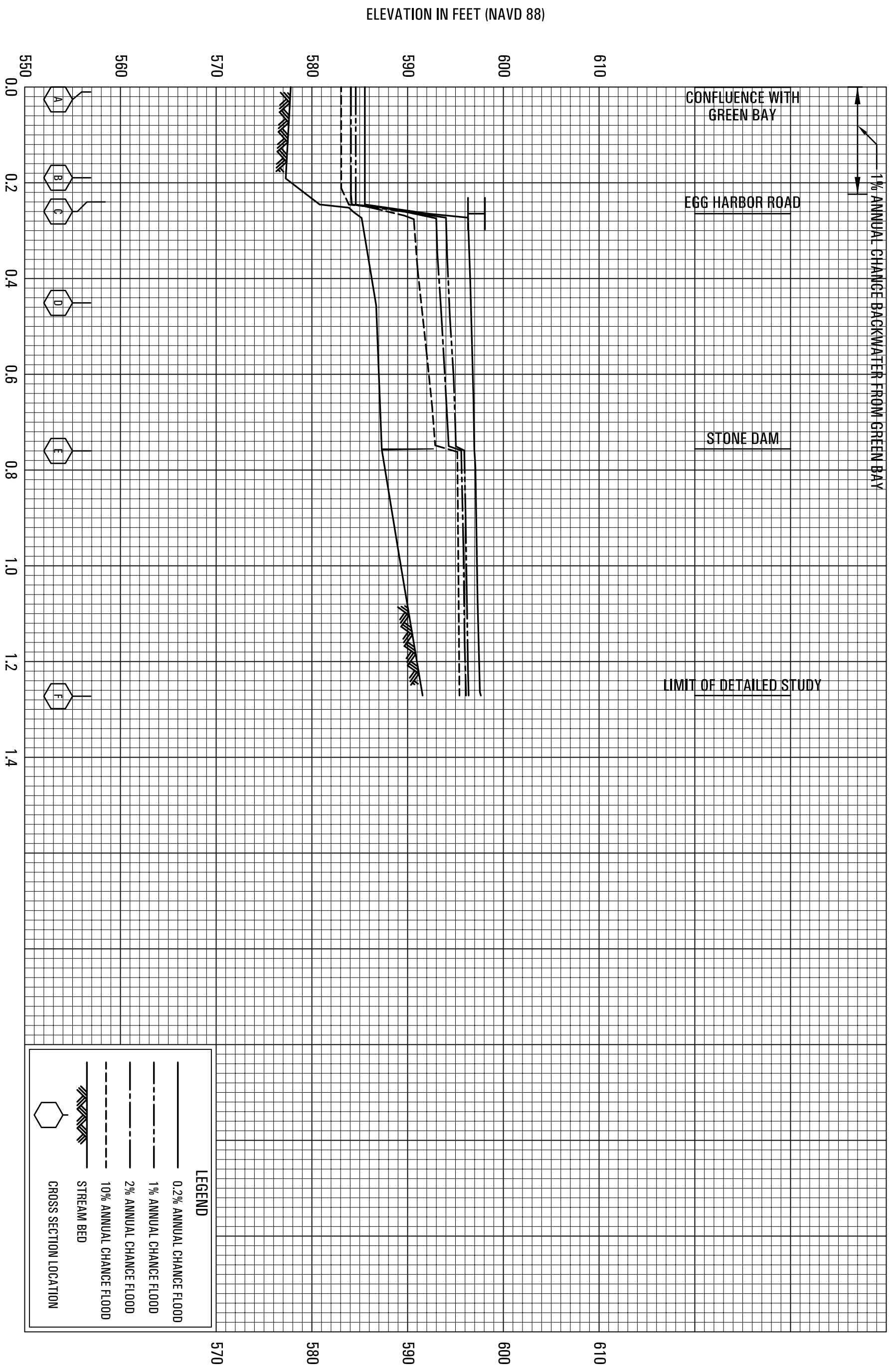
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

AHNAPEE RIVER AUXILIARY SPILLWAY CHANNEL



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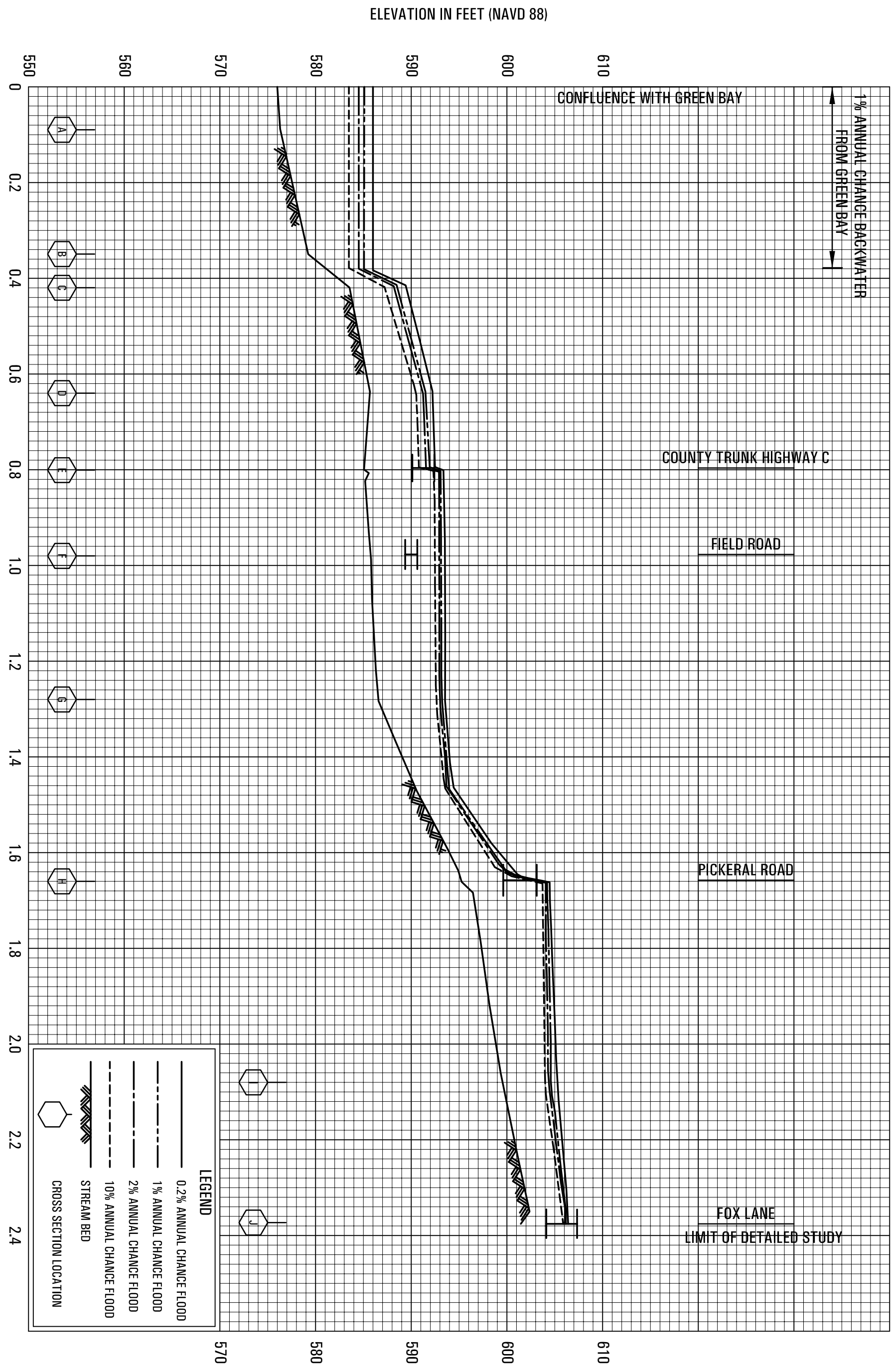
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

FISH CREEK



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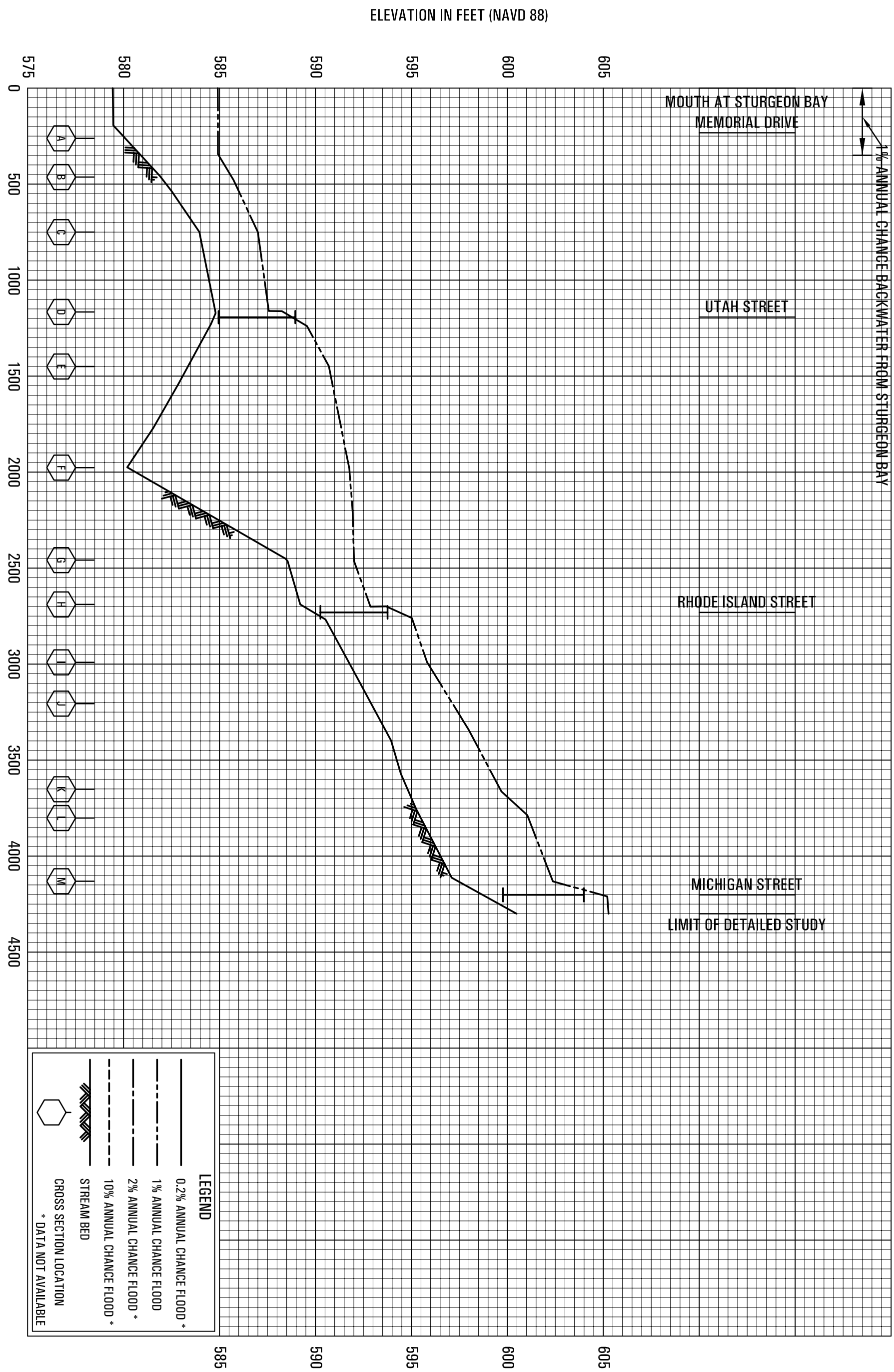
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

KEYES CREEK



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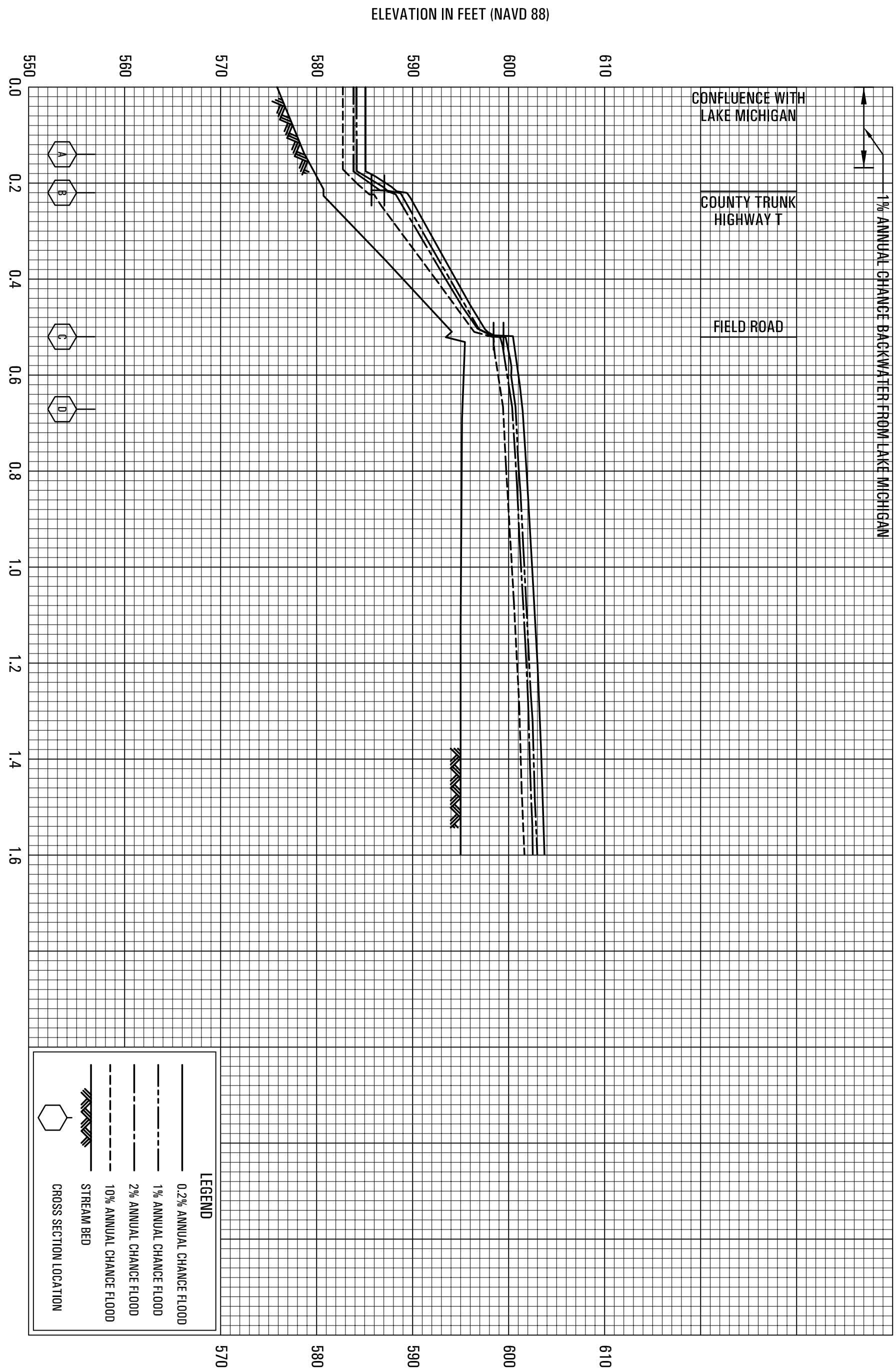
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

LITTLE CREEK



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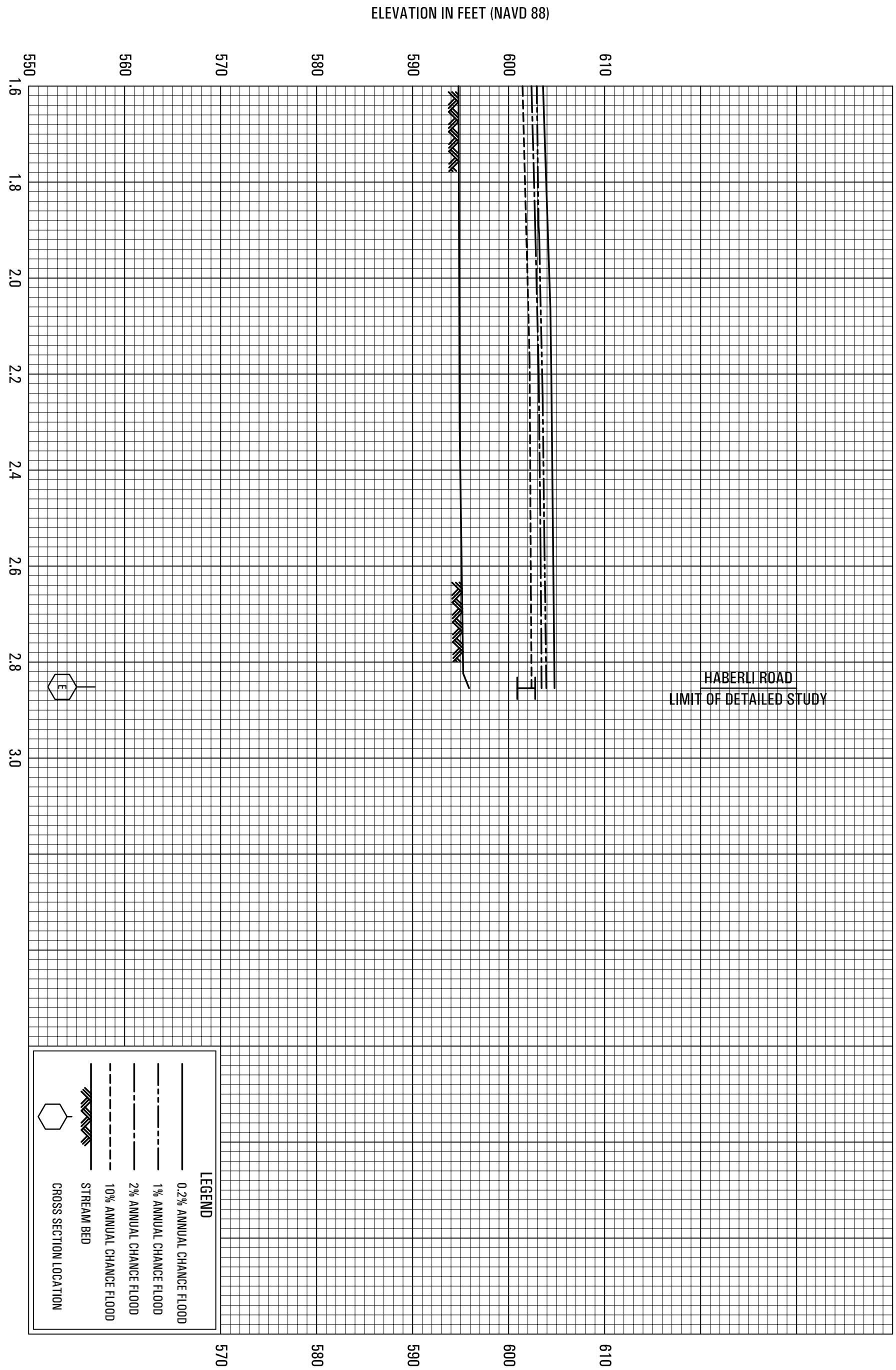
FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

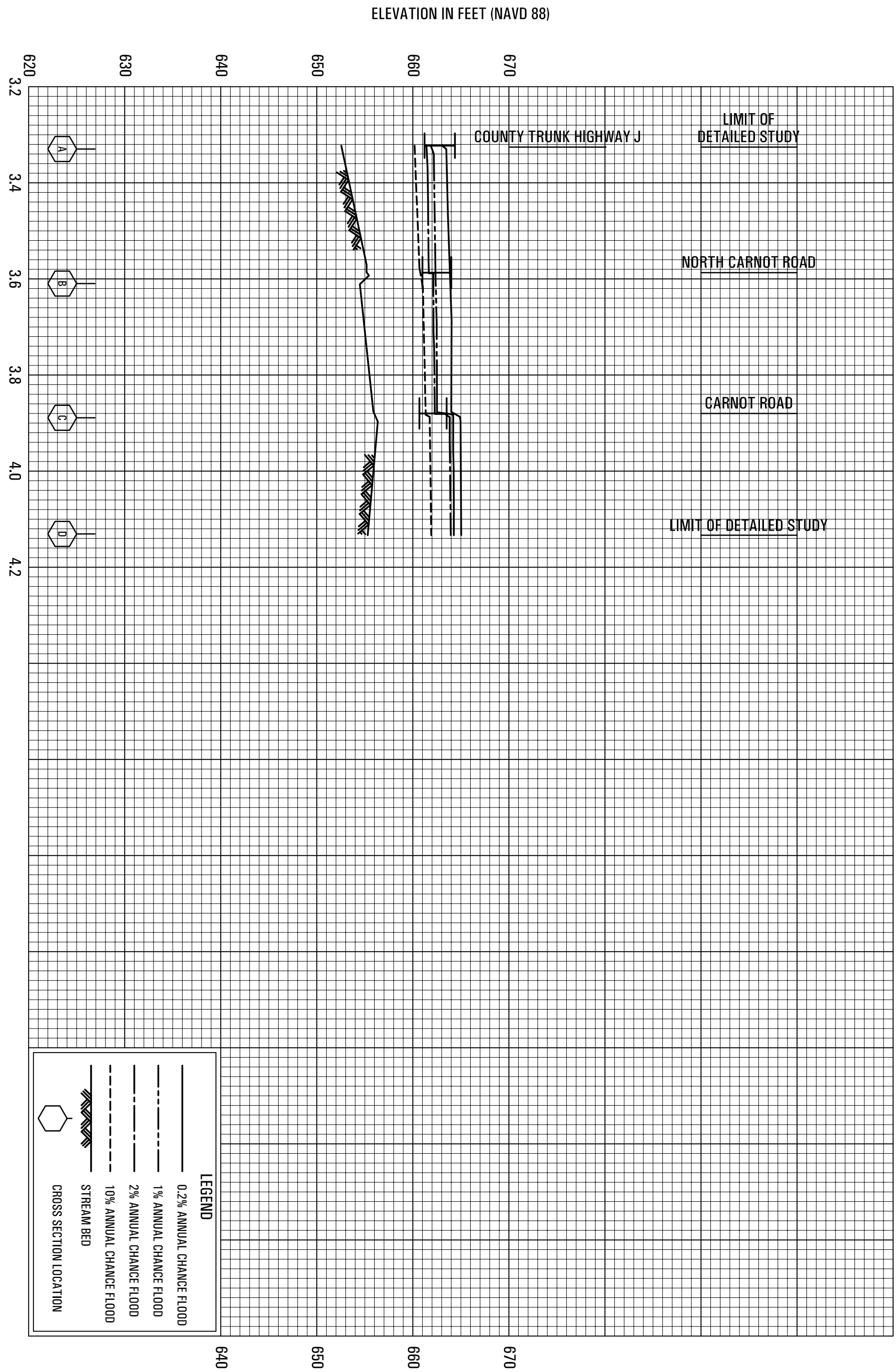
AND INCORPORATED AREAS

FLOOD PROFILES

MAPLE CREEK (SHIVERING SANDS CREEK)



09P	FEDERAL EMERGENCY MANAGEMENT AGENCY DOOR COUNTY, WI AND INCORPORATED AREAS	FLOOD PROFILES MAPLE CREEK (SHIVERING SANDS CREEK)



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FEDERAL EMERGENCY MANAGEMENT AGENCY

DOOR COUNTY, WI

AND INCORPORATED AREAS

FLOOD PROFILES

STONY CREEK