FLOOD INSURANCE STUDY

ERIE COUNTY, OHIO
(AND INCORPORATED AREAS)

COMMUNITY NAME	COMMUNITY NUMBER
BAY VIEW, VILLAGE OF	390595
(1) BELLEVUE, CITY OF	390487
BERLIN HEIGHTS, VILLAGE OF	390650
(2) CASTALIA, VILLAGE OF	390653
ERIE COUNTY (UNINCORPORATED AREAS)	390153
HURON, CITY OF	390154
KELLEYS ISLAND, VILLAGE OF	390738
(3) MILAN, VILLAGE OF	390155
SANDUSKY, CITY OF	390156
(4) VERMILION, CITY OF	395374

Erie County

(1) The City of Bellevue is a tri-county community located in Erie, Huron, and Sandusky Counties. It is not included in the Erie FIS Report and will be mapped with Huron County.

(2) No Special Flood Hazard Areas identified

(3) The Village of Milan is a dual county community located in Erie and Huron Counties. Information for the entire community is included in the Erie County FIS report.

(4) The City of Vermilion is located in Erie and Lorain Counties. The entire community will be mapped with Lorain County. See Lorain County FIS Report.

Revised:
November 19, 2014

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
39043CV000B

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) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report 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, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone(s)	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X

Effective Date: August 28, 2008

PMR Revision FIS Date: November 19, 2014 – to incorporate Zone A approximate studies Physical Map Revision.

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FLOOD INSURANCE STUDY

ERIE COUNTY, OHIO (AND INCORPORATED AREAS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports, Flood Insurance Rate Maps (FIRMs), and Flood Boundary and Floodway Maps (FBFMs) in the geographic area of Erie County, Ohio, including the Cities of Huron and Sandusky, the Villages of Bay View, Berlin Heights, Castalia, Kelleys Island and Milan, and the Erie County Unincorporated Areas (hereinafter referred to collectively as Erie County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The City of Bellevue and the City of Vermilion are excluded from this study and will be included in the FIS for an adjacent county. Village of Castalia is a no special flood hazard areas identified community. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Erie County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and 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.

The Digital Flood Insurance Rate Maps (DFIRMs) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

Redelineation of previously effective flood hazard information for this FIS report and accompanying FIRMs as well as conversion of the unincorporated and incorporated areas of Erie County into Countywide Format was performed by Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM), for FEMA under Contract No. HSFE05-05-D-0026, Task Order No. HSFE05-05-J-0008. This work was completed in September, 2006.

Information on the authority and acknowledgements for each of the previously printed FIS reports for communities within Erie County was compiled, and is provided below.

County of Erie	The previously effective FIS for the County of Erie is dated July 16, 1980. The original hydrologic and hydraulic analyses for the study were performed by Finkbeiner, Pettis & Strout, Limited for the Federal Insurance Administration (FIA), under Contract No. H-4529. This study was completed in March 1979 (Reference 1).
Village of Bay View	The previously effective FIS for the Village of Bay View is dated September 1977. The hydrologic and hydraulic analyses for the study were performed by Dalton-Dalton-Little-Newport for the FIA under Contract No. H-3802. This study was completed in February 1976 (Reference 2).
City of Huron	The previously effective FIS for the City of Huron is dated October 1977. The hydrologic and hydraulic analyses for the study were performed by Dalton-Dalton-Little-Newport for the FIA, under Contract No. H-3802. This study was completed in April 1977 (Reference 3).
Village of Kelleys Island	The previously effective FIS for the Village of Kelleys Island is dated February 17, 1981. The hydrologic and hydraulic analyses for the study were performed by Burgess and Niple, Limited for the FIA, under Contract No. H-4717. This study was completed in October 1979 (Reference 4).
City of Sandusky	The previously effective FIS for the City of Sandusky is dated January, 1977. The hydrologic and hydraulic analyses for the study were performed by the United States Army Corps of Engineers (USACE) Buffalo District under Interagency Agreement No. H-2-73, Project Order No. 12 (Reference 14).

Flood Insurance Studies for the Villages of Berlin Heights, Castalia and Milan have not been previously published. The previously effective Flood Insurance Rate Maps (FIRMs) for the Villages of Milan and Berlin Heights originated from Flood Hazard Boundary Maps (FHBMs) that were converted by letter to FIRMs.

The digital base map files were derived from U.S. Geological Survey (USGS) 1:24,000 scale Digital Line Graph with a contour interval of 5 and 10 feet. The coordinate system used for the production of this DFIRM is State Plane Ohio North 3401 Feet, North American Datum 1983, Lambert Conformal Conic Projection. Differences in the datum and projection system used in the production of DFIRMs 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 this DFIRM.

PMR Revised Authority and Acknowledgements

This countywide revision was initiated by Physical Map Revision (PMR) requests submitted to FEMA to restudy all approximate zone A areas with updated hydrology and hydraulic analyses.

The preliminary mapping and FIS report updates were completed by Michael Baker Jr. Inc. in April 2013 under contract (contract number 110020-10) to the Ohio Department of Natural Resources.

The coordinate system used for the production of this DFIRM is State Plane Ohio North 3401 Feet, North American Datum 1983, Lambert Conformal Conic Projection. Differences in the datum and projection system used in the production of DFIRMs 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 this DFIRM.

Base map information shown on this FIRM was derived from digital orthophotography provided by the Ohio Statewide Imagery Program (OSIP) in SID format as one raster covering the entire county. The imagery was acquired in 2007. Topographic information was also acquired from OSIP. The 2007 OSIP bare-earth Digital Elevation Model (DEM) was derived from digital LiDAR data. The DEM was acquired to meet 1-foot vertical accuracy.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of proposed FIS efforts in the community. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meetings held for the previous FIS reports covering the incorporated and unincorporated areas of Erie County, Ohio are shown in Table 1.

The initial CCO meeting for this countywide FIS was held on August 1, 2005 and attended by representatives of FEMA, local participants and the study contractor. The results of the study were reviewed at the final CCO meeting held on November 14, 2006, and attended by representatives of FEMA, Ohio Department of Natural Resources (ODNR), Erie County, affected communities and study contractor. All problems raised at that meeting have been addressed.

Table 1 – CCO Meeting Dates for Pre-County Wide FIS*

Community Name	Initial CCO Date	Final CCO Date
Bay View, Village of	March 1975	July 1, 1976
Berlin Heights, Village of	N/A	N/A
Castalia, Village of	N/A	N/A
Erie County (Unincorporated Areas)	June 9, 1977	December 4, 1979
Huron, City of	March 1975	March 22, 1977

Kelleys Island, Village of	September 9 ,1976	October 2, 1980
Milan, Village of	N/A	N/A
Sandusky, City of	N/A	N/A

*Source: References 1-4

PMR Revised Coordination

A flood risk review meeting was held on February 26, 2013 with representatives from State of Ohio, the communities, and Michael Baker Jr. Inc. to explain the nature and purpose of a FIS, and to identify the streams to be studied or restudied.

The results of the study were reviewed at the open house held on June 26, 2013, and attended by representatives of Ohio Department of Natural Resources, Erie County and City of Huron. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Erie County, Ohio, including the incorporated communities listed in Section 1.1. The portion of the Village of Milan located in Huron County is also included. The Cities of Bellevue and Vermilion were excluded from this study since the majority of their landmass is located outside of Erie County; they will be included in a FIS for an adjacent county.

For this FIS update, no new approximate or detailed analyses were performed. Effective flood hazard data was redelineated using updated and revised topographic data, and data from each previously effective FIS and FIRM was compiled into FEMA's countywide format. Analyses described herein refer collectively to previous studies, as detailed in References 1-4 and Reference 14.

Approximate methods of analysis were used to study those areas having low development potential and/or minimal flood hazards as identified at the initial CCO meetings identified in Table 1. The scope and methods of study were proposed to and agreed upon by FEMA and the community.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, as well as areas of projected development and proposed construction through 1981 for the City of Huron; and through 1984 for the unincorporated areas of Erie County and the Village of Kelleys Island. Flooding sources studied by detailed methods are defined in Table 2.

Table 2 – Limits of Detailed Studies

Stream Reach	Study Length (miles)	Limit of Detailed Study
Boos Ditch	0.3	Mouth at Sandusky Bay to U.S. Route 6.

Table 2 – Limits of Detailed Studies

Stream Reach	Study Length (miles)	Limit of Detailed Study
Cold Creek	0.7	Mouth at Sandusky Bay to State Route 2.
Edson Creek	0.3	Upstream Corporate Boundary (City of Vermilion) at Haber Road to State Route 2.
Hahn Creek	1.6	Mouth at Lake Erie to approximately 200 feet upstream of State Route 2.
Huron River	6.36	Mouth at Lake Erie to approximately 600 feet upstream of Mason Road.
Kob Ditch	2.0	Corporate Boundary (City of Sandusky) at Norfolk Southern Cooperation Railroad to Hull Road.
Mills Creek	4.4	Mouth at Sandusky Bay to Old Railroad Road.
Mudbrook Creek	1.0	Confluence with Huron River to Corporate Boundary (City of Huron) at Mud Brook Road
Pipe Creek	6.3	Mouth at Sandusky Bay to approximately 200 feet upstream of Schenk Road.
Plum Brook	1.1	Mouth at Sandusky Bay to approximately 1,250 feet upstream of Perkins Avenue.
Sawmill Creek	2.5	Mouth at Lake Erie to Dautch Ditch (approximately 1.36 miles upstream of Boos Road).
Storrs-Hemminger Ditch	2.4	Confluence with Kob Ditch to approximately 1,000 feet upstream of Columbus Avenue.
Sulphur Brook	2.6	Confluence with Taylor Creek to Bogart Road
Taylor Creek	2.8	From confluence with Pipe Creek to approximately 400 feet upstream of Bogart Road.
Windau Ditch	0.4	Confluence with Mills Creek to State Route 2.
Winkler Creek	1.5	Mouth at Lake Erie to upstream corporate boundary (City of Huron) at Sprowl Road.

The following streams were studied by approximate methods: Chappel Creek, Cold Creek (East Branch), Cranberry Creek, Cranberry Creek Tributary No. 1, Cranberry Creek Tributary No. 2, Cranberry Creek Tributary No. 3, Cranberry Creek Tributary No. 4, Darby Creek, Dildine Ditch, East Fork, Frankenburg Creek, Huron River, Huron River East Branch, Huron River Tributary at Jeffries Road, Huron River Tributary at Milan, Huron River West Branch, Huron River West Branch Tributary at Lovers Lane, Linsley Ditch (Tributary to Plum Brook), Mills Creek, Mud Brook, Mud Brook Tributary North of Scheid Road, Mud Brook Tributary No. 1, Mud Brook Tributary No. 2, Old Woman Creek, Old Woman Creek Tributary at Berlin Road No 1, Old Woman Creek Tributary at Berlin Road No. 2, Old Woman Creek Tributary at Berlin Road No. 3, Old Woman Creek Tributary at Berlin Road No. 4, Old Woman Creek Tributary at Berlin Road No. 5, Pipe Creek, Pipe Creek Tributary 1, Pipe Creek Tributary 2, Pipe Creek Tributary

3, Pipe Creek Tributary 4, Plum Brook, Poncas Creek, Poncas Creek Tributary at Jeffries Road, Poncas Creek Tributary at the Ohio Turnpike, Poncas Creek Tributary at State Route 113, Sawmill Creek, Sherod Creek, Snyders Ditch Tributary, Spring Valley Lake Tributary No. 1, Spring Valley Lake Tributary No. 2, Sugar Creek, Sugar Creek Tributary No. 1, Sugar Creek Tributary No. 2, Snyders Ditch, Tributary to Chappel Creek, Tributary to Darby Creek, Tributary to East Fork, Tributary to East Fork North of Denman Road, Tributary to Huron River Tributary at Milan, Tributary to Old Woman Creek at Berlin Road No. 1A, Tributary to Snyders Ditch Tributary at Bragg Road, Tributary to Vermilion River at Dean Road, Tributary to Vermilion River at West Road, Upstream of Camp Timberline, Unnamed Stream at Bluebird Beach, Unnamed Stream at Joppa Road, Vermilion River and two small ditches in the western portion of the City of Huron (References 1, 4 and 14).

This countywide FIS also incorporated the determination of letters issued by FEMA resulting in map changes (Letters of Map Change, or LOMCs). All LOMCs in Erie County for which information could be found are summarized in the Summary of Map Amendment (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS update and in Table 3. Copies of the SOMA may be obtained from the Community Map Repository. Copies of the TSDN may be obtained from FEMA.

Table 3. Letters of Map Change Incorporated

Community	Identifier	Date Issued	Type
City of Sandusky	Taylor Creek	05/22/1987	LOMR

PMR Revised Scope of Study

This revision affects Zone A portions of Erie County, OH. It includes the establishment of revised Zone A flood hazards for the following streams:

Chappel Creek	Mills Creek
Chappel Creek 2	Mills Creek Tributaries A, B & C
Chappel Creek Tributary A	Mudbrook Creek
Chaska Beach Cove Branch	Mudbrook Creek Tributary A, B &C
Cold Creek	Old Woman Creek
Cold Creek Tributary A	Old woman Creek Tributaries A, A1 & A1A
Cranberry Creek	Pipe Creek
Cranberry Creek Tributaries A, B, C, D, & E	Pipe Creek Tributaries A, B, C, D & E
Darby Creek	Plum Brook
Darby Creek Tributary A	Plum Brook Tributary A
East Branch Huron River	Saw Mill Creek
East Fork Vermillion River	Saw Mill Creek Tributary A
East Fork Vermillion River Tributary A	Saw Mill Creek Tributary A1
Frankenburg Creek	Sugar Creek
Frankenburg Creek Tributary A	Sugar Creek 2
Huron River	Sugar Creek 2 Tributaries A & B
Huron River Tributaries A, A1, B, C, C1, D, D1, E, E1 & F	Vermillion River
Lake Erie Tributaries 1,2, 3, 4, 4A, 4B, 4B1, 4B2 & 4B3	West Branch Huron River

2.2 Community Description

Erie County is located in north-central Ohio. Erie County is bounded on the north by Lake Erie, on the west by Sandusky County, on the northeast by Ottawa County, on the south by Huron County, and on the east by Lorain County (Reference 1). Erie County is served by several major highways including Interstate 80, Interstate 90, State Route 2 and U.S. Route 250.

According to United States Census Bureau statistics, the 2004 estimated population for Erie County was 78,976 with the majority of the population concentrated in the City of Sandusky (Reference 7).

Erie County is characterized by extremely flat topography. Over 90 percent of the region has a slope of less than 6 percent. The flat gradients reduce the probability of generating large flows with flashy conditions although these events have been recorded (Reference 1).

The climate is typical of the northern mid-continent but moderated by the surrounding water of Lake Erie (Reference 2). Northerly winds blowing off Lake Erie tend to lower daily high temperatures in summer and raise temperatures in winter. Summers are moderately warm and humid, while winters are reasonably cold and cloudy (Reference 4). Typical temperatures in the county for the summer range from 66 degrees Fahrenheit (F) to 82 degrees F (recorded in July) and from 19 degrees F to 32 degrees F in winter (recorded in January). The average annual precipitation is 34.5 inches. Average annual snowfall is 23.3 inches measured at Sandusky (Reference 5).

Most of the area within Erie County lies on the flat, glaciated lake plain. Approximately 300 to 350 million years ago, large tropical inland seas covered the area, laying down thick deposits of organic and inorganic material. Sedimentary rocks of limestone, dolomite, shales, and sandstone were formed with over 20 percent of this bedrock within five feet of the surface. Beach ridges are apparent in the Townships of Vermilion and Berlin. The Townships of Oxford and Margaretta also possess a number of less developed ridges (Reference 1). Alluvial stream deposits are found in the Townships of Milan and Huron. It is believed that they resulted from the buildup of a delta in the mouth of the Huron River. The Huron River meandered back and forth across the delta dissecting the area into deep, elongated troughs. Drainage of streams from the delta into the river valley caused lateral dissection of the area (Reference 1).

Approximately 70 percent of the area within Erie County is covered by soil which exhibits poor drainage features. The Township of Berlin contains about 120 kinds of soil. The northwestern part of the township is lake plain on which the soils are developed in water-laid deposits ranging from sand to silty clay loam. Soils in the southeastern half of the township are developed in a mixture of glacial ice deposits (glacial till) and gravelly material deposited by rapidly flowing glacial meltwater (outwash) (Reference 1).

The Township of Florence is underlain with sandstone bedrock that is covered to varying depth by glacial till (Reference 1).

The Township of Groton is underlain by limestone bedrock at depths ranging from a few inches to several feet. The bedrock is covered by glacial till and glacial meltwater deposits. The limestone bedrock contains numerous cracks and holes, through which much of the drainage from the area enters the rock. A large portion of the township lacks relief. Until artificial drainage was established, this area was essentially a swamp (Reference 1).

There are relatively few kinds of soils in the Township of Huron, but these soils exist in a very complex pattern. Most of the soils deposited by streams entering Lake Erie have a silty nature (Reference 1).

The Township of Margaretta has a very complicated soil pattern which limits residential development. The limitations revolve around two problems, wetness and shallow rock. The area north of State Route 2 (with the exception of the hill south of Crystal Rock) was essentially a swamp until the engineering of artificial drainage. The area south of State Route 2 (and the hill south of Crystal Rock) is underlain by limestone at depths ranging from a few inches to several feet. Much of the natural drainage in the southern part of the township is through cracks in the limestone (Reference 1).

The Township of Milan contains a predominance of sandy and gravelly soils, especially in the southern part of the township. Limitations for residential development are caused by the presence of bedrock at shallow depths (Reference 1).

The Township of Oxford is a relatively simple shale bedrock area that has been scoured by glacial ice. Varying amounts of glacial till have been left overlying this rock. Ridges from glacial ice also contain an appreciable amount of shale (Reference 1).

The Township of Perkins lies on a lake plain of low relief. Soils with poor to somewhat poor natural drainage typically occupy such areas. In these soils, the water table is within two feet of the surface during wet periods. These wet periods are characterized by wet or flooded basements, muddy lots, and backed-up septic tanks (Reference 1).

The Township of Vermilion has some sandstone hills. Much of the township was essentially a swamp until the installation of artificial drainage. There are large areas within the township in which water table is within two feet of the surface for a part of each year (Reference 1).

At the time of the original flood insurance study for the unincorporated areas of Erie County, approximately 70 percent of the land in Erie County was being used for agriculture. The vegetation associated with the agricultural activities included vegetables, soybeans, corn, wheat, fruit, pasture, and woodland (Reference 1).

The streams studied in the Erie County Unincorporated Areas generally have very mild stream gradients that tend to reduce the probability of generating flash flood conditions. However, very large flows have been recorded. As with most urbanized areas, many bridges and culverts are undersized which lead to significant backups behind these structures. The region (Erie County

Unincorporated Areas) posses 13 distinct watersheds; the largest areas are the Huron River Tributary and the Vermilion River (Reference 1).

With increasing demand for land near existing cities, development pressure tends to encourage more use of flood prone areas. Encroachment is a consideration along the shoreline of Lake Erie, which is a natural attraction for development. Taylor Creek has been intensely encroached upon between Woodlawn Avenue and Dewitt Avenue. This area has been flooded on numerous occasions. Sulphur Brook has scattered areas of encroachment. Particularly near Strub Road, considerable area is subject to inundation, largely due to a restrictive culvert. Franklin Flats on the Huron River, near the extension of Knight Road, is a development that is periodically subject to flooding (Reference 1).

The Village of Bay View is a small residential community of 171 acres on the south shore of Lake Erie and Sandusky Bay, located in the northeast corner of Erie County, Ohio. According to United States Census Bureau statistics, the 2004 estimated population of Village of Bay View was 670.

The rock knobs that form islands in Lake Erie, together with the rock Catawba peninsula, create turbulence in the advancing ice field of the ice age creating pits and pockets. The smaller of these became small lakes which were subsequently filled with plants to form swampy peat pockets. Bay View is typical of these knobs, elevated about eight feet above the level of Lake Erie (Reference 2). Forest vegetation in the Village of Bay View is classified as the Oak-Hickory Zone. The forests have largely been eliminated to make way for residential development. Since the topography of the community varies little, there is very little variation in the visual characteristics of the flora of the area. Development in the floodplain areas of Bay View is totally residential in the southern portion of the community, while the north portion is mixed residential, small business and government. (Reference 2).

The City of Bellevue is a tri-county community located in north-central Ohio with portions in southwestern Erie County, southeast Sandusky County, and northwest Huron County. According to United States Census Bureau statistics, the 2004 estimated population of City of Bellevue was 8,091. Though a portion of Bellevue is located in Erie County, Bellevue was not included in the Erie Countywide Flood Map Project since the majority of the landmass is located outside of Erie County. The City of Bellevue will be included in future Countywide Flood Map Projects in Sandusky County. No information for flood hazards in the City of Bellevue is included in the Erie County FIS Report.

The Village of Berlin Heights is located in southeastern Erie County in north-central Ohio. According to United States Census Bureau statistics, the 2004 estimated population of Village of Berlin Heights was 665.

The Village of Castalia is located southwest of Sandusky, Ohio in northwestern Erie County. According to United States Census Bureau statistics, the 2004 estimated population of Village of Castalia was 919. It is a non flood prone community.

The City of Sandusky is located on Sandusky Bay in northwestern Erie County, midway between Cleveland and Toronto. It is the county seat and has over 22 miles of shoreline within the city limits. According to United States Census Bureau statistics, the 2004 estimated population of the City of Sandusky was 26,997.

Due to the fact that the City of Sandusky borders Lake Erie, the topography is flat and does not vary more than forty feet from a low of about 571 feet above the city datum. The average annual precipitation in the area is 28 inches (Reference 14).

At the time of the original FIS, most of Sandusky was urbanized and vegetation was relatively sparse throughout the city. Development along the shoreline of Lake Erie and Sandusky Bay consisted mainly of industrial and commercial, with some residential occurring along the extreme eastern and western portions. Mostly residential development was found in the floodplain of Pipe Creek. The floodplains of the main and east branches of Cold Creek and Mills Creek were relatively undeveloped (Reference 14).

The City of Huron is located on the south shore of Lake Erie at the mouth of the Huron River in northeastern Erie County, Ohio. According to United States Census Bureau statistics, the 2004 estimated population of City of Huron was 7,692. The economy of this community of 3.2 square miles includes heavy industry primarily engaged in shipping, small businesses engaged in agriculture, recreational boating, and retail stores (Reference 3). The rock mantle along the south shore of Lake Erie rises gently from west to east, reaching a level of approximately 50 feet above mean lake water surface elevation in the Huron area. The advancing glacier of the ice age was deflected vertically by the rock and slid over the clay overburden creating a flat plain. Water collecting on this plain drained to the north forming the Huron River, its tributaries, and several other streams which traverse the community (Reference 3). Forest vegetation in the City of Huron is classified as Oak-Hickory zone although most of the natural forest has been eliminated by urban development. The limited variation in topography and soils limits the variety of visual characteristics and flora of the region. Development in the floodplain of the Huron River takes the form of heavy industry and shipping, small businesses engaged in the sales, and service of recreational boats. Other recreational businesses are located near the river mouth with residential or recreational development along the upper portions of the river. Development along other streams in this community is primarily residential (Reference 3).

The Village of Kelleys Island is located in northern Erie County, 11 miles north of the City of Sandusky. According to United States Census Bureau statistics, the 2004 estimated population of Village of Kelleys Island was 383. The community is surrounded by Lake Erie and primarily serves as a summer resort community where residents of urban areas maintain summer homes. Due to the seasonal influx of tourists, commercial enterprises are oriented toward summer recreation, boating, and eating establishments. Access to the village is by ferry service or airlines that land at the Kelleys Island Municipal Airport (Reference 4). Kelleys Island is situated primarily on nearly level to gently sloping areas. The Castalia-Millsdale-Milton Soil Association, which consists of a silty loam, covers the

majority of Kelleys Island. Kelleys Island was once covered by a forest consisting of oaks, sugar maples, elms, and ashes. Most of this forest has been cleared from the island. The shoreline is susceptible to flooding and erosion, and is substantially developed (Reference 4).

The Village of Milan is a dual-county community located in north-central Ohio. The city lies in south-central Erie County and north-central Huron County. According to United States Census Bureau statistic, the 2004 estimated population of Village of Milan was 1,394. Since the majority of the landmass is located in Erie County, the entire community of the Village of Milan is being mapped with the Erie Countywide Flood Map Project and is included in this FIS report.

The City of Vermilion is a dual-county community located in north-central Ohio on the shore of Lake Erie. According to United States Census Bureau statistic, the 2004 estimated population of City of Vermilion was 10,971. The city lies in the northeast corner of Erie County and the northwest corner of Lorain County, adjacent to Lorain County's west side (Reference 6). Since the majority of the landmass is located in Lorain County, the entire community of the City of Vermilion is being mapped with the Lorain Countywide Flood Map Project. Information for the City of Vermilion is included in the Lorain County FIS Report and is not included in this FIS report.

2.3 Principal Flood Problems

The principal flood problems in Erie County have been on those streams where urbanization has taken place in the floodplain. These streams include Mills Creek, Pipe Creek, Taylor Creek, and the Huron River. Major floods occurred on Mills Creek on March 23, 1913 and February 10, 1959. Major floods on Pipe Creek have taken place on March 26, 1913, March 22, 1948, and February 15, 1959. A major flood occurred on Taylor Creek on February 15, 1950. In general, the flooding problems that occur are the result of encroachment in the floodplain or restrictive culverts (Reference 1).

Table 4 presents frequency estimates based on gage data for the Huron River collected at Milan (USGS Gage No: 04199000) (References 1 and 3).

Table 4 – Frequency Estimates for Huron River, Milan, Ohio

Date	Flow (cfs)	Frequency (years)[1]
1913	**	80+
December 3, 1950*	10,300	5
March 2, 1952*	13,200	8
May 12, 1956	18,200	20
April 4, 1957*	10,500	5
January 22, 1959	25,800	45
February 10, 1959	18,500	20
April 26, 1961	13,600	10
July 5, 1969	49,600	500+

[1] Frequency estimates based on data available at the time the previously effective FIS reports (References 1 and 3) were published.
* Date was taken from USGS National Water Information System website. http://waterdata.usgs.gov/
** No discharge available (largest storm of record except 1969)

Flooding along the shoreline of Lake Erie in the unincorporated areas of Erie County has been due to high tidal states, with damage occurring to both residential and commercial properties. Significant flooding was recorded in November 1972 and March 1973 (Reference 1).

The principal flooding problem in communities bounded by Lake Erie, including the Villages of Bay View and Kelleys Island, is high water levels of Lake Erie created by a combination of still water level (SWL) and wind setup to the northeast. Lake Erie lake levels are affected by three categories of fluctuations: long-term, seasonal, and short-period. Long-term fluctuations are caused principally by an increase or decrease of precipitation of the Great Lake's basin. Flooding can occur along the shoreline when consecutive annual rainfalls are higher than the mean annual precipitation. The time intervals between successive high water periods are of irregular length and can sometimes cause abrupt increases in the lake level. In accordance with seasonal fluctuations, high lake levels occur in the spring when runoff increases due to snowmelt and decreased rates of evaporation from the lake and land surface. Short-period fluctuations of lake levels are caused by wind blowing over the lake. The wind drives surface water in great volumes toward the shore, thus raising the water level at one side of the lake while lowering the water level at the other side. These factors resulted in severe floods that occurred in the fall of 1972 and the spring of 1973. The 1972 flood reached a still water elevation of 575.8 feet above the North American Vertical Datum of 1988 (NAVD88) which, based on recurrence calculations is in the range of a 10- to 20-year flood, while the 1973 flood reached the elevation of 576.5 feet (NAVD88) and would be rated as a 20- to 50-year flood. These floods also affect a large portion of the central business district in the City of Huron. The high water levels also follow the Huron River inland and cause flooding of the adjacent portions of the community (References 2, 3, and 4).

The principal flood problems in the City of Huron are caused by the overflow of the Huron River and Mudbrook Creek. Major floods of record have occurred in 1950, 1952, 1956, and 1959 with the maximum flood of record (at the time of the 1972 FIS) occurring in 1969 (Reference 3).

The majority of flooding in the Village of Bay View has occurred on the extreme north and south edges of the community. This has historically been caused by overland infiltration and reverse flow in the storm sewers, which are both caused by high Lake Erie water levels in Sandusky Bay (Reference 2).

Principal flooding in the City of Sandusky at the time of the original FIS resulted from discharges in excess of channel capacity along Mills Creek and Pipe Creek. Flooding along the shoreline of Lake Erie and Sandusky Bay was due to high tidal stages (Reference 14).

2.4 Flood Protection Measures

At this time, there are no existing or planned flood protection measures for the unincorporated areas of Erie County (Reference 1).

The primary flood protection measure in the Village of Bay View is a system of dikes. Under "Operation Forsite," a program of property protection measures, the United States Army Corps of Engineers (USACE) constructed a rockfill dike along the southern boundary of the community. This, combined with the private dikes constructed along the west edge of the community and the shore protection measures provided by the community and other agencies along the north shore, serve to protect the community from overland flooding caused by Lake Erie. (Reference 2)

The majority of the storm runoff and infiltration through the dikes is collected by a series of storm sewers and ditches, and disposed of by a pump station in the south-central area of Bay View. The conditions of the existing private dikes and pump station were noted in the 1977 FIS for Village of Bay View (Reference 2). The private dikes were in various states of repair. In the existing condition, they provided protection for the southern portion of the community. However, it was evident that repair and continued maintenance would be necessary to protect the community. The pump station was temporary in nature, and was adequate for removing storm water runoff. Failure of this pump station will create an increased storm hazard. As indicated in the 1977 FIS, the capacity of the pump station was not adequate to remove the local flooding caused by the 1-percent-annual-chance flood inside of the dikes (Reference 2).

The dikes in the Village of Bay view provided adequate protection from the 1- and 0.2-percent-annual-chance (100- and 500-year recurrence interval) floods from Lake Erie for the majority of the village. The exceptions are where there is an opening in the dikes in the extreme southeastern corner of the community to permit the passage of State Route 269, and along unrepaired portions where sheet flooding occurs over the dikes and causes ponding to occur in low-lying areas. The northern boundary of the community is a natural barrier to the 1-percent-annual-chance flood from Lake Erie due to the sharply rising shoreline in this area (Reference 2).

Field inspection and calculations showed that the community was protected from significant wave action by the causeway construction from Ohio Route 2, Bay View Road, and the Conrail Transportation Company (Reference 2).

No flood protection measures were found or planned in the City of Huron. However, the USACE has constructed a dredge soil disposal area at the mouth of Huron River. The dike which confines this area provides a measure of protection to the community shoreline, especially from the severe northeast storms that have caused extensive wave damage in the community (Reference 3).

A levee at Whites Landing along Lake Erie within Margaretta Township was designed and constructed by USACE Buffalo District. The total length of the levee is approximately 0.8 mile and the design was completed in 2000. FEMA is

currently reviewing this study. At the time of this FIS, certification data for this levee had not been approved or provided; therefore this area is not shown as protected from the 1-percent annual chance flood.

The Village of Kelleys Island has no local flood protection measures. Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These are land use regulations adopted from the Code of Federal Regulations which controls building within areas that have a high risk of flooding (Reference 4).

The City of Sandusky has no existing or planned flood protection measures (Reference 14).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in Erie County, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for these studies. Flood events of a magnitude that 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 that equals or exceeds the 1-percent- annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). For this FIS update, no new analyses were performed and the data reported is based on the previously effective flood insurance studies for each of the communities. The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of the original study except for the portion of Pipe Creek in the City of Sandusky. It was studied for both current and planned conditions at the time of the original 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 each flooding source studied by detailed methods affecting Erie County and the incorporated communities. A summary of peak discharges for the 10-, 2-, 1-, and 0.2-percent annual chance floods of each flooding source studied in detail in Erie County is presented. A description of the derivation of flood discharges for each stream follows.

For each stream studied in detail, a hydrologic investigation was performed to generate flow quantities. The U.S. Geological Survey, in cooperation with the ODNR, has developed a statewide frequency analysis procedure for estimating floods on ungaged watersheds (Reference 8). This procedure considers drainage area, basin slope, soils, and the regional location of the basin to

generate flood quantities. The procedure was applied to the following streams: Boos Ditch, Edson Creek, Kob Ditch, Mills Creek, Pipe Creek (outside of City of Sandusky), Plum Brook, Sawmill Creek, Storrs-Hemminger Ditch, Sulphur Brook, Taylor Creek and Windau Ditch. Certain portions of Pipe Creek experience a decrease in discharge with an increase in drainage area. This is due to the flow being affected by storage routing at the Chessie System railroad (Reference 1).

For ungaged streams in the City of Huron, the mean annual flood was obtained by the method outlined in Bulletin 43, Floods in Ohio (Reference 9). Frequency factors given for storms of 5- and 2-percent annual chance floods were used to extrapolate frequency factors for the selected recurrence intervals. These factors were applied to the mean annual flood by a computer program to obtain the probable discharges for the 10-, 2-, 1-, and 0.2-percent annual chance floods. The computer program used in the hydrologic calculations was developed by the study contractor to adapt the information contained in Bulletin 43 to FEMA flood studies (Reference 3).

Discharges from the USGS gaging station on the Huron River at Milan (USGS Gage No: 04199000) were used to obtain flood discharges for the City of Huron. At the time the study was performed, the gage had 26 years of record. This was sufficient data to permit frequency-discharge calculations meeting the requirements outlined in Bulletin 17 (Reference 10). The peak discharges for the 10-, 2-, 1-, and 0.2-percent annual chance floods were calculated using the FREQFLO computer program for log-Pearson Type III distribution presented in the referenced publication and adapted to a Sperry/Univac 1100/10 computer by the study contractor. A log-Pearson Type III frequency analysis was also used to calculated flood discharges in the Unincorporated Areas of Erie County (References 1 and 3).

For streams studied by detailed methods within the City of Sandusky, generalized graphical representation of the relationship between mean annual peak discharge and drainage basin area from Geological Survey Water-Supply Paper 1677 (Reference 15) was used to determine the mean annual discharge. To establish the peak discharge for the selected recurrence intervals, the mean annual discharge was mulitiplied by a factor taken from another graph in the same publication on which the relationship between discharge in ration to mean annual flood and recurrence interval in years was plotted. Since this curve had only been extended to the recurrence interval of once in fifty years, extrapolation was necessary to establish the mulitiplication factors for the 100-year and 500-year discharge (Reference 14).

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events are shown in Table 5.

Table 5 – Summary of Discharges

		PEAK DISCHARGE (CFS)			
Flooding Source and Location	Drainage Area (sq. miles)	10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Boos Ditch					

Flooding Source and Location	Drainage Area (sq. miles)	PEAK DISCHARGE (CFS) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
At mouth	1.6	269	412	478	583
Edson Creek					
City of Vermilion Corporate Boundary	4.7	723	1,124	1,318	1,620
Hahn Creek					
At mouth	2.38	382	574	657	850
At Conrail	2.18	356	537	615	796
At southern City of Huron Corporate Boundary	1.96	337	509	583	755
Huron River					
At mouth	403.4	16,478	22,852	25,550	31,836
At southern City of Huron Corporate Boundary [1]	393.5	16,193	22,457	25,109	31,287
Downstream Erie County Boundary [2]	392.0	15,100	26,000	32,400	41,000
Kob Ditch					
City of Sandusky Corporate Boundary	3.8	541	827	960	1,185
Perkins Avenue	3.3	498	765	890	1,085
Above Storrs-Hemminger Ditch	0.6	220	350	430	600
Mills Creek					
Perkins Avenue	39.7	2,818	4,201	4,858	5,890
Old Railroad Road	36.9	2,649	3,952	4,570	5,510
Above Windau Ditch	33.4	2,419	3,610	4,173	5,030
Above State Route No. 2	28.1	2,081	3,111	3,597	4,340
Mudbrook Creek					
At confluence with Huron River	9.45	720	1,067	1,217	4,960
At southern City of Huron Corporate Boundary (Mud Brook Road)	9.23	674	1,000	1,140	1,467
Pipe Creek					
Perkins Avenue	27.2	2,350	3,523	4,082	4,960
Above Taylor Ditch	23.6	2,110	2,335	2,525	2,790
Campbell Street	23.0	2,074	3,116	3,612	4,370
State Route No. 2	21.5	1,997	3,005	3,486	4,240
Plum Brook					
At Mouth	7.5	934	1,425	1,657	2,020
Perkins Avenue	7.1	901	1,377	1,603	1,955

Flooding Source and Location	Drainage Area (sq. miles)	PEAK DISCHARGE (CFS) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Sawmill Creek					
At mouth	17.58	1,857	2,731	3,107	3,981
Conrail	13.4	1,354	2,038	2,359	2,864
Storrs-Hemminger Ditch					
Above Kob Ditch	1.8	327	506	590	725
Milan Road	1.5	249	381	439	530
State Route No. 2	0.4	93	142	164	200
Sulphur Brook					
At Mouth	1.5	277	429	500	611
Marshall Avenue	1.2	231	359	418	513
Strub Road	0.9	184	285	332	405
Turnpike	0.3	80	124	144	176
Taylor Creek					
At Mouth	3.6	518	791	918	1,120
Above Sulphur Brook	2.0	316	482	558	681
Strub Road	1.7	277	423	489	596
Cemetery Drive	1.5	234	355	408	497
Windau Ditch					
At Mills Creek	2.2	371	574	668	835
Winkler Creek					
At confluence with Lake Erie	1.97	371	561	642	831
At Cleveland Road East (State Route 2)	1.94	363	550	630	815
At Conrail	1.76	341	516	592	767
At southern City of Huron Corporate Boundary	1.51	286	433	497	644

[1] Reference 3

[2] Reference 1

PMR Revised Hydrologic Analysis - Approximate (Zone A) Studies

Hydrologic Analyses were carried out to establish peak discharge-frequency relationships for a total of 135 miles of approximate (Zone A) streams. Erie County, OH and incorporated areas have previously printed FIS report dated August 2008 (Reference 16)

Approximate (Zone A) Studies

Peak discharges for the 1-percent annual chance storm event were determined at various locations throughout each of the approximate study

reaches in Erie County. Hydrologic calculations were performed using regression equations presented in *A Streamflow Statistics (StreamStats) Web Application for Ohio by G.F.Koltun, Stephanie P. Kula, and Barry M. Puskas,* 2006 USGS Scientific Investigations Report (SIR) 2006-5312 (Reference 17). To perform these calculations, flow change locations were chosen at confluences, upstream of structures, and at additional locations where the increase in flow was approximately 15% between flow changes.

The regression equation used to calculate the flows on ungaged Zone A streams is shown below:

$$Q_{100} = (RC)(DA)^{0.757}(SL_{10\text{-}85})^{0.232}(W+1)^{-0.295}$$

Where:

Q_{100} = Peak Discharge in cfs

RC = 214.7 (Regression Constant for Hydrologic Region A)

DA = Drainage area in sq. miles

$SL_{10\text{-}85}$ = Slope in ft/mile (from 10-85 method)

W = Percent of drainage area as wetlands and open water

Standard Error of Prediction = 37.9%

Three gages were located within the studied streams. Huron River at Milan (#04199000), Old Woman Creek at Berlin Road near Huron (#04199155) and Vermilion River near Vermilion (#04199500). HEC-SSP (Reference 18) was used to perform a Bulletin 17B analysis. A weighted gage analysis was performed for the above gages using method described in the NSS weighting procedure for stream-gaging stations. Weighting is based on the years of record for the estimates obtained from the station records and on the equivalent years of record for the regression estimates. This weighted analyses produced the 1-percent annual chance flood discharges for Huron River, Old Woman Creek in Erie County, OH and Vermillion River in Lorain County.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristic 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 report in conjunction with the data shown on the FIRM.

Flood elevations on the streams studied by detailed methods were determined using the computer program HEC-2 developed by the USACE (Reference 11). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of selected recurrence intervals (Exhibit 1).

Stream cross sections and dimensions of hydraulic structures (bridges, culverts, dams, control weirs, etc.) were obtained from field surveys.

Locations of selected cross sections used in detailed hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

Values of Manning's "n" were obtained from on-site inspections or evaluation of aerial oblique photographs obtained (References 2, 3 and 4). The values are tabulated in Table 6.

Table 6 – Channel and Overbank Roughness (Manning's "n") Factors

Stream Name	Roughness Coefficient	
	Channel	Overbank
Boos Ditch (Erie County)	0.05 – 0.055	0.032 – 0.09
Edson Creek (Erie County)	0.03 – 0.035	0.03 – 0.09
Hahn Creek (City of Huron)	0.015 – 0.025	0.035 – 0.045
Huron River (Erie County)	0.03 – 0.035	0.035 – 0.09
Huron River (City of Huron)	0.015 – 0.025	0.025 – 0.045
Kob Ditch (Erie County)	0.03 – 0.04	0.035 – 0.095
Mills Creek (Erie County)	0.03 – 0.039	0.03 – 0.10
Mudbrook Creek (City of Huron)	0.015 – 0.030	0.025 – 0.045
Plum Brook (Erie County)	0.03 – 0.045	0.03 – 0.08
Pipe Creek (Erie County)	0.035 – 0.043	0.03 – 0.10
Sawmill Creek (Erie County)	0.03 – 0.04	0.035 – 0.08
Sawmill Creek (City of Huron)	0.015 – 0.025	0.035
Storrs-Hemminger Ditch (Erie County)	0.035 – 0.05	0.03 – 0.08
Sulphur Creek (Erie County)	0.03 – 0.045	0.02 – 0.048
Taylor Creek (Erie County)	0.02 – 0.055	0.03 – 0.10
Windau Ditch (Erie County)	0.05 – 0.10	0.035 – 0.06
Winkler Creek (City of Huron)	0.015 – 0.025	0.015 – 0.055

Starting water-surface elevations were obtained for each stream reach studied based on existing available data. The water-surface elevation of Lake Erie was used as the starting water-surface elevation for Kob Ditch, Hahn Creek, Huron River, Sawmill Creek, Cold Creek, Mills Creek, Pipe Creek and Winkler Creek. For Windau Ditch, normal depth techniques were used to establish starting the water-surface elevation; however, the stream profile does reflect the backwater effect of Mills Creek. Normal depth techniques were also used to establish starting-water surface elevations for Sulphur Brook and Taylor Creek; however,

the stream profiles reflect the downstream backwater effect. Normal depth techniques were used for Storrs-Hemminger Ditch; however, the stream profile does reflect the backwater effect from Kob Ditch. Starting water-surface elevations for Boos Ditch and Plum Brook were established using normal depth procedures; however, the stream profiles do reflect backwater effects from Lake Erie. The starting water-surface elevations for the portion of the Huron River within the unincorporated areas of Erie County were taken from the City of Huron FIS published in October 1977 and adapted to the portion within the unincorporated areas of Erie County. Normal depth was used as starting water-surface elevation for Edson Creek (References 1 to 4).

The open-coast flood levels for Lake Erie, derived from 10-, 2-, 1-, and 0.2-percent-annual-chance flood levels computed for each station, taking into consideration such factors as the number of years of record, physical environment of the gage, levels at other gages on the lake, and the configuration of the adjoining shoreline, were developed from information presented by the USACE in the Revised Report on Great Lakes Open-Coast Flood Levels prepared in April, 1988 (Reference 12). The elevations for the selected recurrence intervals for Lake Erie were shown in Table 7 with the reaches defined in reference 12. The original report, Great Lakes Open-Coast Flood Levels was published by the USACE in February 1977 (Reference 13) and was revised to include additional data collected and the extreme water levels experienced since the original study was completed. The open-coast flood levels between gaging stations were interpolated for a smooth transition to avoid showing irrational rises and falls in the levels. The derivation of open-coast levels at the stations and between stations in some cases is judgmental rather than mathematical in nature. Although the high levels at all current Canadian and U.S. Stations were considered in determining the open-coast flood levels, more weight was given to the levels at the stations with the longer periods of record. In the 1977 study, the data was analyzed using a log-Pearson Type III frequency distribution. In the revised study, the Pearson Type III distribution was adopted after an analysis found that the log-Pearson Type III and Pearson Type III gave the same flood levels for long record gages for a given return period (Reference 12).

For the purpose of this FIS, the base flood elevations for Lake Erie are based upon 1-percent annual chance (100-year recurrence period) stillwater elevations. Wave height and wave run up are greater, although in certain cases, the wave run up reaches considerably greater heights. The onshore wave height does not affect the backwater elevations in channels that form a confluence with Lake Erie. This is due to the dissipation of the wave energy caused by the narrow openings of the channels and the angular approach of the waves at the shoreline.

The elevations for selected recurrence intervals for Lake Erie are shown in Table 7.

Areas of both Lake Erie and stream flooding were studied for both sources, and the greatest calculated stillwater flood stage was used in this study.

Table 7 – Summary of Stillwater Elevations

Flooding Source and Location	Elevations (NAVD88) 10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Lake Erie Reach				
T	575.2	576.0	576.4	577.3
U	575.4	576.3	576.7	577.6
V	575.6	576.6	577.0	578.0
W	575.7	576.8	577.2	578.3
X	575.9	577.0	577.5	578.5

For streams studied by approximate methods in Erie County unincorporated areas, areas of inundation were determined using the Flood Hazard Boundary Map, and USGS flood prone maps for Bellevue, Berlin Heights, Castalia, Huron, Kimbal, Kipton, Milan, Sandusky, Vermilion East, and Vermilion West (Reference 1). For streams studied by approximate methods in the City of Huron, the elevations of the 1-percent annual chance (100-year recurrence interval) flood were taken from historical records and basic application of the rational method (Reference 3). The approximate areas of the main and east branches of Cold Creek in the City of Sandusky were taken from the City's Flood Hazard Boundary Map (Reference 14).

Flooding in Erie County is occasionally compounded by ice jams created during the annual spring breakup. However, ice jamming was not considered in the hydraulic analyses.

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, and if the channel and overbank conditions remain essentially the same as ascertained during the study. Flood profiles were drawn showing computer calculated water-surface elevations for an accuracy of 0.5 feet for floods of the selected recurrence intervals.

PMR Revised Hydraulic Analysis - Approximate (Zone A) Studies

Hydraulic analyses were carried out using HEC-RAS 4.1 (Reference 19) to establish BFEs and floodplain areas for all 135 miles streams by approximate zone A method.

Approximate (Zone A) Studies

Water surface elevations for the 1–percent annual chance flood event were computed through use of the USACE HEC-RAS version 4.1 computer program (Reference 4). Starting water surface elevations were calculated using the normal depth method. Cross-sections were cut (2.5 ft. DEM topography) along the study reaches with a spacing ranging from 500-2000 feet, and with closer spacing if needed. The banks and ineffective flow areas were established manually. Structures were not included in the hydraulic

model and thus the floodplain analysis do not considered the backwater effects caused by bridges and culverts located within the floodplain.

Aerial photography was used to estimate the Manning's roughness coefficient ("n" value) for the channel and overbank areas. Roughness values for the main channel range from 0.04 to 0.045 with floodplain roughness values ranging from 0.045 to 0.08.

3.3 Vertical Datum

All FIS reports 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 FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are now being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent counties may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the county boundary.

Effective information for this FIS was converted from NGVD29 to NAVD88 based on data presented in Figure 1 and Table 8. An average conversion of -0.686 feet (NGVD29 – 0.686 = NAVD88) was applied uniformly across the county to convert all effective BFEs and other profile elevations. Prior to this, the City of Sandusky required an additional conversion of -0.19 feet to convert from city datum to NGVD29.

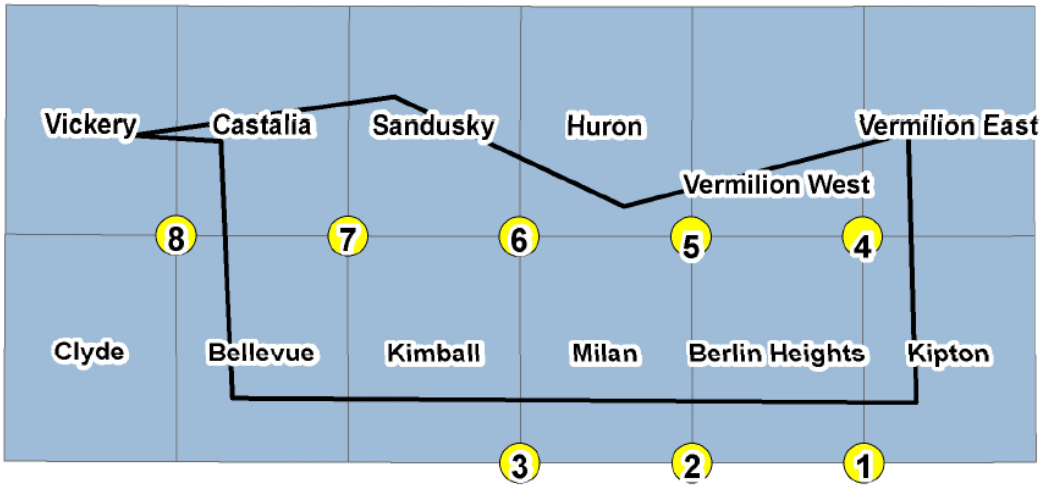


Figure 1 Vertical Datum Conversion

Table 8 – Vertical Datum Adjustment

ID Number	Quadrangle Name	Corner	NAD 27 Longitude (dec. deg.)	NAD 27 Latitude (dec. deg.)	Change (feet)
1	Kipton	SW	-82.375	41.25	-0.604
2	Milan	SE	-82.5	41.25	-0.591
3	Kimball	SE	-82.625	41.25	-0.673
4	Vermilion West	SE	-82.375	41.375	-0.696
5	Huron	SE	-82.5	41.375	-0.689
6	Sandusky	SE	-82.625	41.375	-0.738
7	Castalia	SE	-82.75	41.375	-0.761
8	Vickery	SE	-81.875	41.375	-0.732
				Min	-0.591
				Max	-0.761
				Maximum Offset	0.095
				Average	-0.686

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA, June 1992), or contact the Spatial Reference System Division of the National Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring Metro Center 3, 1315 East-West Highway, Silver Spring, Maryland 20910-3282 (301) 713-3242 (Internet address http://www.ngs.noaa.gov).

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 FIRMs for this community. Interested individuals may contact FEMA to access these data, if available.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance flood elevations and delineations of the 1- and 0.2-percent-annual-chance floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Tables and Summary of Stillwater Elevations Tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local 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 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. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with 5 and 10 foot contour intervals for all incorporated communities except the City of Huron and the Village of Bay View and Kelleys Island. In the City of Huron, floodplain boundaries were interpolated using a topographic map at a scale of 1:2,400 with a contour interval of 2 feet (reference 3). In the Village of Kelleys Island floodplain boundaries were interpolated using a topographic map at a scale of 1:24,000 with a contour interval of 5 feet. In the Village of Bay View floodplain boundaries were delineated using a topographic map at a scale of 1:4,800 with a contour interval of 2 feet.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. 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 (shaded Zone X). 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 studies by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM.

The mapped Special Flood Hazard Areas for the Chaska Beach Cove Ditch reflect the backwater of Lake Erie and the BFE is equivalent to the published stillwater elevations for the lake (Lake Erie Reach U in Table 7). The profile for this reach was not published since it consisted solely of the Lake Erie backwater elevation.

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. The floodways in this study 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.

For the purpose of the floodway studies in the City of Huron, the Ohio Flood Plain Regulation Criteria, as adopted by the State of Ohio, Department of Natural Resources, were applied. The permitted cumulative increase in flood heights was 0.5 foot, provided that hazardous velocities are not produced. However, increases of over 0.7 foot in overbank areas of isolated sections were permitted provided the average increase did not exceed 0.5 foot in any reach (Reference 3). For floodway studies in the Erie County unincorporated areas, the permitted cumulative increase was 1.0 foot (Reference 1).

The floodways presented in this FIS report and on the FIRM 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 have been tabulated for selected cross sections (Table 9). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown. In cases where the 1-percent-annual-chance flood is contained by a levee, the floodway boundary has been shown on the landward side of the levee to prevent encroachment that may adversely affect the integrity or effectiveness of the levee.

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 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 2.

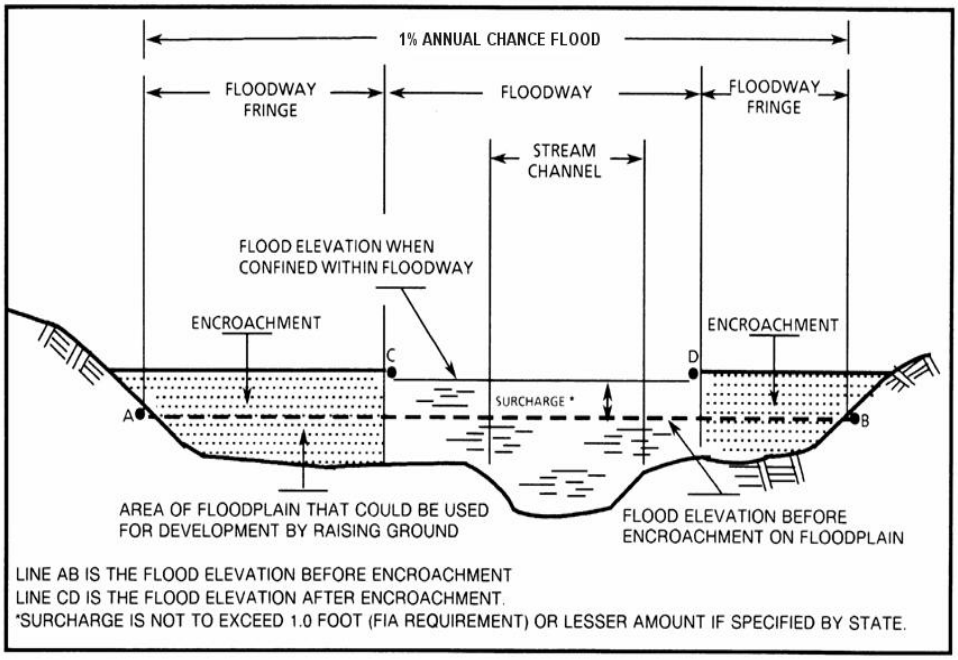


Figure 2 – Floodway Schematic

As part of the conversion of this FIS to FEMA's Countywide Format, floodway widths for previously effective detailed studies were digitized from the previously effective FIRM and transferred onto the updated base mapping. As a result of differences between the original and updated base mapping, floodway widths in some areas may have changed in association with the redelineated floodplain boundary. In those instances, revised floodway widths have been included in Table 9.

A floodway is not generally appropriate in areas such as those that may be inundated by the floodwaters from Lake Erie. Thus, no floodway was prepared for the Lake Erie shore where flooding results form high lake levels rather than stream flow.

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Boos Ditch									
A	40	67	206	2.3		577.0[3]	574.9[4]	575.9	1.0
B	835	100	270	1.8		580.0	580.0	581.0	1.0
C	1,200	47	142	3.4		581.9	581.9	582.4	0.5

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER FROM LAKE ERIE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

BOOS DITCH

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Cold Creek (Main Branch)									
A	1,845	44	126	0.3		586.6	586.6	586.7	0.1
B	1,930	90	378	2.8		586.9	586.9	587.4	0.5
C	2,600	76	355	2.9		587.3	587.3	588.1	0.8

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

COLD CREEK (MAIN BRANCH)

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Edson Creek									
A	7,790	170	231	5.7		617.9	617.9	618.0	0.1
B	9,590	79	196	6.7		627.0	627.0	627.1	0.1

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

EDSON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Hahn Creek									
A	300	93	160	4.10		576.7[3]	576.3[4]	576.3	0.0
B	400	230	796	0.83		576.7[3]	576.4[4]	576.7	0.3
C	500	56	153	4.30		576.7[3]	576.4[4]	576.7	0.3
D	580	263	809	0.81		576.7[3]	576.6[4]	576.8	0.2
E	770	265	733	0.90		576.7[3]	576.6[4]	576.8	0.2
F	990	193	577	1.14		576.7[3]	576.6[4]	576.8	0.2
G	1,136	24	98	6.71		576.7[3]	576.6[4]	576.8	0.2
H	1,186	191	665	0.99		577.2	577.2	577.4	0.2
I	1,836	90	259	2.54		577.2	577.2	577.4	0.2
J	2,456	140	328	2.00		577.5	577.5	577.7	0.2
K	2,606	18	63	10.49		577.5	577.5	577.7	0.2
L	2,881	19	78	8.39		578.4	578.4	578.4	0.0
M	2,931	95	569	1.16		579.6	579.6	579.6	0.0
N	3,171	95	342	1.92		579.6	579.6	579.6	0.0
O	3,391	35	120	5.46		579.7	579.7	579.7	0.0
P	3,544	120	582	1.13		580.2	580.2	580.3	0.1
Q	3,674	85	423	1.55		580.3	580.3	580.3	0.0
R	3,804	55	229	2.86		580.3	580.3	580.3	0.0
S	3,953	55	399	1.65		584.2	584.2	584.2	0.0
T	4,078	45	367	1.68		584.2	584.2	584.2	0.0
U	4,213	40	307	2.00		584.2	584.2	584.2	0.0
V	4,447	40	458	1.34		588.1	588.1	588.1	0.0
W	4,937	35	380	1.54		588.1	588.1	588.1	0.0
X	5,071	42	428	1.36		589.1	589.1	589.1	0.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER FROM LAKE ERIE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

HAHN CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Hahn Creek									
Y	5,338	30	300	1.94		589.1	589.1	589.1	0.0
Z	5,738	25	262	2.23		589.1	589.1	589.2	0.1
AA	6,188	15	150	3.89		589.1	589.1	589.2	0.1
AB	6,338	55	470	1.24		589.1	589.1	589.4	0.3
AC	6,688	20	167	3.49		589.1	589.1	589.4	0.3
AD	7,188	50	368	1.58		589.2	589.2	589.6	0.4
AE	7,908	12	82	7.09		589.2	589.2	589.6	0.4
AF	8,408	109	303	1.92		589.3	589.3	589.6	0.3

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

HAHN CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Huron River									
A	0	248	7,235	3.53		576.7[3]	576.3[4]	576.3	0.0
B	950	253	7,548	3.39		576.7[3]	576.3[4]	576.3	0.0
C	1,510	761	19,277	1.33	-75	576.7[3]	576.3[4]	576.3	0.0
D	1,975	226	4,273	5.98	-39	576.7[3]	576.3[4]	576.3	0.0
E	3,170	249	5,191	4.92		576.7[3]	576.3[4]	576.3	0.0
F	3,366	270	7,358	3.47		576.7[3]	576.3[4]	576.3	0.0
G	3,559	461	7,487	3.41		576.7[3]	576.3[4]	576.3	0.0
H	3,669	830	8,821	2.90		576.7[3]	576.3[4]	576.3	0.0
I	3,849	1,042	13,529	1.89	-77	576.7[3]	576.3[4]	576.3	0.0
J	3,939	1,398	15,334	1.67		576.7[3]	576.3[4]	576.3	0.0
K	4,219	1,156	12,394	2.03		576.7[3]	576.3[4]	576.3	0.0
L	5,299	1,406	10,860	2.31		576.7[3]	576.3[4]	576.3	0.0
M	6,884	949	6,767	3.71	-232	576.7[3]	576.3[4]	576.4	0.1
N	7,249	970	8,796	2.85	-125	576.7[3]	576.6[4]	576.7	0.1
O	9,329	2,004	14,657	-	-299	577.0	577.0	577.1	0.1
P	13,079	2,533	19,123	1.31	-250	577.6	577.6	577.7	0.1
Q	22,884	965	6,504	5.00		578.8	578.8	579.7	0.9
R	26,284	1,000	7,489	4.30		581.6	581.6	582.1	0.5
S	30,884	1,436	12,463	2.60		583.9	583.9	584.5	0.6
T	35,334	1,057	10,458	3.10		585.2	585.2	586.0	0.8
U	39,704	1,312	12,348	2.60		586.7	586.7	587.7	1.0
V	42,384	1,057	12,758	2.50		587.2	587.2	588.2	1.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] FLOODWAY ELEVATIONS WERE NOT ADJUSTED FOR REVISED BACKWATER ELEVATIONS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

HURON RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Kob Ditch									
A	1,810	392	3515	0.3		579.9	579.9	580.9	1.0
B	3,210	302	2475	0.4		579.9	579.9	580.9	1.0
C	4,243	215	1989	0.4		580.7	580.7	581.1	0.4
D	6,785	153	708	1.3		581.4	581.4	582.3	0.9
E	8,200	150	421	2.1		581.9	581.9	582.9	1.0
F	9,800	50	187	4.8		585.2	585.2	586.2	1.0
G	11,300	41	98	9.1		589.9	589.9	590.9	1.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

KOB DITCH

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Mills Creek									
A	584	28	468	12.6		577.4	577.4	577.4	0.0
B	2,000	286	3352	1.8		585.9	585.9	586.9	1.0
C	3,500	299	2341	2.5		588.1	588.1	589.1	1.0
D	4,100	221	2351	2.5		589.0	589.0	589.6	0.6
E	5,700	199	1009	5.9		589.7	589.7	589.9	0.2
F	6,700	299	1245	4.7		590.9	590.9	591.2	0.3
G	6,830	299	2783	2.1		596.8	596.8	596.9	0.1
H	7,155	490	4976	1.0		597.1	597.1	598.0	0.9
I	8,955	420	2719	1.8		597.4	597.4	598.3	0.9
J	10,645	462	3417	1.3		597.9	597.9	598.9	1.0
K	12,340	300	628	7.3		599.2	599.2	599.3	0.1
L	14,430	300	1251	3.7		602.7	602.7	603.4	0.7
M	15,995	410	1704	2.7		604.4	604.4	605.0	0.6
N	17,435	267	1241	3.7		605.3	605.3	606.0	0.7
O	18,845	180	967	4.3		607.2	607.2	607.5	0.3
P	20,860	244	1149	3.6		614.5	614.5	615.2	0.7
Q	21,655	209	1433	2.5		617.8	617.8	618.2	0.4
R	22,265	150	588	6.1		617.8	617.8	618.4	0.6

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

MILLS CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Mudbrook Creek									
A	1,200	485	2378	0.51		576.7[3]	576.3[4]	576.3	0.0
B	1,690	347	1754	0.69	-82	576.7[3]	576.3[4]	576.3	0.0
C	2,260	344	1258	0.97	-144	576.7[3]	576.3[4]	576.3	0.0
D	2,850	318	1146	1.06	-118	576.7[3]	576.3[4]	576.3	0.0
E	3,770	498	994	1.22	-298	576.7[3]	576.3[4]	576.3	0.0
F	4,185	382	913	1.33	-182	576.7[3]	576.3[4]	576.3	0.0
G	4,865	285	973	1.25	-85	576.7[3]	576.3[4]	576.3	0.0
H	5,305	188	390	3.12	-143	576.7[3]	576.3[4]	576.3	0.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] FLOODWAY ELEVATIONS WERE NOT ADJUSTED FOR REVISED BACKWATER ELEVATIONS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

MUDBROOK CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Pipe Creek									
A	1,278	215	1341	3.3		578.1	578.1	578.2	0.1
B	2,250	122	1141	3.8		578.4	578.4	578.5	0.1
C	3,050	224	1860	2.4		580.8	580.8	581.0	0.2
D	3,900	324	1156	3.8		580.9	580.9	581.3	0.4
E	4,630	299	2185	2.0		581.7	581.7	582.0	0.3
F	4,682	408	2165	1.9		582.4	582.4	583.4	1.0
G	6,013	64	737	3.4		583.1	583.1	584.1	1.0
H	7,313	71	239	10.6		585.2	585.2	585.5	0.3
I	8,273	59	361	7.0		591.6	591.6	592.4	0.8
J	9,513	223	1154	2.2		596.0	596.0	596.8	0.8
K	10,613	250	1945	1.9		599.8	599.8	600.4	0.6
L	11,813	447	2572	1.4		599.8	599.8	600.7	0.9
M	13,573	418	1427	2.5		600.0	600.0	600.9	0.9
N	14,573	540	1687	2.1		600.7	600.7	601.6	0.9
O	16,233	365	1325	2.7		601.7	601.7	602.7	1.0
P	17,493	350	1759	2.1		605.1	605.1	606.1	1.0
Q	19,663	325	1027	3.5		607.4	607.4	608.2	0.8
R	20,713	240	1069	3.4		610.9	610.9	611.2	0.3
S	23,013	140	532	6.8		611.8	611.8	612.7	0.9
T	25,063	312	1018	3.4		615.4	615.4	615.9	0.5
U	26,413	309	1298	2.7		618.4	618.4	619.3	0.9

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

PIPE CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Pipe Creek									
V	27,513	252	1196	2.9		621.1	621.1	622.0	0.9
W	29,283	246	827	4.2		624.4	624.4	624.9	0.5
X	30,518	175	1447	2.4		630.9	630.9	631.6	0.7
Y	32,013	310	1816	1.9		631.0	631.0	631.9	0.9
Z	33,278	290	1616	2.2		631.2	631.2	632.2	1.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

PIPE CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Plum Brook									
A	790	588	1095	1.5	-225	577.0[3]	572.6[4]	573.6	1.0
B	2,600	256	683	2.4		577.0[3]	573.8[4]	574.2	0.4
C	3,905	304	2473	0.7		579.6	579.6	579.6	0.0
D	5,240	298	2197	0.7		580.1	580.1	580.3	0.2

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER FROM LAKE ERIE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

PLUM BROOK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Sawmill Creek									
A	1,550	78	457	5.2		576.7[3]	576.0[4]	576.7	0.7
B	2,200	200	741	3.2		577.5	577.5	578.3	0.8
C	3,140	127	553	4.3		580.7	580.7	581.1	0.4
D	4,750	84	434	5.4		584.7	584.7	585.3	0.6
E	6,180	62	508	4.6		589.6	589.6	590.5	0.9
F	7,680	142	753	3.1		593.0	593.0	594.0	1.0
G	9,135	156	641	3.7		596.4	596.4	596.7	0.3
H	11,550	244	1080	2.2		600.7	600.7	601.4	0.7

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER FROM LAKE ERIE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

SAWMILL CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Storrs-Hemminger Ditch									
A	320	70	173	3.40		581.7	581.2[3]	582.2	1.0
B	2,015	70	175	3.40		585.0	585.0	585.6	0.6
C	3,010	40	264	2.20		592.8	592.8	592.8	0.0
D	4,410	46	196	2.20		593.0	593.0	593.3	0.3
E	5,800	37	91	4.80		607.9	607.9	608.5	0.6
F	7,600	43	138	3.20		613.3	613.3	614.2	0.9
G	9,390	38	82	2.00		615.6	615.6	616.4	0.8
H	10,300	120	504	0.30		619.2	619.2	620.2	1.0
I	11,500	39	123	1.30		619.3	619.3	620.3	1.0
J	12,700	58	159	1.00		622.9	622.9	623.0	0.1

[1] FEET ABOVE CONFLUENCE WITH KOB DITCH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM KOB DITCH

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

STORRS-HEMMINGER DITCH

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Sulphur Brook									
A	300	49	278	1.80		584.8	584.8	585.7	0.9
B	1,700	28	126	4.00		585.9	585.9	586.9	1.0
C	2,690	59	147	3.40		588.3	588.3	588.8	0.5
D	3,230	110	534	0.90		594.6	594.6	594.6	0.0
E	4,800	102	428	1.00		598.6	598.6	598.7	0.1
F	6,140	38	51	6.50		600.3	600.3	600.3	0.0
G	6,720	63	259	1.30		606.2	606.2	606.9	0.7
H	7,400	86	605	0.50		613.4	613.4	614.4	1.0
I	9,000	34	152	2.20		613.6	613.6	614.6	1.0
J	10,800	43	62	5.40		617.6	617.6	617.8	0.2
K	12,300	61	126	1.10		622.4	622.4	622.7	0.3
L	13,640	18	30	4.70		622.8	622.8	623.3	0.5

[1] FEET ABOVE CONFLUENCE WITH TAYLOR CREEK

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

SULPHUR BROOK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Taylor Creek									
A	200	42	195	4.7		582.5	575.9[3]	576.9	1.0
B	1,200	89	472	1.9		582.5	580.1[3]	580.8	0.7
C	2,473	63	212	2.6		582.9	582.9	583.7	0.8
D	3,385	13	104	5.4		589.7	589.7	590.3	0.6
E	3,765	59	298	1.9		592.3	592.3	593.0	0.7
F	4,100	129	503	1.1		594.2	594.2	595.2	1.0
G	4,500	34	193	2.9		594.6	594.6	595.6	1.0
H	4,710	67	266	2.1		597.0	597.0	597.8	0.8
I	5,270	194	1079	0.5		600.5	600.5	600.5	0.0
J	7,305	36	194	2.5		611.6	611.6	612.3	0.7
K	9,200	40	58	7.0		613.9	613.9	613.9	0.0
L	10,095	42	120	3.4		616.9	616.9	617.6	0.7
M	11,000	44	115	3.6		617.8	617.8	618.7	0.9
N	12,400	26	87	4.7		619.1	619.1	619.9	0.8
O	13,590	50	128	3.2		621.1	621.1	621.6	0.5
P	14,200	69	157	2.6		622.8	622.8	623.0	0.2
Q	14,745	59	201	2.0		624.0	624.0	624.4	0.4

[1] FEET ABOVE CONFLUENCE WITH PIPE CREEK
[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS
[3] ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER FROM PIPE CREEK

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

TAYLOR CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Windau Ditch									
A	300	79	247	2.7		606.5	606.5	607.5	1.0
B	808	50	399	1.7		612.0	612.0	612.0	0.0
C	1,600	57	177	3.8		612.0	612.0	612.1	0.1

[1] FEET ABOVE CONFLUENCE WITH MILLS CREEK
[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

WINDAU DITCH

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY[2] (FEET)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Winkler Creek									
A	0	N/A	N/A	N/A	N/A	576.7[3]	576.3[4]	576.3	0.0
B	515	295	95	6.74	-282	579.1	579.1	579.1	0.0
C	755	202	2,330	0.28		579.1	579.1	579.3	0.2
D	1,135	73	797	0.81		579.1	579.1	579.3	0.2
E	1,255	63	492	1.30		579.1	579.1	579.3	0.2
F	2,020	45	286	2.25		579.3	579.3	579.6	0.3
G	2,585	43	278	2.31		579.4	579.4	579.6	0.2
H	3,275	100	398	1.62		579.4	579.4	579.6	0.2
I	3,431	10	133	4.83		588.1	588.1	588.1	0.0
J	3,886	40	674	0.95		594.5	594.5	594.5	0.0
K	4,106	85	1,282	0.50		594.5	594.5	594.5	0.0
L	4,686	28	319	2.01		594.5	594.5	594.5	0.0
M	5,536	25	338	1.90		594.5	594.5	594.5	0.0
N	6,321	30	311	2.06		594.5	594.5	594.6	0.1
O	6,565	16	175	3.67		595.3	595.3	595.3	0.0
P	7,325	25	197	3.25		595.3	595.3	595.9	0.6
Q	7,945	281	578	1.11		595.4	595.4	595.4	0.0
R	8,035	287	228	2.82		597.2	597.2	597.2	0.0

[1] FEET ABOVE MOUTH

[2] SEE EXPLANATION IN SECTION 4.2 FLOODWAYS

[3] REGULATORY ELEVATIONS REFLECT REVISED LAKE ERIE BACKWATER ELEVATIONS FROM "*REVISED REPORT ON GREAT LAKES OPEN-COAST FLOOD LEVELS*" (REFERENCE 12).

[4] FLOODWAY ELEVATIONS WERE NOT ADJUSTED FOR REVISED BACKWATER ELEVATIONS

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH

(AND INCORPORATED AREAS)

FLOODWAY DATA

WINKLER 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. These zones are as follows:

Zone A

Zone A is the flood insurance risk 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 BFEs or base flood depths are shown within this zone.

Zone AE

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

Zone AH

Zone AH is the flood insurance risk 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 BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance risk 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 base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Zone AR is the flood insurance risk zone that corresponds to an 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 risk 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 BFEs or depths are shown within this zone.

Zone V

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

Zone VE

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

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, 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 that 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

Zone X (Future Base Flood)

Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-condition hydrology. No BFEs or base flood depths are shown within this zone.

Zone D

Zone D is the flood insurance risk 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 risk 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 BFEs or average depths. Insurance agents use the zones and BFEs 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.

The current FIRM presents flooding information for the entire geographic area of Erie County with the exception of the areas within the Cities of Bellevue and Vermilion.

Flooding information for the portion of the Village of Milan within Huron County is also presented in the current FIRM. Previously, separate FIRMs were prepared for each identified flood prone incorporated community and for the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 10.

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies on streams studied in this report and should be considered authoritative for purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, Federal Emergency Management Agency Region V, 536 South Clark Street, 6th Floor, Chicago, IL 60605-1509.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Bay View, Village of	March 22, 1974	June 4, 1976	September 15, 1977	None
Berlin Heights, Village of	April 5, 1974	May 7, 1976	August 28, 2008	N/A
Castalia, Village of[1]	N/A	N/A	N/A	N/A
Erie County (Unincorporated Areas)	January 31, 1975	November 5, 1976	January 16, 1981	September 20, 1995
Huron, City of	February 1, 1974	N/A	April 3, 1978	None
Kelleys Island, Village of	April 18, 1975	N/A	August 17, 1981	September 20, 1995
Milan, Village of	April 12, 1974	May 21, 1976	September 1, 1978	None
Sandusky, City of	June 21, 1974	July 7, 1976	July 5, 1977	None

[1] No Special Flood Hazard Areas Identified. This community does not has map history prior to the first countywide mapping.

9.0 BIBLIOGRAPHY AND REFERENCES

1.) Federal Emergency Management Agency, Flood Insurance Study, County of Erie, Unincorporated Areas, Ohio, July 16, 1980.

2.) Federal Emergency Management Agency, Flood Insurance Study, Village of Bay View, Ohio, September 1977.

3.) Federal Emergency Management Agency, Flood Insurance Study, City of Huron, Ohio, October 1977.

4.) Federal Emergency Management Agency, Flood Insurance Study, Village of Kelleys Island, Ohio, February 17, 1981.

5.) Midwest Regional Climate Center, 1971-2000 NCDC Normals, http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_data_summaries.htm#

6.) Federal Emergency Management Agency, Flood Insurance Study, City of Vermilion Ohio, March 1979.

7) U.S. Census Bureau, 2004 Population Estimate, http://www.census.gov/popest/counties/

8.) Ohio Department of Natural Resources, Bulletin No. 45, Floods in Ohio, Magnitude and Frequency, Earl E. Webber and William P. Bartlett, Jr., U.S. Geological Survey, May 1977.

9.) Ohio Department of Natural Resources, Bulletin No. 43, Floods in Ohio, William P. Cross and Ronald I. Mayo, April 1969.

10.) U.S. Water Resources Council, Bulletin No. 17, Guidelines for Determining Flood Flow Frequencies, Washington, D.C., March 1976, revised by Change Bulletin, 1977.

11.) U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Users, Davis, California November 1976

12.) U.S. Army Corps of Engineers, Detroit District, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988.

13.) U.S. Army Corps of Engineers, Detroit District, Great Lakes Open-Coast Flood Levels, February 1977.

14.) Federal Emergency Management Agency, Flood Insurance Study, City of Sandusky, Ohio, January 1977.

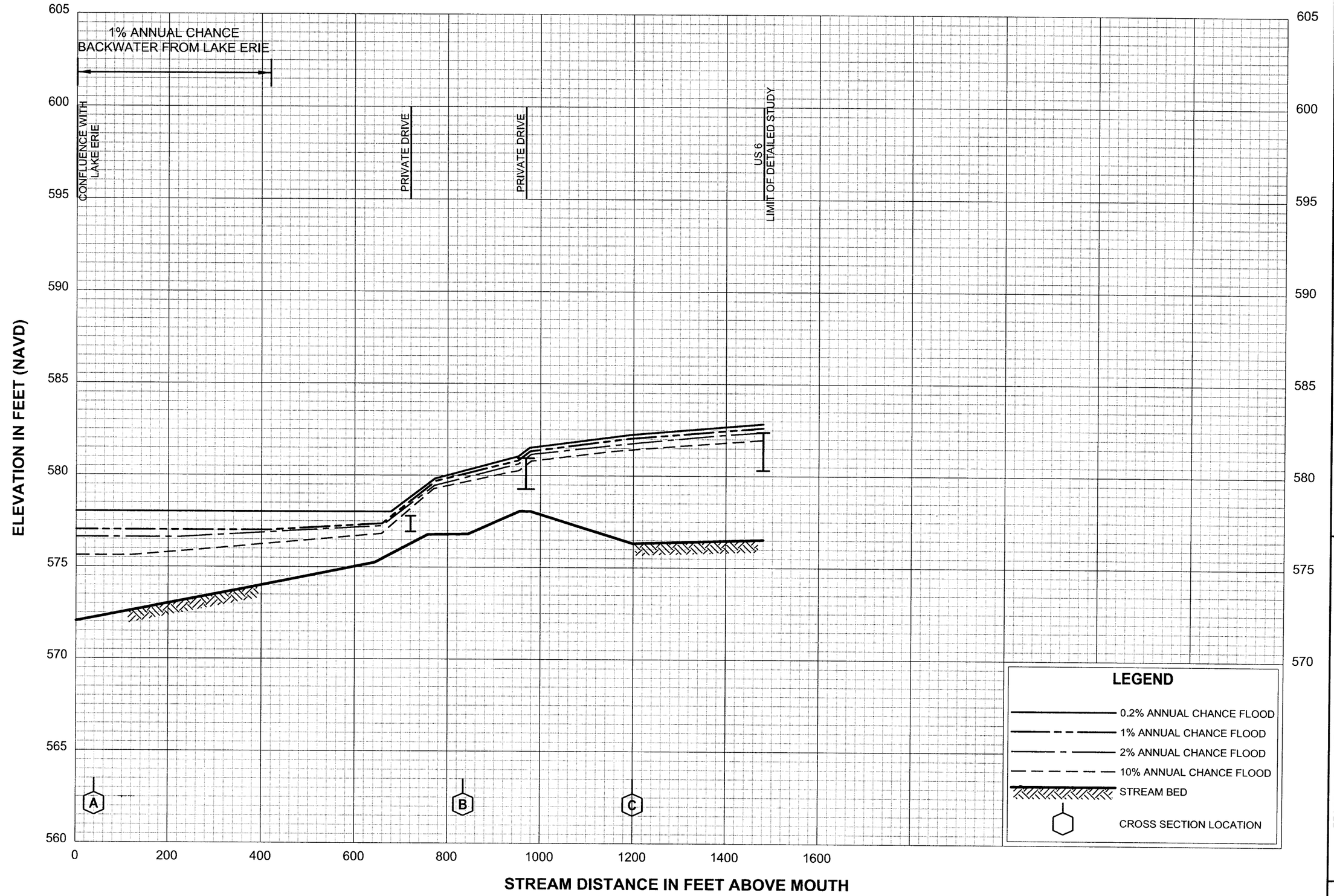
15.) U.S. Department of the Interior, Magnitude and Frequency of Floods in the U.S., Part 4, St. Lawrence River Basin, Geological Survey Water – Supply Paper 1677.

16) Federal Emergency Management Agency, Flood Insurance Study, County of Erie, and incorporated Areas, Ohio, August 28, 2008.

17) U.S. Department of the Interior, U.S. Geological Survey, A Streamflow Statistics (StreamStats) Web Application for Ohio, Scientific Investigations Report 2006-5312.

18) U.S. Army Corps of Engineers, HEC-SSP Statistical Software Package Version 2.0, 2010.

19) HEC-RAS Hydraulic Reference Manual Version 4.1.0 US Army Corps of Engineers, January 2010.



FLOOD PROFILES

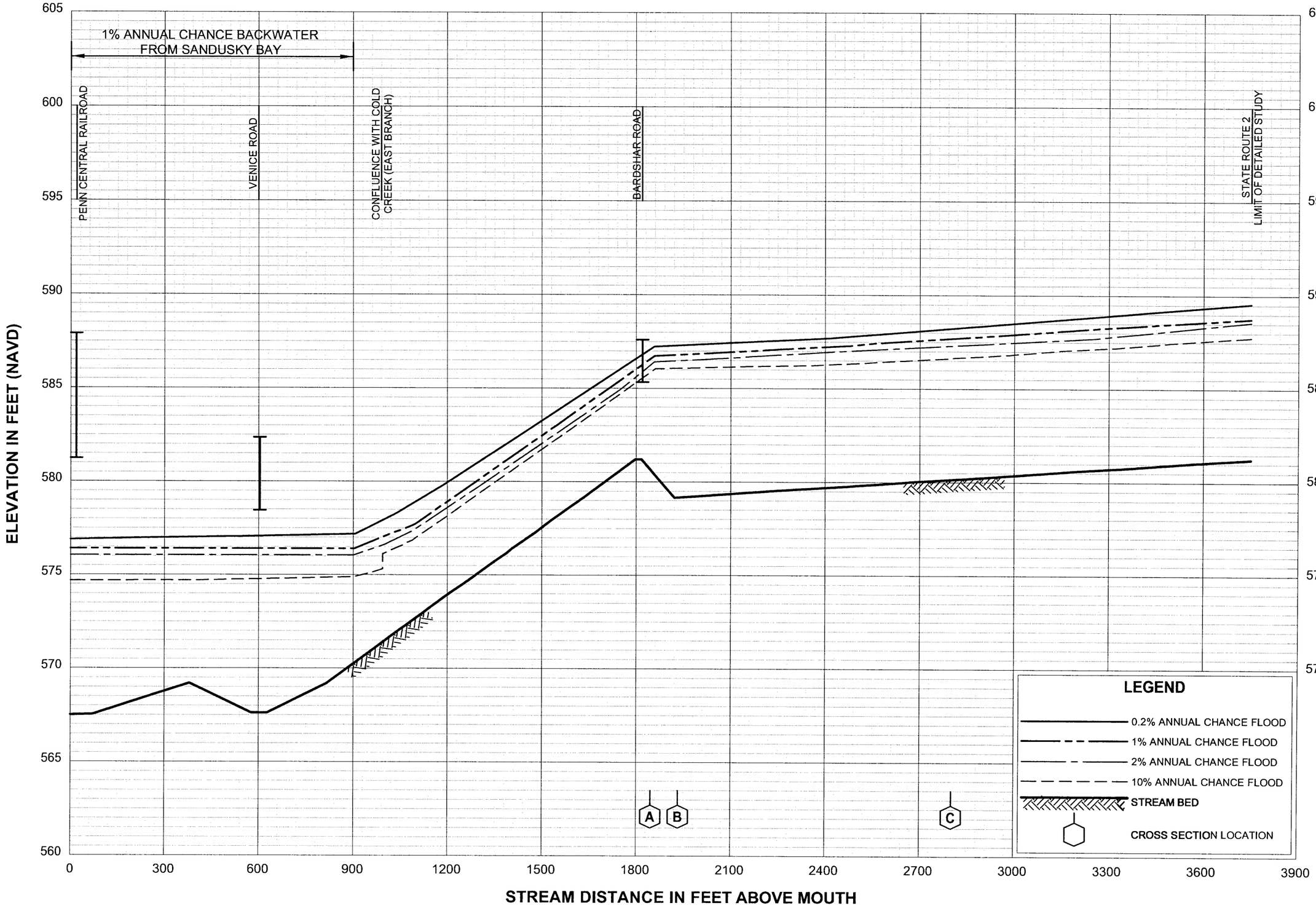
BOOS DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

01P



FLOOD PROFILES

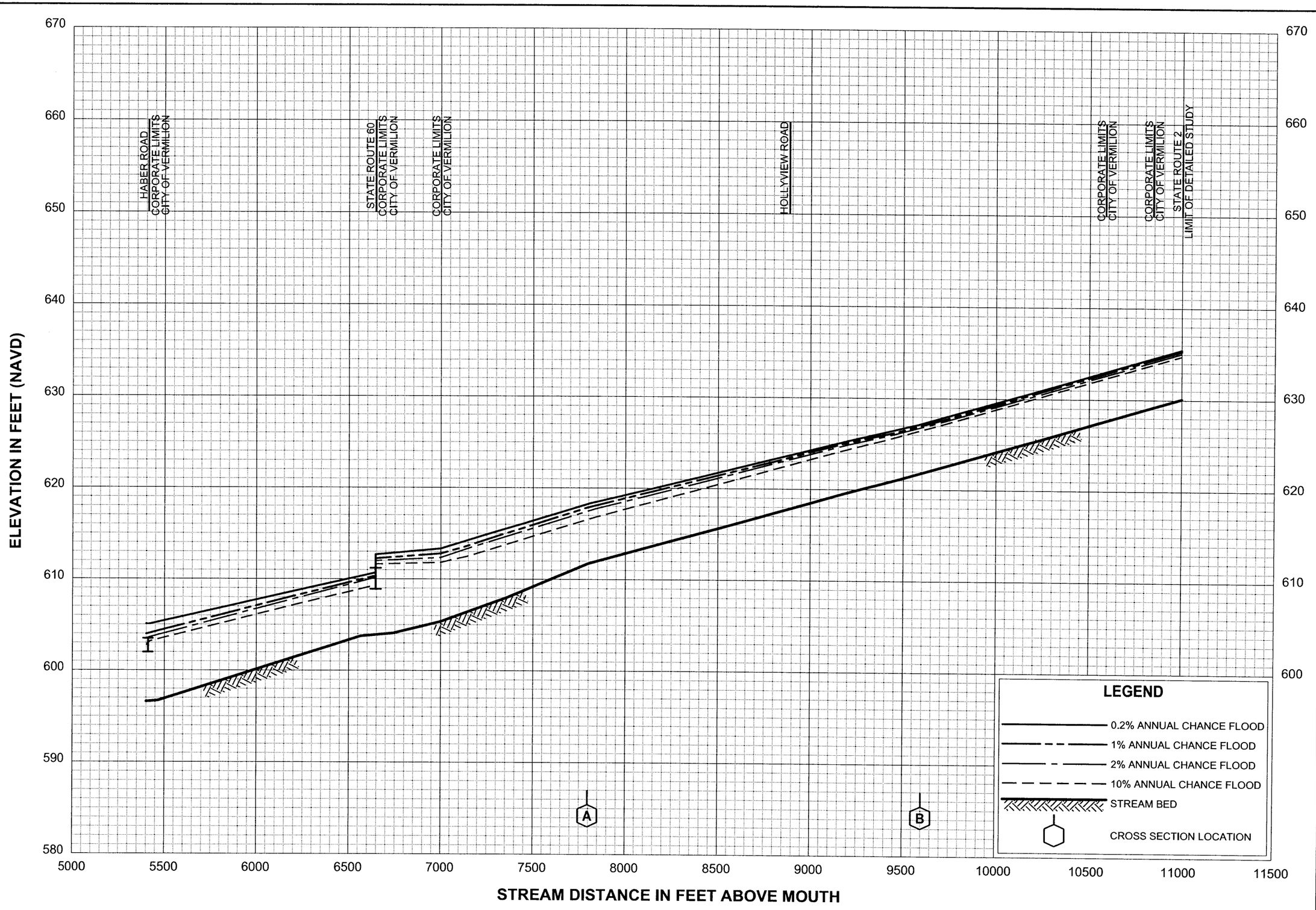
COLD CREEK (MAIN BRANCH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

02P



FLOOD PROFILES

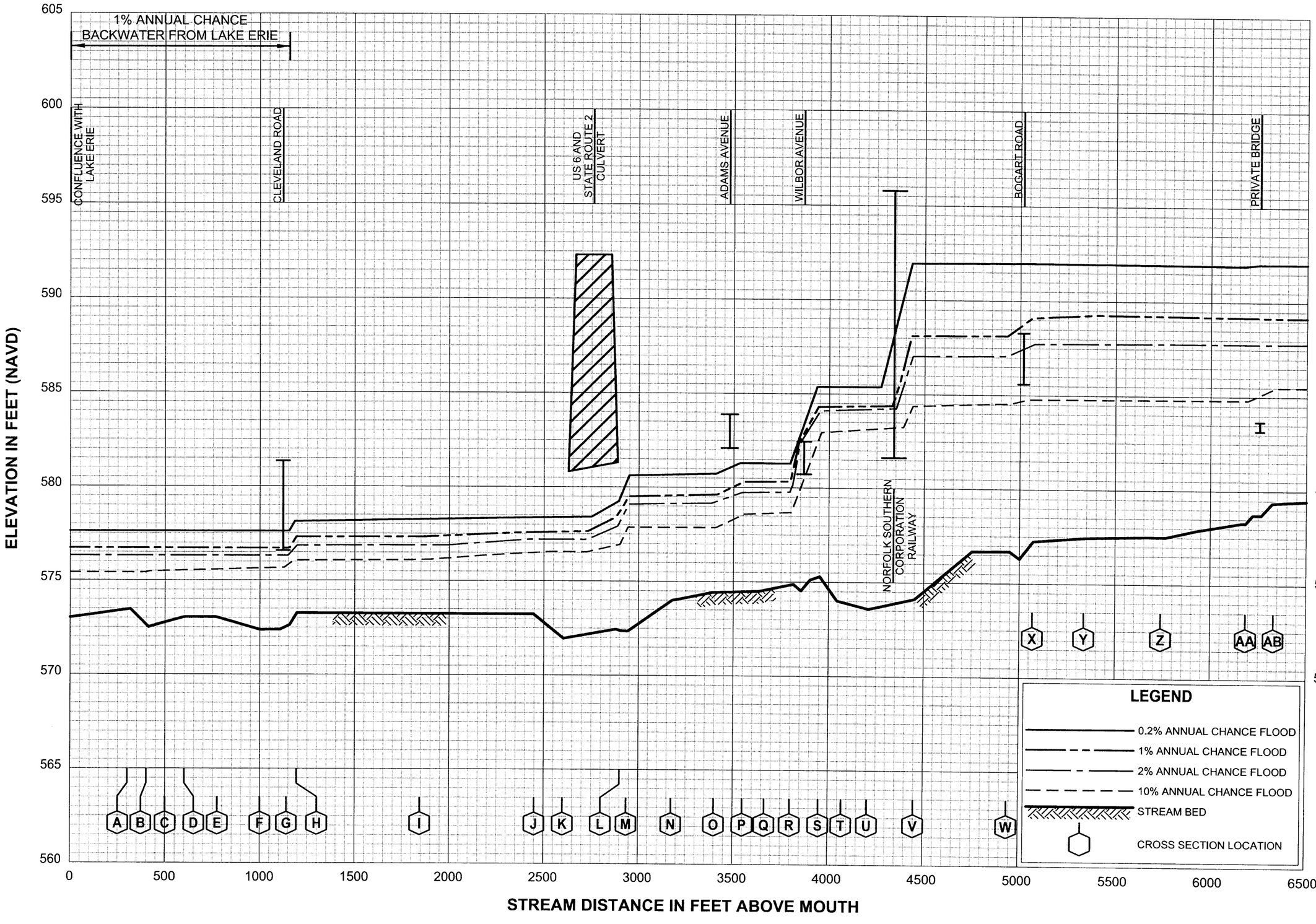
EDSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

03P



FLOOD PROFILES

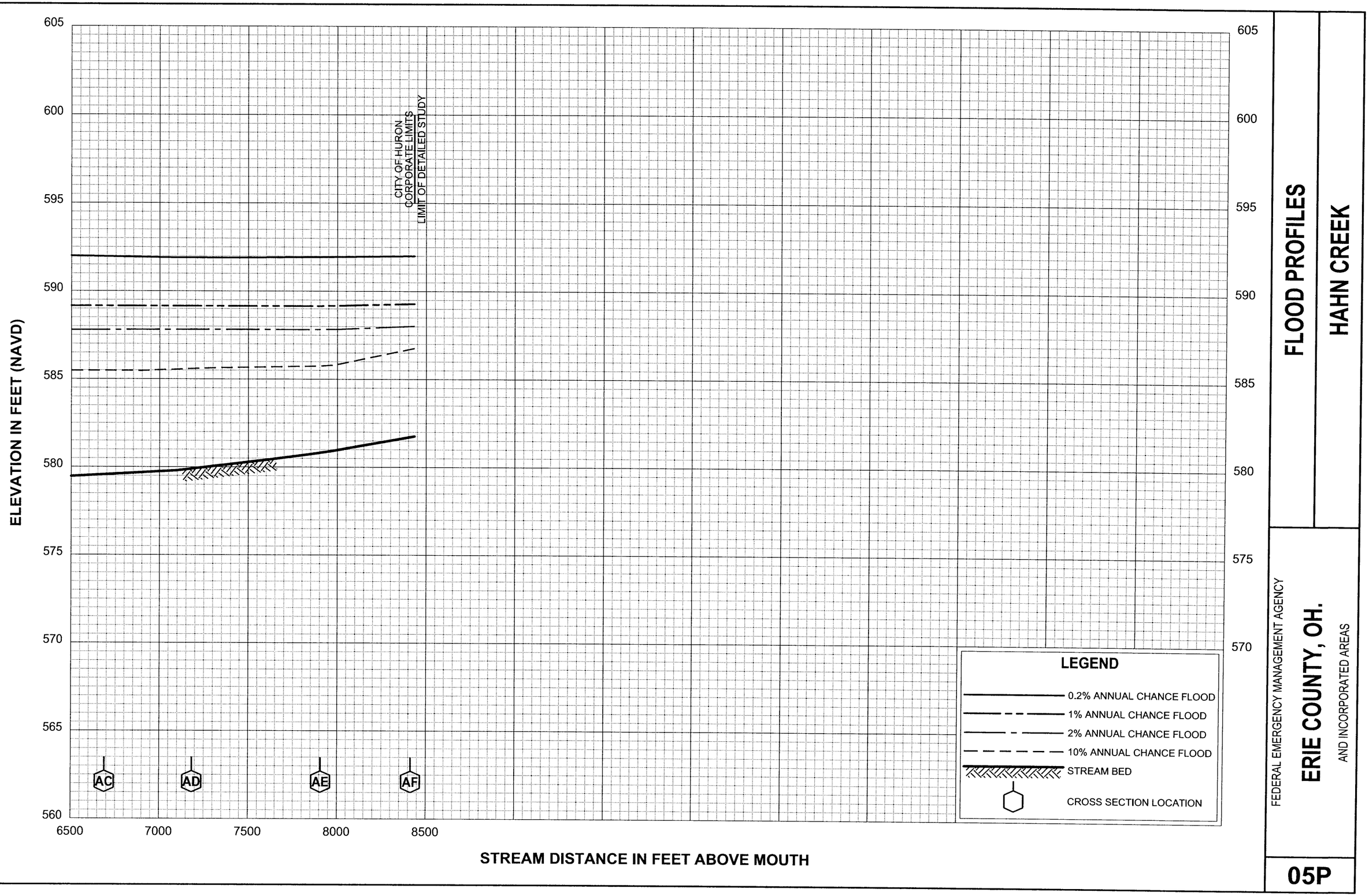
HAHN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

04P



FLOOD PROFILES

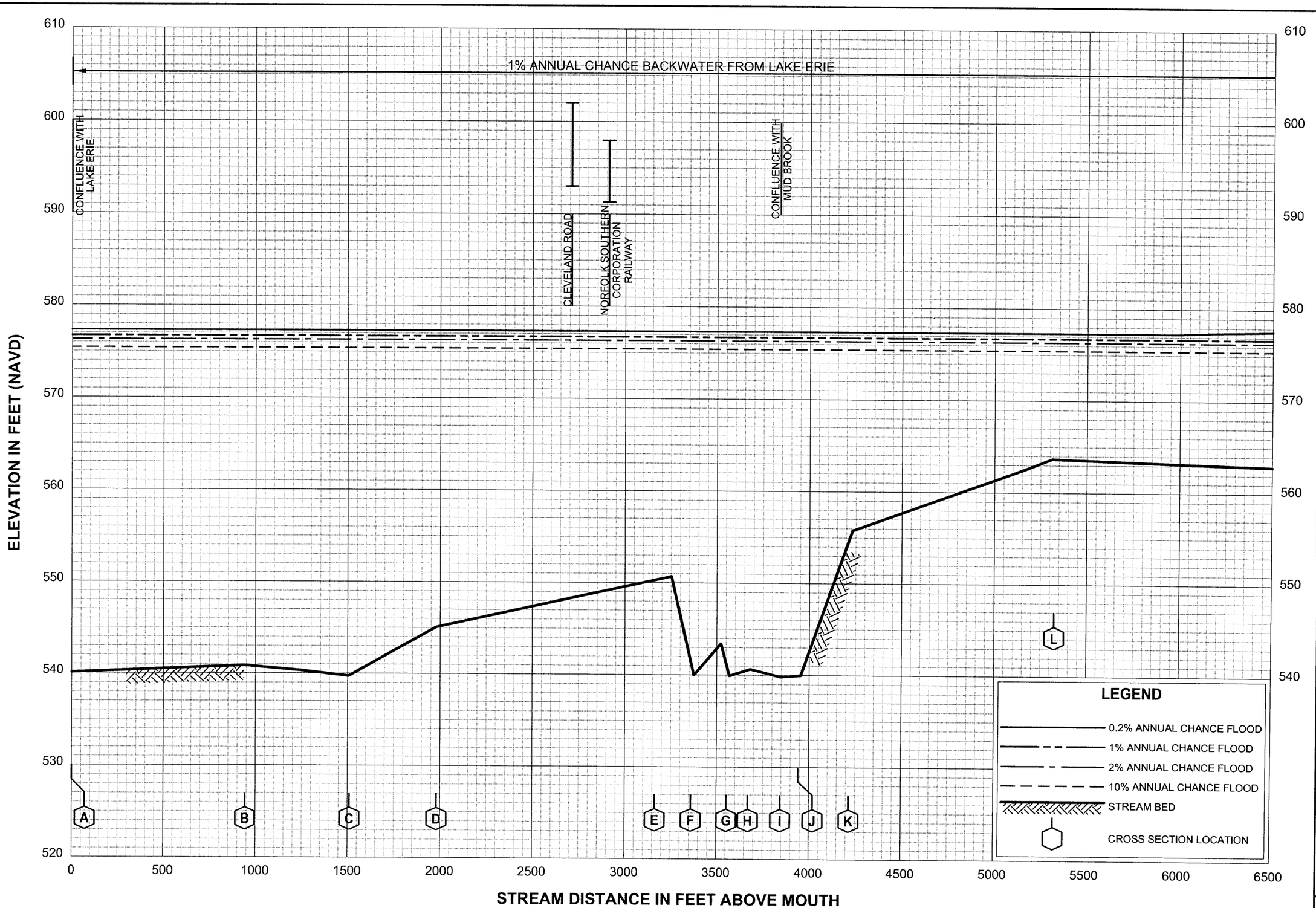
HAHN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

05P



FLOOD PROFILES

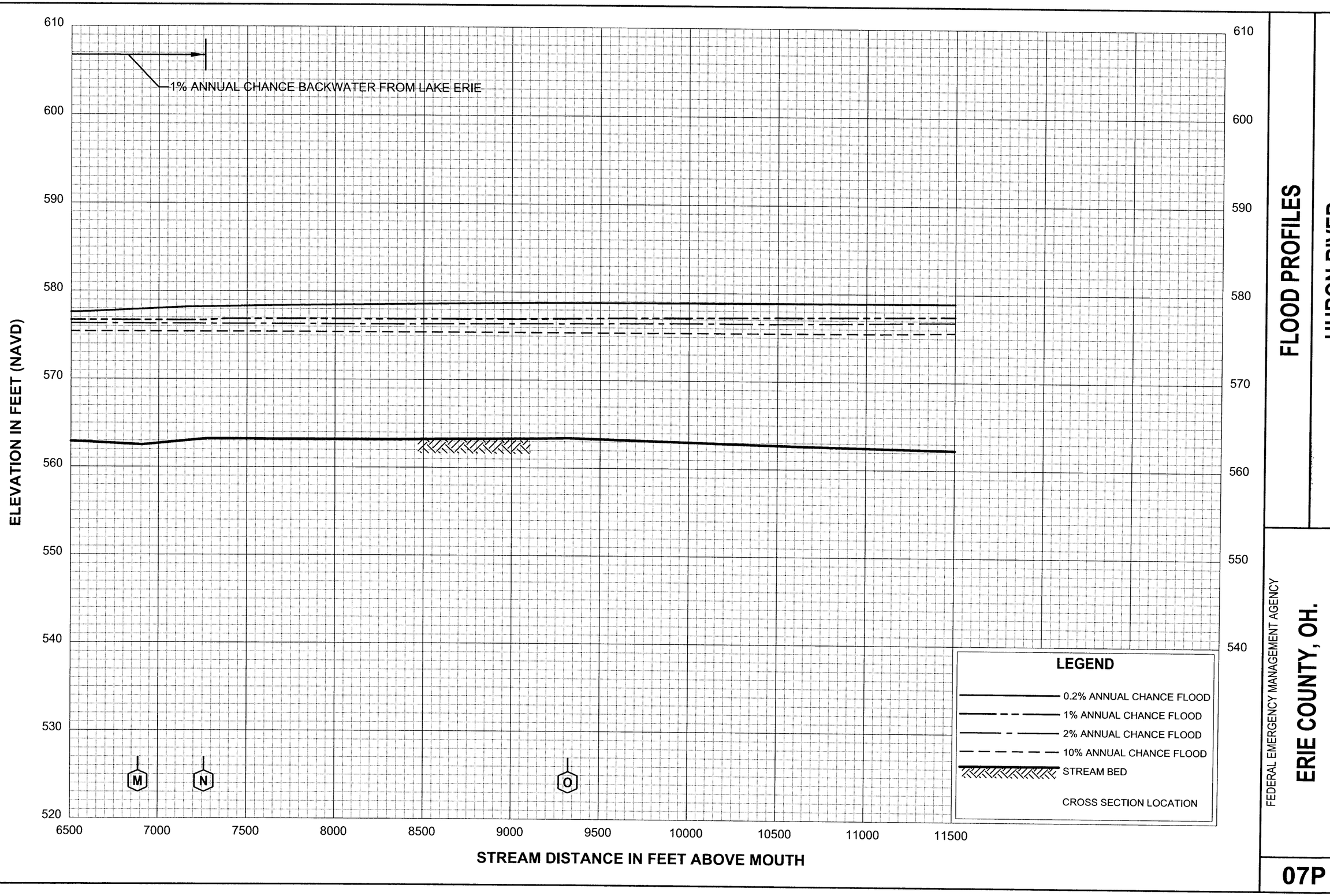
HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

06P



FLOOD PROFILES

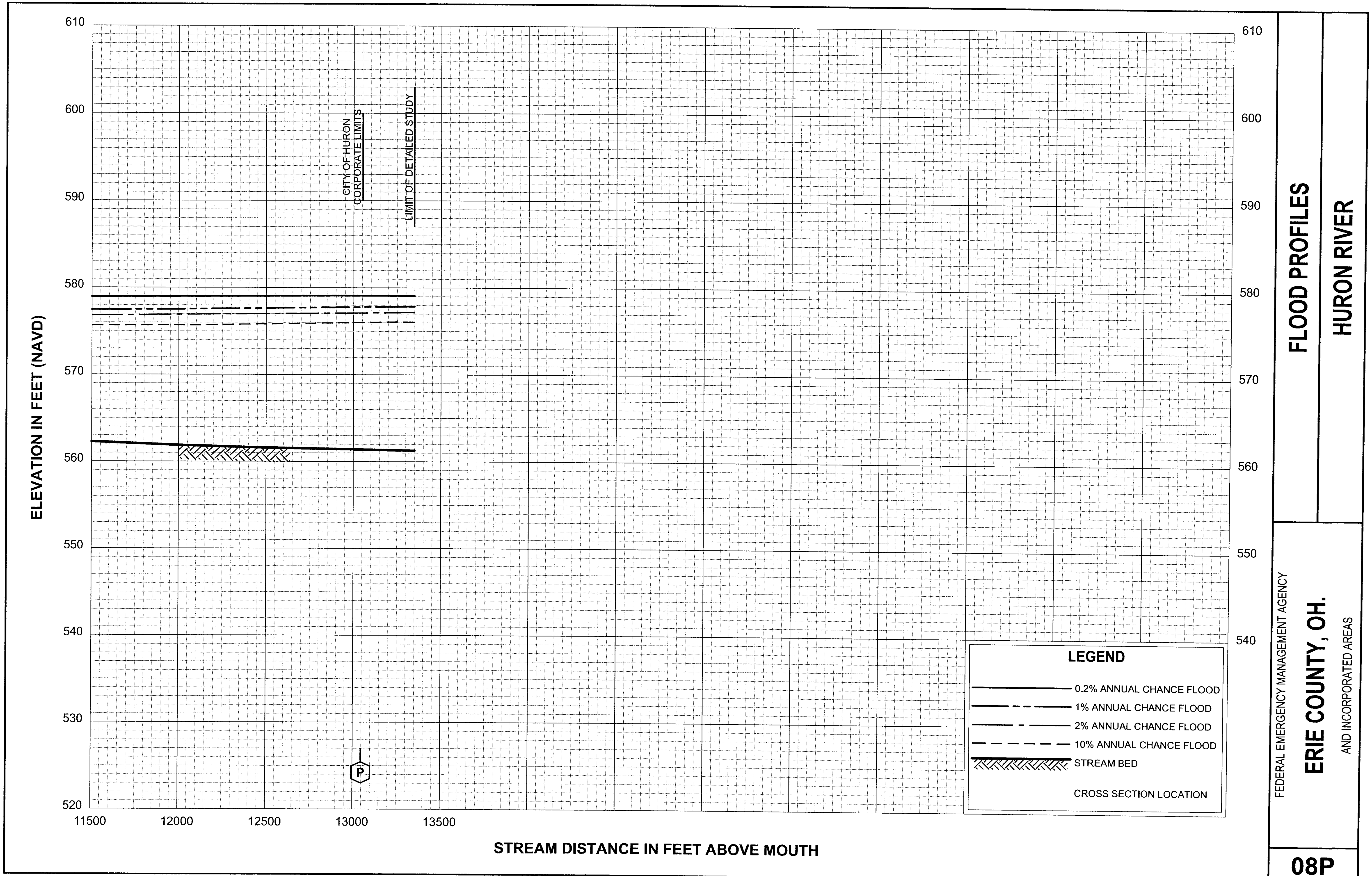
HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

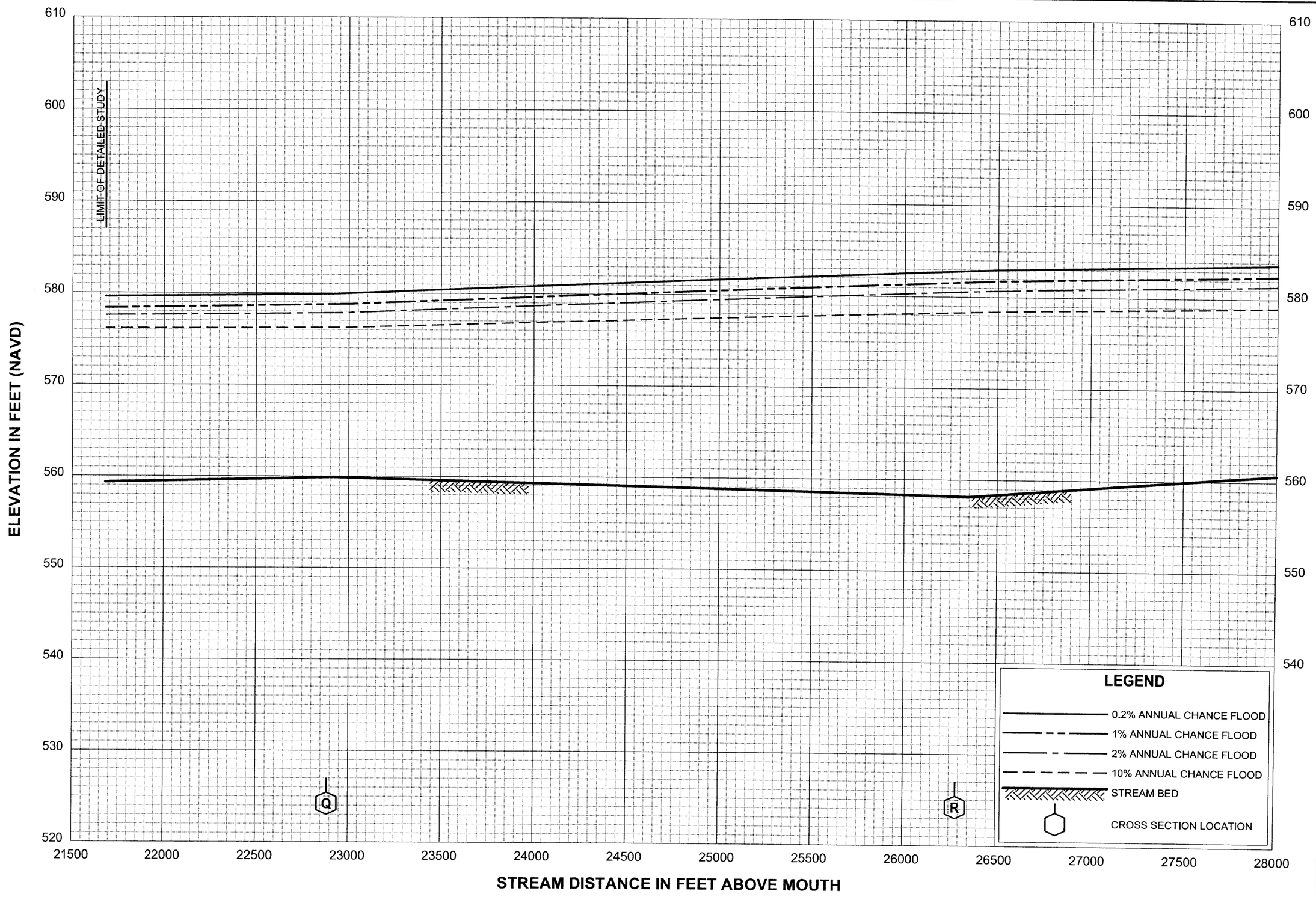
ERIE COUNTY, OH.

AND INCORPORATED AREAS

07P



610
600
590
580
570
560
550
540
530
520
ELEVATION IN FEET (NAVD)
CITY OF HURON CORPORATE LIMITS
LIMIT OF DETAILED STUDY
P
11500
12000
12500
13000
13500
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
HURON RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
ERIE COUNTY, OH.
AND INCORPORATED AREAS
08P



FLOOD PROFILES

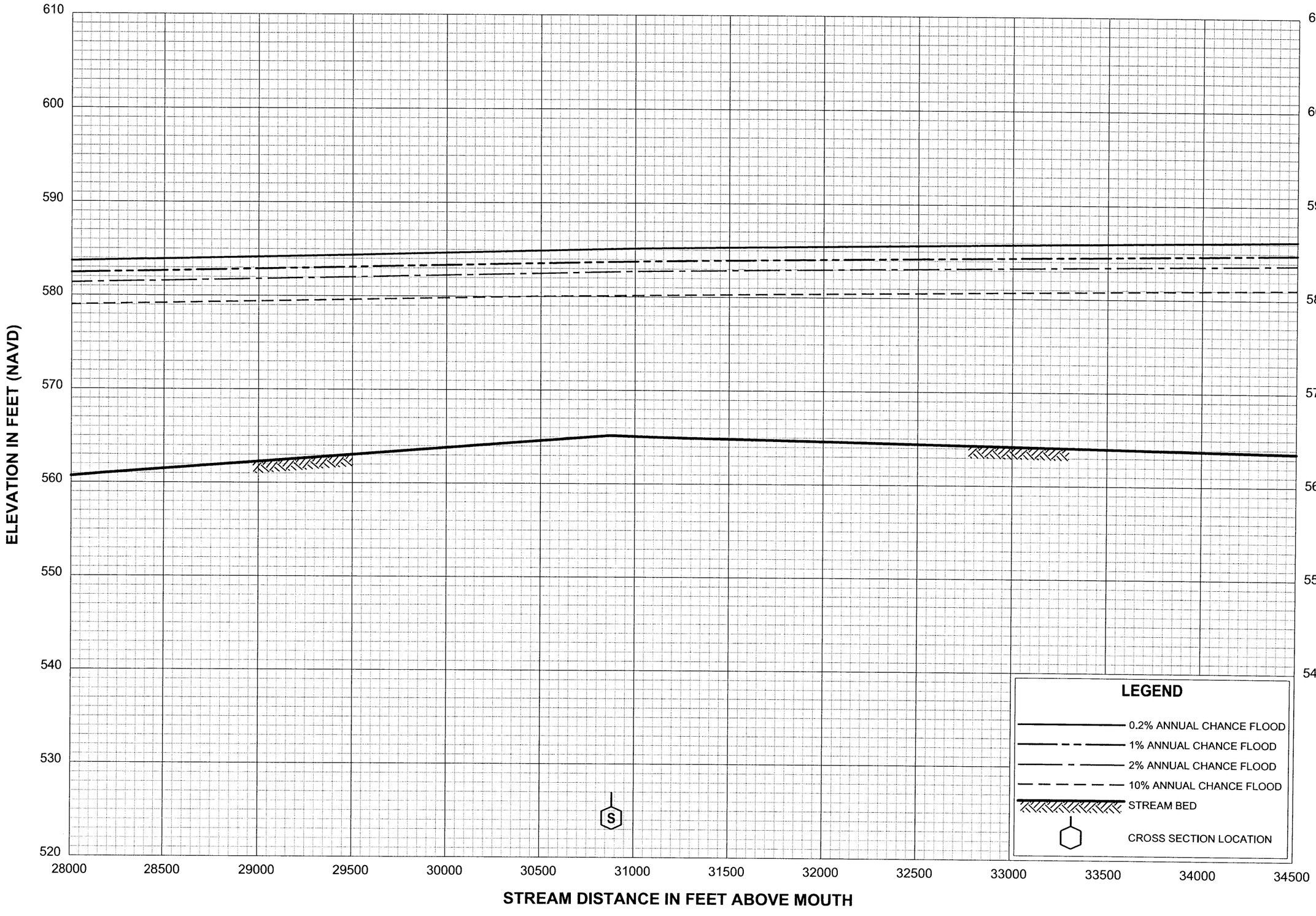
HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

09P



FLOOD PROFILES

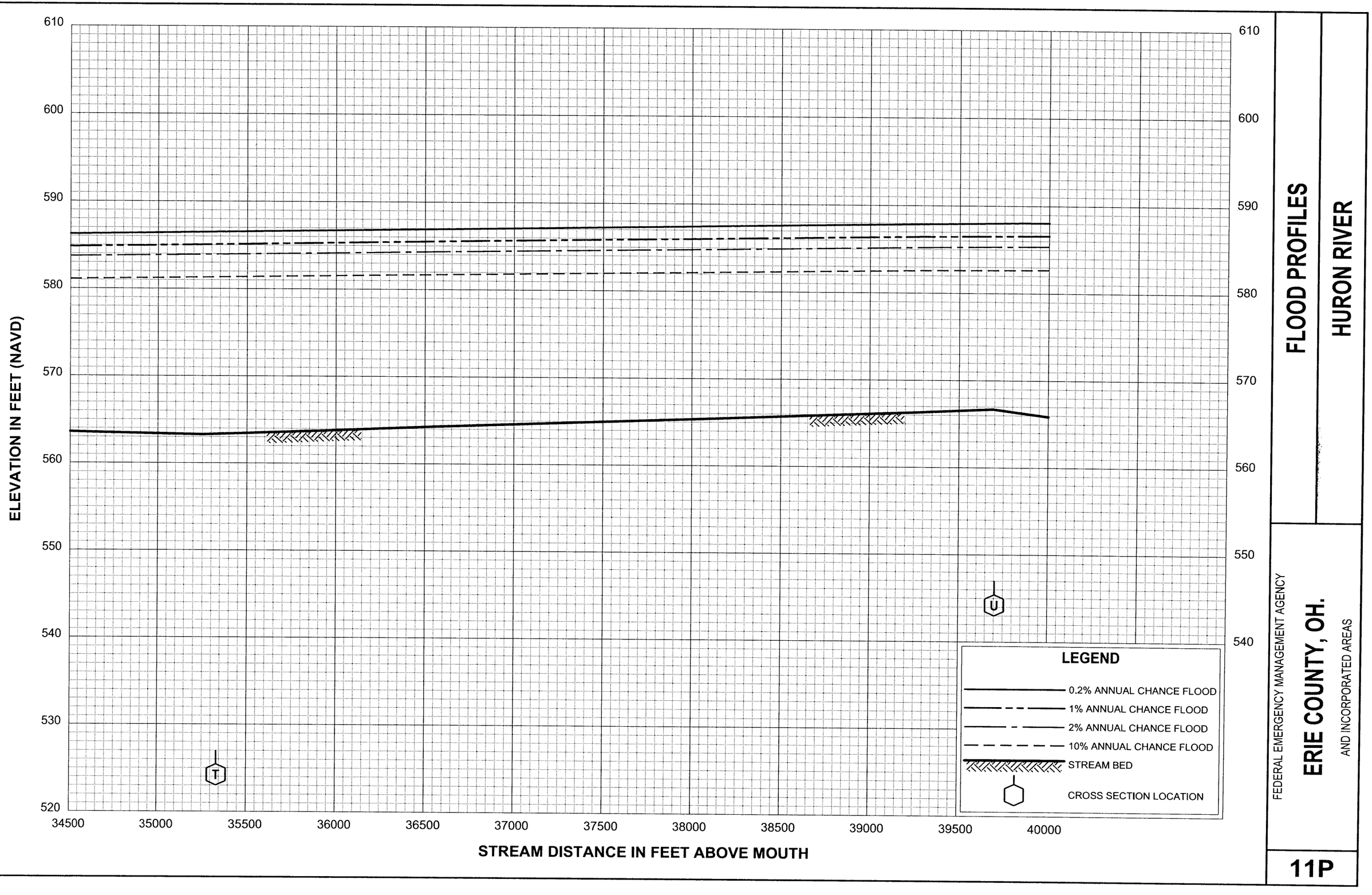
HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

10P



FLOOD PROFILES

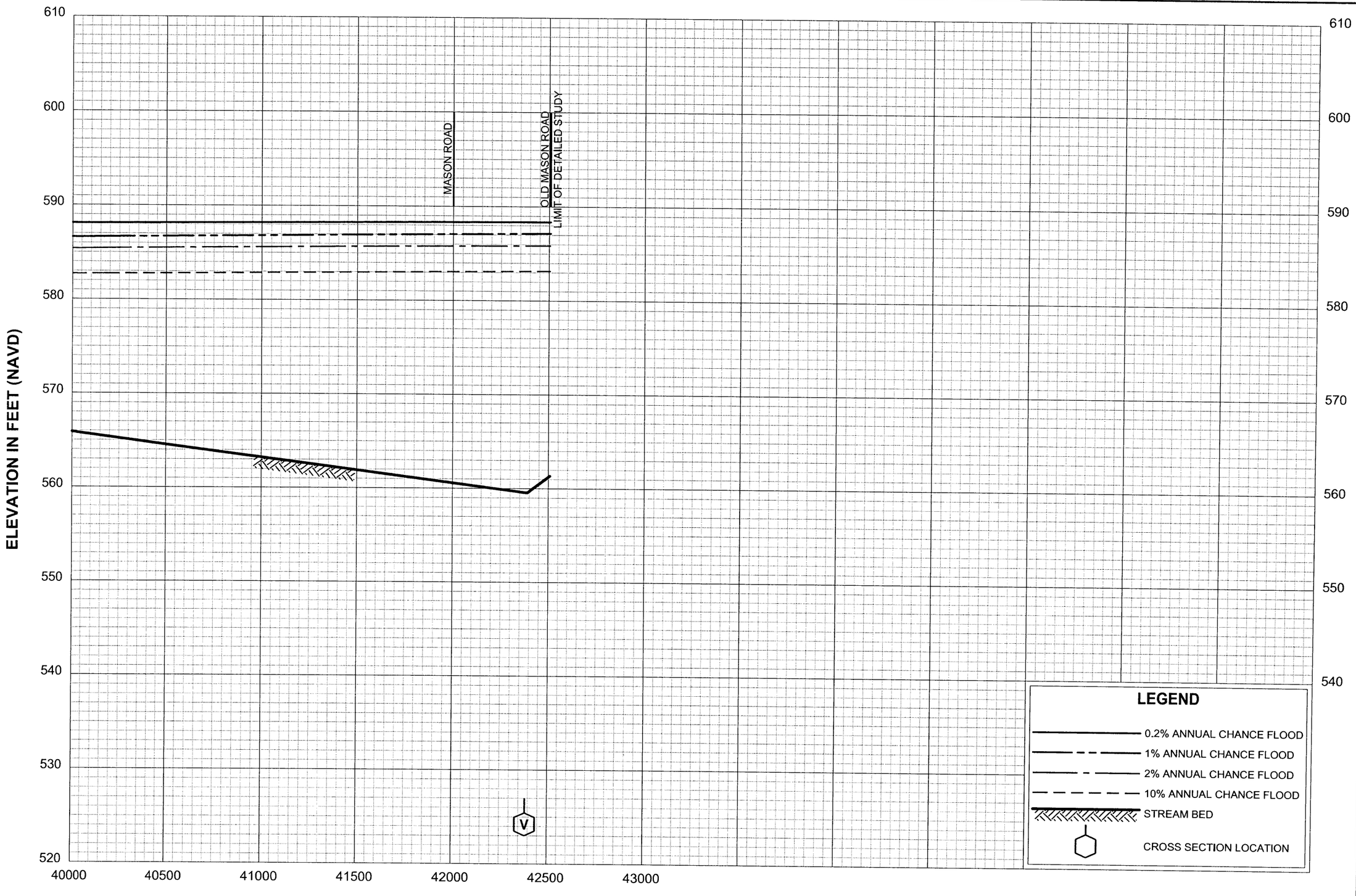
HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

11P



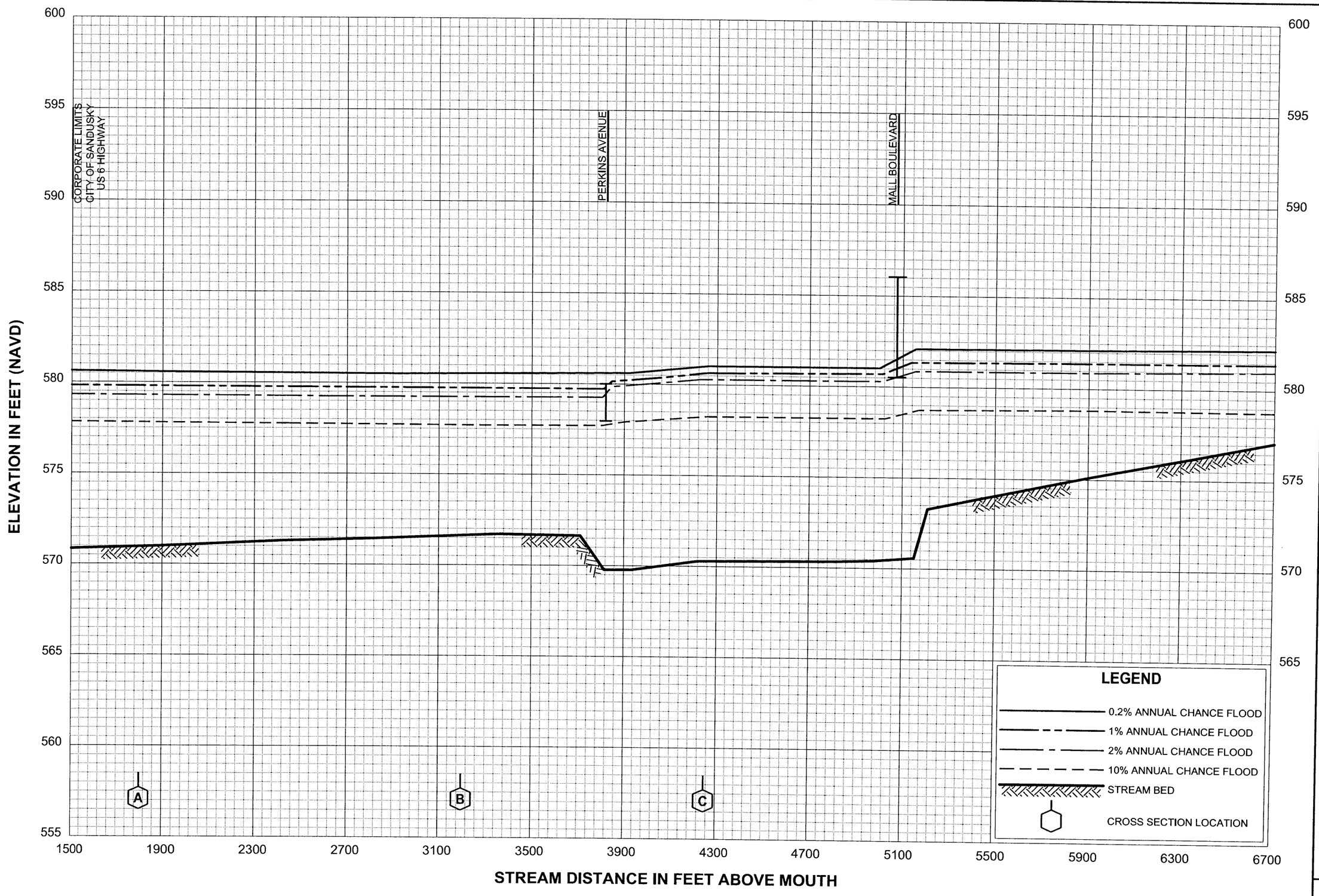
FLOOD PROFILES

HURON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS



FLOOD PROFILES

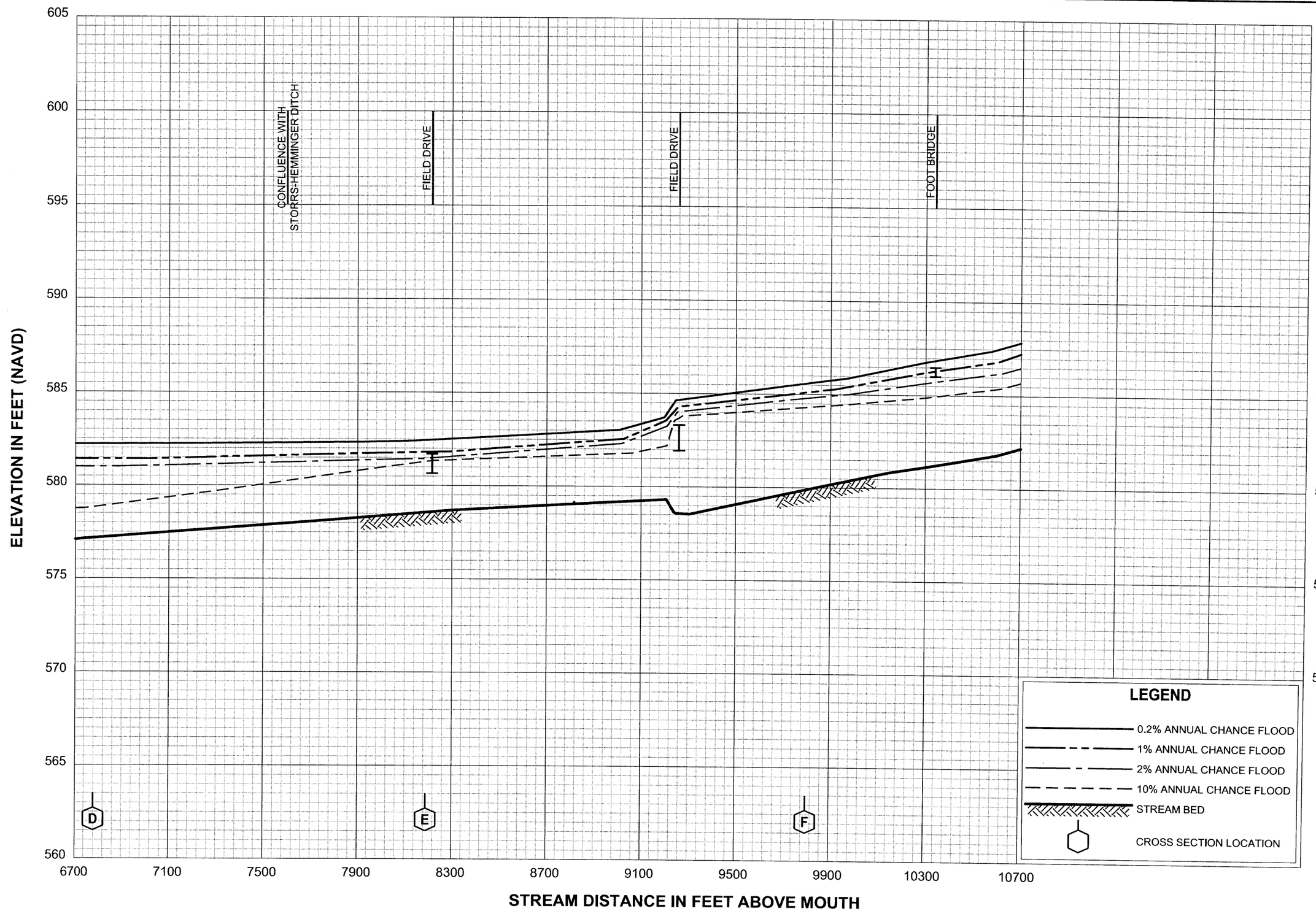
KOB DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

13P



FLOOD PROFILES

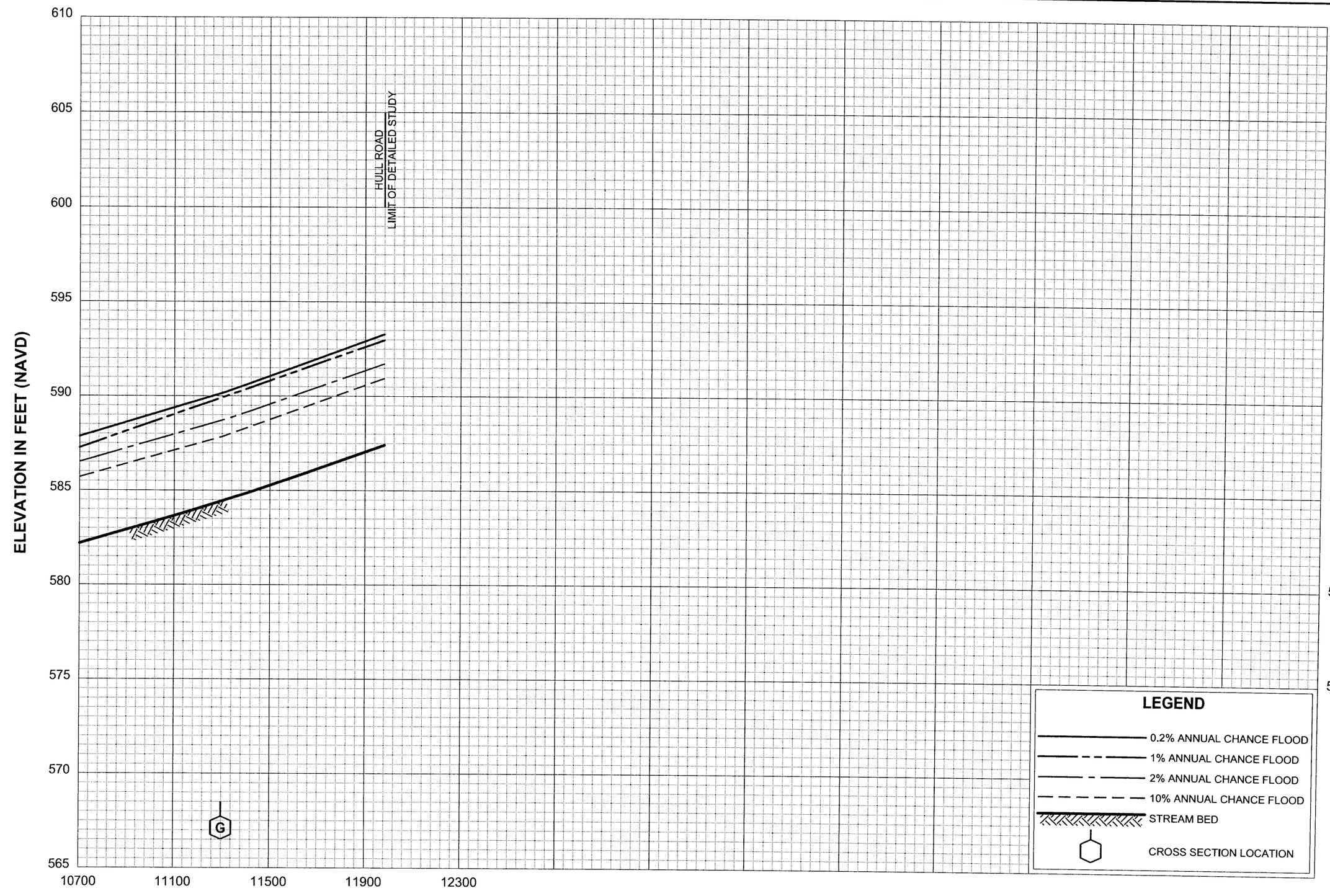
KOB DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

14P



FLOOD PROFILES

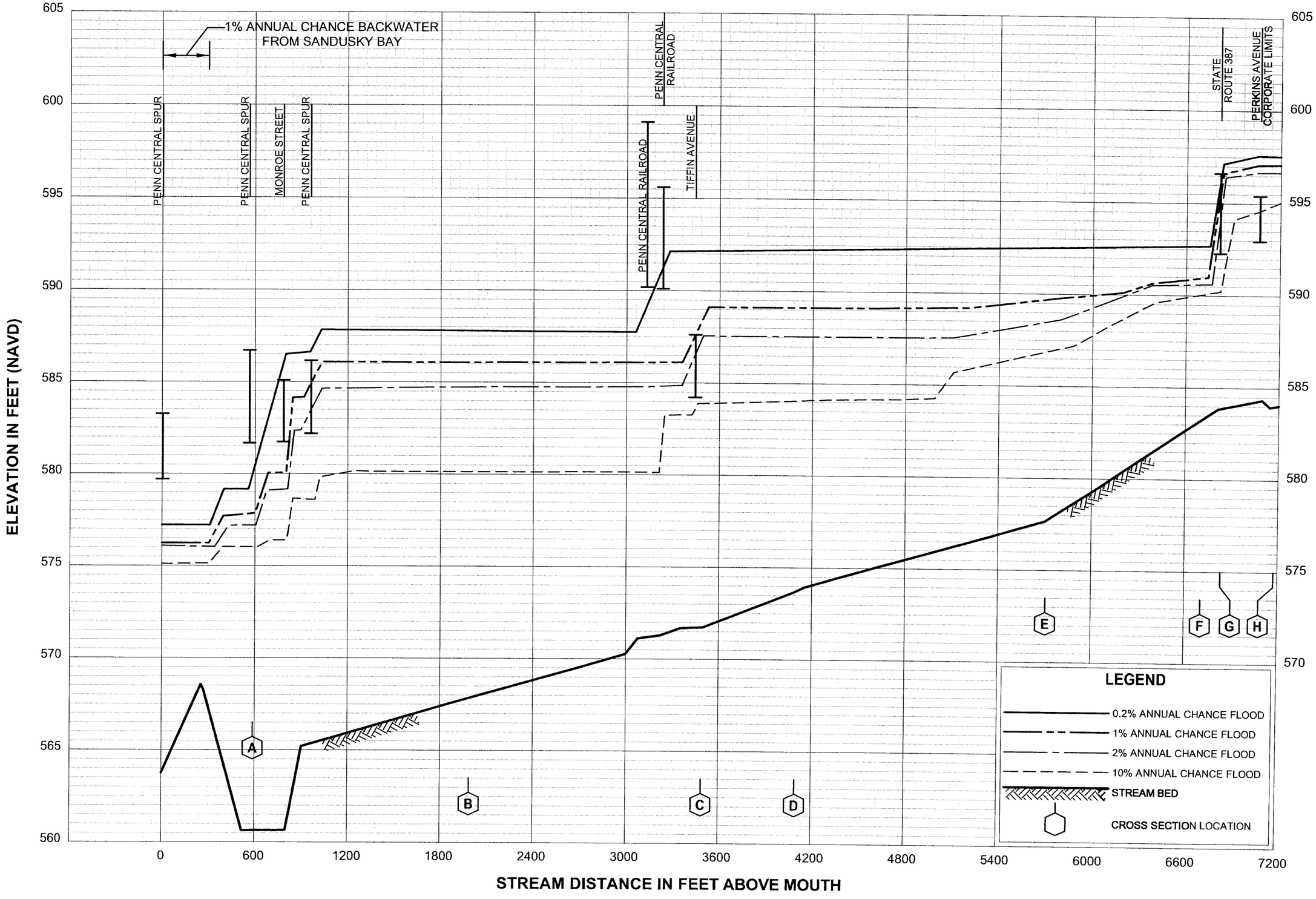
KOB DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

15P



FLOOD PROFILES

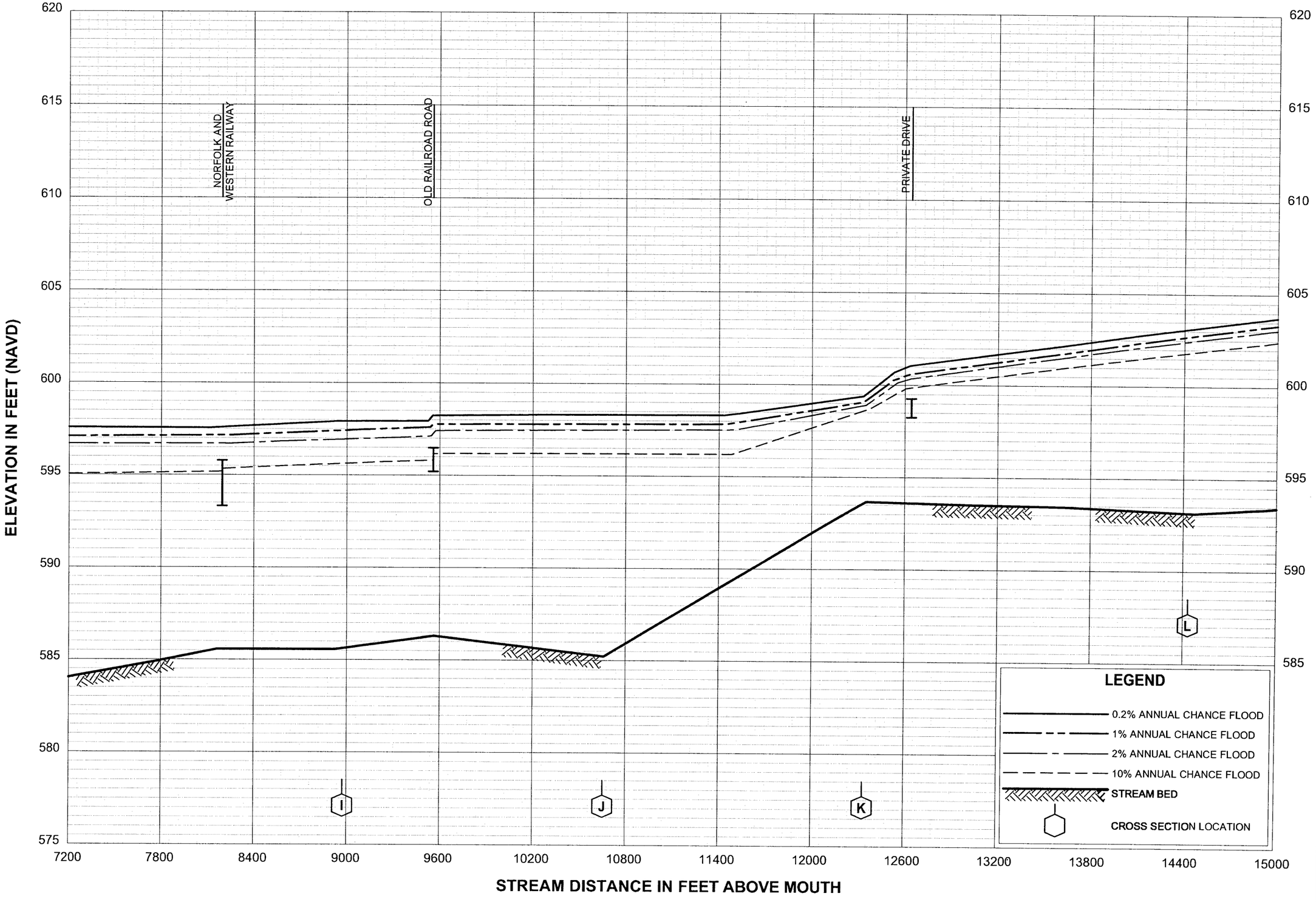
MILLS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

16P



FLOOD PROFILES

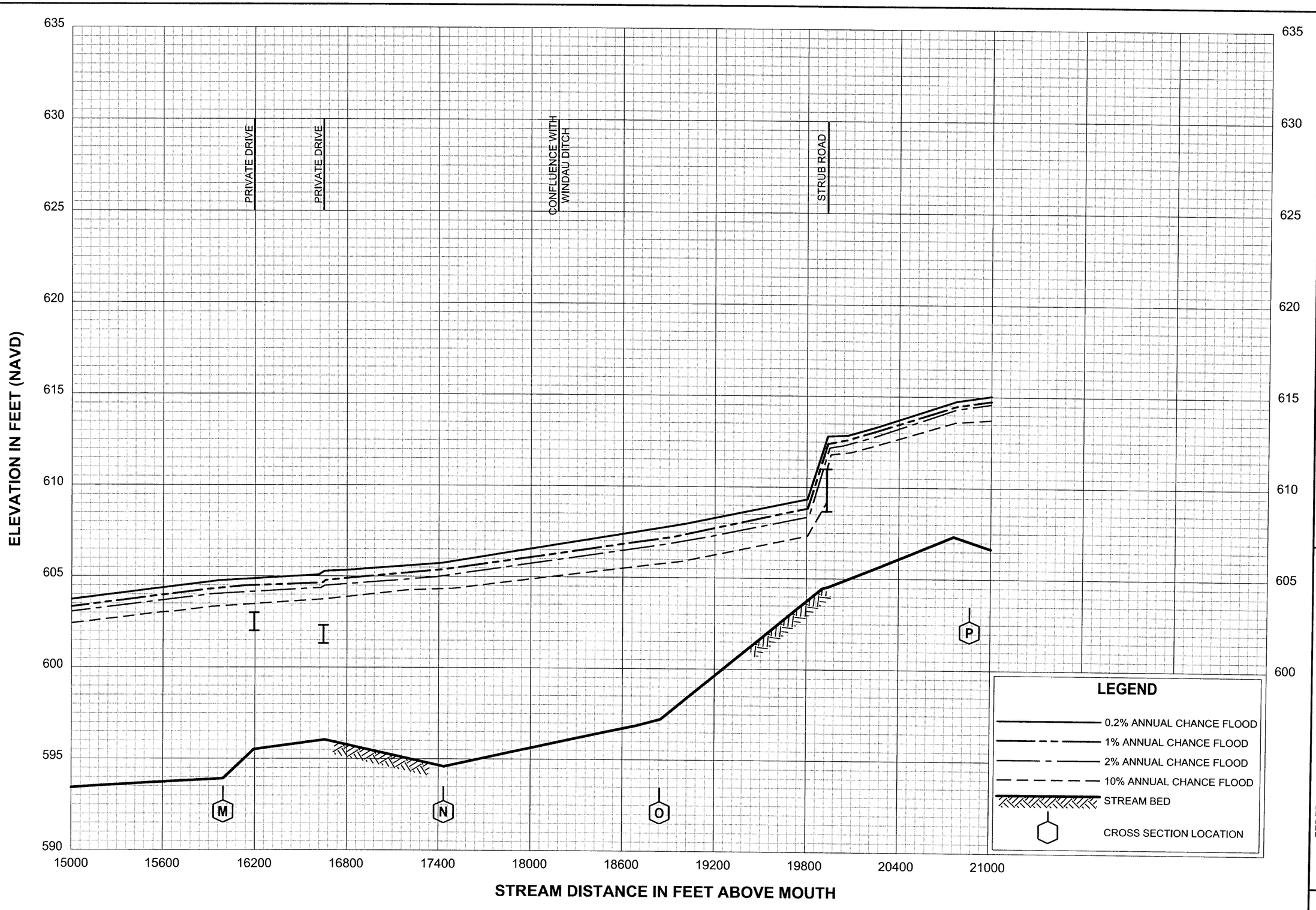
MILLS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

17P



FLOOD PROFILES

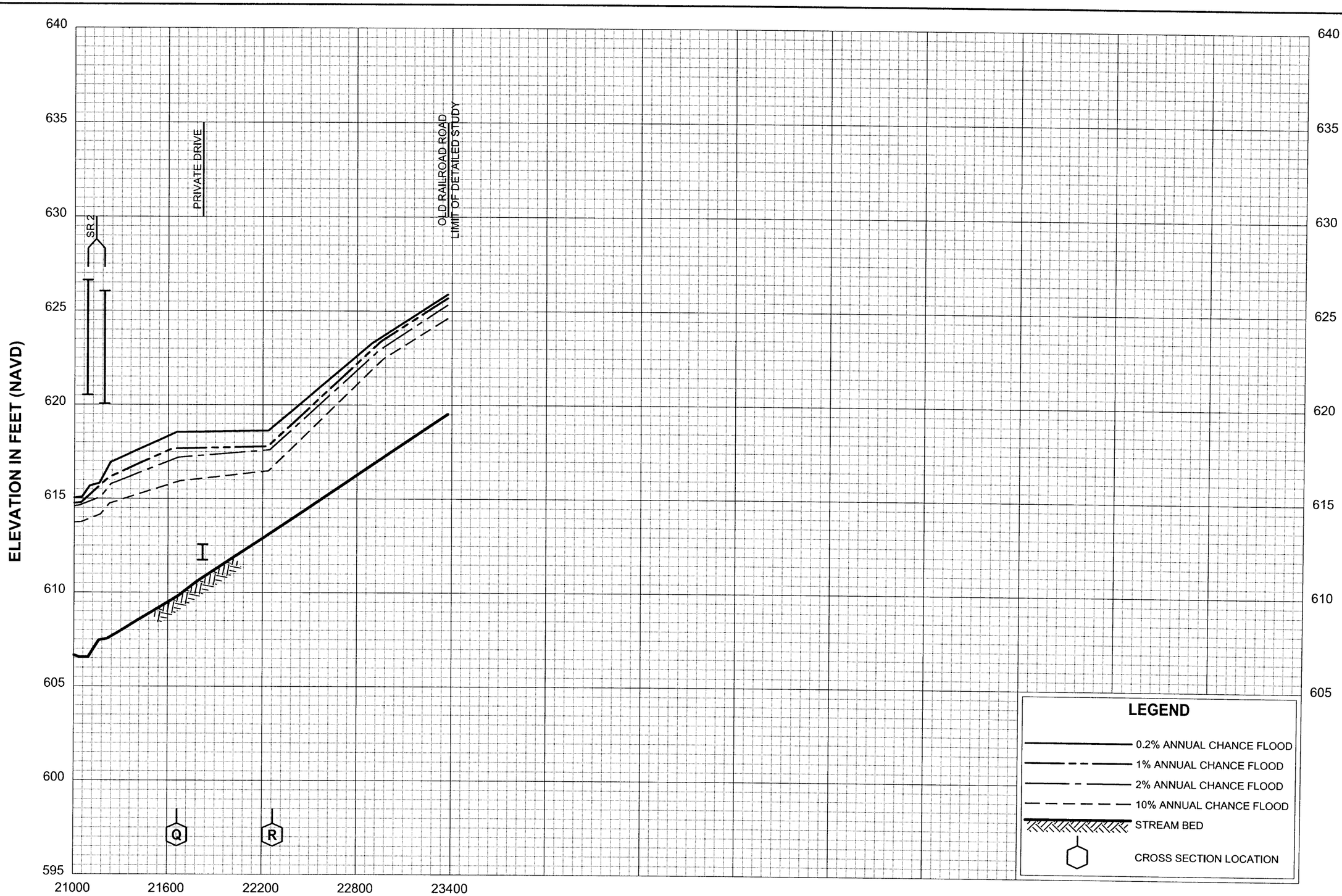
MILLS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

18P



FLOOD PROFILES

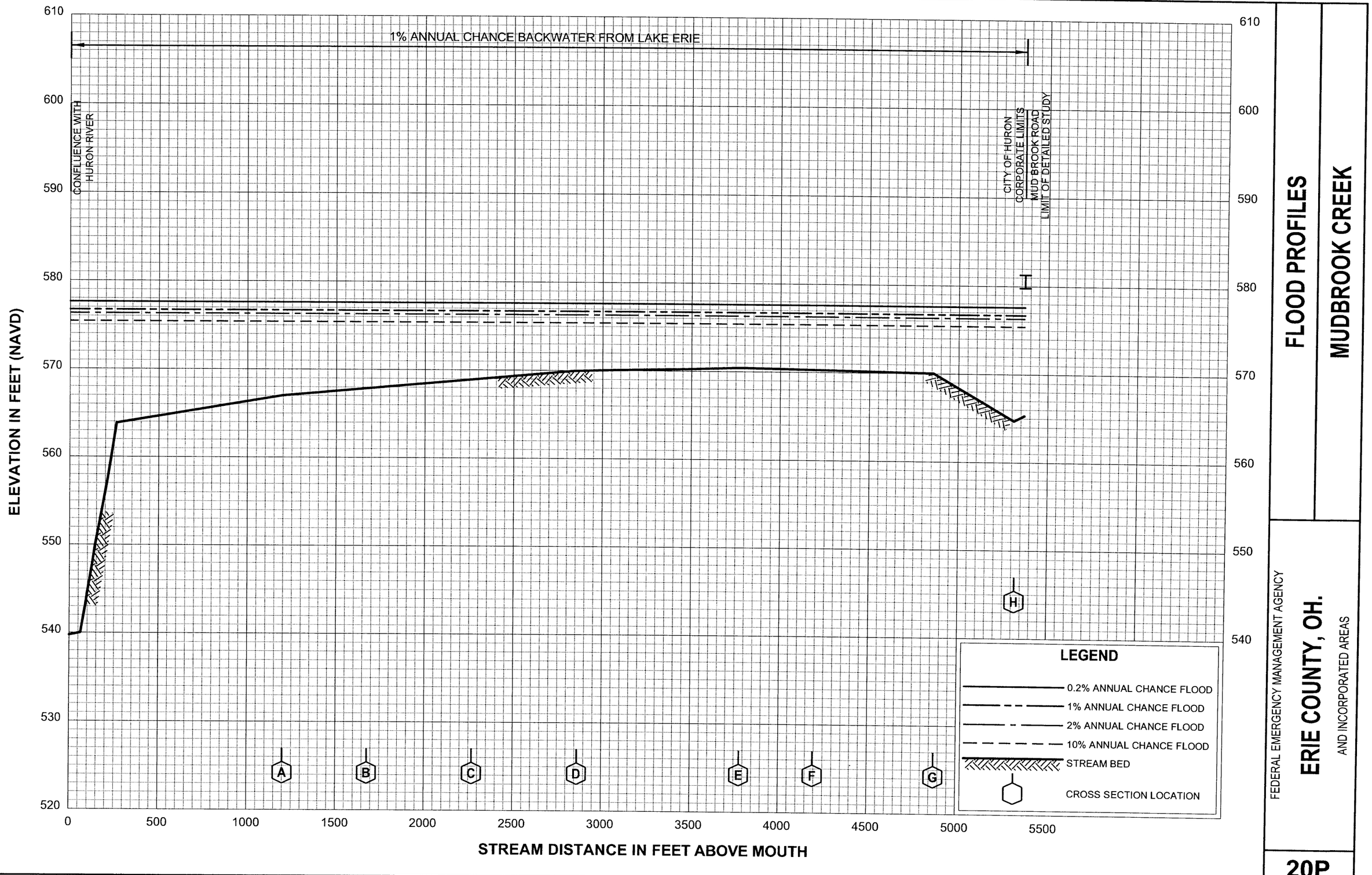
MILLS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

19P



FLOOD PROFILES

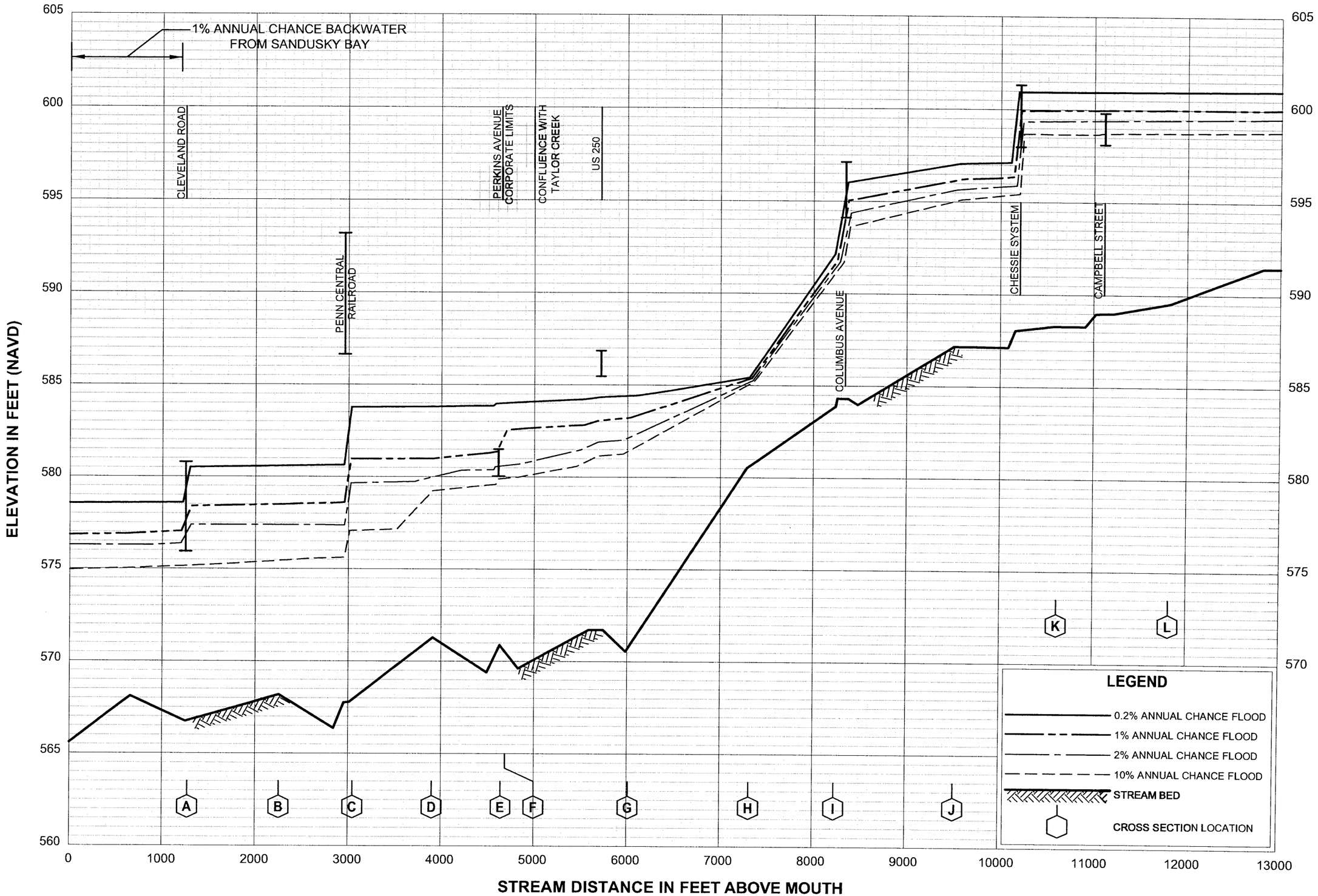
MUDBROOK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

20P



FLOOD PROFILES

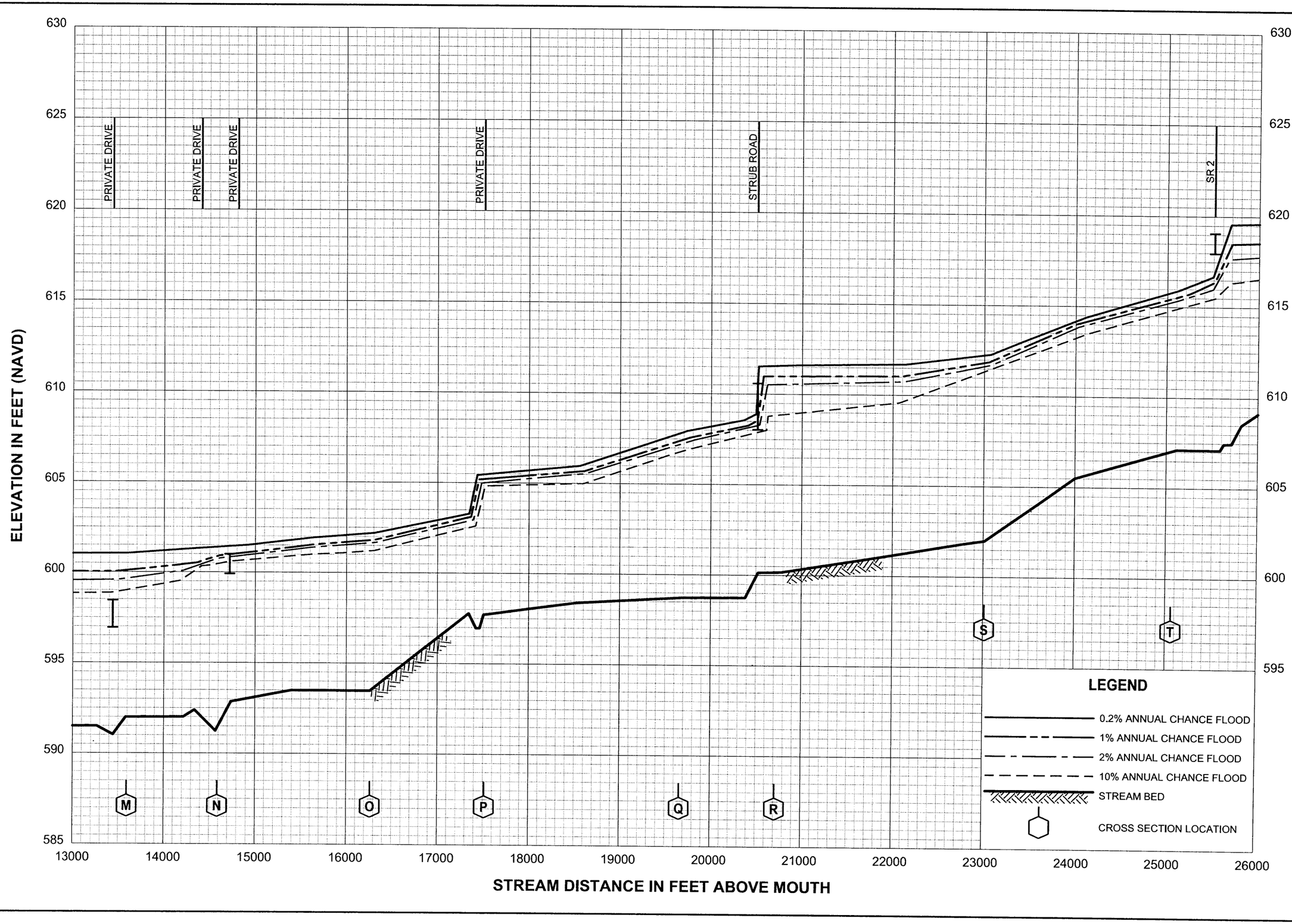
PIPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

21P



FLOOD PROFILES

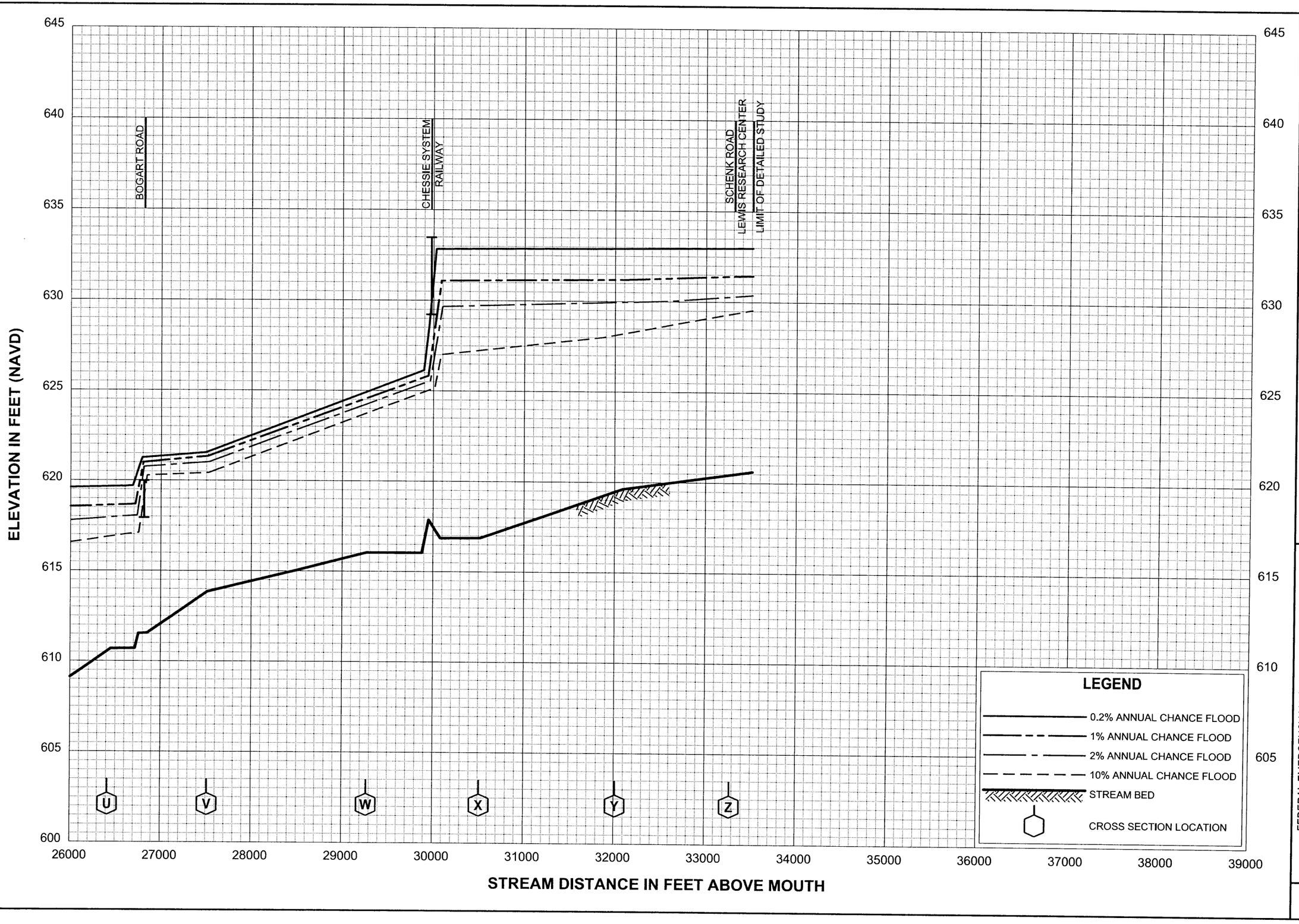
PIPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

22P



FLOOD PROFILES

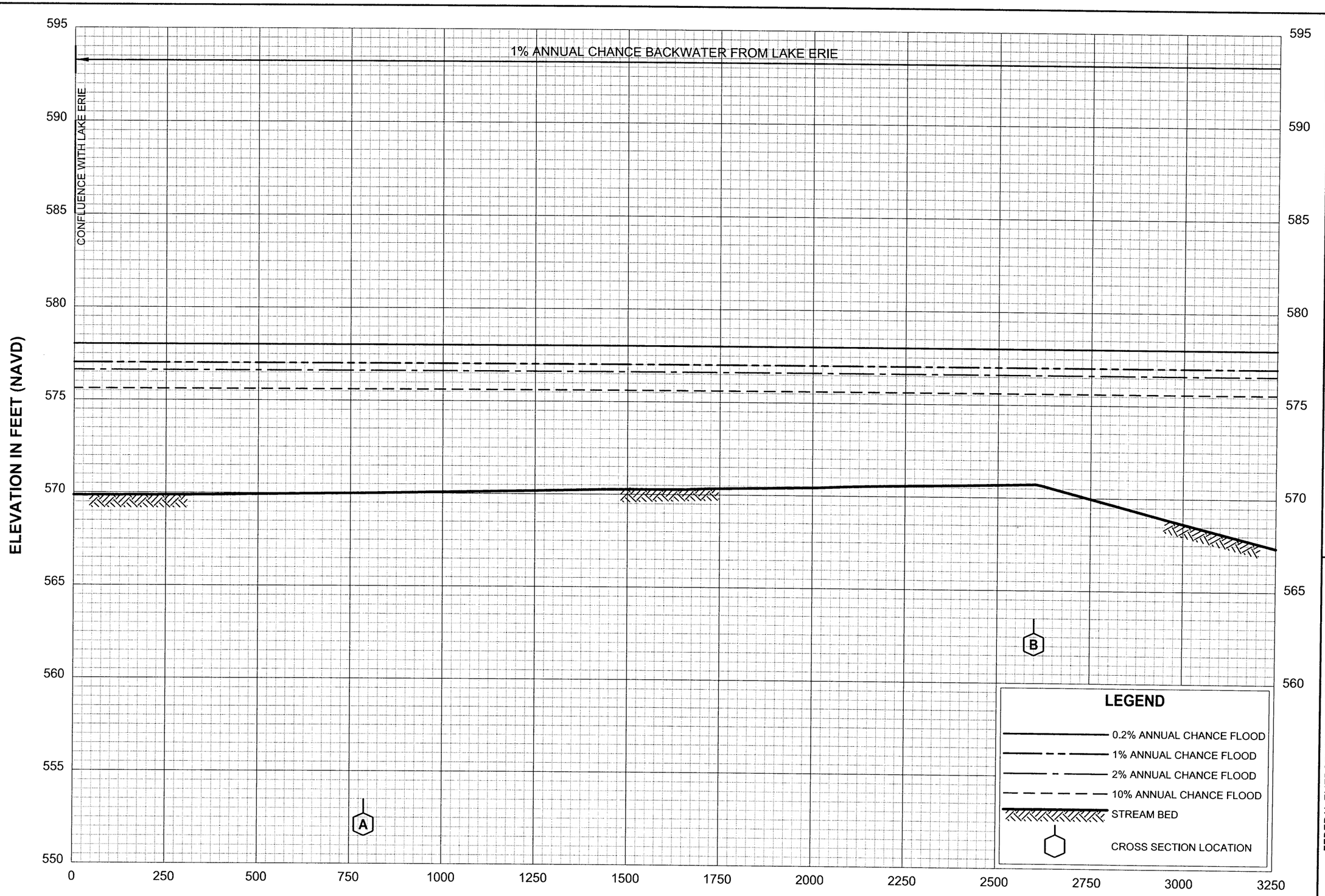
PIPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

23P



FLOOD PROFILES

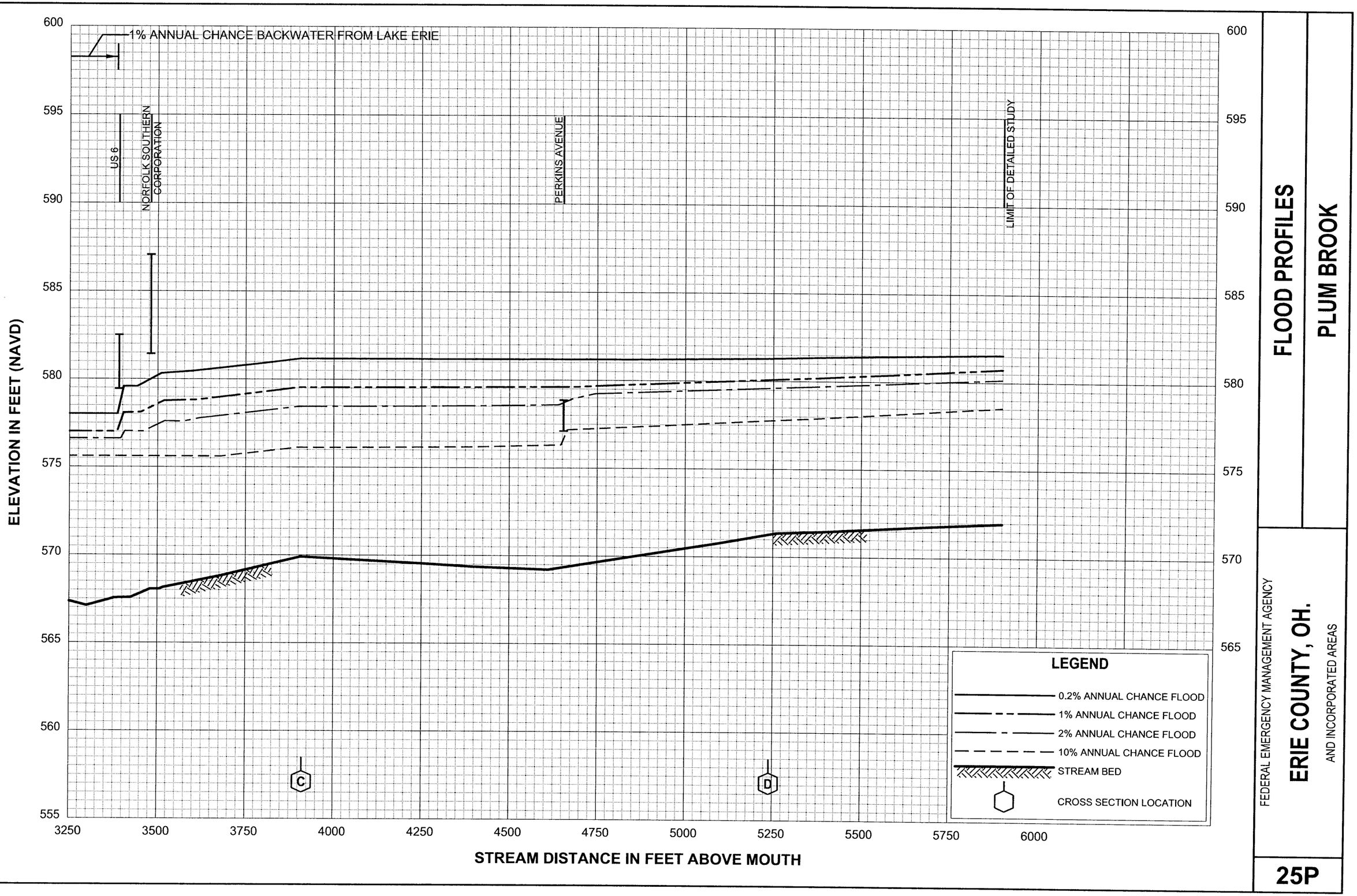
PLUM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

24P



FLOOD PROFILES

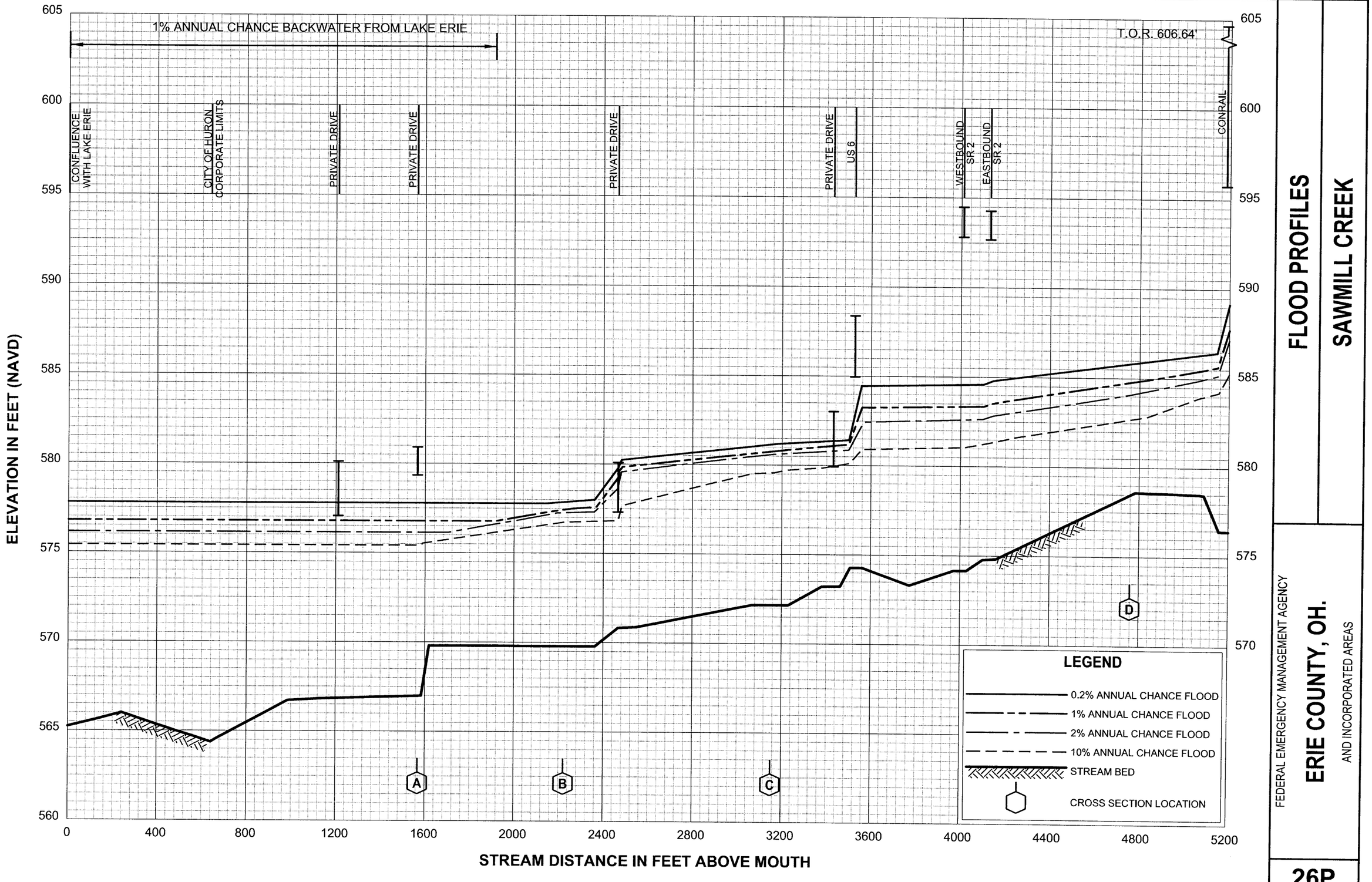
PLUM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

25P



FLOOD PROFILES

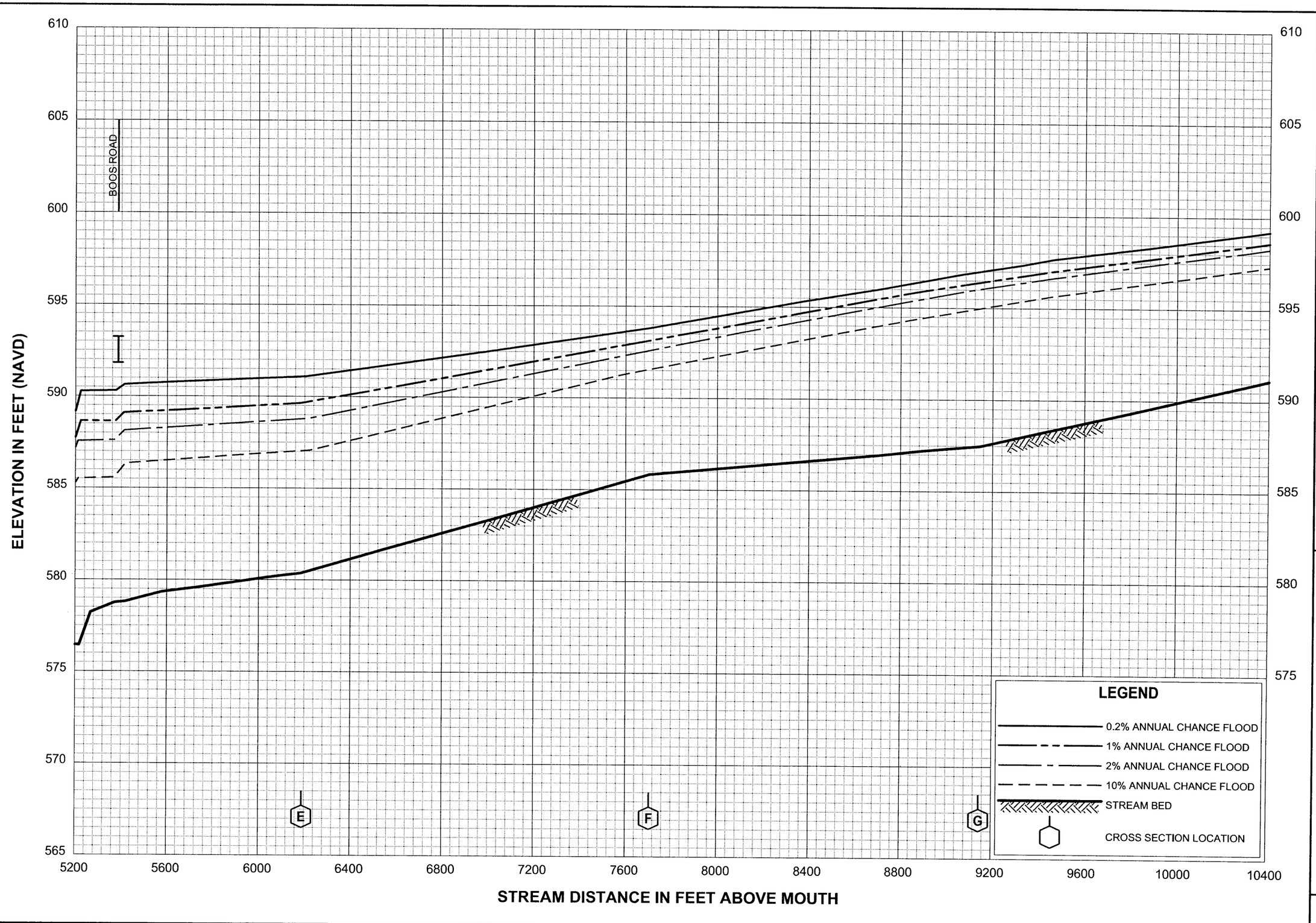
SAWMILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

26P



FLOOD PROFILES

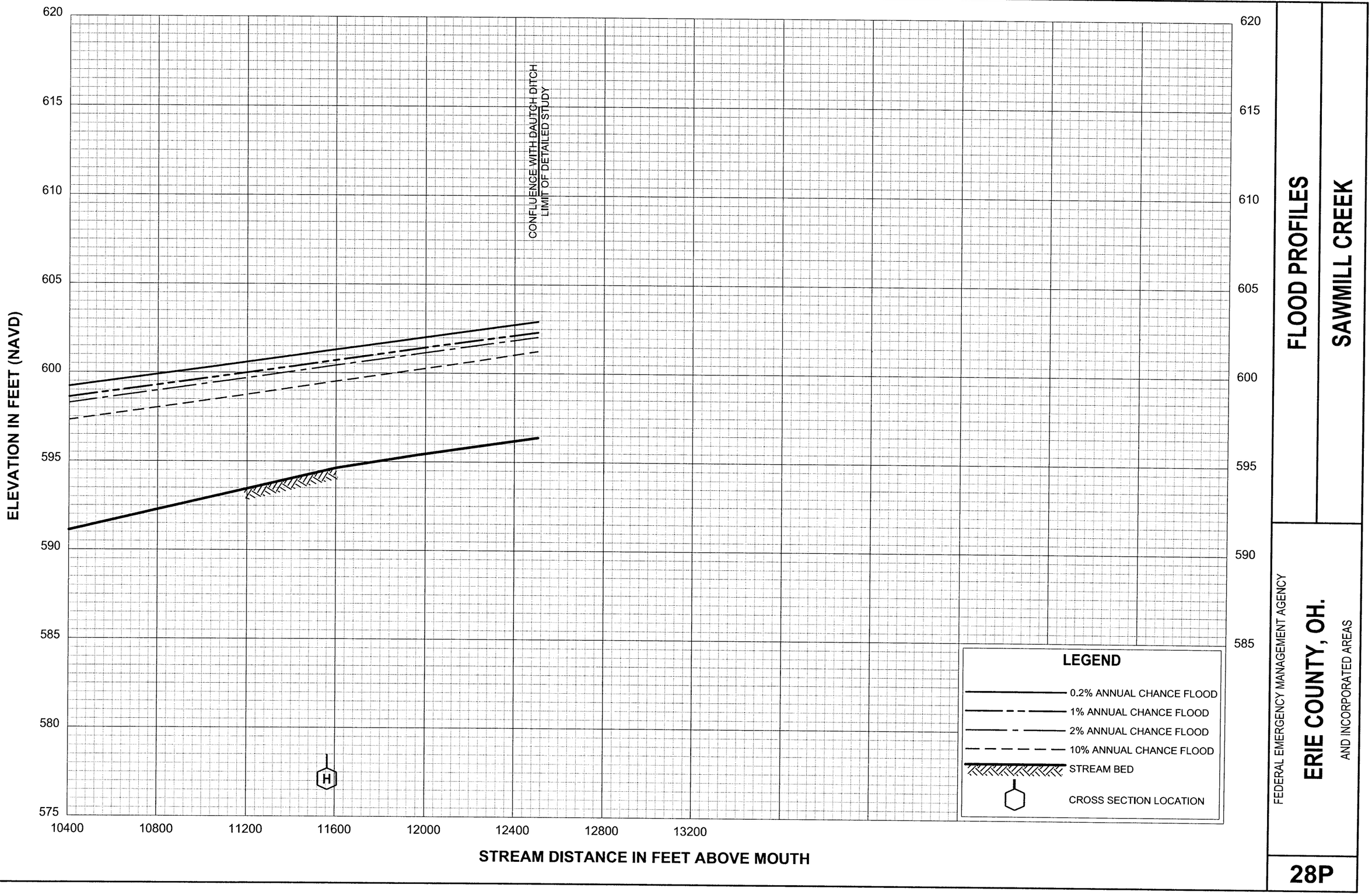
SAWMILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

27P



FLOOD PROFILES

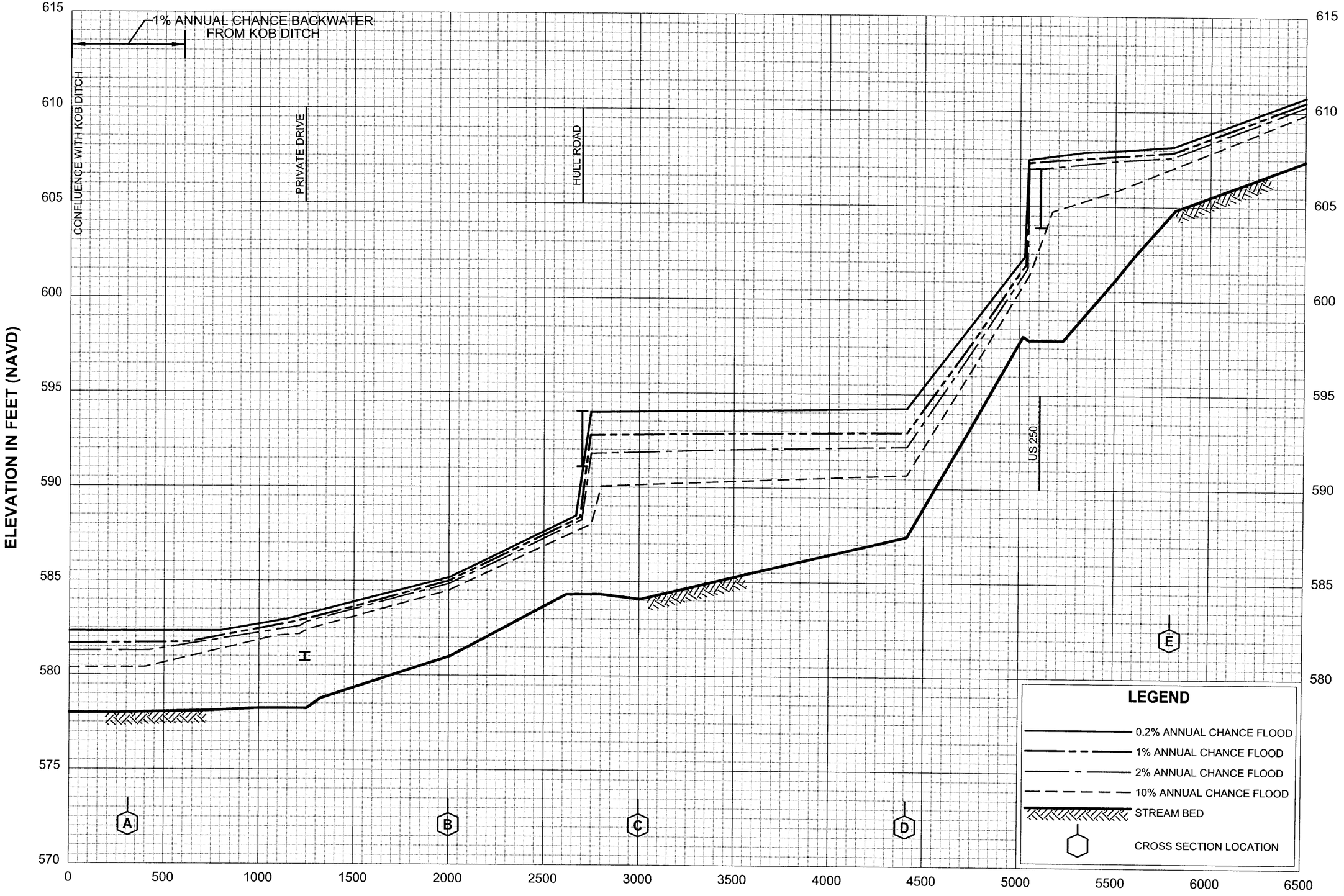
SAWMILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

28P



FLOOD PROFILES

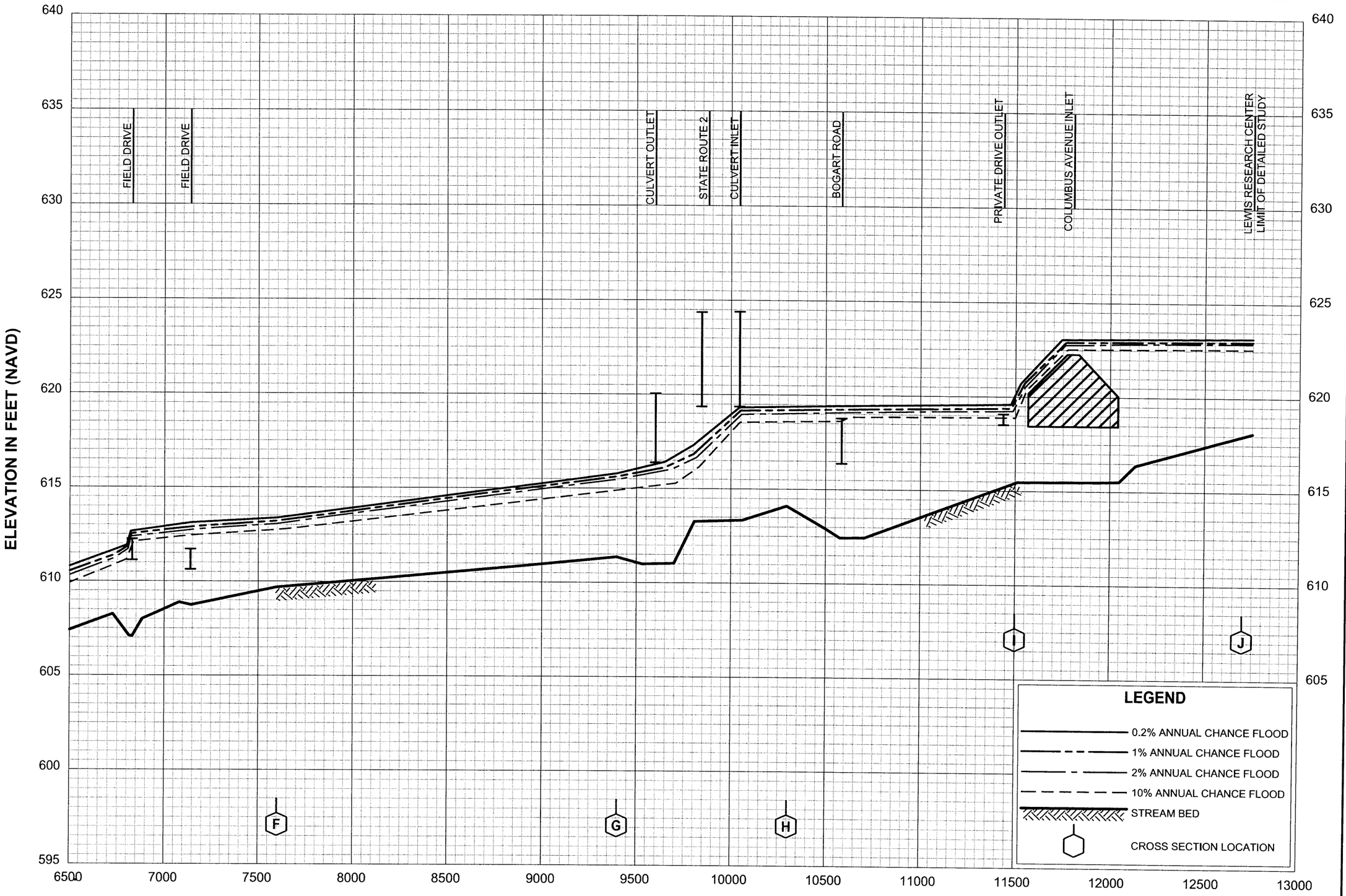
STORRS-HEMMINGER DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

29P



FLOOD PROFILES

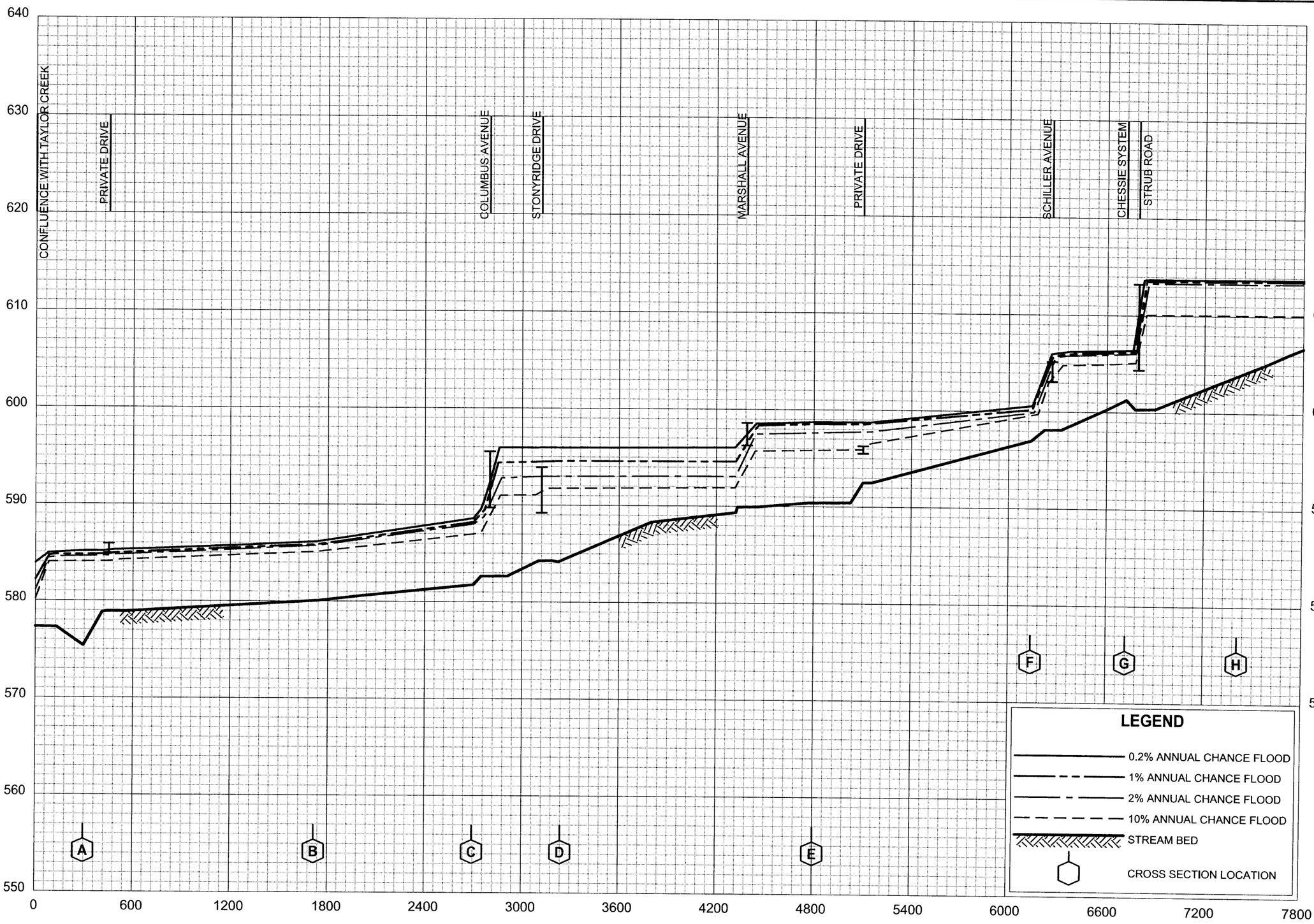
STORRS-HEMMINGER DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

30P



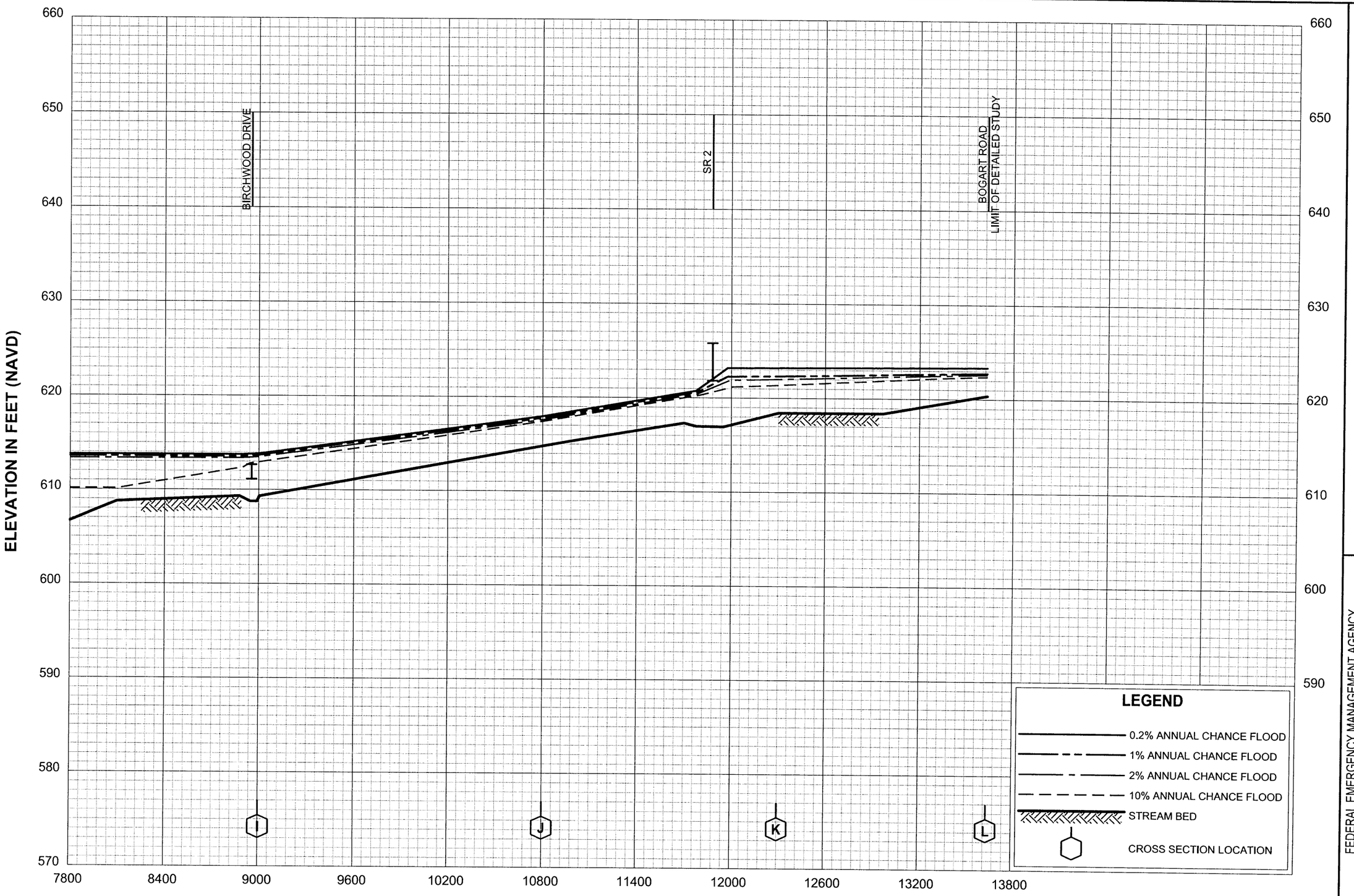
FLOOD PROFILES

SULPHUR BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS



FLOOD PROFILES

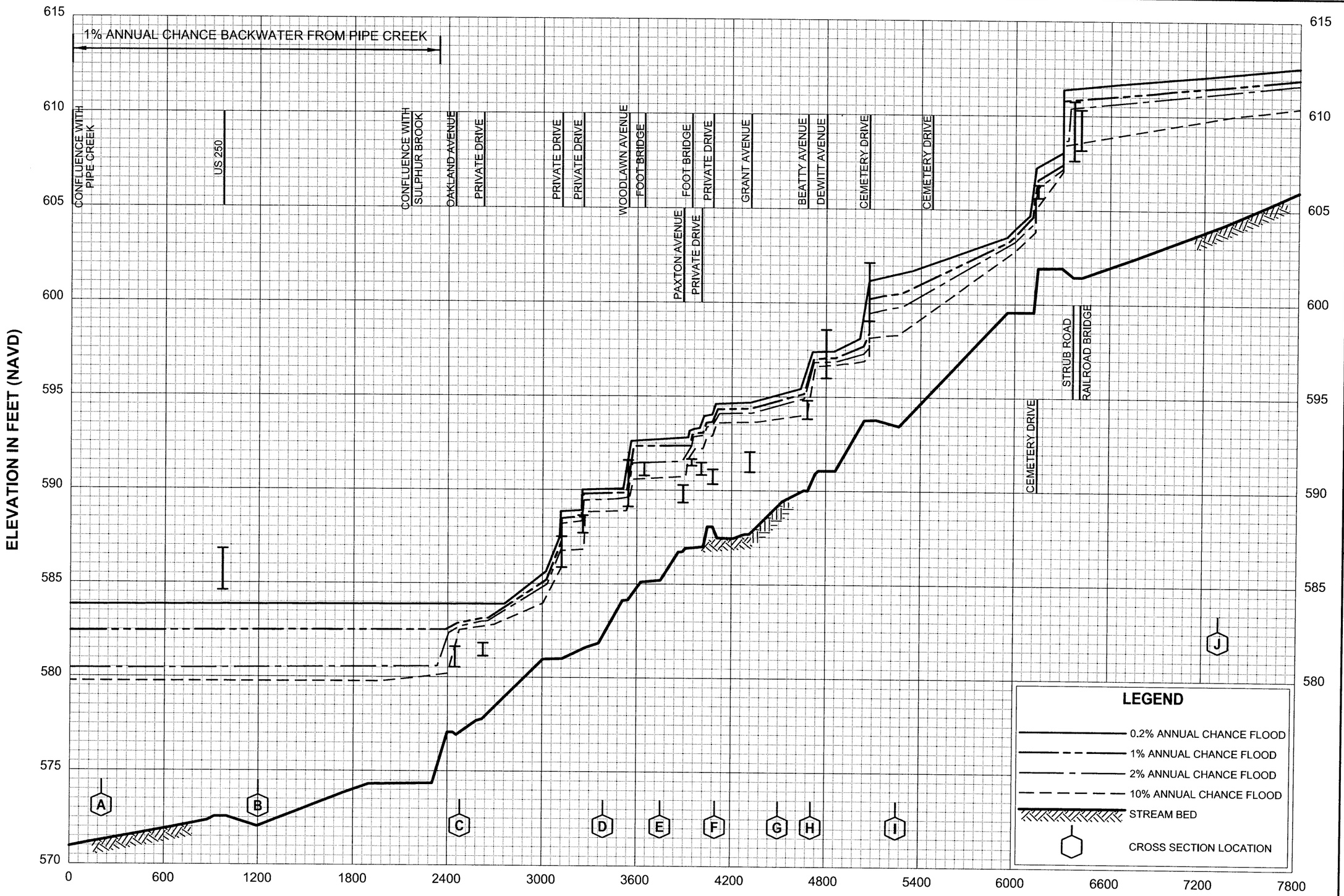
SULPHUR BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

32P



FLOOD PROFILES

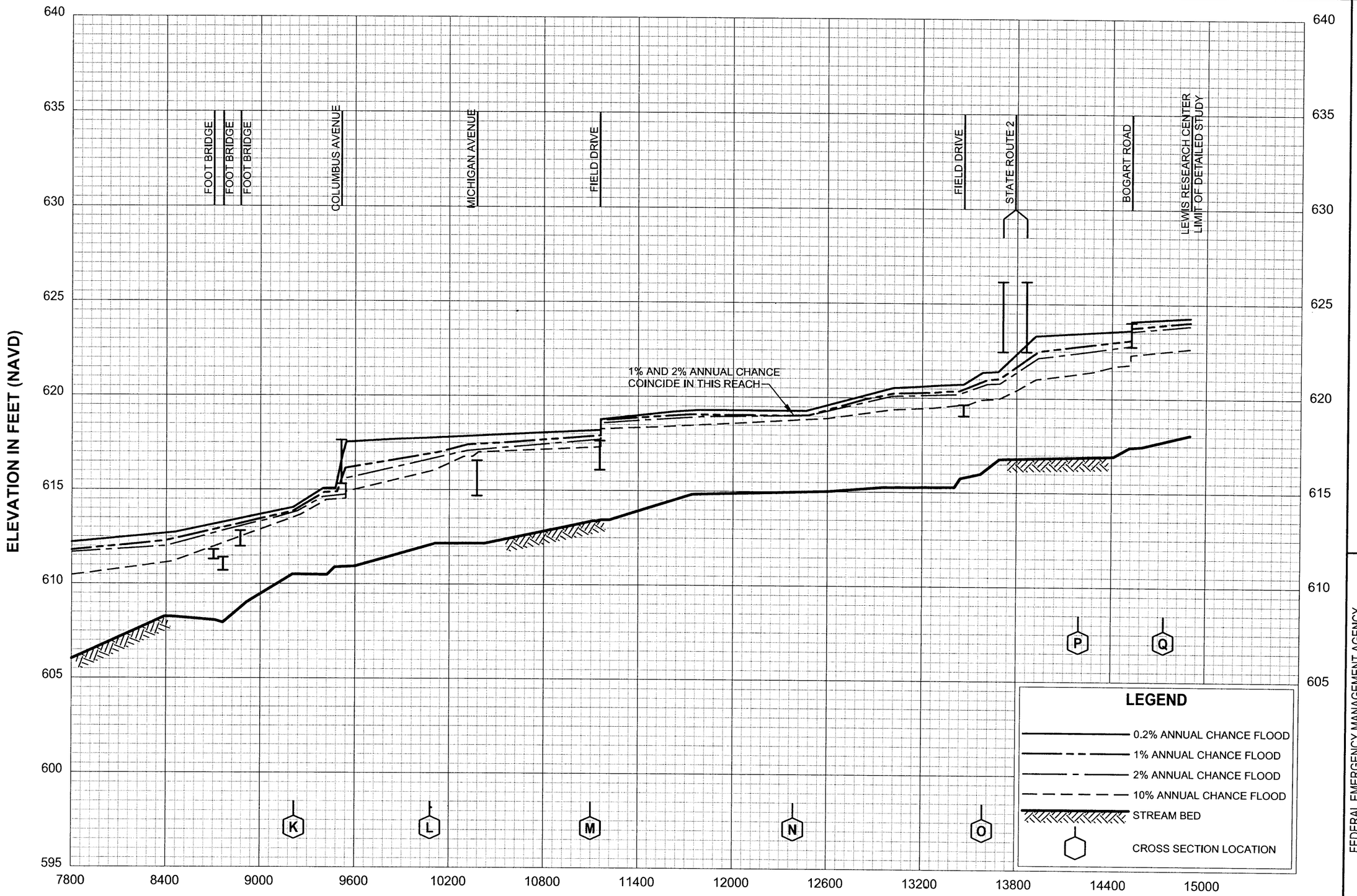
TAYLOR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

33P



FLOOD PROFILES

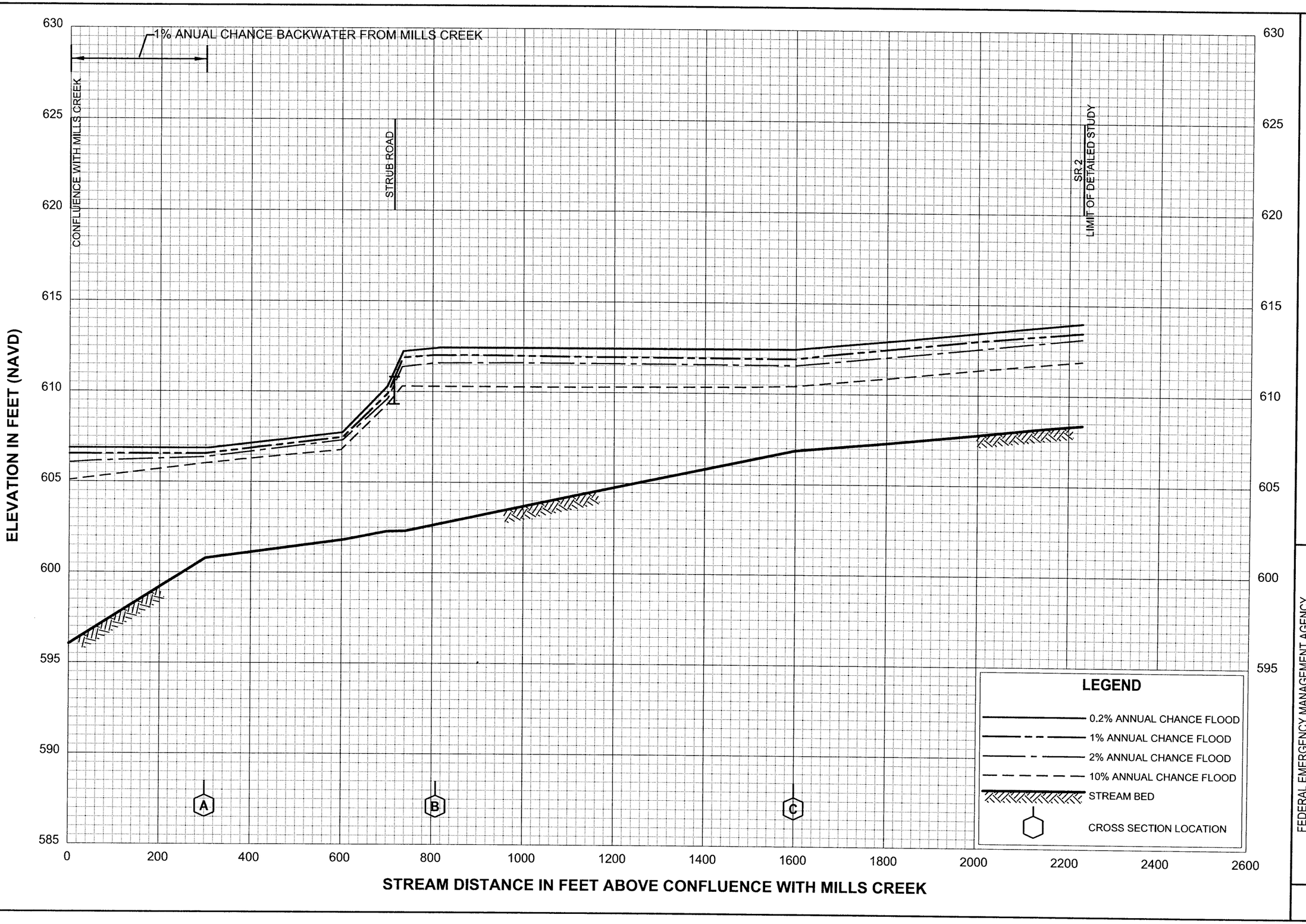
TAYLOR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

34P



FLOOD PROFILES

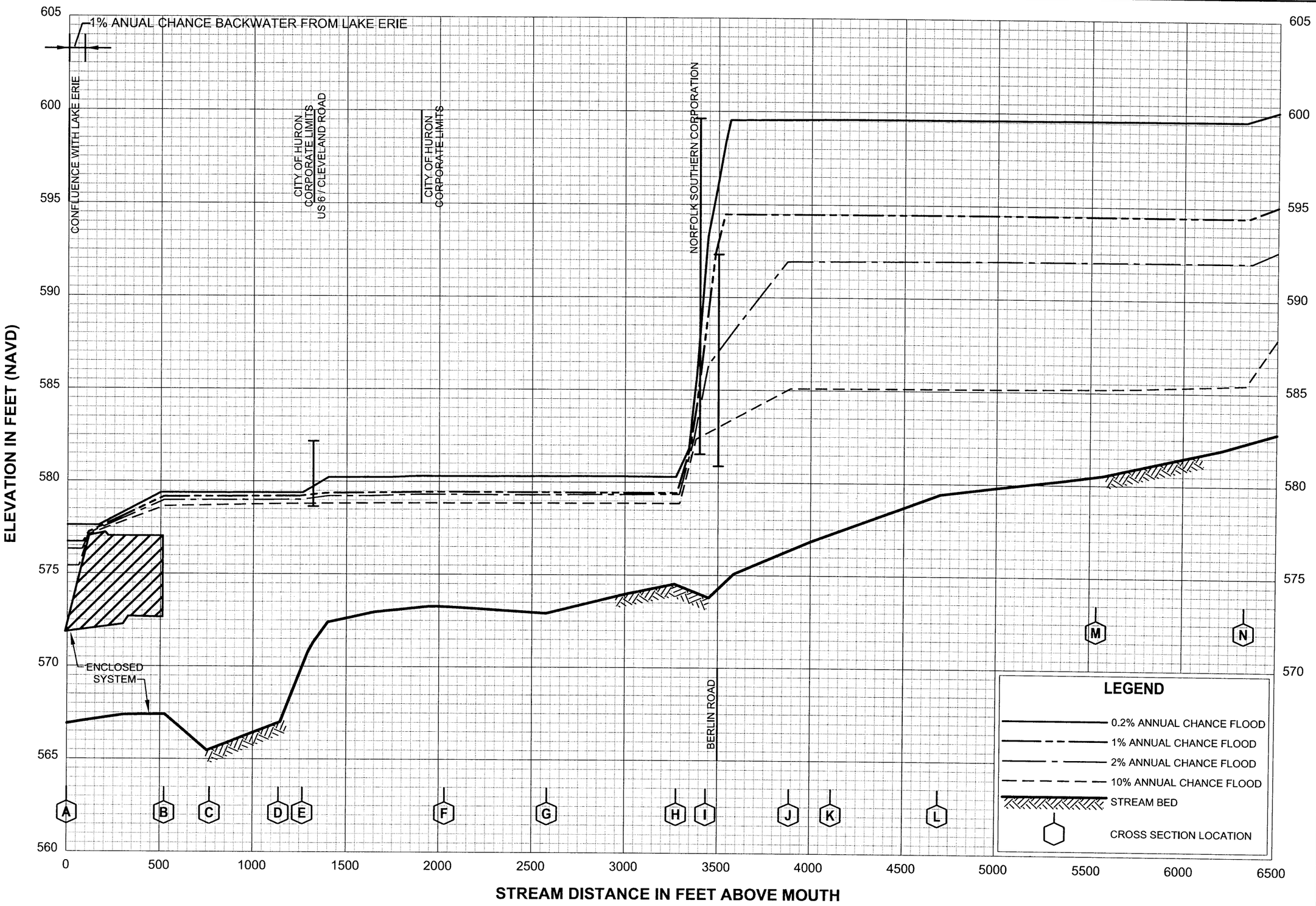
WINDAU DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

35P



FLOOD PROFILES

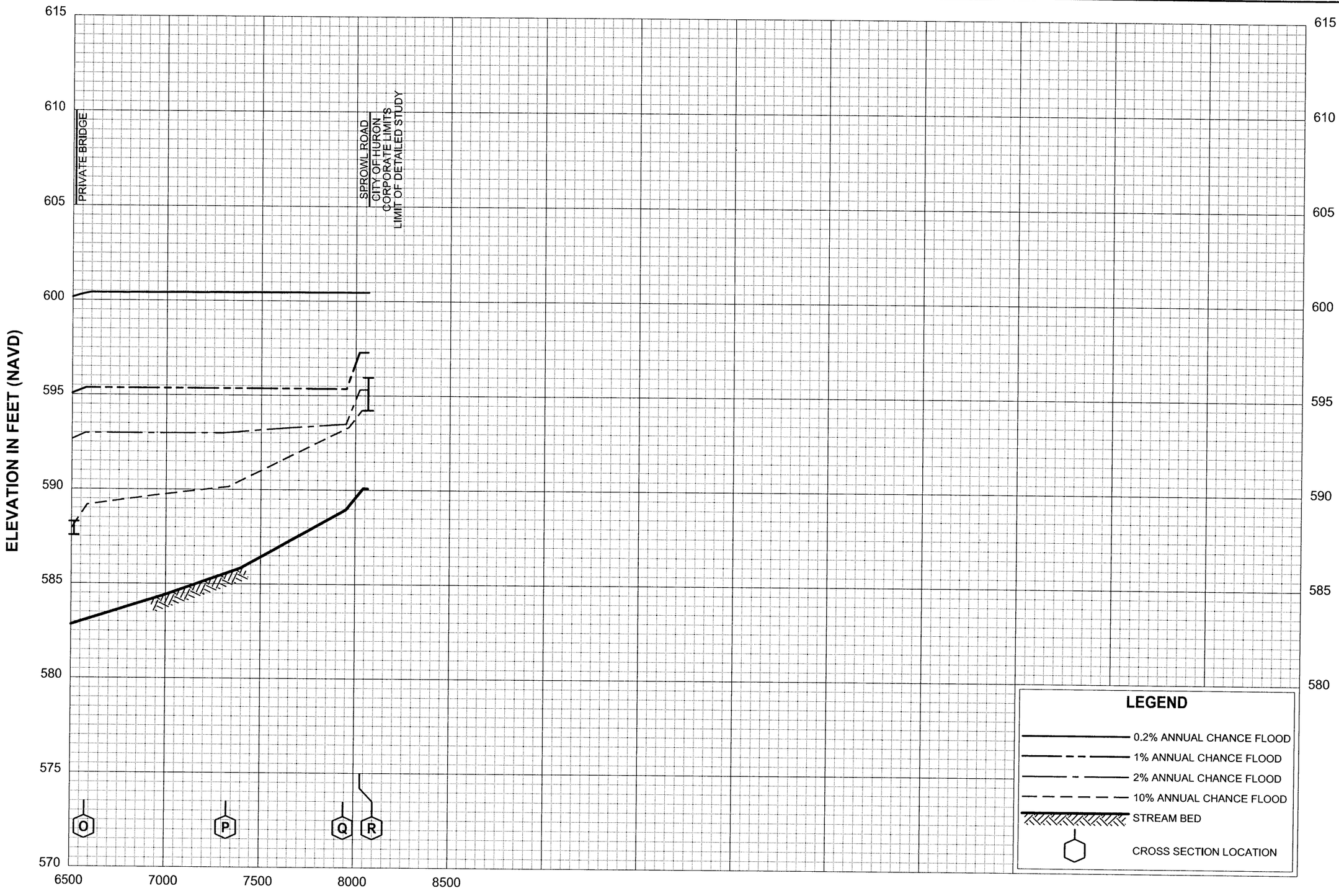
WINKLER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

36P



FLOOD PROFILES

WINKLER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

ERIE COUNTY, OH.

AND INCORPORATED AREAS

37P