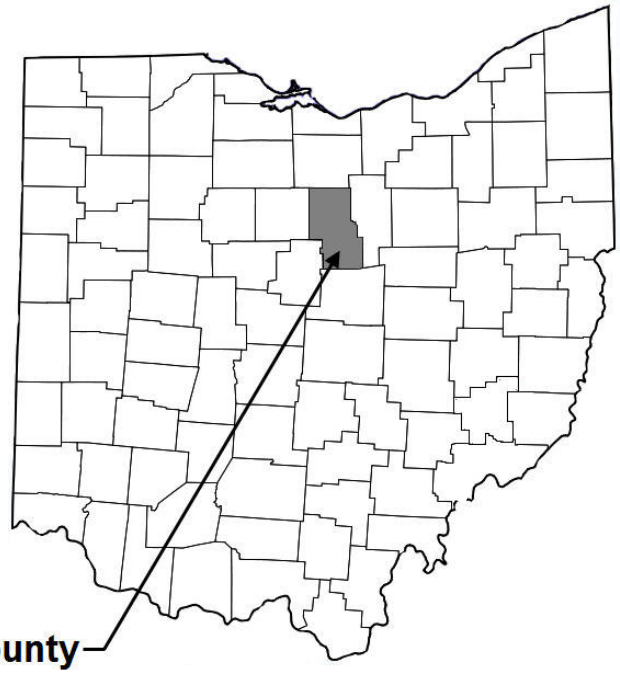
FLOOD INSURANCE STUDY

RICHLAND COUNTY, OHIO
AND INCORPORATED AREAS

Community Name	Community Number
BELLVILLE, VILLAGE OF	390604
BUTLER, VILLAGE OF	390605
LEXINGTON, VILLAGE OF	390618
LUCAS, VILLAGE OF	390661
MANSFIELD, CITY OF	390477
ONTARIO, VILLAGE OF	390478
PLYMOUTH, VILLAGE OF	390287
RICHLAND COUNTY, (UNINCORPORATED AREAS)	390476
SHELBY, CITY OF	390479
*SHILOH, VILLAGE OF	395508



*No Special Flood Hazard Area Identified

April 4, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
39139CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. 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 at any time. In addition, part of this FIS report may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date: April 4, 2011

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
B	X (shaded)
C	X

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Hartman Bargaheiser Ditch	Panels 23P-24P
Lower Tuby Tributary	Panel 25P
Painters Creek	Panels 26P-28P
Rocky Fork	Panels 29P-32P
Seltzer Park Creek	Panels 33P-36P
Seltzer Park Tributary	Panels 37P-38P
Touby Run	Panel 39P
Tuby Run	Panels 40P-43P
Upper Tuby Tributary	Panel 44P
West Branch	Panel 45P
West Branch Bear Run	Panels 46P-47P
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Published Separately -

Flood Insurance Rate Map Index

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
RICHLAND COUNTY, OHIO AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and supersedes the FIS reports and/or Flood Insurance Rate Maps (FIRMs) in the geographic area of Richland County, Ohio, including the unincorporated areas of Richland County, the Cities of Mansfield and Shelby, and the Villages of Bellville, Butler, Lexington, Lucas, Ontario, Plymouth, and Shiloh (hereinafter referred to collectively as Richland County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. No Special Flood Hazard areas (SFHAs) have been identified in the Village of Shiloh. 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 Richland 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 Map (DFIRM) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet 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 digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

The Village of Plymouth is a multi-county community which is geographically located in Richland and Huron counties. The City of Crestline is a multi-county community which is geographically located in Crawford and Richland counties. The City of Galion is also a multi-county community which is geographically located in Crawford, Morrow and Richland counties. The flood hazard information for the Village of Plymouth is included entirely within this FIS. The flood hazard information for the cities of Crestline and Galion is included entirely within the Crawford County FIS.

1.2 Authority and Acknowledgements

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

Pre-Countywide Analyses

Village of Bellville. The hydrologic and hydraulic analyses for the September 2, 1993 FIS for the Village of Bellville (Reference 1) were performed by the US Army Corps of Engineers (USACE), Huntington District, for FEMA under Inter-Agency Agreement No. EMW-90-E-3263, Project Order No.10. This study was completed in May 1991.

Village of Butler. The hydrologic and hydraulic analyses for the November 15, 1989 FIS for the Village of Bulter (Reference 2) were performed by Burgess & Niple, Limited for FEMA under Contract No. EMW-86-C-2251. This study was completed in March 1988.

City of Mansfield. The hydrologic and hydraulic analyses for the January 3, 1986 FIS for the City of Mansfield (Reference 3) were performed by the Dodson-Lindblom Associates, Inc., Columbus, Ohio for FEMA under Contract No. EMW-83-C-1166, Project Order No.10. This study was completed in March 1984.

Richland County (Unincorporated Areas). The hydrologic and hydraulic analyses for the April 2, 1991 FIS for Richland County, Unincorporated Areas (Reference 4) were performed by Burgess & Niple, Limited, for FEMA under Contract No. EMW-86-C-2251. This study was completed in March 1988.

City of Shelby. The hydrologic and hydraulic analyses for the March 2, 1989 FIS for the City of Shelby (Reference 5) were performed by the U.S. Department of Agriculture, Soil Conservation Service for FEMA, under report "Flood Plain Management Study, Black Fork of Mohican River and Tributaries, Richland County, OH" This study was completed in January 1987.

The authority and acknowledgements for the Villages of Lexington, Lucas, Ontario, Plymouth, and Shiloh are not available because no FIS reports were published for these communities.

Countywide Analyses

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 Richland County into countywide format and analyses for approximate studies were performed by Stantec Consulting Services Inc. (Stantec) for FEMA under contract HSFE05-05-D-0026, Task Order 35. This work was completed on October 4, 2010.

The digital base mapping information was provided by the Richland County GIS Consortium, 35 N. Park St., Suite 230, Mansfield, Ohio, 44902. Further information about the base mapping is available by contacting the Consortium. Base Map data meet or exceed National Map Accuracy Standards.

Orthophotos were provided at a 6-inch resolution. Topographic information was provided in LiDAR mass points based on a 2005 flight. The LiDAR data has sufficient vertical accuracy to support the generation of 2-foot contours.

The coordinate system used for the production of the digital FIRMS was State Plane Ohio North (SPCS Zone 3401), referenced to the North American Datum of 1983.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. 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 incorporated communities within the boundaries of Richland County are shown in the following table. An intermediate meeting with officials of Richland County was held March 11, 1988, to review the draft Flood Insurance Study and floodplain and floodway boundaries as prepared by the Study Contractor.

Table 1 – CCO Meeting Dates for Pre-Countywide FISs

Community Name	Final CCO Date	Initial CCO Date
Bellville, Village of	Oct 8, 1990	Aug 18, 1992
Butler, Village of	Jan 31, 1986	Dec 15, 1988
Lexington, Village of	Not available	Not available
Lucas, Village of	Not available	Not available
Mansfield, City of	April 1983	Nov 15, 1984
Ontario, Village of	Not available	Not available
Plymouth, Village of	Not available	Not available
Richland County, (Unincorporated Areas)	Jan 31, 1986	Oct 10, 1989
Shelby, City of	Not available	Feb 24, 1988

For this countywide study, an initial CCO meeting was held on June 26, 2007, and was attended by representatives of FEMA, the Ohio Department of Natural Resources (ODNR), Richland County (Unincorporated Areas), Cities of Mansfield and Shelby; and Villages of Bellville, Crestline and Lexington. The results of the study were review at the final CCO meeting held on December 2, 2009, and attended by representatives from the Ohio Department of Natural Resources (ODNR), Richland County (Unincorporated Areas), Cities of Mansfield and Shelby; and Villages of Lexington, Plymouth and Ontario. All problems raised at that meeting have been addressed.

The following organizations were contacted to gather information for the pre-countywide FISs: FEMA; Richland County; Ohio Department of Natural Resources (ODNR); US Department of Agriculture - Soil Conservation Service (SCS); U.S. Bureau of Reclamation; Muskingum Watershed Conservancy District; and U.S. Geological Survey (USGS).

Flood data was provided by the U.S. Army Corps of Engineers (USCOE), Huntington District pertaining to local protection projects along parts of Rocky Fork and Touby Run. CSX Railroad and the Ohio Department of Transportation (ODOT) were contacted for bridge data used in the hydraulic analyses. Benatec Associates, original designers of the Clear Fork Dam on the Clear Fork Mohican River, were contacted regarding data for the dam and reservoir. Additional flood information was obtained from the 1982 study of flood problems along Rocky Fork above Longview Avenue (Reference 6). Information on past flooding problems was obtained from microfilm copies of the local Mansfield newspaper, the Mansfield New Journal.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Richland County, Ohio. Including the incorporated communities listed in Section 1.1 and unincorporated areas. This FIS is a compilation of previously effective FIS reports for the communities of Bellville, Butler, Mansfield and Shelby and unincorporated areas. Previously effective FIS reports were not available for the communities of Lexington, Lucas, Plymouth and Shiloh. A portion of Rocky Fork, previously within the unincorporated areas of Richland County, is now within the Village of Ontario.

Existing detailed studies were redelineated for all or portions of the flooding sources listed in Table 2. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRMs.

Table 2 – Streams Studied by Detailed Methods

Bear Run	Seltzer Park Creek
Black Fork Mohican	Seltzer Park Tributary
Clear Fork Mohican River	Touby Run
East Branch Bear Run	Tuby Run
Hartman Bargaheiser Ditch	Upper Tuby Tributary
Lower Tuby Tributary	West Branch
Painters Creek	West Branch Bear Run
Rocky Fork	West Branch Tributary

New engineering analysis has been performed on all approximate study streams. These streams are listed in Table 3.

Table 3 – Streams Studied By Approximate Method

Bear Run
Black Fork Mohican River
Black Fork Mohican River Tributary14
Black Fork Mohican River Tributary 18
Black Fork Mohican River Tributary 22
Black Fork Mohican River Tributary 32
Black Fork Mohican River Tributary 33
Black Fork Mohican River Tributary 37
Black Fork Mohican River Tributary 37.1
Black Fork Mohican River Tributary 42
Black Fork Mohican River Tributary 43
Brubaker Creek
Brubaker Creek Tributary 1
Brubaker Creek Tributary 1.2
Cedar Fork
Cedar Fork Tributary 4
Cedar Fork Tributary 6
Cedar Fork Tributary 8
Clear Creek
Clear Fork Mohican River
Clear Fork Mohican River Tributary 1.1
Clear Fork Mohican River Tributary 2
Clear Fork Mohican River Tributary 19
Clear Fork Mohican River Tributary 20
Clear Fork Mohican River Tributary 27.1.2
Clear Fork Mohican River Tributary 31
Friends Creek
Honey Creek
Honey Creek Tributary 2
Leatherwood Creek
Lost Run
Markle Run Tributary 3.1.1
Markle Run Tributary 3.1.2.1
Marsh Run
Marsh Run Tributary 1
Marsh Run Tributary 1.2
Marsh Run Tributary 3
Marsh Run Tributary 3.1
Painters Creek
Painters Creek Tributary 1
Possum Run
Ritters Run
Rocky Fork
Rocky Fork Tributary 5
Rocky Fork Tributary 7
Rocky Fork Tributary 8
Rocky Fork Tributary 11
Rocky Fork Tributary 13
Rocky Fork Tributary 15
Rocky Fork Tributary 15.1
Rocky Fork Tributary 20
Sandusky River
Sandusky River Tributary 2
Seltzer Park Tributary
Shipp Creek
Shipp Creek Tributary 3
Slater Run
Smoky Run
Southwest Branch Vermilion River
Switzer Creek
Toby Run
Touby Run
Tuby Run
Upper Tuby Tributary
Unnamed Tributary 1
Unnamed Tributary 1.1
West Branch
West Branch Bear Run
West Branch Huron River
West Branch Huron River Tributary 3
West Branch Huron River Tributary 3.1
West Branch Huron River Tributary 3.2
Whetstone Creek

The areas studied by detailed methods in previous FIS report were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through March 1993. Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation. The scope and methods of study were proposed to and agreed upon by FEMA and Richland County.

Table 4 – Limits of Detailed Studies (from Prior Studies)

Flooding Source	Limits of Detailed Study
Bear Run	Meyers Road to Mouth at Black Fork Mohican River
Black Fork Mohican River	River Mile 7.25 to Plymouth-Springmill Road and City of Shelby
Clear Fork Mohican River	Clear Fork Dam to River Mile 21 above mouth; and Villages of Butler and Bellville
East Branch Bear Run	River Mile 0.72 to Mouth at Bear Run
Hartman Bargaheiser Ditch	River Mile 1.8 to City of Shelby Corporate Limits (School Lane) and City of Shelby
Lower Tuby Tributary	River Mile 0.84 to Mouth at Tuby Run
Painters Creek	Confluence with Rocky Fork to just downstream of Grace Street
Rocky Fork	City of Mansfield Corporate Limits to Interstate 71 and City of Mansfield
Seltzer Park Creek	River Mile 3.5 to City of Shelby Corporate Limits and City of Shelby
Seltzer Park Tributary	River Mile 1.3 to mouth at Seltzer Park Creek
Touby Run	Bowman Street to Confluence with Rocky Fork

Table 4 – Limits of Detailed Studies (from Prior Studies)
(Continued)

Flooding Source	Limits of Detailed Study
Tuby Run	River Mile 3.6 to City of Shelby Corporate Limits (Vernon Road) and City of Shelby
Upper Tuby Tributary	River Mile 0.83 to Mouth at Tuby Run
West Branch	River Mile 1.5 to City of Shelby Corporate Limits and City of Shelby
West Branch Bear Run	Smiley Road East to Mouth at Bear Run and City of Shelby
West Branch Tributary	River Mile 0.96 to Mouth at West Branch

This FIS also incorporates the letters of determination issued by FEMA resulting in Letters of Map Revision (LOMRs) and Letters of Map Amendment (LOMAs). LOMRs and mappable LOMAs that are incorporated into the countywide FIS are shown in Table 5.

Table 5 – Incorporated LOMRs

Community	Flooding Source	Date Issued	Type	Case No.
City of Mansfield	Rocky Fork Tributary 15	04/23/1990	102	199102156FIA
City of Shelby	Tuby Run at Vernon Rd.	06/01/1999	102	99-05-061P

LOMAs incorporated for this study are summarized in the summary of Maps Actions (SOMA) include in the Technical Support Data Notebook (TSDN) associated with this FIS. Copies of The TSDN may be obtained from the community Map Repository.

2.2 Community Description

Richland County is in north-central Ohio and is bordered by Huron County on the north, Ashland County on the east, Knox County on the south, and Morrow and Crawford

Counties on the west. The major highways serving the county are Interstate 71, U.S. Route 36, and State Routes 13, 39, 95, 30, and 546. The county is also served by CSX Railroad. The estimated 2008 population is 124,999 (Reference 7).

Richland County is on the southern boundary of the Wisconsin glaciation area. The soils of the county have been classified into 11 soil associations. The majority of the northern portion of Richland County consists of the Bennington-Cardington association, while most of the southern portion of the county is in the Wooster-Canfield association. The Bennington-Cardington soils are nearly level to sloping, and somewhat poor to moderately well-drained. The Wooster-Canfield association consists of mostly sloping to steep, well-drained and moderately well-drained soils (Reference 8).

The climate of Richland County is classified as continental, characterized by large annual2 and day-to-day ranges of temperature. Summers are pleasant, with low humidity and temperatures rarely above 90 degrees Fahrenheit (°F). Winters produce cloudy skies and considerable snow flurry activity, with daytime temperatures rarely above 32°F. The mean annual precipitation for the county is 30.63 inches (Reference 9).

2.2.1 Village of Bellville

The Village of Bellville is in the south central part of Richland County and lies about 50 miles north of the City of Columbus, Ohio. The village is bordered on all sides by unincorporated areas of Richland County, Ohio. Principle highways which serve the area include State Routes 13 and 97. The estimated 2008population is 1,702 (Reference 7).

The headwaters of the Clear Fork Mohican River originate in Morrow and Richland Counties and flow into the Mohican River before reaching the Muskingum River.

Development in the Clear Fork Mohican River floodplain includes commercial structures located in the central portion of the village and in the vicinity of the Hines Avenue Bridge. A few residential structures are interspersed among them. Two large railroad bridges, from the abandoned rail line, remain in place across the Clear Fork Mohican River in the Village of Bellville.

2.2.2 Village of Butler

The Village of Butler is in southeast Richland County in north-central Ohio. It is situated about 50 miles north-northeast of the City of Columbus, Ohio, and approximately 70 miles southwest of the City of Cleveland, Ohio. The village is completely surrounded by the unincorporated areas of Richland County. The estimated 2008 population is 880 (Reference 7).

The Clear Fork Mohican River flows southeast through southern Richland County and crosses into the northern portion of the Village of Butler. The stream is 36.6 miles long with an average gradient of 11.0 feet per mile (Reference 10) and has a drainage area of 217 square miles (Reference 11).

2.2.3 City of Mansfield

The City of Mansfield is located in central Richland County, in north-central Ohio. It is situated about 60 miles north-northeast of Columbus, Ohio and about 70 miles southwest of Cleveland, Ohio. The city is bordered by the Village of

Ontario to the west. The rest of the city is completely surrounded by unincorporated areas of Richland County. The estimated 2008 population is 49,579 (Reference 7).

The extent of development within the flood plain of Mansfield is primarily limited to a few residences and private businesses and some redevelopment within the industrial complexes along Touby Run and Rocky Fork.

2.2.4 City of Shelby

The City of Shelby is in northwestern Richland County, which lies in north-central Ohio approximately 65 miles north of Columbus. Shelby is served by State Routes 39, 61, 96, and 314, and CSX railroad. The estimated 2008 population is 9,311 (Reference 7).

The headwaters of the Black Fork Mohican River lie just south of the City of Shelby. The main stem flows directly north through the center of the city with several small tributaries joining it along the way.

Previously effective FIS reports were not available for the communities of Lexington, Lucas, Ontario and Plymouth;, therefore no community description is provided.

2.3 Principal Flood Problems

Past flooding of the streams within Richland County indicates that flooding may occur during any season of the year. Major floods have resulted from both intense summer storms, and winter storms that are worsened when the rain is accompanied by melting snow.

A major flood also occurred on Tuby Run and Rocky Fork in March 1913. This event was estimated to be a 2- to 1-percent-annual-chance flood.

Flooding from the Black Fork Mohican River and its tributaries causes both urban and agricultural damage. Numerous commercial and residential properties would be damaged by a 1-percent-annual-chance flood.

2.3.1 Village of Bellville

Principal flood problems in the Village of Bellville result from overflow of the Clear Fork Mohican River. This flooding affects both sides of the stream from the undeveloped floodplain area in the northwest portion of the village to the moderately developed portions of the floodplain in the central and eastern portions of the village. The massive structures of the two railroad bridges constrict high flows and pose potential hazards during flood events.

The history of flooding within the community indicates that flooding can occur at any time of the year. Major floods have occurred in the village in 1959 and 1987. The July 1, 1987, flood resulted from a severe summer storm sequence from June 29 through July 2, 1987. The most intense part of the storm began on the morning of July 1 at 5:00 a.m. and lasted until 8:00 a.m. the next morning. Rainfall gaging stations at Marion, Galion, and Mansfield, Ohio, approximately 10 to 30 miles from Bellville, indicate at least 3.98 inches of rainfall occurred within a 27-hour period. This storm was preceded by 2.28 inches of rainfall on June 29 and 30. The Mansfield, Ohio, rainfall gage stations recorded 6.26 inches of precipitation for the period preceding July 1987 (References 12 and 13). On

February 6, 2008 Bellville schools were closed due to flooding caused by two inches of rain which fell overnight (Reference 14).

2.3.2 Village of Butler

Major floods occurred on the Clear Fork Mohican River in January 1959 and July 1987. The discharges associated with these events recorded at the USGS gage (No. 3-1320) at Butler, Ohio, were 14,300 cubic feet per second (cfs) and 21,300 cfs, respectively. These events were approximately 1- to 0.2-percent-annual-chance floods, respectively, and were based on flood discharge-frequency analyses at the gage (Reference 15).

2.3.3 City of Mansfield

Records of past flooding indicate that flooding may occur at Mansfield during any season of the year, but the more serious floods of this century have occurred during the winter and summer seasons.

A few of these more serious floods occurred in Mansfield in March 1913, June 1947, January 1959, July 1969, June 1981, July 1987 (Reference 16) and August 2007 (Reference 17). No discharges associated with any of these major floods were obtained for Painters Creek, so it is not possible to give an estimate of the return periods for these flood events for that stream. For Touby Run and Rocky Fork, the 1913 event was approximately a 2- to 1-percent-annual-chance flood. The 1959 flood was approximately a 10-percent-annual-chance flood (Reference 18). The ice blockage that occurred during the 1959 flood increased the flooding somewhat above that normally associated with a 10-percent-annual-chance flood event. From gaging station records on Touby Run, it is also estimated that the 1947 event on this stream was a 4-percent-annual-chance flood and the 1969 event was a 10-percent-annual-chance flood. No flood discharge records for the 1981 flood exist in the immediate Mansfield area, but records from adjacent streams indicate that discharges associated with this flood event were lower than those for the 1959 and 1969 flood events.

Past flooding in Mansfield has been primarily in the low-lying overbank areas along Rocky Fork throughout most of the city and along Touby Run from Bowman Street to the confluence with Rocky Fork. Development in these areas substantially decreases the conveyance of the floodplains. The Conrail Bridge over Rocky Fork near the confluence of Touby Run appears to restrict the flow in Rocky Fork and causes substantial backwater flooding upstream. The remaining bridges do not appear to be excessively restrictive.

2.3.4 City of Shelby

Flooding from the Black Fork Mohican River and its tributaries causes both urban and agricultural damage. Numerous commercial and residential properties would be damaged by a 1-percent-annual-chance flood. The City of Shelby encountered major flooding in 1913, 1959, 1987 and 2007 (Reference 19). The 2007 flood resulted in the need to demolish 19 homes (Reference 20).

Previously effective FIS reports were not available for the communities of Lexington, Lucas, Ontario, Plymouth and Shiloh; therefore no principal flood problems are provided.

2.4 Flood Protection Measures

The Clear Fork Dam on the Clear Fork Mohican River creates the Clear Fork Reservoir. This facility was not constructed for flood control purposes and therefore does not provide meaningful protection to the county. Nonstructural measures in the form of land use regulations for flood protection are being used to aid in the prevention of future damage.

2.4.1 Village of Bellville

Flood protection measures are not known to exist within the study area.

2.4.2 Village of Butler

Flood protection measures are not known to exist within the study area.

2.4.3 City of Mansfield

A levee exists at the wastewater treatment plant along Rocky Fork, however this levee is not accredited per NFIP requirements. Therefore, the area landward of the levee is mapped as a Special Flood Hazard Area (SFHA), as appropriate. Non-structural measures of flood protection are presently being used to aid in the prevention of future flood damage. These measures include regulations that control development in flood plain areas.

2.4.4 City of Shelby

Flood protection measures are not known to exist within the study area.

Previously effective FIS reports were not available for the communities of Lexington, Lucas, Ontario, Plymouth and Shiloh therefore no flood protection measures are provided.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1-, and 0.2- percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1-percent-annual-chance flood) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied by detail methods affecting the county.

This countywide FIS report includes information from previously published FIS reports where streams were studied in detail. This countywide FIS also included new information for streams studied by approximate methods.

Pre-Countywide

3.1.1 Detailed Studies

Peak discharge-frequency relationships obtained from the SCS Floodplain Management Study were established by valley flood routings computed using a SCS watershed model (Reference 21. This program uses the Modified Att-kin Reach Routing Method for stream and valley flood routing. The model was calibrated to match previous high-water marks and historical flood data

The 1-percent-annual-chance peak inflow at Clear Fork Dam was initially determined from the recommended estimating equation presented in Bulletin No. 45 (Reference 22. The estimating equation, however, does not reflect the influence of the maximum flood event on the Clear Fork Mohican River observed on July 1, 1987, at the Butler gage, located about 5 miles below the Village of Bellville. The 1-percent-annual-chance discharge from the recent frequency analysis provided by the USGS (Reference 15) at the gage is 19.5 percent greater than that obtained by the estimating equation at the gage. The estimating equation reservoir peak inflow was therefore adjusted by increasing it 19.5 percent to make it more consistent with the recent frequency analysis at the gage.

Peak inflow versus outflow data for Clear Fork Reservoir was obtained from hydrologic analyses made as part of an ODNR dam inspection (Reference 23). Nominal extrapolation of this data provided the 1-percent-annual-chance peak outflow resulting from the adjusted estimating equation derived peak inflow. A log-log plot of discharge versus drainage area was then developed from the peak reservoir outflow and the recent USGS frequency analysis at the gage.

This log-log plot was compared with data for the July 1987 flood event to determine if its results were reasonable. The USGS provided the peak discharge for the event at the gage (Reference 15). The City of Mansfield and the ODNR provided information on the approximate peak stage in Clear Fork Reservoir during the event. Applying this peak stage data to the spillway rating curve from the ODNR dam inspection yielded the estimated peak outflow. The gage flow and reservoir outflow, when added to the log-log plot, gave results generally parallel to the 1-percent-annual-chance plot. The 1-percent-annual-chance peak discharges at intermediate points along the Clear Fork Mohican River were therefore interpolated from the log-log plot.

Flood discharges for Painters Creek were determined using equations presented in Bulletin No. 45 (Reference 22).

Village of Bellville

No stream gaging stations exist in the Clear Fork Mohican River Basin.

Therefore, the flood frequency discharges were based on calculations and a series of curves developed for small drainage areas for the Clear Fork Mohican River basin, and the surrounding region. Natural discharge-frequency curves used were developed on a regional basis in accordance with the methods outlined in previous reports (References 24 and 25).

The flood discharge frequency analysis utilized standard computerized methodologies to analyze data from 13 gaging stations in the region. Of these stations, three were located in Richland County. Periods of record ("n") range from 30 to 70 years and represent drainage areas of 5.2 to 1,502 square miles. An "n" value of 60 years was adopted as being representative and was used in the computations.

The flood discharges for detailed streams were derived from generalized curves based on the stream gaging station at Greer, Ohio, and developed for the Mohican River and tributaries.

Village of Butler

The stream gage on the Clear Fork Mohican River in the village has a continuous period of record from 1944 through 1975. The 1-percent-annual-chance flood frequency peak discharge (10,500 cfs) given for this gage in ODNR Bulletin 45 (Reference 22) was revised by the USGS following the July 1987 event.

There is some change in drainage area of Clear Fork through the study reach. Transfer techniques recommended in the previously referenced Bulletin 45 were used in conjunction with the updated gage 1-percent-annual-chance peak discharge to determine discharges through the study reach.

City of Mansfield

Flood discharges for the detailed study reaches along Rocky Fork and Touby Run were provided by the USCOE, Huntington District related to a local protection project in the City of Mansfield (Reference 26). The data for Touby Run was developed from annual peak discharges recorded at a gaging station on Touby Run. Those for Rocky Fork were developed from analyses of the annual peak discharges recorded at 11 gaging stations on neighboring watersheds. From these analyses, generalized skew coefficients and relationships between the drainage area and the standard deviations and means of the annual peak discharges were developed. The skew coefficient, standard deviations, and means for the drainage areas of Rocky Fork at Mansfield that were studied were obtained from these generalized relationships. The log-Pearson Type III statistical distribution was then used, as recommended in the Interagency Advisory Committee on Water Data Bulletin No. 17B (Reference 24), to develop the peak discharge-frequency estimates for Rocky Fork.

Flood discharges for the remaining reaches studied were determined using the equations presented in ODNR Bulletin 45 (Reference 22). These equations are regionalized regression equations and, for the Mansfield area, relate the drainage area and channel slope to the peak discharge.

City of Shelby

Flood discharges were established by valley flood routings computed using the SCS watershed model "Project Formulation, Hydrology" (Reference 21). This

program uses the Modified Att-kin Reach Routing Method for stream and valley flood routing. The model was calibrated to match previous high-water marks and historical flood data.

A summary of the peak discharges for the detailed streams is included in the following Table 6.

Table 6 – Summary of Discharges for Detailed Studies

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Bear Run					
at mouth	8.40	1,560	2,010	2,180	2,600
Black Fork Mohican River					
at mouth	60.60	7,510	10,040	11,020	13,530
Clear Fork Mohican River					
just downstream of Slater Run	151.30	--[1]	--[1]	15,200	--[1]
just upstream of Slater Run	142.60	--[1]	--[1]	14,600	--[1]
just downstream of Smoky Run	142.30	--[1]	--[1]	14,600	--[1]
just upstream of Smoky run	136.00	--[1]	--[1]	14,100	--[1]
1,300 feet downstream of Hines Avenue	115.00	5,400	9,800	12,300	19,900
just downstream of Cedar Fork	112.00	--[1]	--[1]	11,700	--[1]
just upstream of Cedar Fork	64.40	--[1]	--[1]	7,020	--[1]
at Interstate 71	61.30	--[1]	--[1]	6,700	--[1]
at U.S. Route 42	51.20	--[1]	--[1]	5,680	--[1]
at Lexington Spring Mill Road	45.20	--[1]	--[1]	4,460	--[1]
just downstream of Clear Fork Dam	33.60	--[1]	--[1]	3,830	--[1]
East Branch Bear Run					
at mouth	1.30	450	610	670	810
Hartman Bargaheiser Ditch					
at mouth	0.90	240	320	350	430
Lower Tuby Tributary					
at mouth	0.60	140	190	210	260
Painters Creek					
at confluence with Rocky Fork	2.10	535	980	1,215	1,800
Rocky Fork					
at Interstate 71	54.30	--[1]	--[1]	7,100	--[1]
at County Route 424	38.80	--[1]	--[1]	5,700	--[1]
1,100 ft downstream of Painters Cr. confluence	34.40	2,400	4,000	4,850	7,200
just upstream of confluence of Touby Run	19.70	1,850	3,050	3,700	5,500
just upstream of U.S. Route 30	15.10	1,550	2,650	3,200	4,700
900 ft upstream of upstream Chessie System Br.	11.30	1,300	2,200	2,700	3,400

[1]Data not available

Table 6 - Summary of Discharges for Detailed Studies (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Seltzer Park Creek					
at mouth	3.50	1,020	1,400	1,540	1,860
Seltzer Park Tributary					
at mouth	1.20	400	550	600	740
Touby Run					
at confluence with Rocky Fork	9.80	1,170	1,980	2,400	3,580
Tuby Run					
at mouth	4.60	540	700	760	890
at confluence of Lower Tuby Tributary	2.40	330	430	500	600
Upper Tuby Tributary					
at mouth	0.40	80	110	120	140
West Branch					
at mouth	4.60	950	1,250	1,370	1,610
at confluence of West Branch Tributary	3.30	670	920	1,030	1,250
West Branch Bear Run					
at mouth	1.20	330	450	500	610
West Branch Tributary					
at mouth	0.80	250	350	380	470

Countywide

3.1.2 Approximate Studies

Hydrologic calculations were performed using the USGS StreamStats application for the State of Ohio (Reference 27) and processed using the methodology presented in USGS Scientific Investigations Report 2006-5312 (Reference 28).

Hydrologic calculations were performed using regression equations presented in SIR 2006-5312. The regression equations were developed using generalized least-squares (GLS) regression analyses on data from 305 gaging stations. The regression equations were developed to estimate flood discharges on unregulated streams based on the total-contributing drainage area, channel slope determined from the 10-85 method, percentage of drainage area as open water and wetlands, and hydrologic regional factors. Additional information about the model development is contained in USGS Water Resources Investigations Report (WRIR) 03-4164 (Reference 29).

Peak discharges for the 1-percent-annual-chance storm event for approximate study reaches were determined at various flow change locations. Flow change locations were set at the downstream limits, areas that were found to have an approximately 50% change in discharge value, and areas downstream of flow-regulating structures along a study reach. The 1-percent-annual-chance peak discharge values were determined using regression equations or best available data from existing gages, dams, or FISs.

Two USGS gaging stations, Clear Fork at Butler and Touby Run at Mansfield are located on the study streams in Richland, County. One USGS gage, Black Fork below Charles Mill, is located in Ashland County upstream of a Richland County study stream.

Dams impacting study streams include the Clear Fork Reservoir Dam, Charles Mill Lake Dam, and Pleasant Hill Lake Dam. Dam outflow data obtained from the ODNR for the Clear Fork Reservoir Dam is consistent with the original 1-percent-annual-chance peak discharge downstream of the dam listed in the FIS. The Charles Mill Lake and Pleasant Hill Lake Dams are located in Ashland County but impact study streams in Richland County. A USGS gage downstream of Charles Mill Lake and outflow data for the dam obtained from the Muskingum Watershed Conservancy District was utilized to adjust the regression discharge for the approximate study reach of the Black Fork Mohican River, downstream of the dam. The 1-percent-annual-chance water-surface elevation for the Pleasant Hill Lake Dam obtained from Muskingum Watershed Conservancy District was utilized to map the upstream approximate study floodplain for the Clear Fork of the Mohican River.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table 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.

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

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the FIRMs.

This section includes information form previously published FIS reports where streams were studied in detail. It also includes new information for streams studied by approximate methods.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD). Elevation reference marks used in this study, and their descriptions, are shown on the FIRM.

Pre-Countywide

3.2.1 Detailed Studies

Photogrammetry was employed to obtain floodplain cross sections and pertinent bridge/roadway profiles on the Clear Fork Mohican River and Rocky Fork. The below-water portion of these selected cross sections and waterway openings of pertinent bridges was field measured. In many cases, these waterway openings were taken from available bridge plans. All other cross sections and dimensions of backwater-producing structures were obtained from field survey.

Roughness coefficients (Manning's "n") for the Clear Fork Mohican River and Rocky Fork were chosen based upon field observation of the stream and floodplain areas. For Rocky Fork, the channel value equaled 0.028 and the overbank values range from 0.042 to 0.084. The channel values for the Clear Fork Mohican River range from 0.035 to 0.040, and the overbank values range from 0.05 to 0.12.

All other roughness coefficients for channel and floodplain areas were based on field observations and developed using SCS guidelines (Reference 30).

A summary of the n-values used for the detailed streams is listed in the Table 7.

Table 7 – Manning's "n" Values

Stream	Channel	Overbanks
Bear Run	0.031 – 0.050	0.050 – 0.110
Black Fork Mohican River	0.035 – 0.045	0.050 – 0.120
East Branch Bear Run	0.062	0.080
Hartman Bargaheiser Ditch	0.031 – 0.036	0.040 – 0.100
Lower Tuby Tributary	0.037 – 0.057	0.080 – 0.120
Painters Creek	0.030 – 0.065	0.050 – 0.100
Rocky Fork	0.040 – 0.065	0.050 – 0.100
Seltzer Park Creek	0.026 – 0.072	0.040 – 0.120
Seltzer Park Tributary	0.077	0.080 – 0.120
Touby Run	0.040 – 0.070	0.060 – 0.120
Tuby Run	0.030 – 0.060	0.055 – 0.120
Upper Tuby Tributary	0.052 – 0.057	0.050 – 0.120
West Branch	0.032 – 0.047	0.075 – 0.080
West Branch Tributary	0.036	0.080
West Branch Bear Run	0.040	0.080

For the Clear Fork Mohican River, the ODNR had previously computed a flood profile at the Village of Bellville, Ohio (Reference 31). The ODNR also supplied an observed flood profile at Bellville for the July 1987 event (Reference 32). The starting water-surface elevation for the Clear Fork Mohican River study reach was determined by interpolation between those two flood profiles. The starting water-surface elevation for Rocky Fork and Painters Creek was determined using the slope-area method.

The step-backwater method was used to determine the 10-, 2-, 1-, and 0.2-percent-annual-chance flood profiles. For the Clear Fork Mohican River, Rocky Fork, and Painters Creek, the water-surface elevations and floodway widths were computed using the HEC-2 step-backwater computer program (Reference 33). Water-surface elevations for all other streams studied in detail were computed using the WSP-2 step-backwater computer program (Reference 34) and were compared to high-water marks and found to agree closely. The floodway widths for these streams were determined using SCS Technical Release No. 64 (Reference 35).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 2- and 1-percent-annual-chance flood elevations are close together, due to limitations of the profile scale, only the 1-percent-annual-chance flood profile has been shown.

Village of Bellville

Cross-section data and bridge dimensions for the hydraulic analyses were obtained by field surveys.

The profiles for the selected recurrence interval floods were computed using the USCOE HEC-2 step-backwater computer program (Reference 36). Starting water-surface elevations for the streams studied were developed using the slope-area method. Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment from field inspection of the channels and floodplain areas. Values ranged from 0.033 to 0.036 in the channel and from 0.05 to 0.06 in the overbank areas.

An attempt was made to calibrate the 1-percent-annual-chance flood discharge to the available high water mark data. Roughness coefficients (Manning's "n") of 0.036 for the channel and 0.06

for the overbank were required to approximate the high water marks. This appears to be reasonable since the storm occurred during the summer when foliage along the stream banks and floodplain had reached the maximum growth state.

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

Village of Butler

Photogrammetry was employed to obtain floodplain cross sections and the State Route 95 bridge/roadway profile. The below-water portion of selected cross sections and the State Route 95 Bridge was field surveyed. Other aspects of the State Route 95 bridge-waterway opening were taken from available bridge plans.

Channel and overbank roughness coefficients (Manning's "n") for the Clear Fork Mohican River were chosen based on field observation of the stream and floodplain areas. The channel "n" value is 0.052, while the overbank "n" values range from 0.075 to 0.180.

Water-surface elevations were computed using the HEC-2 step-backwater computer program (Reference 33). Starting water-surface elevations were determined using the slope-area method.

The rating curve for the gage station at Butler was revised by the USGS following the July 1987 flood. The water-surface elevation calculated at that gage for this report agrees with the gage height associated with the 1-percent-annual-chance discharge determined from the rating curve.

City of Mansfield

Cross sections for the backwater analyses for the detailed studies of Rocky Fork, Touby Run, and Painters Creek were obtained from field surveys and topographic mapping. For Rocky Fork upstream of U.S. Route 30 and for Painters Creek upstream of Ashland Road, all sections were field surveyed. For the remaining segments of Rocky Fork and Painters Creek and for all of Touby Run, representative channel sections were field surveyed and the overbank portion of the cross sections was obtained from 1981 aerial photographs and 1982 topographic mapping based on those photographs (Reference 37). All bridges and culverts were field surveyed to obtain elevation data and structural geometry. The USCOE, Huntington District, provided the cross-section data for Rocky Fork up to U.S. Route 30 and for Touby Run up to Mulberry Street (Reference 18). The USCOE also provided the 1982 topographic mapping and the bridge elevation data and structural geometry for Touby Run from Mulberry Street to Bowman Street (Reference 18).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on aerial photographs, field observations of the streams and flood plain areas, and published data for roughness factors of natural channels (References 38, 39, and 40).

For the detailed study reaches on Rocky Fork, Touby Run, and Painters Creek, water-surface elevations of floods of the selected recurrence intervals were computed through use of the USCOE HEC-2 step-backwater computer program (Reference 33).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Rocky Fork and Painters Creek were calculated using the slope-area method. Those for Touby Run were assumed to be equal to the flood elevations for the same flood event on Rocky Fork at the confluence with Touby Run.

During a 1-percent-annual-chance flood event, Touby Run overflows its banks downstream of

Mulberry Street. A portion of the floodwater cascades over the railroad tracks with 1 to 2 feet of head.

City of Shelby

Cross sections and dimensions of backwater-producing structures were obtained from field survey.

Channel and floodplain roughness factors (Manning's "n") used in the hydraulic computations were developed using the "Guide for Selecting Roughness Coefficient "n" Values for Channels" (Reference 30) and from field observation.

The floodway width was computed using the SCS "Floodway Determination Computer Program" (Reference 35). The floodway width was determined by equal conveyance.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 2- and 1-percent-annual-chance flood elevations are close together, due to limitations of the profile scale, only the 1-percent-annual-chance profile has been shown.

Countywide

3.2.2 Approximate Studies

For this Countywide FIS, hydraulic analyses were performed on the approximate study stream reaches to determine the water surface elevations for the 1-percent-annual-chance flood event. Water surface elevations were computed using the USCOE HEC-RAS 4.0.0. Cross-section geometric data was extracted from a Triangulated Irregular Network (TIN) created from 2005 Light Detection and Ranging (LIDAR) points obtained form the Richland County GIS Consortium.

Overbank Manning's "n" values were estimated from a 2001 National Land Cover Dataset of Ohio prepared by the USGS. Field reconnaissance was not performed. Channel "n" values were assumed to be 0.035. The overbank "n" values were extracted from GIS using HEC-GeoRAS 4.1. Table 8 shows the overbank Manning's "n" values used for each corresponding land use. These values were taken from Chow (Reference 40) and McCuen (Reference 41).

Table 8 – Roughness Coefficients (Manning's n-Values) for Approximate Studies

Land Cover	N-values
Open Water	0.04
Barren Land	0.03
Cultivated Crops	0.04
Deciduous Forest	0.10
Developed, High Intensity	0.08
Developed, Low Intensity	0.05
Developed, Medium Intensity	0.06
Developed, Open Space	0.04
Emergent Herbaceous Wetlands	0.05
Evergreen Forest	0.10
Grassland/Herbaceous	0.05
Mixed Forest	0.10
Pasture/Hay	0.05
Shrub/Scrub	0.05
Woody Wetlands	0.06

Reach boundary conditions were selected in accordance with FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, May 2005. The boundary conditions applied were either the known water-surface elevation taken from existing detailed studies or the normal depth at the most downstream end of each stream.

The Zone A lakes in Richland County were not modeled using HEC-RAS. Instead, the lakes were mapped to the 1-percent-annual-chance flood pool elevation based on data supplied by the ODNR – Division of Water and the Muskingum Watershed Conservancy District.

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 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 county must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between communities. Effective information for this countywide FIS was converted from NGVD29 to NAVD88 utilizing VERTCON (Reference 42). An average conversion of -0.508 from NGVD29 to NAVD88 was applied uniformly across the county to convert all effective BFEs and other profile elevations.

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 Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring, Maryland 20910 (Internet address http://www.ngs.noaa.gov).

All qualifying bench marks within a given jurisdiction that are cataloged by the Nation Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock).

- Stability B: Monuments which generally hold their position/elevation will (e.g., concrete bridge abutment).

- Stability C: Monuments which may be affected by surface ground movements (e.g. concrete monument blow frost line).

- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post).

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be place on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

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

It is important to note that 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 TSDN associated with this FIS and FIRM. Interested individuals my contact FEMA to access this data.

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 and Floodway Data table. 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

In order 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 and a Triangulated Irregular Network (TIN) created from LiDAR points that support the generation of 2-foot contours. The LiDAR was collected by the Richland County GIS Consortium in 2005.

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. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary was delineated.

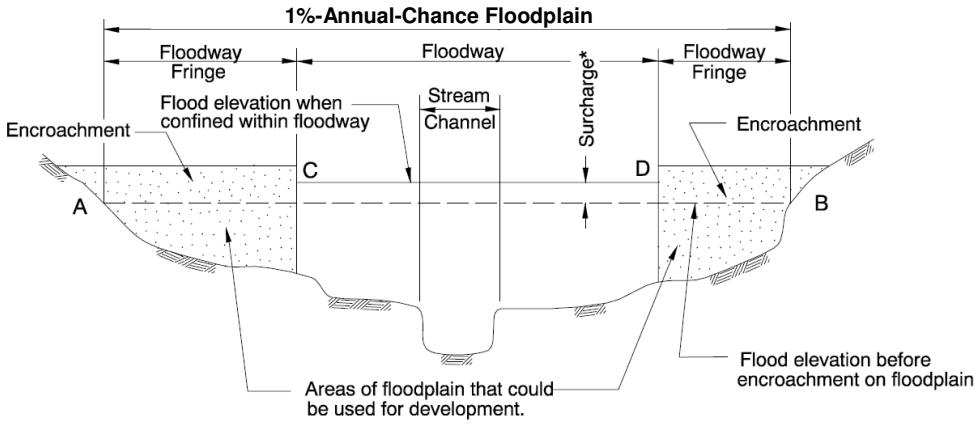
4.2 Floodways

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.

The floodway presented in this FIS report and on the FIRM was 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, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections shown in the Floodway Data Tables, Table 9. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are close together or collinear, only the floodway boundary has been shown.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross-sections is provided in Table 9. In order to reduce the risk of property damage in areas where the stream velocities are high, the jurisdiction may wish to restrict development in areas outside the floodway.

The area between the floodway and 1-percent-annual-chance floodplain boundary 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 1, Floodway Schematic.



Line A - B is the flood elevation before encroachment
Line C - D is the flood elevation after encroachment

*Surcharge is not to exceed 1.0 foot (FEMA requirement) or lesser amount if specified by state.

Figure 1 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BEAR RUN								
A	4,512	264	2256	1.0	1068.2	1068.2	1069.2	1.0
B	8,813	335	1633	1.3	1072.3	1072.3	1073.3	1.0
C	10,836	143	830	2.6	1076.6	1076.6	1077.6	1.0
D	12,411	123	646	3.4	1078.5	1078.5	1079.5	1.0
E	15,049	61	407	5.3	1083.6	1083.6	1084.6	1.0
F	17,452	117	728	3.3	1093.4	1093.4	1094.4	1.0
G	18,351	96	619	3.8	1096.0	1096.0	1097.0	1.0
H	21,024	134	738	3.2	1101.5	1101.5	1102.5	1.0
I	21,278	137	840	2.8	1102.3	1102.3	1103.3	1.0
J	24,178	75	523	4.3	1110.1	1110.1	1111.1	1.0
K	26,185	165	763	1.9	1114.4	1114.4	1115.4	1.0
L	28,068	50	274	5.2	1123.7	1123.7	1124.7	1.0
M	31,256	66	299	2.6	1132.6	1132.6	1133.6	1.0
N	33,054	32	179	4.3	1140.0	1140.0	1141.0	1.0
O	34,741	80	238	3.2	1148.0	1148.0	1149.0	1.0
P	35,204	42	207	3.7	1150.7	1150.7	1151.7	1.0
Q	37,267	171	556	1.4	1160.9	1160.9	1161.9	1.0
R	38,543	121	430	1.8	1168.1	1168.1	1169.1	1.0
S	39,429	123	297	2.6	1174.6	1174.6	1175.6	1.0

[1] FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

BEAR RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BLACK FORK MOHICAN RIVER								
A	80	159	1773	6.2	1066.9	1066.9	1067.9	1.0
B	2,391	571	7062	1.4	1072.6	1072.6	1073.6	1.0
C	6,087	964	12507	0.8	1073.3	1073.3	1074.3	1.0
D	7,560	645	7584	0.8	1073.4	1073.4	1074.4	1.0
E	9,049	785	7265	0.9	1073.5	1073.5	1074.5	1.0
F	11,721	311	2424	2.6	1074.3	1074.3	1075.3	1.0
G	15,762	468	3338	2.0	1078.6	1078.6	1079.6	1.0
H	16,749	330	2571	2.6	1079.0	1079.0	1080.0	1.0
I	17,098	102	1012	6.7	1079.5	1079.5	1080.5	1.0
J	17,968	137	1304	5.2	1082.3	1082.3	1083.3	1.0
K	19,673	60	744	9.3	1085.3	1085.3	1086.3	1.0
L	20,968	298	2596	2.1	1088.6	1088.6	1089.6	1.0
M	21,618	214	1887	2.9	1088.8	1088.8	1089.8	1.0
N	22,977	126	1344	4.1	1089.8	1089.8	1090.8	1.0
O	24,283	279	1892	2.9	1090.9	1090.9	1091.9	1.0
P	24,779	291	1847	3.0	1091.3	1091.3	1092.3	1.0
Q	25,040	209	1582	3.6	1092.3	1092.3	1093.3	1.0
R	25,861	427	2173	2.6	1093.5	1093.5	1094.5	1.0
S	27,148	86	732	6.1	1096.5	1096.5	1097.5	1.0
T	28,937	237	1182	3.8	1099.5	1099.5	1100.5	1.0
U	30,464	254	1356	3.3	1102.3	1102.3	1103.3	1.0
V	34,113	185	1110	4.2	1111.5	1111.5	1112.5	1.0
W	35,948	82	659	7.1	1117.8	1117.8	1118.8	1.0
X	36,905	145	1291	3.6	1122.7	1122.7	1123.7	1.0

[1] FEET ABOVE PLYMOUTH-SPRINGMILL ROAD

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

BLACK FORK MOHICAN RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEAR FORK MOHICAN RIVER								
A	23,827	1125	5770	2.4	1067.1	1067.1	1068.0	0.9
B	52,442	312	2929	4.2	1117.2	1117.2	1117.9	0.7
C	53,436	992	5757	2.1	1118.1	1118.1	1118.8	0.7
D	53,891	899	2606	4.7	1119.3	1119.3	1119.3	0.0
E	54,771	330	1467	8.4	1120.2	1120.2	1120.2	0.0
F	55,931	117	1075	11.4	1123.2	1123.2	1123.5	0.3
G	56,549	320	2420	5.1	1128.7	1128.7	1128.7	0.0
H	57,258	456	4258	2.9	1129.3	1129.3	1129.4	0.1
I	58,536	390	4084	3.0	1129.5	1129.5	1129.7	0.2
J	59,474	212	3013	4.1	1130.5	1130.5	1130.8	0.3
K	59,935	325	2552	4.6	1130.5	1130.5	1131.5	1.0
L	61,759	610	3790	3.1	1132.0	1132.0	1133.0	1.0
M	63,005	240	2214	5.4	1134.1	1134.1	1134.6	0.5
N	64,668	465	2963	4.0	1136.8	1136.8	1137.7	0.9
O	69,241	700	6591	1.1	1138.4	1138.4	1139.3	0.9
P	71,887	520	2003	3.5	1138.9	1138.9	1139.6	0.7
Q	76,961	375	2707	2.6	1149.0	1149.0	1149.6	0.6
R	80,138	240	1418	5.0	1152.3	1152.3	1153.0	0.7
S	82,334	600	3208	2.2	1154.6	1154.6	1155.5	0.9
T	86,210	620	3707	1.7	1156.3	1156.3	1157.2	0.9
U	91,216	775	4299	1.4	1157.6	1157.6	1158.6	1.0
V	95,198	865	3527	1.7	1159.8	1159.8	1160.8	1.0
W	106,235	90	736	7.0	1171.7	1171.7	1172.3	0.6

[1] FEET ABOVE PLEASANT HILL ROAD

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR FORK MOHICAN RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLEAR FORK MOHICAN RIVER (CONTINUED)								
X	109,814	325	1431	3.1	1177.3	1177.3	1177.3	0.0
Y	112,555	140	1116	4.0	1178.6	1178.6	1178.7	0.1
Z	114,604	43	432	9.2	1180.1	1180.1	1180.2	0.1

[1]FEET ABOVE PLEASANT HILL ROAD

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

CLEAR FORK MOHICAN RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
EAST BRANCH BEAR RUN								
A	1,516	64	226	2.9	1109.2	1109.2	1110.2	1.0
B	2,746	47	157	4.3	1117.5	1117.5	1118.5	1.0
C	3,671	137[2]	167	4.0	1123.2	1123.2	1124.2	1.0

[1]FEET ABOVE CONFLUENCE WITH BEAR RUN [2]FLOODWAY WIDTH is EQUAL TO WIDTH OF 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

EAST BRANCH BEAR RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
HARTMAN BARGAHEISER DITCH								
A	1,916	130	753	0.5	1083.4	1083.4	1084.4	1.0
B	2,273	167	864	0.4	1083.5	1083.5	1084.5	1.0
C	2,826	22	116	3.1	1084.0	1084.0	1085.0	1.0
D	3,718	38	134	2.6	1084.7	1084.7	1085.7	1.0
E	4,898	91	322	1.1	1088.6	1088.6	1089.6	1.0
F	5,695	34	129	2.7	1090.0	1090.0	1091.0	1.0
G	6,460	20	84	4.2	1092.0	1092.0	1093.0	1.0
H	7,814	24	113	3.1	1096.4	1096.4	1097.4	1.0
I	7,899	24	113	3.1	1096.4	1096.4	1097.4	1.0

[1]FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

HARTMAN BARGAHEISER DITCH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LOWER TUBY TRIBUTARY								
A	478	24	75	2.8	1109.7	1109.7	1110.7	1.0
B	1,961	31	125	1.7	1111.8	1111.8	1112.8	1.0
C	3,143	24	101	2.1	1113.4	1113.4	1114.4	1.0

[1] FEET ABOVE CONFLUENCE WITH TUBY RUN

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

LOWER TUBY TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
PAINTERS CREEK								
A	330	46	230	5.3	1138.7	1135.8[2]	1136.0	0.2
B	796	58	153	7.9	1139.7	1139.7	1139.8	0.1
C	1,053	50	319	3.8	1147.1	1147.1	1147.2	0.1
D	1,375	35	168	7.2	1148.2	1148.2	1148.3	0.1
E	2,568	105	419	2.9	1151.0	1151.0	1151.7	0.7
F	3,593	38	182	6.7	1157.1	1157.1	1157.4	0.3
G	4,507	72	312	3.9	1163.5	1163.5	1164.1	0.6
H	5,303	60	202	6.0	1170.2	1170.2	1170.7	0.5
I	6,186	36	195	6.2	1178.2	1178.2	1178.2	0.0
J	6,393	32	240	5.1	1180.7	1180.7	1180.7	0.0

[1]FEET ABOVE CONFLUENCE WITH ROCKY FORK [2]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM ROCKY FORK

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

PAINTERS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCKY FORK								
A	353	124	1397	5.1	1122.7	1122.7	1122.7	0.0
B	2,832	98	656	10.8	1128.6	1128.6	1128.6	0.0
C	6,372	186	1211	5.0	1134.2	1134.2	1134.2	0.0
D	9,091	95	1135	5.3	1135.5	1135.5	1135.5	0.0
E	13,265	90[2]	918	6.5	1137.5	1137.5	1137.7	0.2
F	14,511	96	954	5.1	1138.5	1138.5	1139.5	1.0
G	15,591	102	1168	4.2	1139.7	1139.7	1140.7	1.0
H	17,101	79	804	6.0	1141.1	1141.1	1141.9	0.8
I	18,107	84	879	5.5	1142.3	1142.3	1143.2	0.9
J	18,931	72	817	5.9	1143.9	1143.9	1144.4	0.5
K	19,419	83	887	5.5	1145.5	1145.5	1145.5	0.0
L	19,914	112	847	5.7	1146.2	1146.2	1146.3	0.1
M	21,116	101	993	4.9	1148.3	1148.3	1148.5	0.2
N	22,345	150	1202	3.1	1150.9	1150.9	1151.5	0.6
O	23,385	430	3762	1.0	1151.1	1151.1	1152.0	0.9
P	24,077	440	3171	1.2	1151.2	1151.2	1152.1	0.9
Q	24,983	288	1601	2.3	1151.5	1151.5	1152.5	1.0
R	25,583	520	2791	1.3	1151.9	1151.9	1152.9	1.0
S	26,674	800	5740	0.6	1151.9	1151.9	1152.9	1.0
T	27,715	847	6961	0.5	1151.9	1151.9	1152.9	1.0
U	29,045	850	5821	0.5	1152.0	1152.0	1153.0	1.0
V	30,509	565	3357	0.9	1152.1	1152.1	1153.1	1.0

[1]FEET ABOVE INTERSTATE HIGHWAY 71 [2]FLOODWAY IS WIDTH OF 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

ROCKY FORK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCKY FORK (CONTINUED)								
W	31,774	150	657	4.6	1155.0	1155.0	1155.2	0.2
X	32,452	175	1224	2.5	1156.4	1156.4	1156.7	0.3
Y	32,856	275	1654	1.8	1156.8	1156.8	1157.2	0.4
Z	33,372	400	2112	1.4	1156.9	1156.9	1157.6	0.7
AA	34,195	400	1040	2.6	1156.9	1156.9	1157.7	0.8
AB	35,220	400	2111	1.3	1157.6	1157.6	1158.5	0.9

[1] FEET ABOVE INTERSTATE HIGHWAY 71

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

ROCKY FORK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SELTZER PARK CREEK								
A	472	87	680	2.3	1088.8	1088.8	1089.8	1.0
B	667	36	335	4.6	1088.8	1088.8	1089.8	1.0
C	951	46	372	4.1	1092.7	1092.7	1093.7	1.0
D	1,240	58	386	4.0	1092.8	1092.8	1093.8	1.0
E	1,543	142	1074	1.4	1094.4	1094.4	1095.4	1.0
F	2,285	110	786	2.0	1094.7	1094.7	1095.7	1.0
G	2,499	128	758	2.0	1094.8	1094.8	1095.8	1.0
H	3,204	35	210	7.3	1096.2	1096.2	1097.2	1.0
I	3,732	26	148	10.4	1098.9	1098.9	1099.9	1.0
J	4,674	34	191	8.0	1102.7	1102.7	1103.7	1.0
K	5,527	32	195	7.9	1106.5	1106.5	1107.5	1.0
L	7,002	35	219	7.0	1111.5	1111.5	1112.5	1.0
M	7,787	32	209	7.4	1114.3	1114.3	1115.3	1.0
N	7,905	68	538	2.9	1121.0	1121.0	1122.0	1.0
O	8,581	93	898	1.7	1121.2	1121.2	1122.2	1.0
P	8,759	195	2007	0.6	1123.4	1123.4	1124.4	1.0
Q	10,960	308	2093	0.5	1125.7	1125.7	1126.7	1.0
R	12,486	221	1052	0.9	1126.5	1126.5	1127.5	1.0
S	14,184	172	586	1.7	1128.7	1128.7	1129.7	1.0
T	15,104	68	231	1.3	1129.3	1129.3	1130.3	1.0
U	16,056	68	224	1.3	1131.1	1131.1	1132.1	1.0
V	18,121	43	136	2.2	1134.2	1134.2	1135.2	1.0

[1] FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

SELTZER PARK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SELTZER PARK TRIBUTARY								
A	2,160	106	396	1.5	1133.3	1133.3	1134.3	1.0
B	3,755	192	323	1.9	1138.8	1138.8	1139.8	1.0
C	5,279	238	1374	0.4	1150.6	1150.6	1151.6	1.0

[1] FEET ABOVE CONFLUENCE WITH SELTZER PARK CREEK

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

SELTZER PARK TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TOUBY RUN								
A	555	96	575	4.2	1151.0	1151.0	1151.0	0.0
B	1,091	210	1112	2.2	1153.0	1153.0	1153.0	0.0
C	2,423	260	1032	2.3	1154.9	1154.9	1155.7	0.8
D	2,821	170	712	3.4	1156.4	1156.4	1156.9	0.5
E	3,127	96	571	4.2	1157.7	1157.7	1158.2	0.5
F	3,636	140	543	4.4	1158.5	1158.5	1159.2	0.7
G	4,141	225	687	3.5	1159.8	1159.8	1160.6	0.8
H	5,002	50	329	7.3	1163.2	1163.2	1164.0	0.8
I	5,411	44	281	8.5	1166.3	1166.3	1166.6	0.3

[1] FEET ABOVE CONFLUENCE WITH ROCKY FORK

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

TOUBY RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TUBY RUN								
A	755	50	467	1.6	1089.8	1089.8	1090.8	1.0
B	1,411	62	329	2.3	1090.1	1090.1	1091.1	1.0
C	1,813	31	261	2.9	1090.5	1090.5	1091.5	1.0
D	2,278	128	835	0.9	1097.5	1097.5	1098.5	1.0
E	2,945	124	918	0.8	1097.8	1097.8	1098.8	1.0
F	3,337	53	446	1.7	1097.9	1097.9	1098.9	1.0
G	5,149	79	292	2.6	1100.8	1100.8	1101.8	1.0
H	6,588	48	250	3.0	1102.9	1102.9	1103.9	1.0
I	6,818	137	722	1.0	1103.1	1103.1	1104.1	1.0
J	11,981	24	136	3.6	1112.2	1112.2	1113.2	1.0
K	16,050	68	273	1.8	1119.0	1119.0	1120.0	1.0
L	18,301	104	389	1.3	1120.8	1120.8	1121.8	1.0

[1]FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

TUBY RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
UPPER TUBY TRIBUTARY								
A	2,874	20	73	1.6	1109.4	1109.4	1110.4	1.0
B	4,349	26	103	1.1	1112.3	1112.3	1113.3	1.0

[1] FEET ABOVE CONFLUENCE WITH TUBY RUN

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

UPPER TUBY TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WEST BRANCH								
A	766	156	920	1.5	1094.9	1094.9	1095.9	1.0
B	1,424	34	299	4.6	1095.2	1095.2	1096.2	1.0
C	3,154	40	287	4.8	1098.4	1098.4	1099.4	1.0
D	4,302	44	256	5.3	1101.4	1101.4	1102.4	1.0
E	5,444	30	245	5.6	1103.8	1103.8	1104.8	1.0
F	6,896	30	208	4.9	1106.4	1106.4	1107.4	1.0
G	7,456	38	208	4.9	1109.4	1109.4	1110.4	1.0

[1] FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

WEST BRANCH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WEST BRANCH BEAR RUN								
A	1,743	158	923	0.5	1068.4	1068.4	1069.4	1.0
B	2,734	108	382	1.3	1069.2	1069.2	1070.2	1.0
C	3,857	59	180	2.8	1072.0	1072.0	1073.0	1.0
D	4,532	24	91	5.5	1076.5	1076.5	1077.5	1.0
E	6,236	30	145	3.5	1086.2	1086.2	1087.2	1.0
F	8,774	39	132	3.8	1093.8	1093.8	1094.8	1.0
G	9,857	28	104	4.8	1100.3	1100.3	1101.3	1.0
H	11,337	36	156	3.2	1103.4	1103.4	1104.4	1.0

[1] FEET ABOVE CONFLUENCE WITH BEAR RUN

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

WEST BRANCH BEAR RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET/SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WEST BRANCH TRIBUTARY								
A	943	40	238	1.6	1104.7	1104.7	1105.7	1.0
B	1,713	91	265	1.4	1106.5	1106.5	1107.5	1.0
C	2,859	32	132	2.9	1110.0	1110.0	1111.0	1.0
D	4,422	34	113	3.4	1115.7	1115.7	1116.7	1.0

[1] FEET ABOVE CONFLUENCE WITH WEST BRANCH

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH AND INCORPORATED AREAS

FLOODWAY DATA

WEST BRANCH TRIBUTARY

5.0 INSURANCE APPLICATION

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 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-depths derived from the detailed hydraulic analyses are shown 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 than 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.

6.0 FLOOD INSURANCE RATE MAP

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

The FIRM for Richland County is, for insurance purposes, the principal result of the FIS. This map (published separately) contains the official delineation of flood insurance zones and BFE line. BFE lines how the locations of the expected whole-foot WSELs of the base flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

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 Richland County. 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, up to and including this countywide FIS, are presented in Table 10.

7.0 OTHER STUDIES

This FIS supersedes previously printed FIS reports for Richland County, Ohio. This FIS also supersedes the Flood Boundary and Floodway Maps for Richland County that were printed as part of previous FIS reports. The information on the Flood Boundary and Floodway Maps has been added to the FIRM accompanying this FIS. 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 FEMA, Mitigation Division, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605 or visiting their website: http://www.fema.gov/.

Future revisions may be made that do not result in the republishing of the FIS report. To ensure that any user is aware of all revisions, it is advisable to contact the map repository of the flood hazard data located in the community.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
Bellville, Village of	August 1, 1975	None	March 16, 1989	September 12, 1993
Butler, Village of	July 25, 1975	September 15, 1978	November 15, 1989	None
Lexington, Village of	October 18, 1974	August 1, 1975 October 20, 1978	September 28, 1979	February 27, 1981
Lucas, Village of	April 5, 1974	September 26, 1975 June 24, 1977	September 1, 1993	None
Mansfield, City of	May 17, 1974	October 17, 1975 March 2, 1979	January 3, 1986	None
Ontario, Village of	April 4, 2011	None	April 4, 2011	None
Plymouth, Village of	May 3, 1974	May 21, 1976	April 4, 2011	None
Richland County (Unincorporated Areas)	February 24, 1978	None	April 2, 1991	None
Shelby, City of	November 9, 1973	October 3, 1975	March 2, 1989	None
* Shiloh, Village of	N/A	None	N/A	None

*No Special Flood Hazard Areas Identified

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OHIO
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

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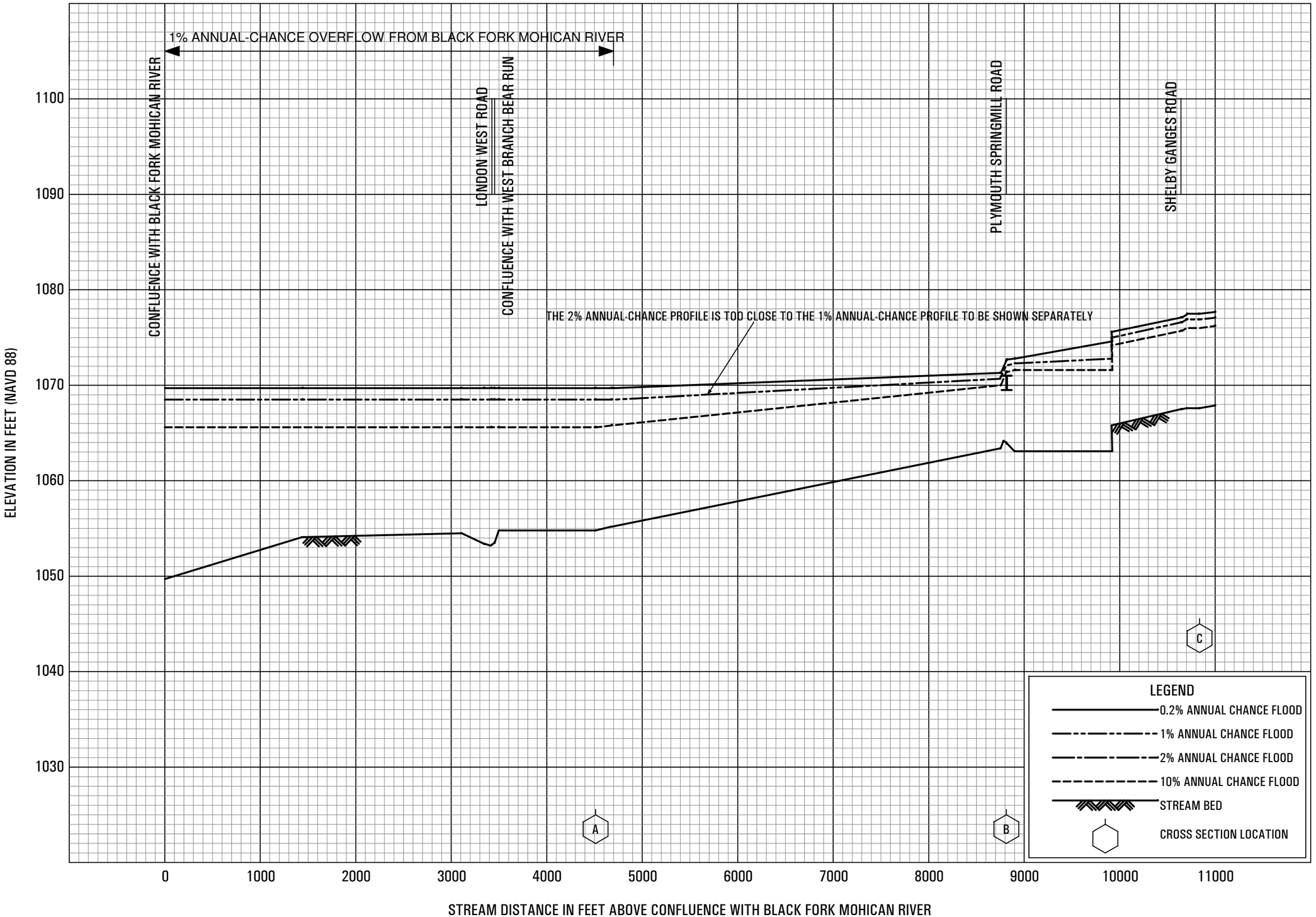

FLOOD PROFILES

BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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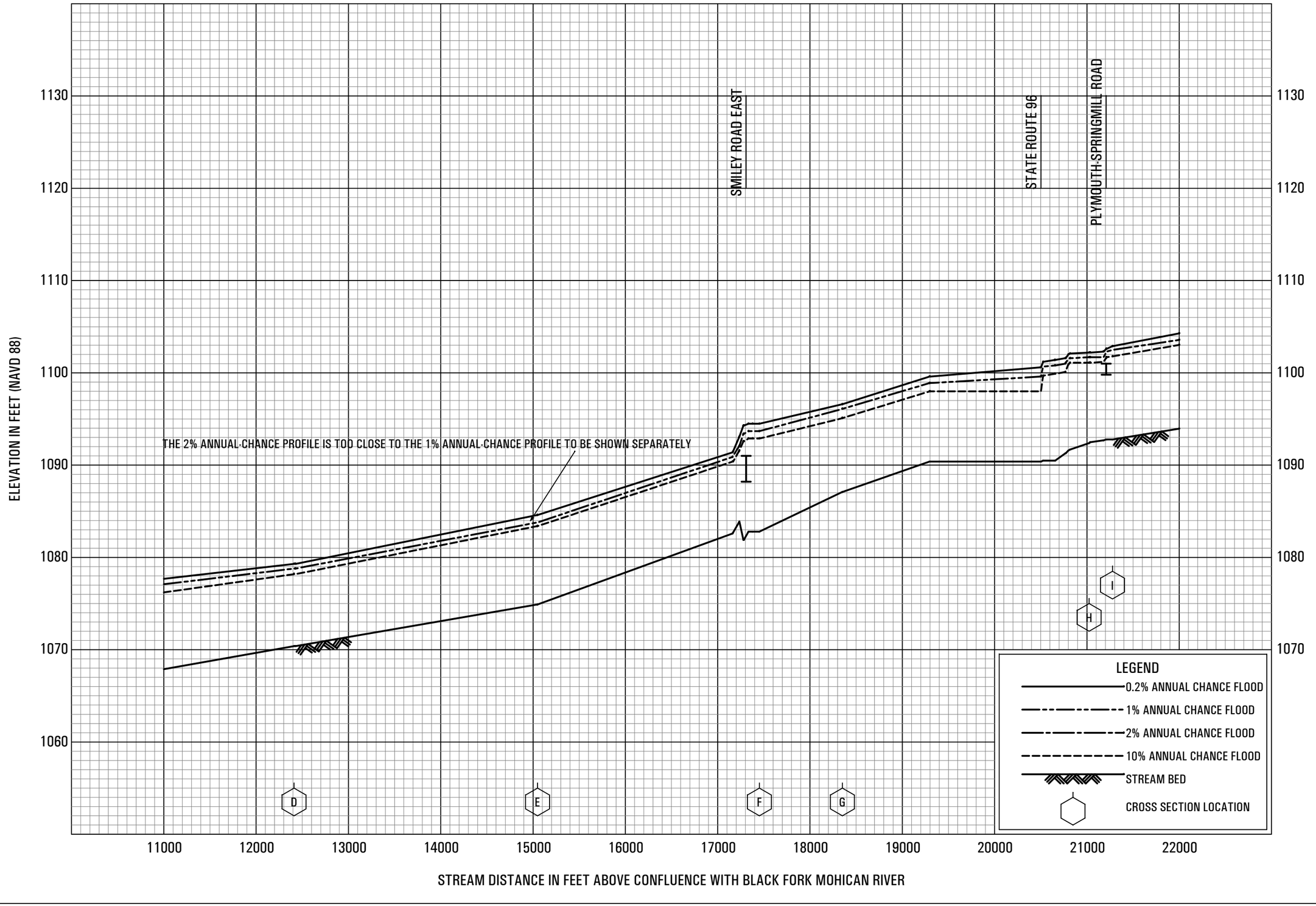

FLOOD PROFILES

BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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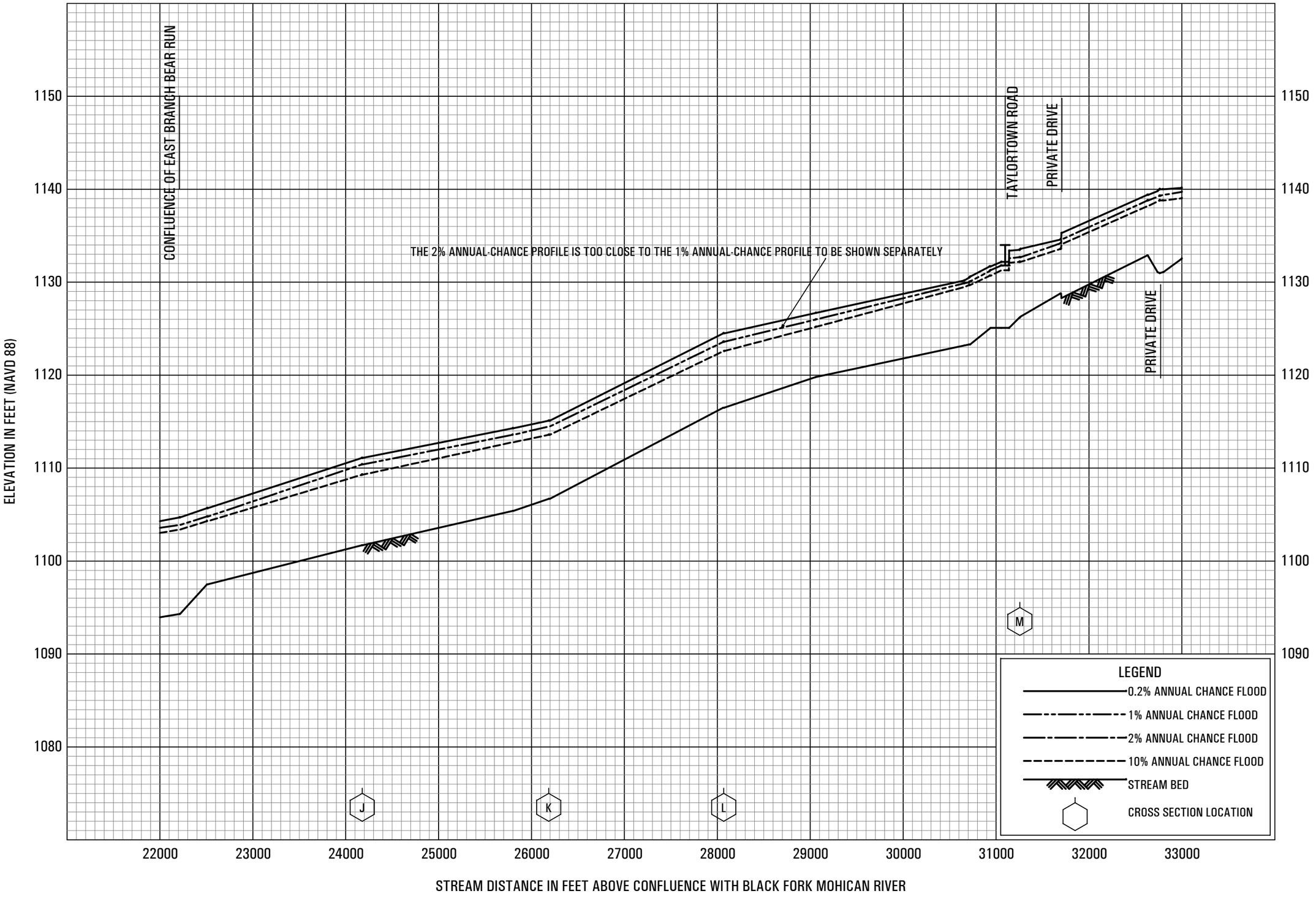

FLOOD PROFILES

BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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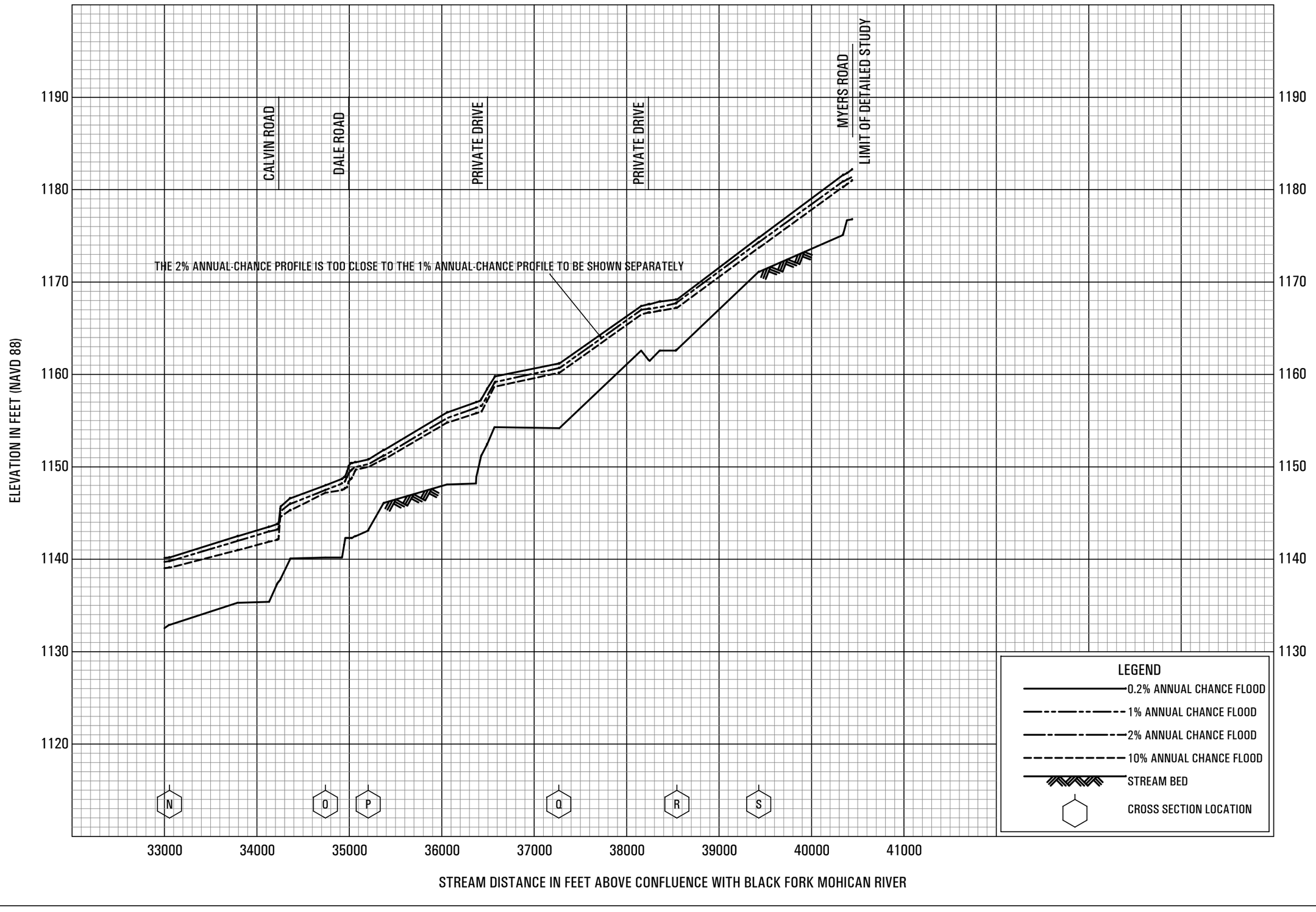

FLOOD PROFILES

BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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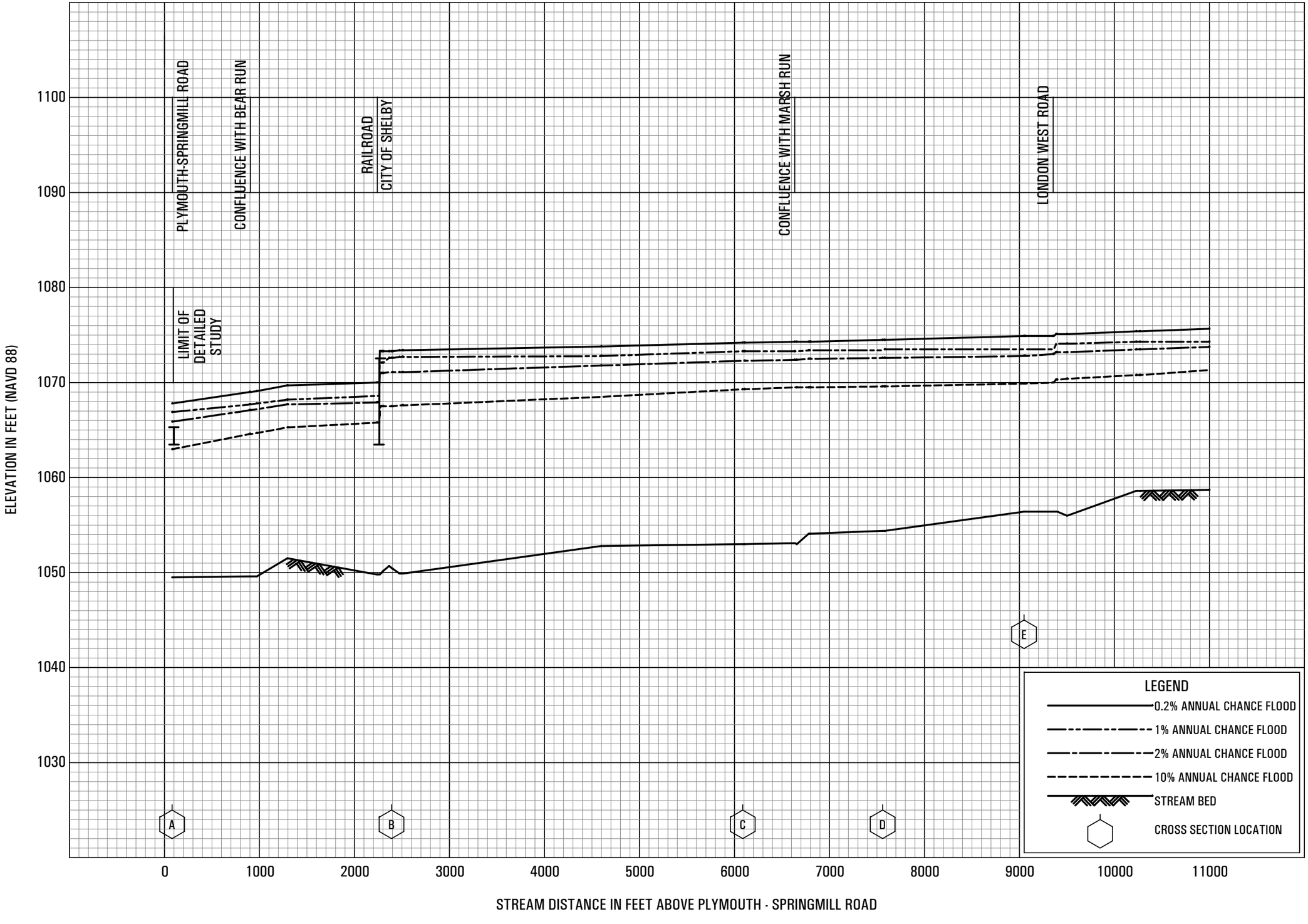

FLOOD PROFILES

BLACK FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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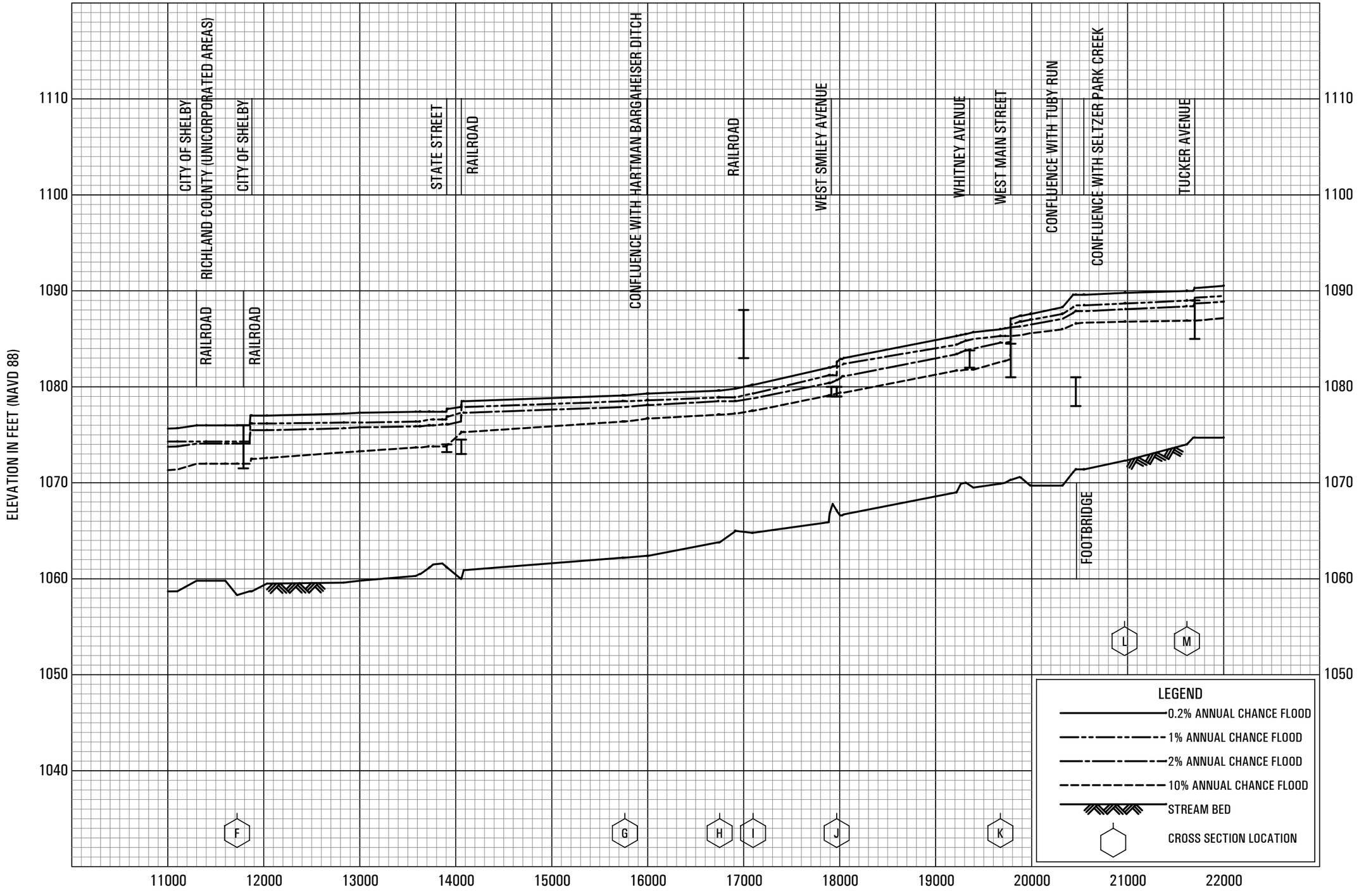
FLOOD PROFILES

BLACK FORK MOHICAN RIVER



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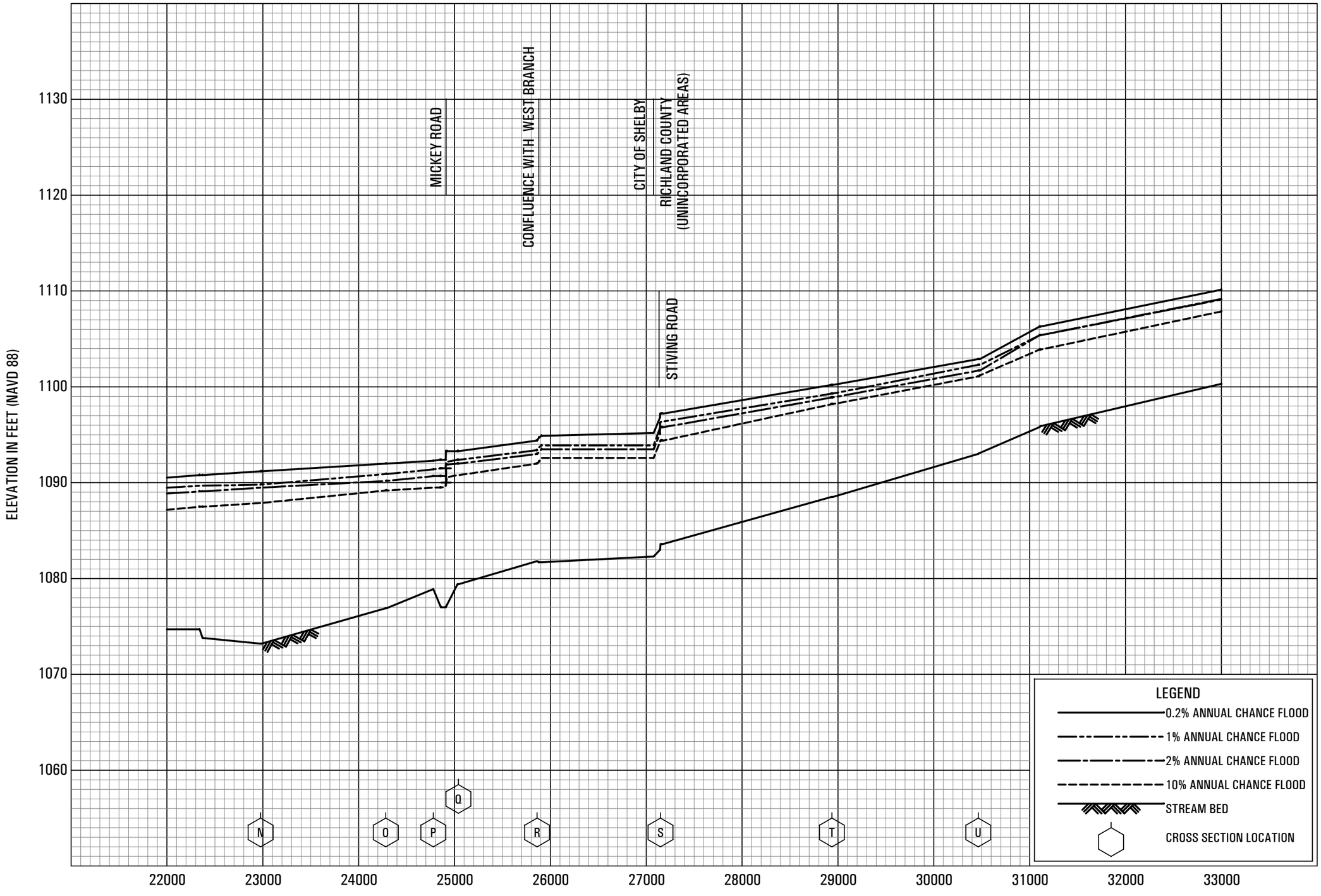
RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

BLACK FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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FLOOD PROFILES

BLACK FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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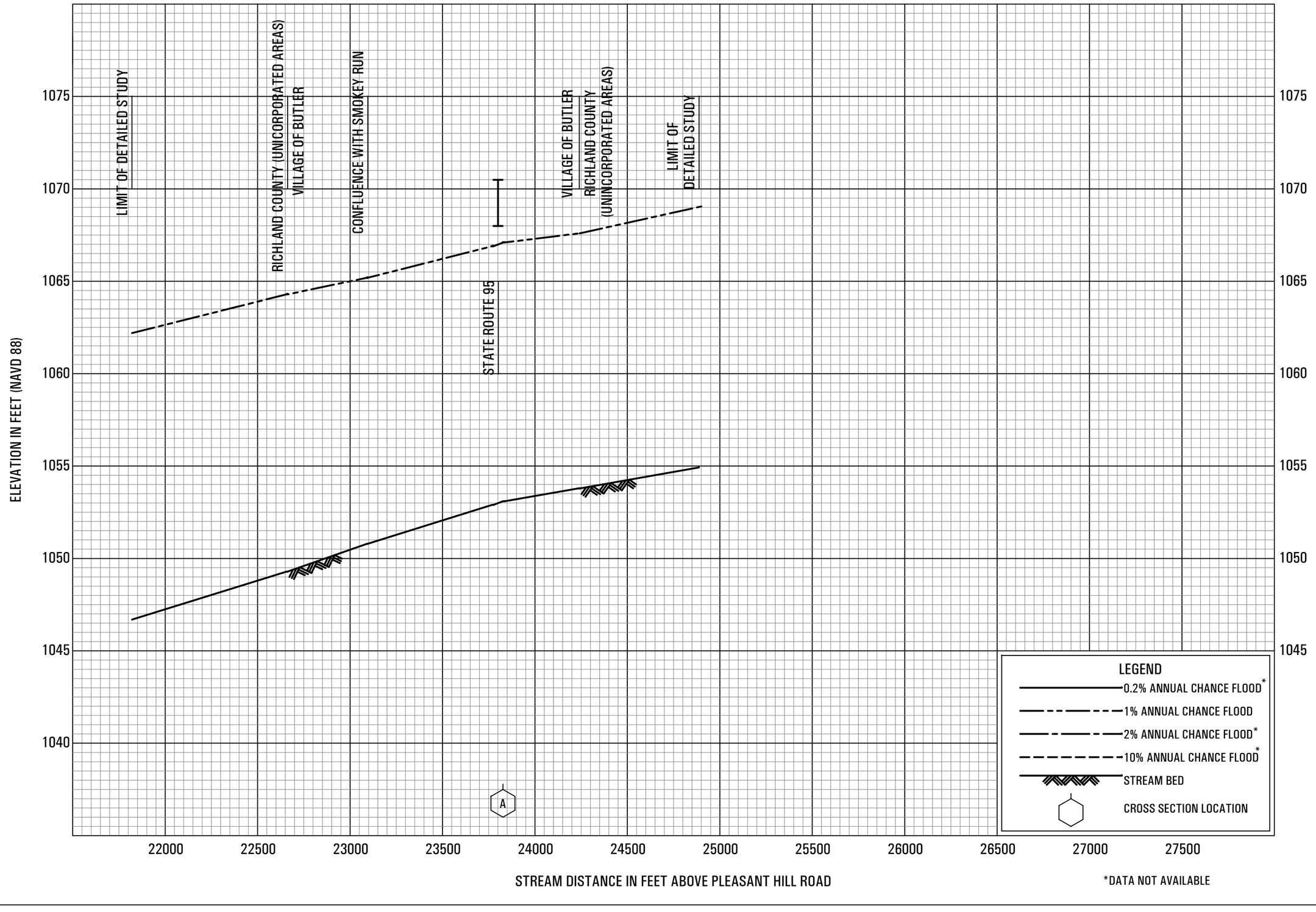


FLOOD PROFILES

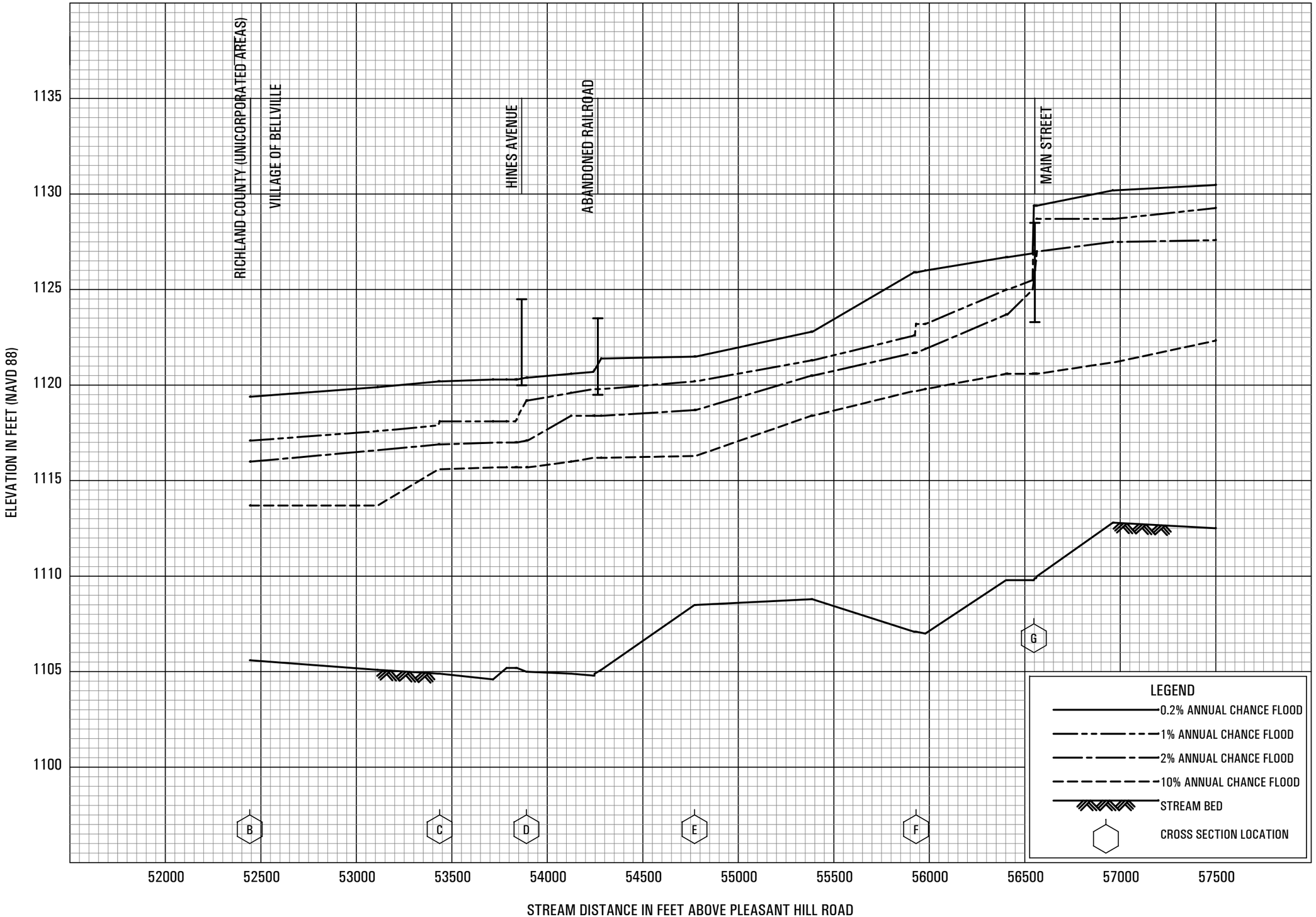
CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

09P



FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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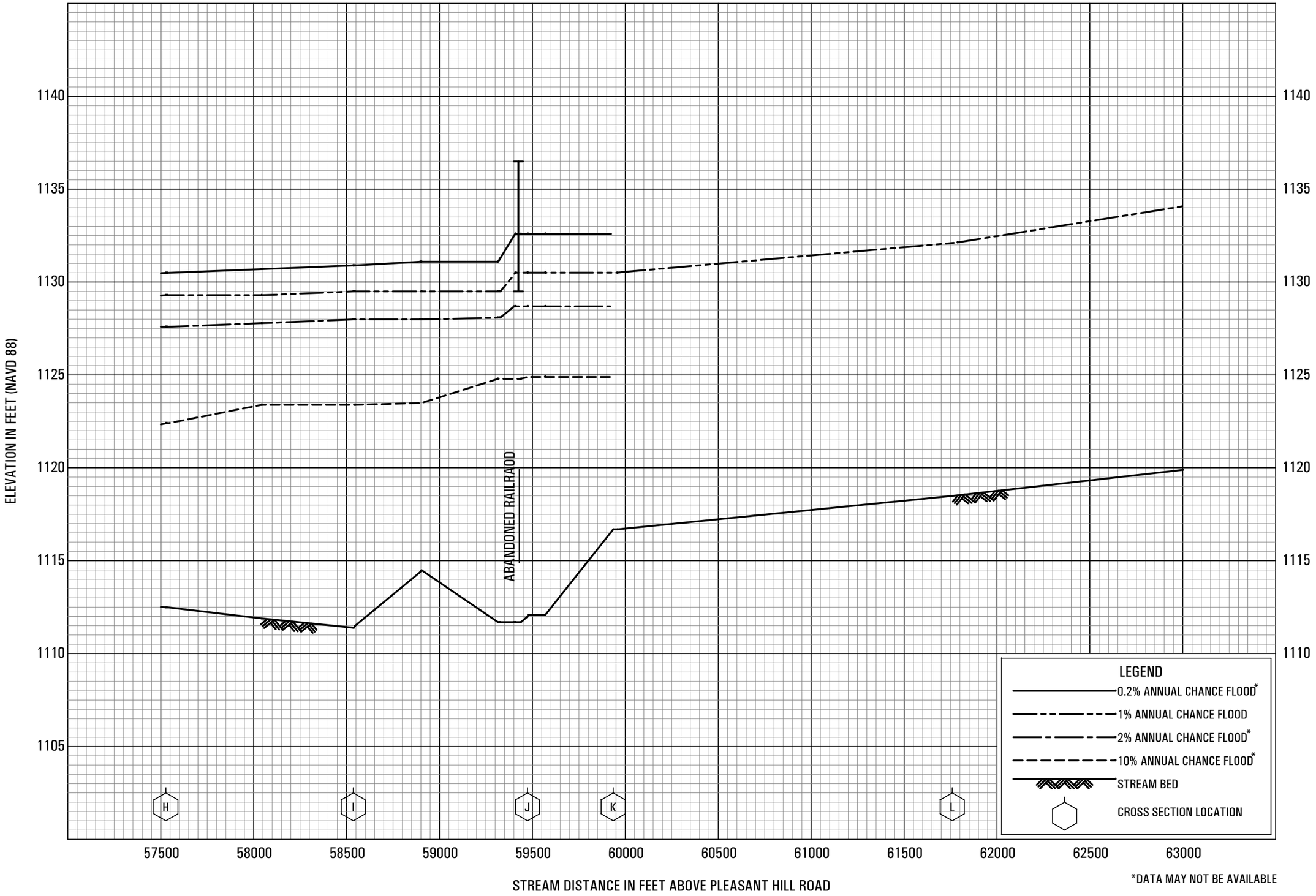


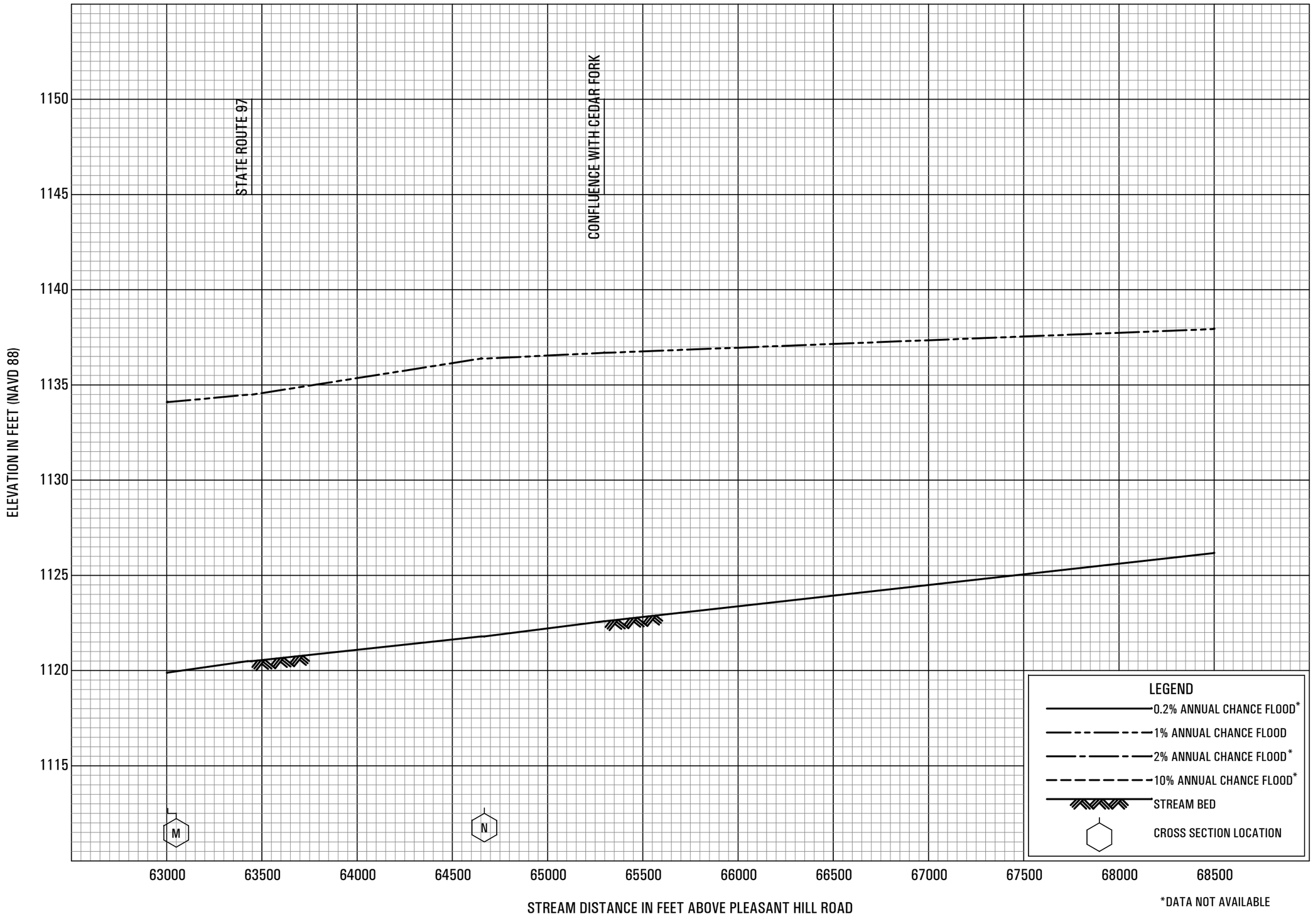
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



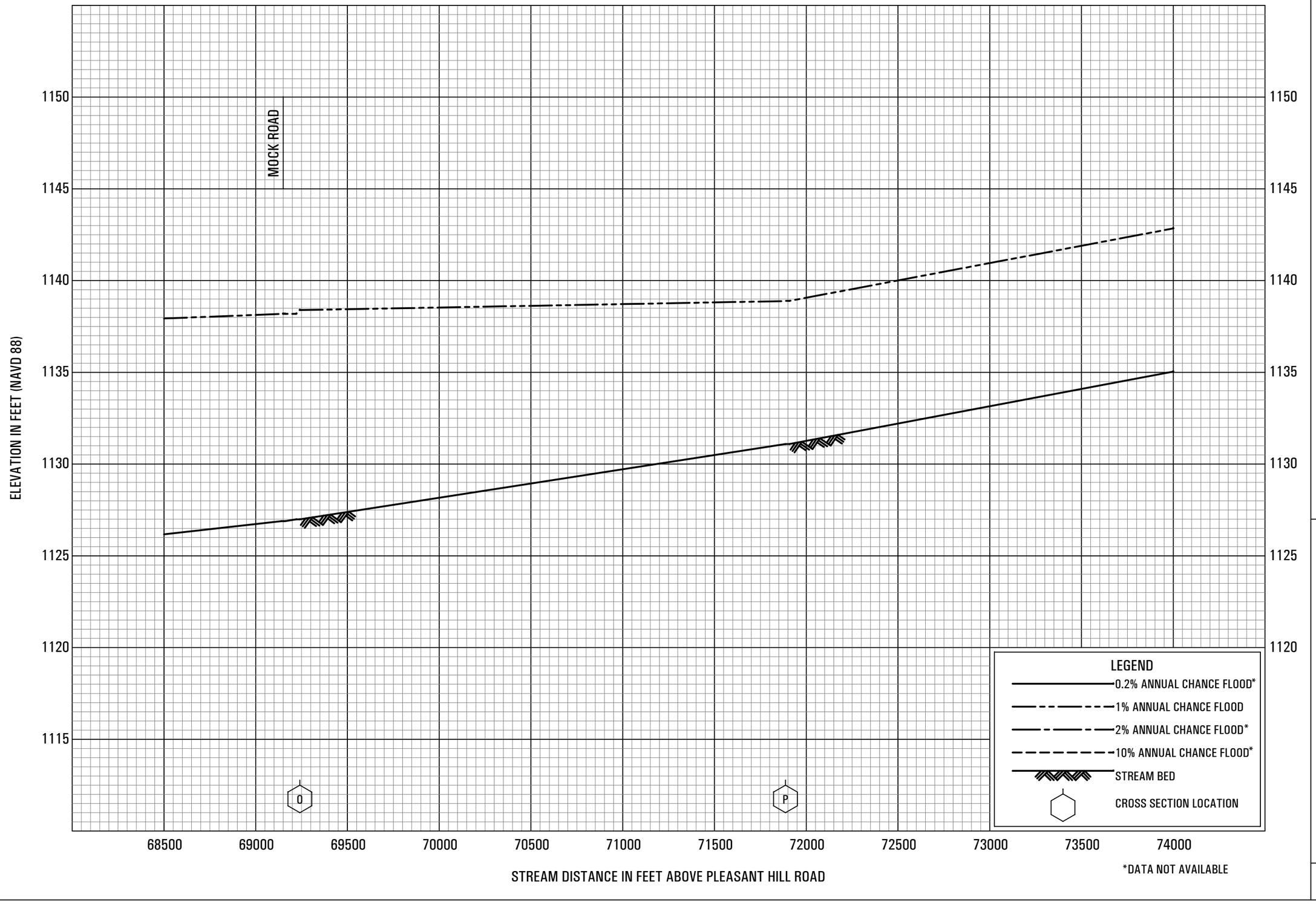
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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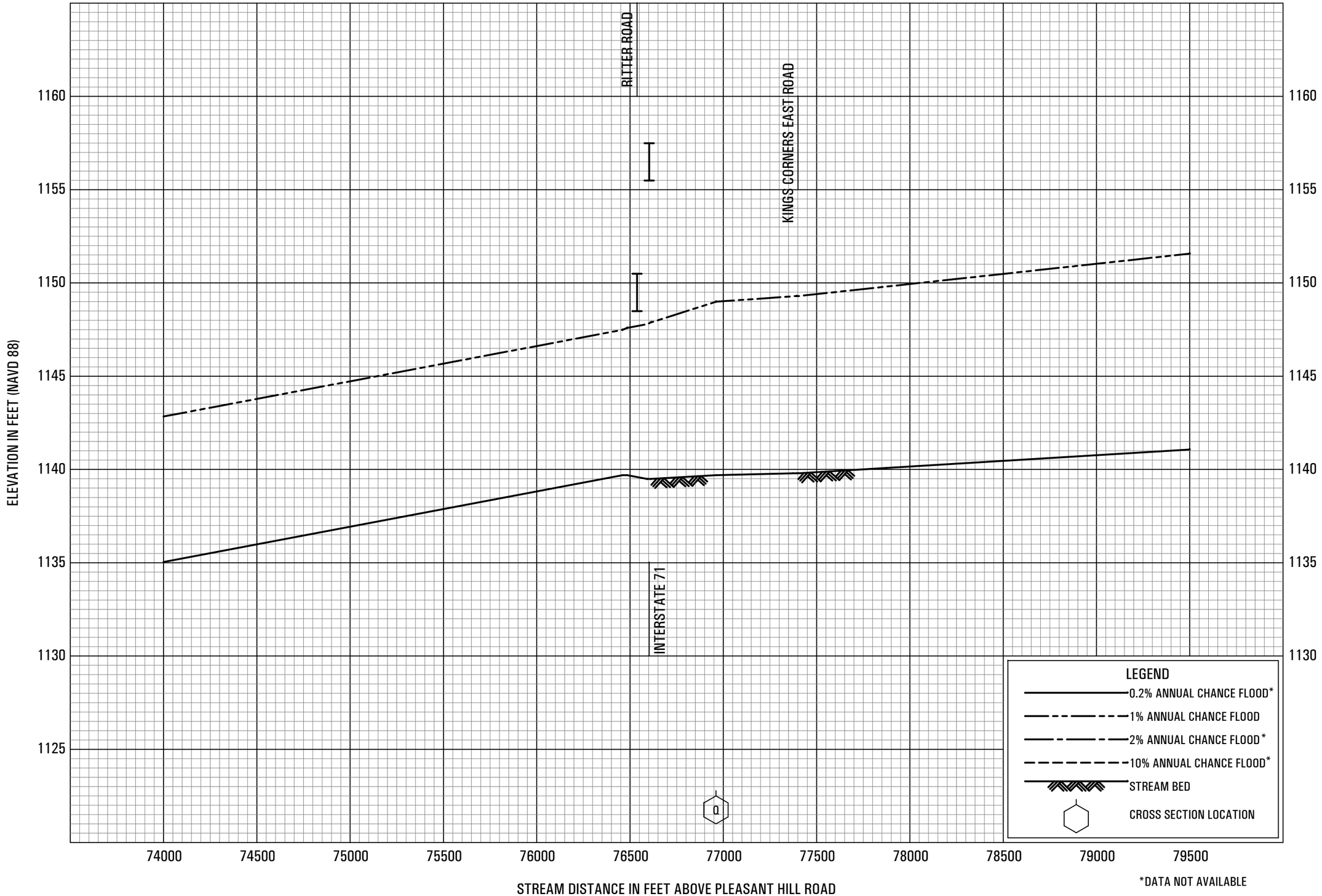


*DATA NOT AVAILABLE

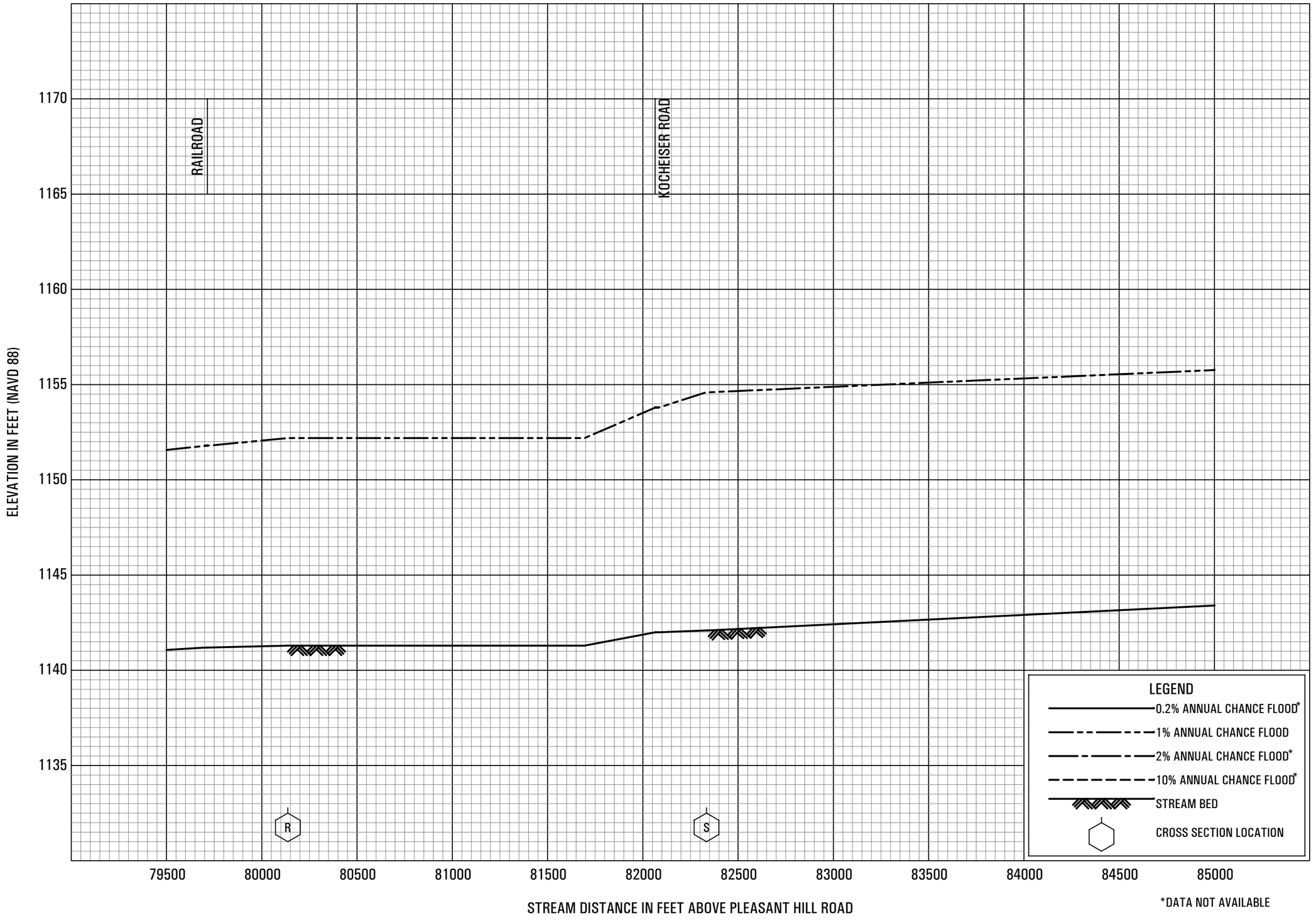
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



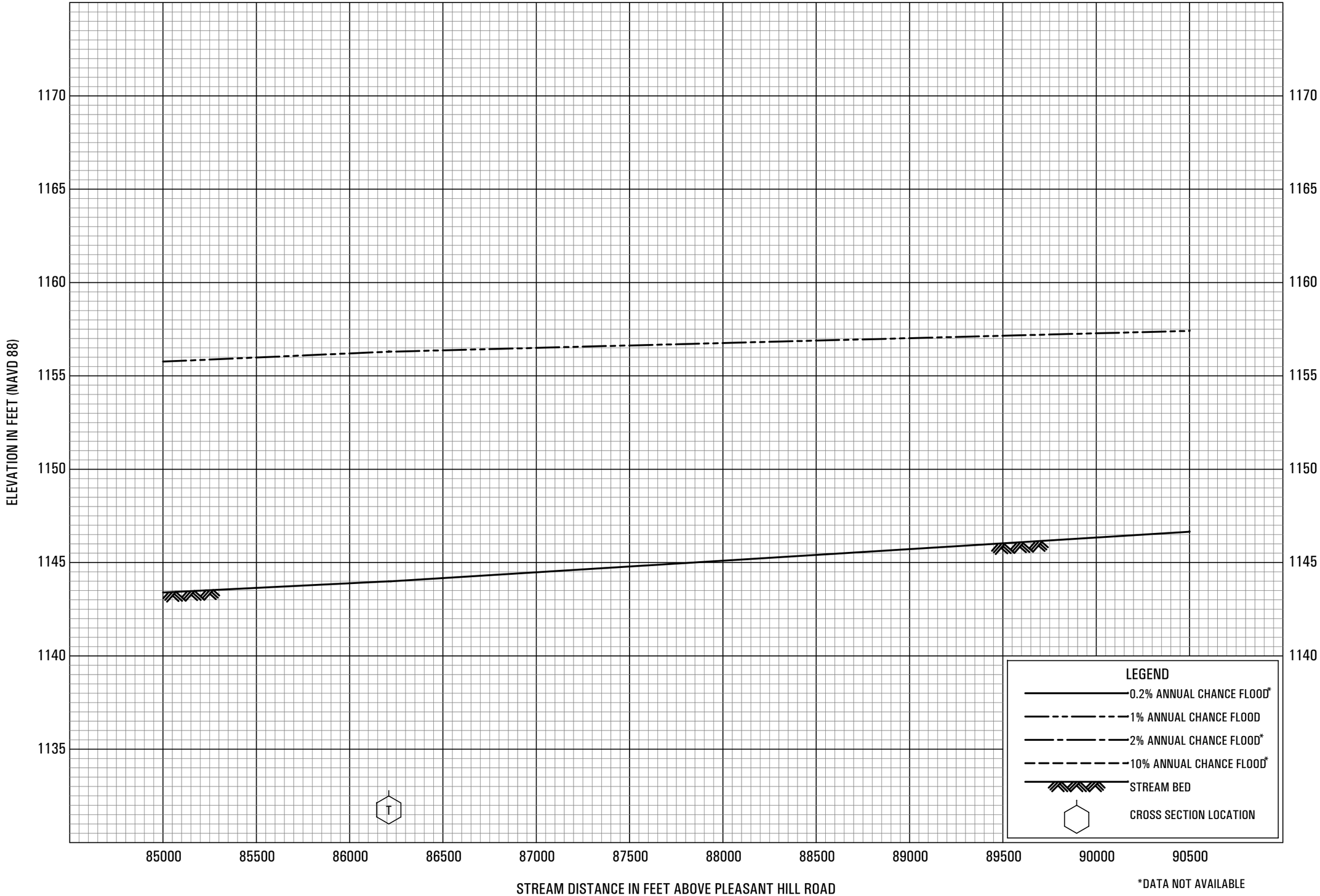
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

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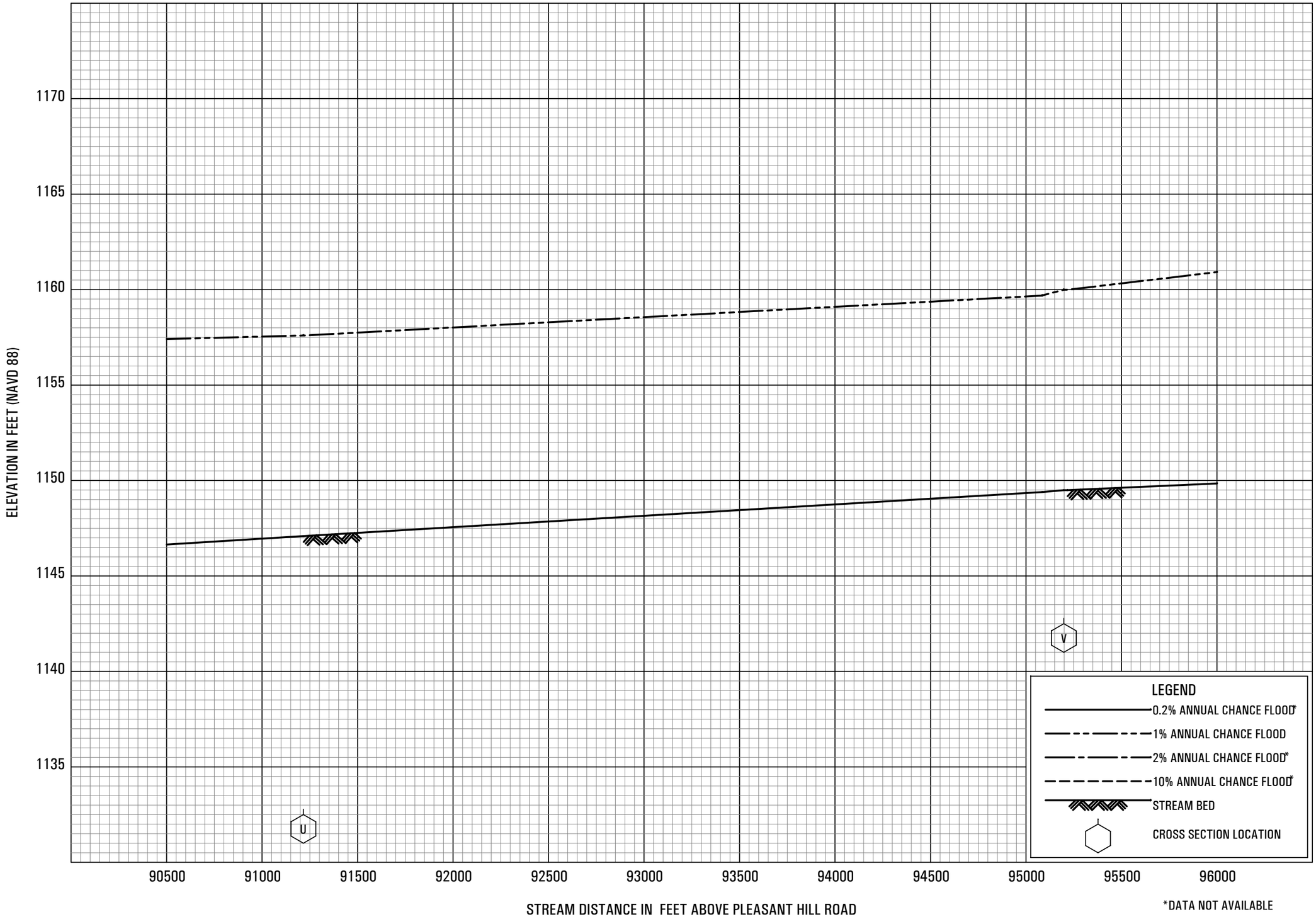


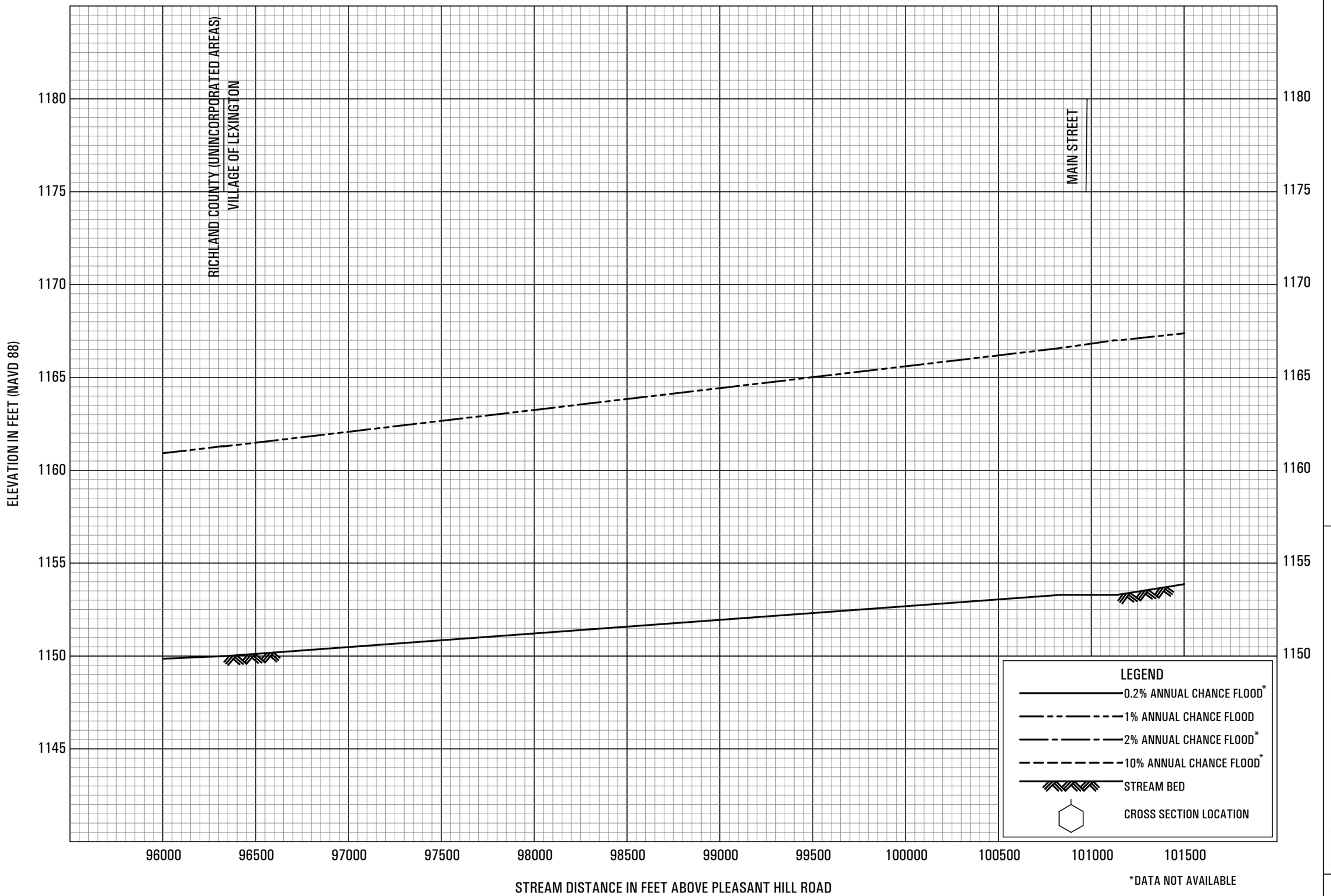
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



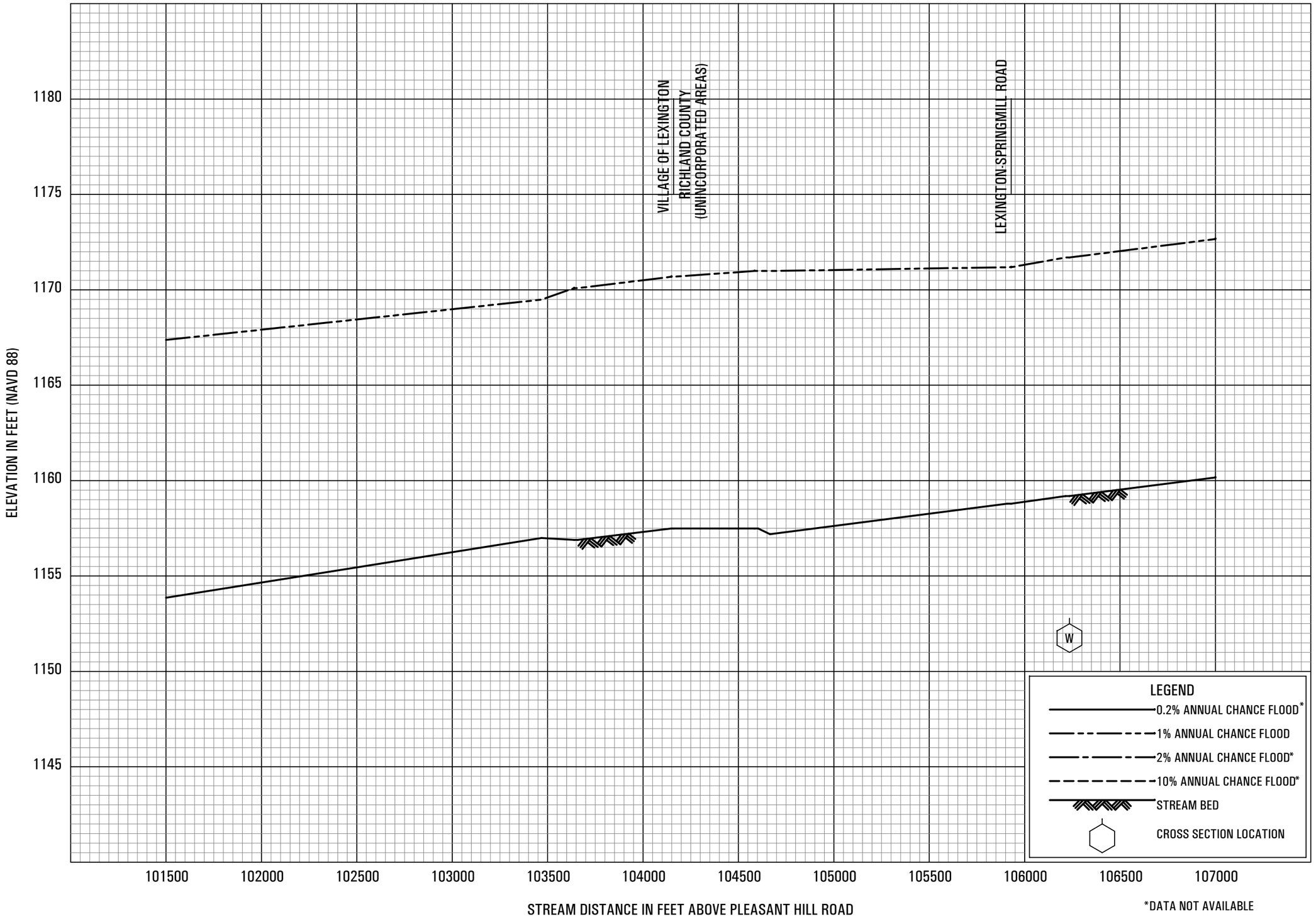
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



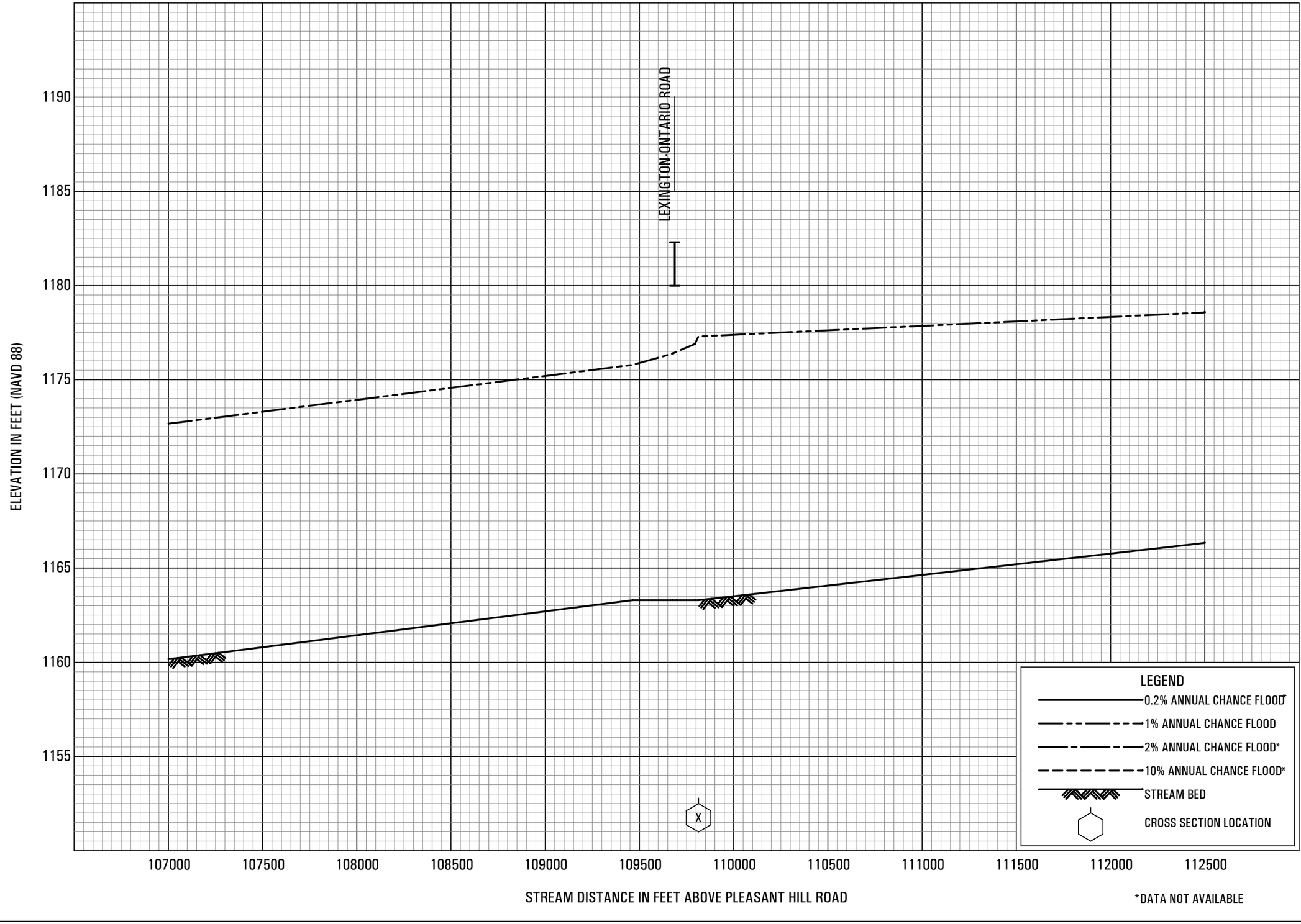
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



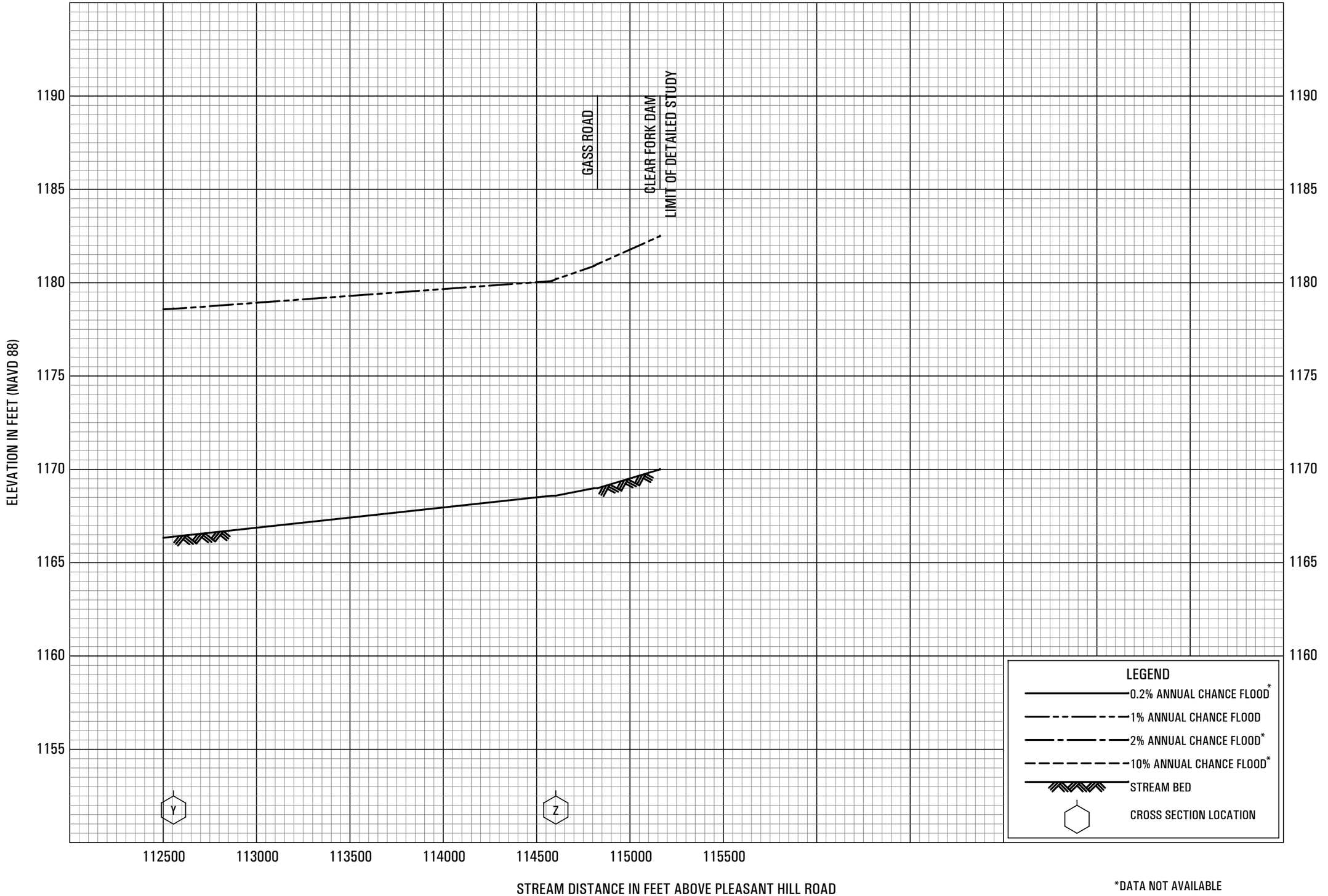
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



*DATA NOT AVAILABLE

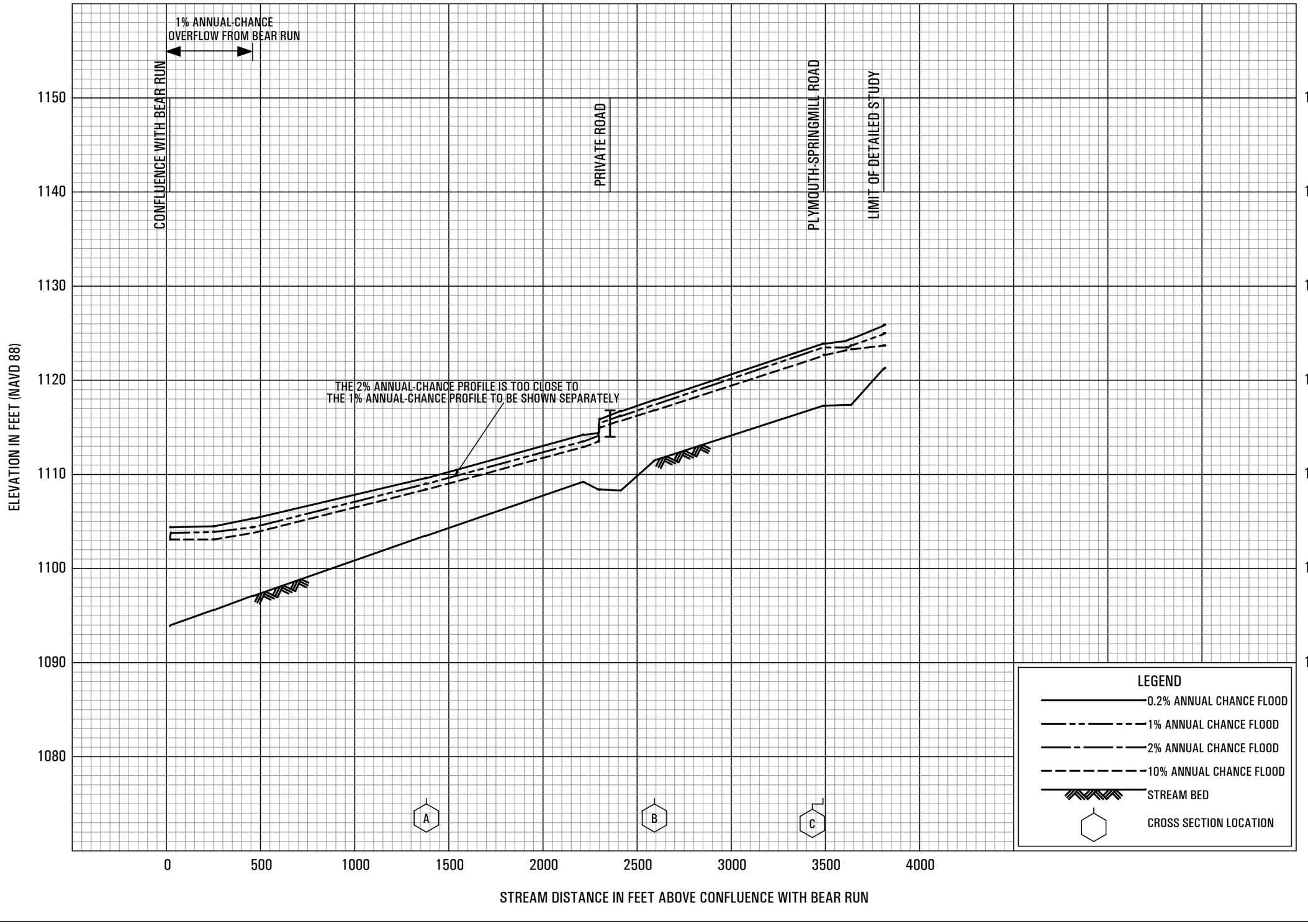
FLOOD PROFILES

CLEAR FORK MOHICAN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

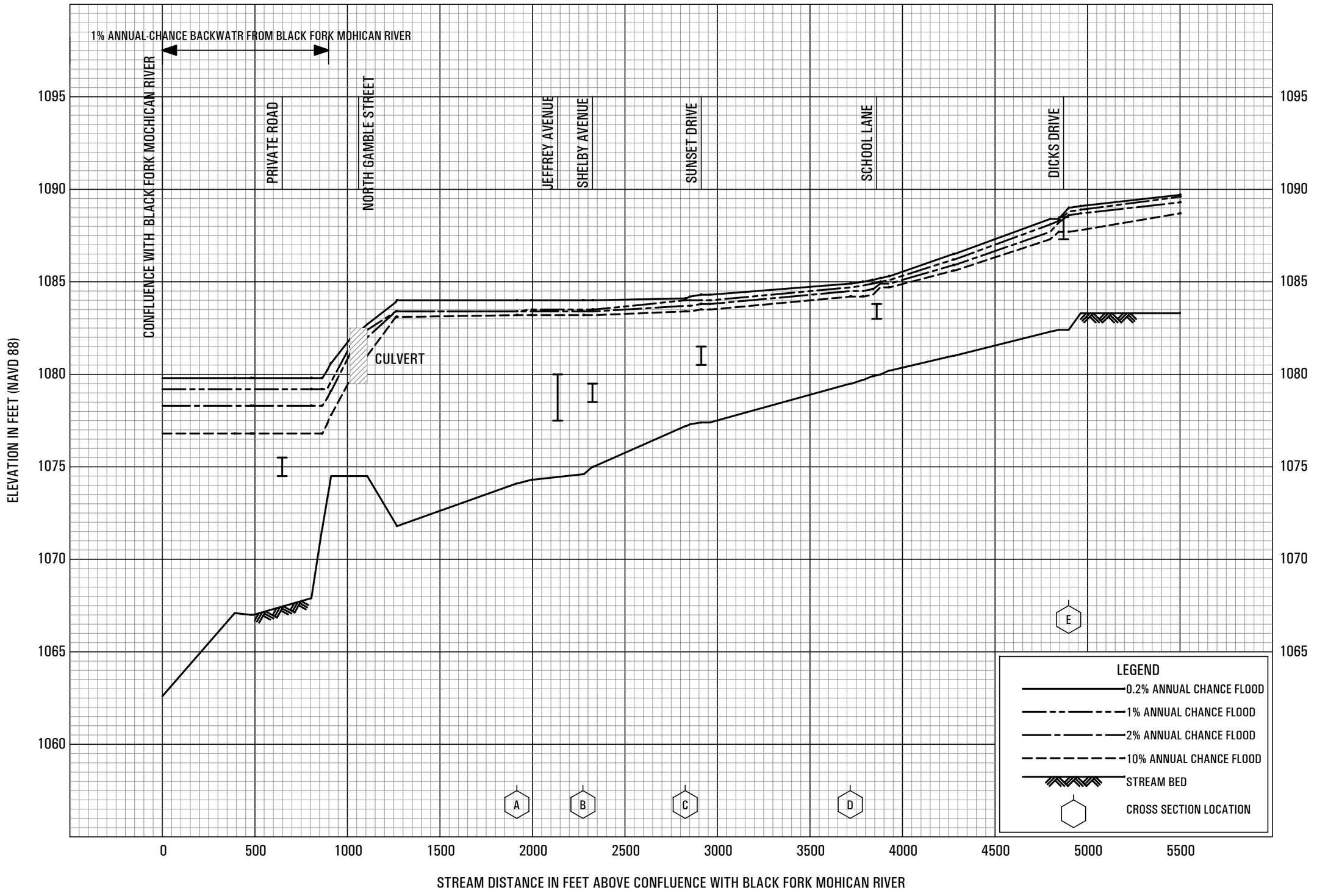
EAST BRANCH BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

22P



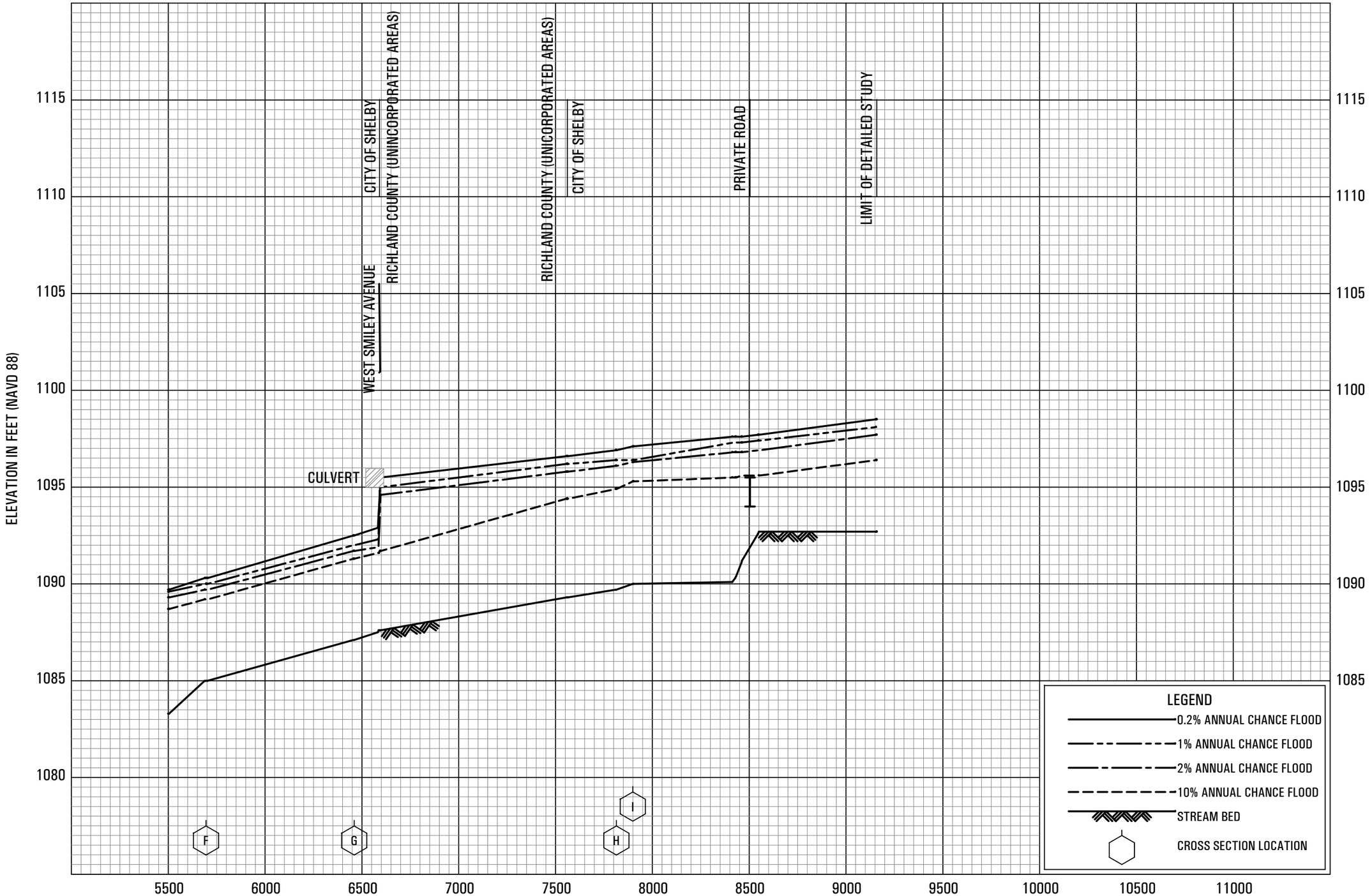
FLOOD PROFILES

HARTMAN BARGAHEISER DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



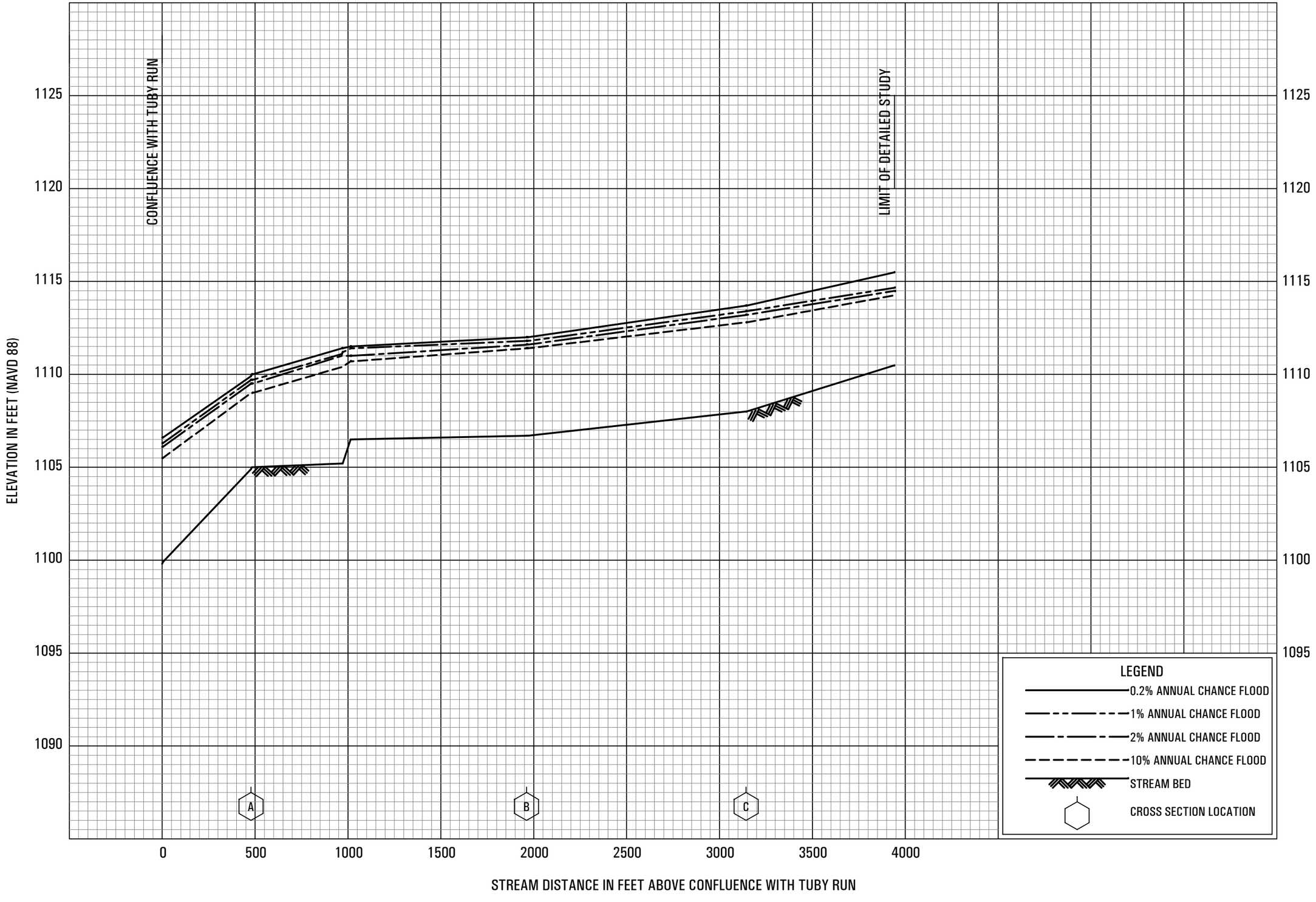
FLOOD PROFILES

HARTMAN BARGAHEISER DITCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



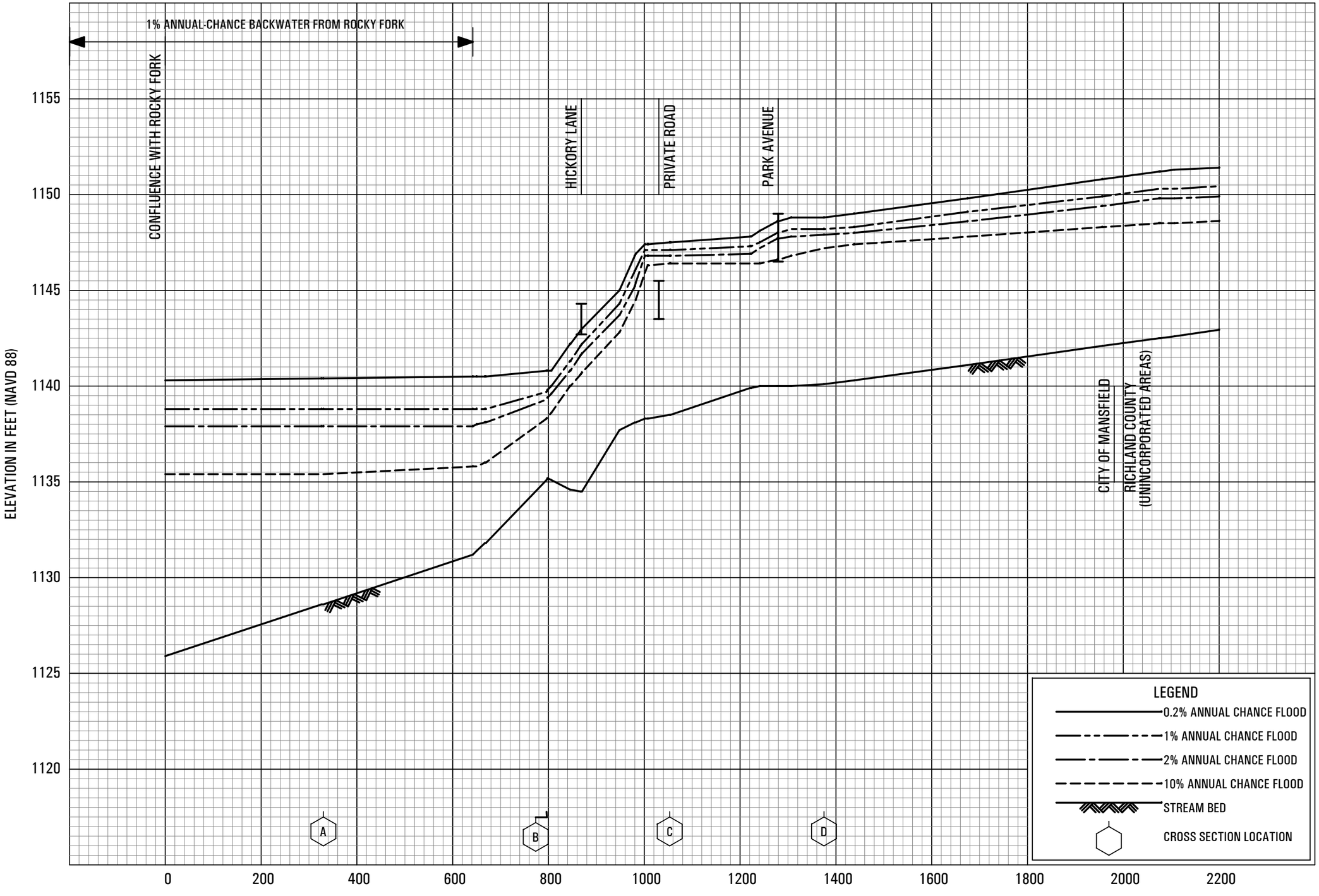
FLOOD PROFILES

LOWER TUBY TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



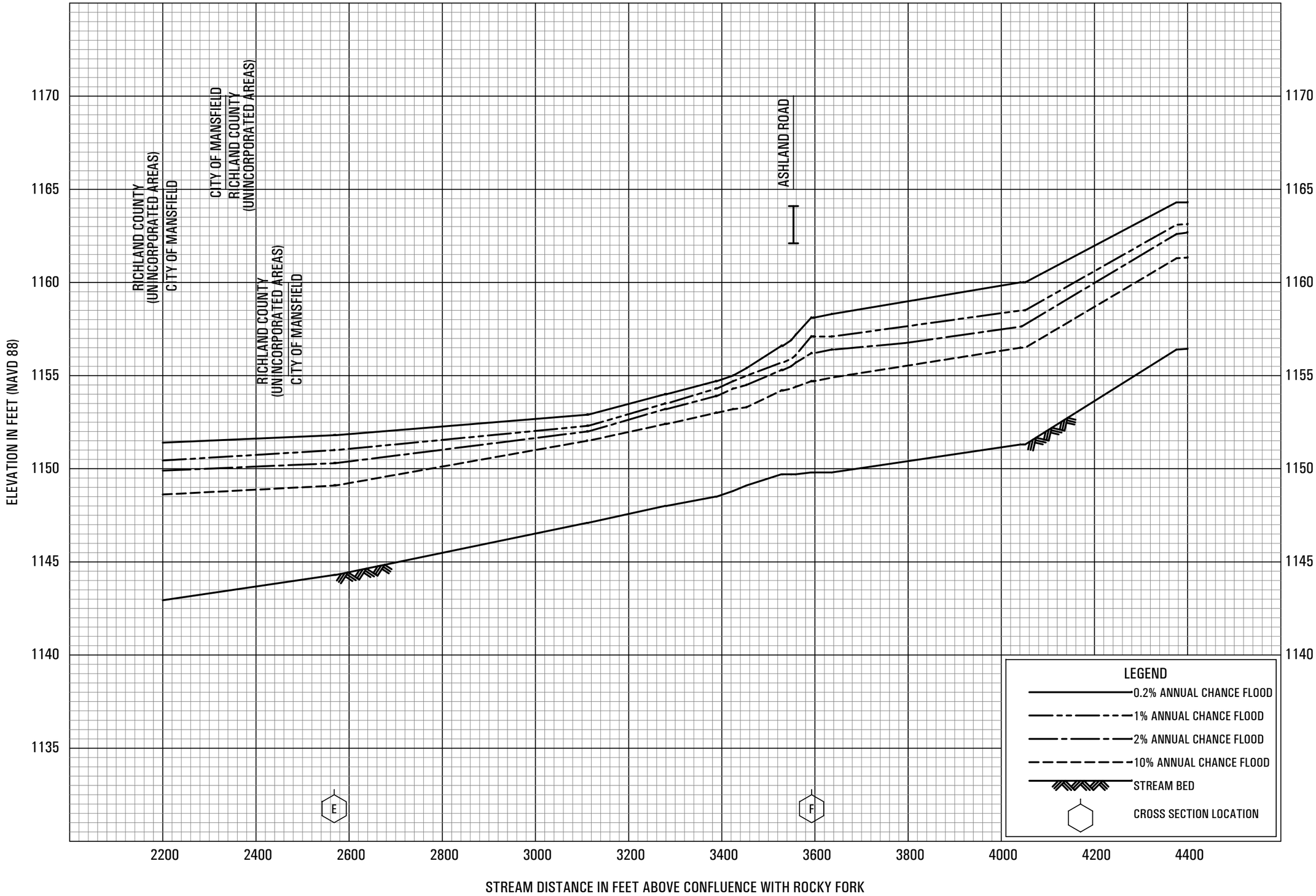
FLOOD PROFILES

PAINTERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

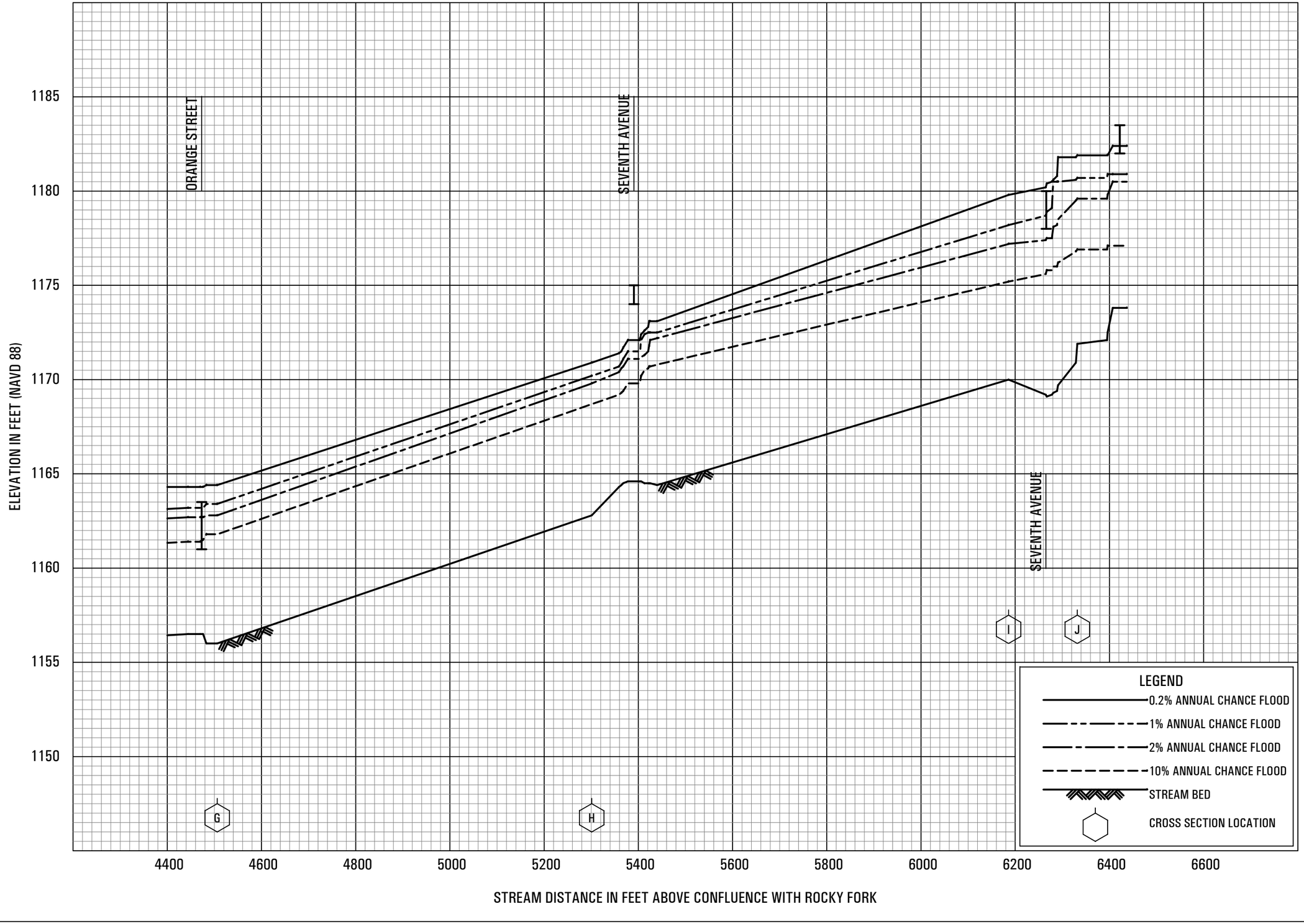
PAINTERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

27P



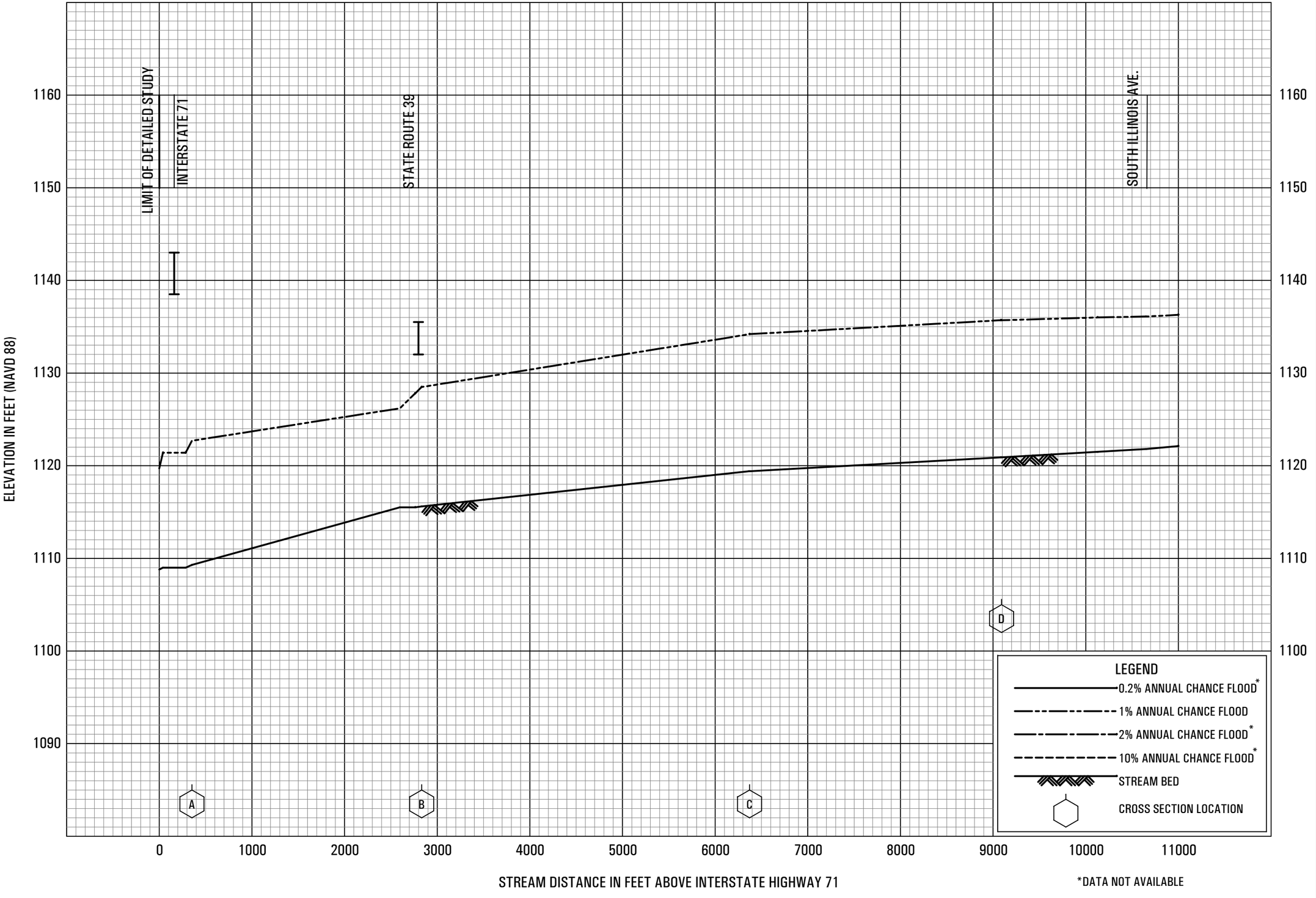
FLOOD PROFILES

PAINTERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



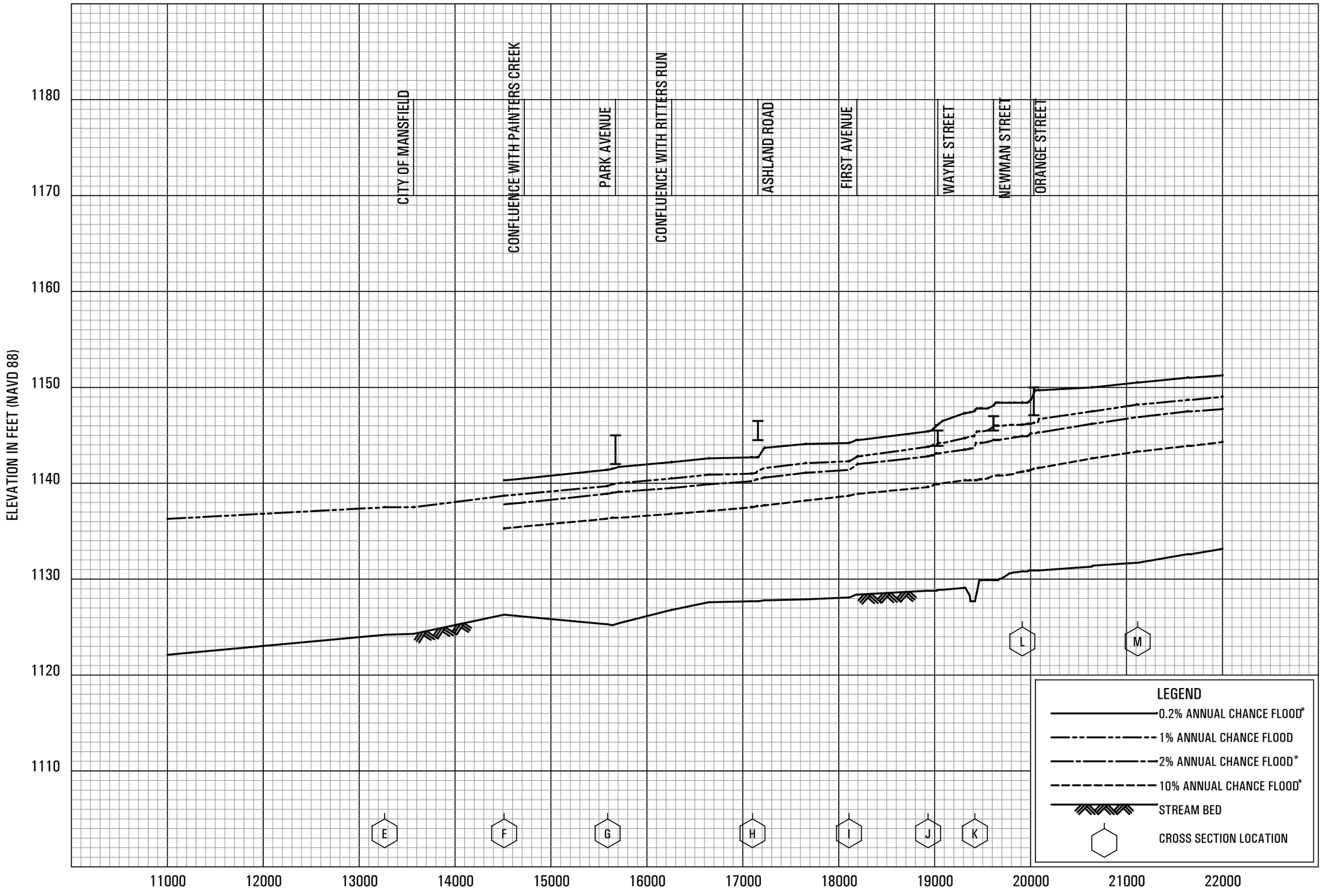
FLOOD PROFILES

ROCKY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



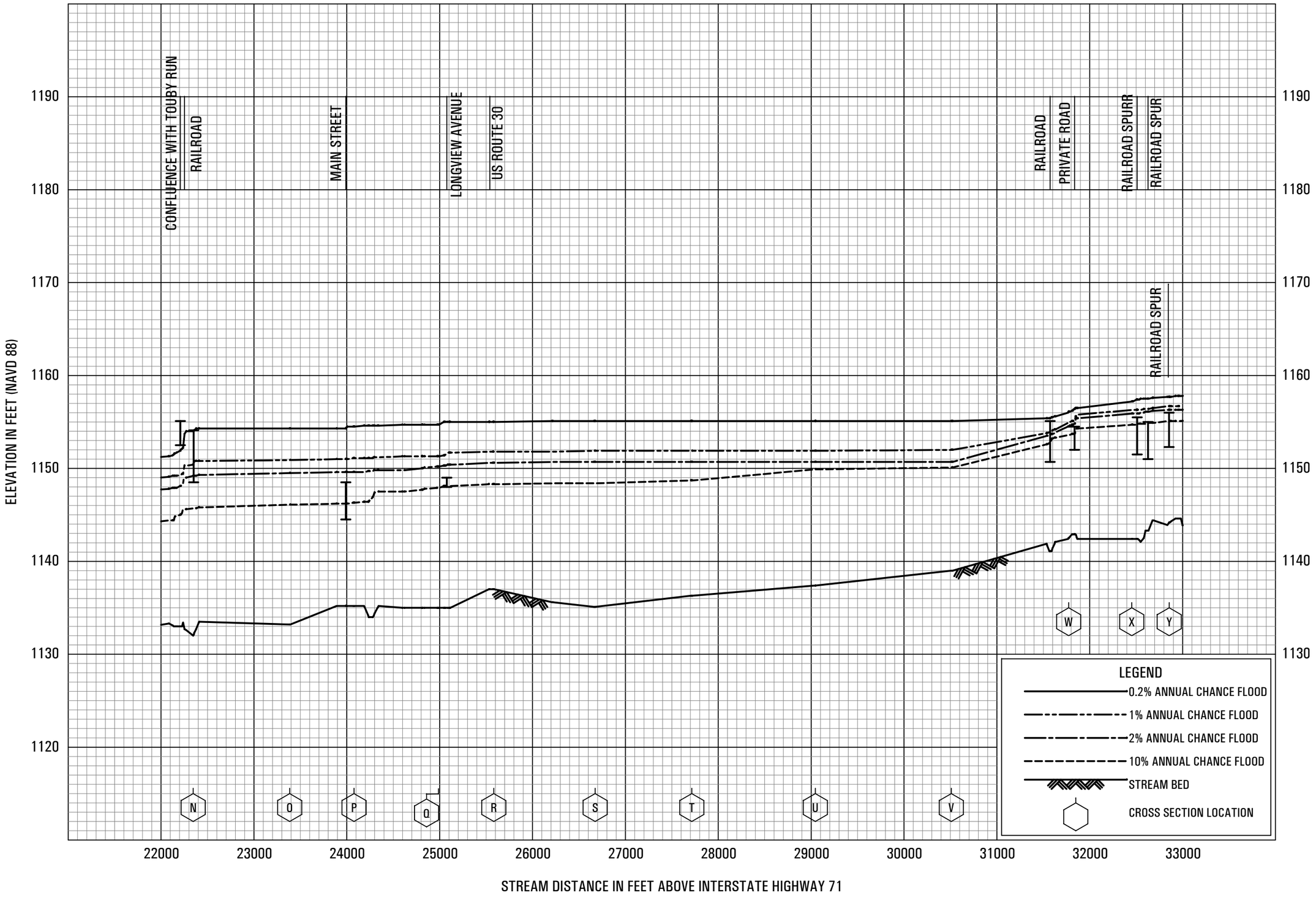
FLOOD PROFILES

ROCKY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



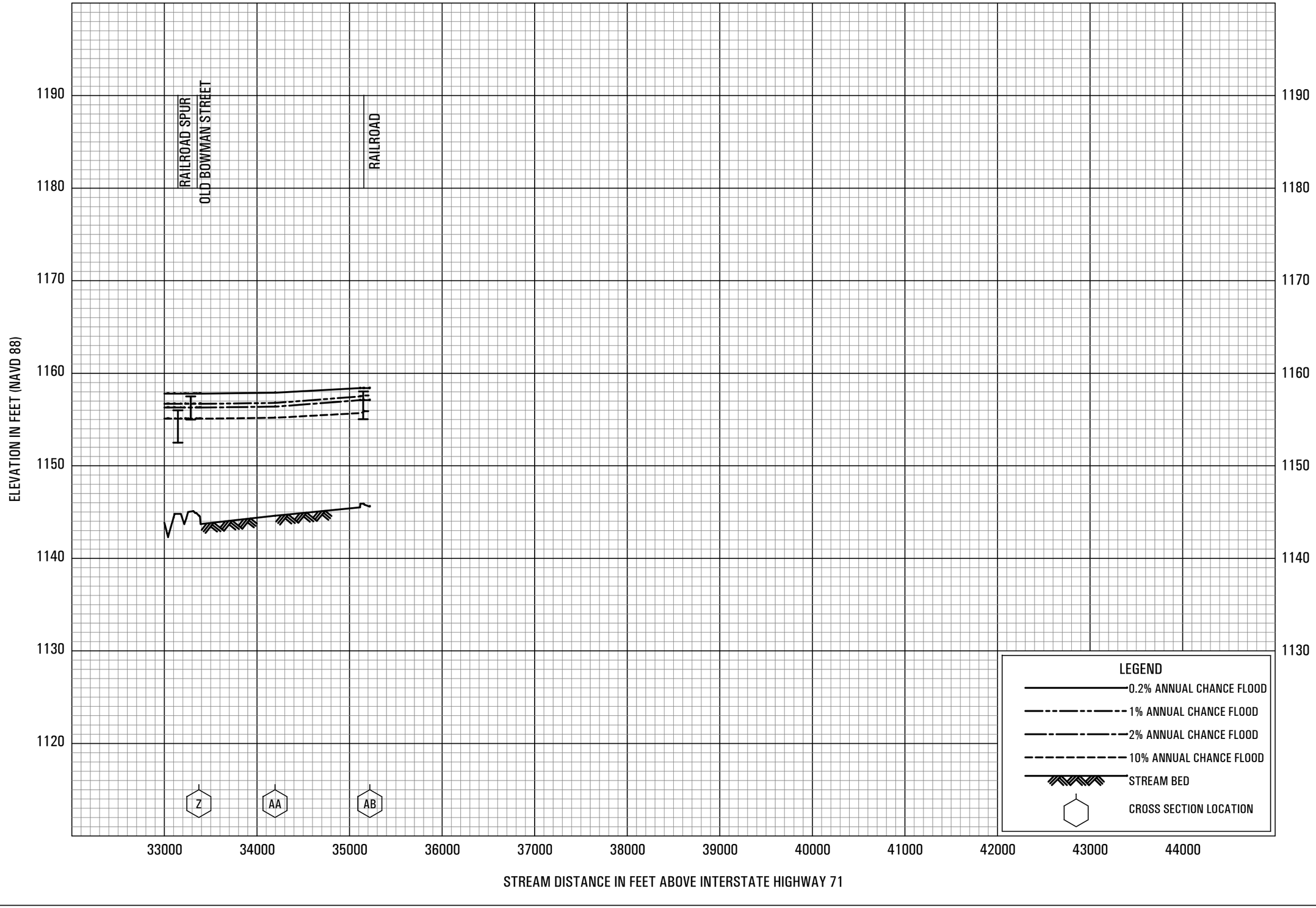
FLOOD PROFILES

ROCKY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



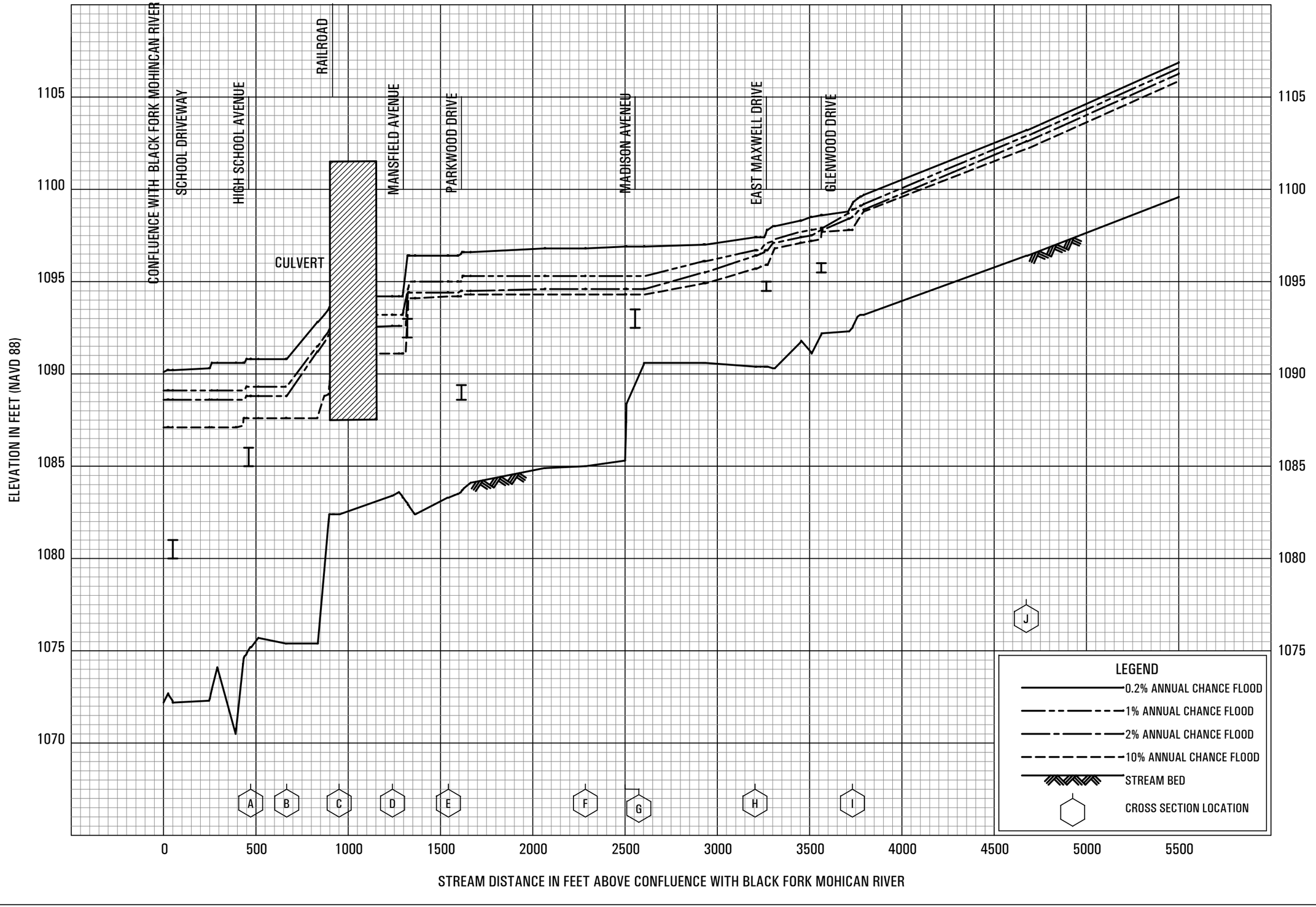
FLOOD PROFILES

ROCKY FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

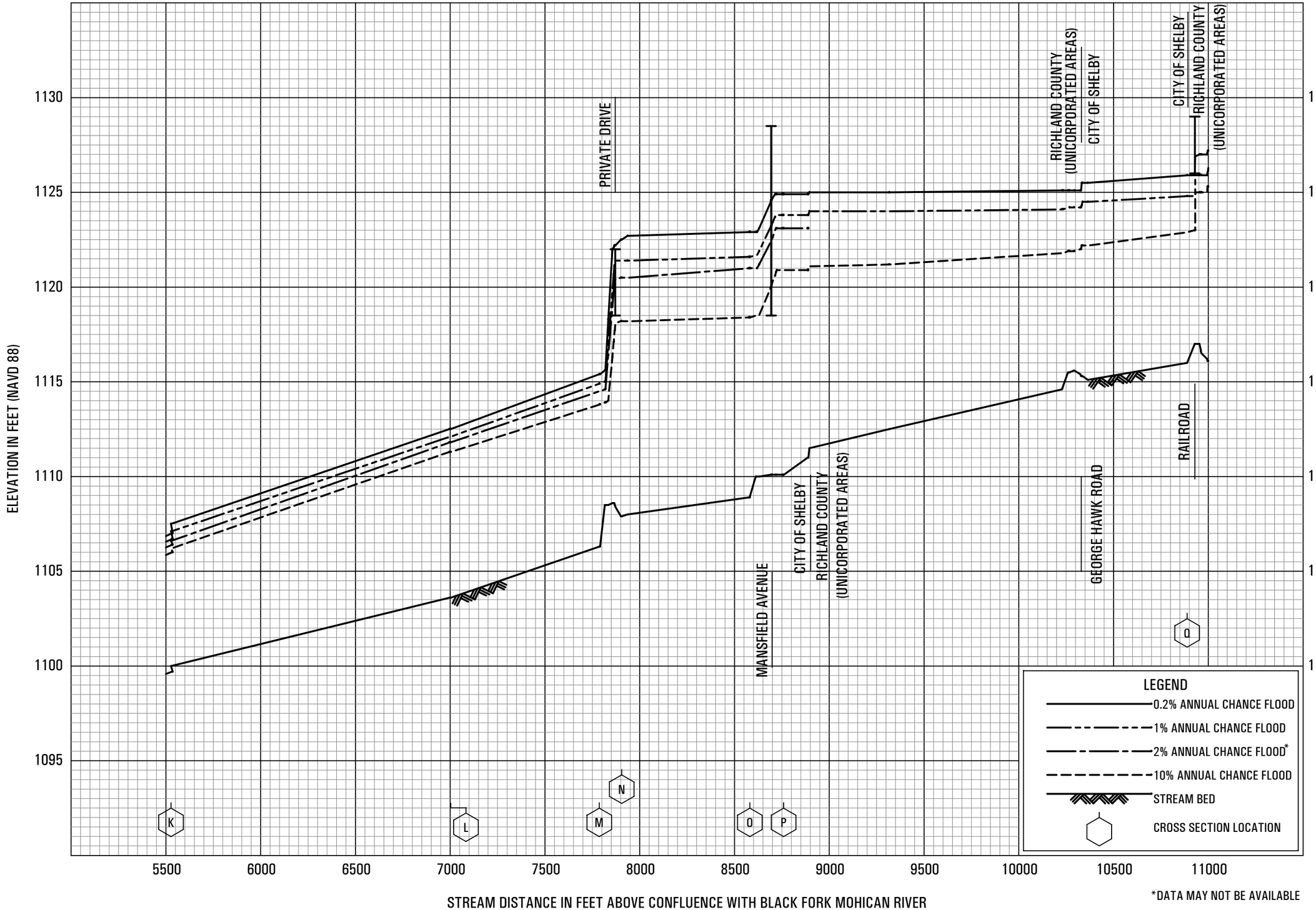
SELTZER PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

33P



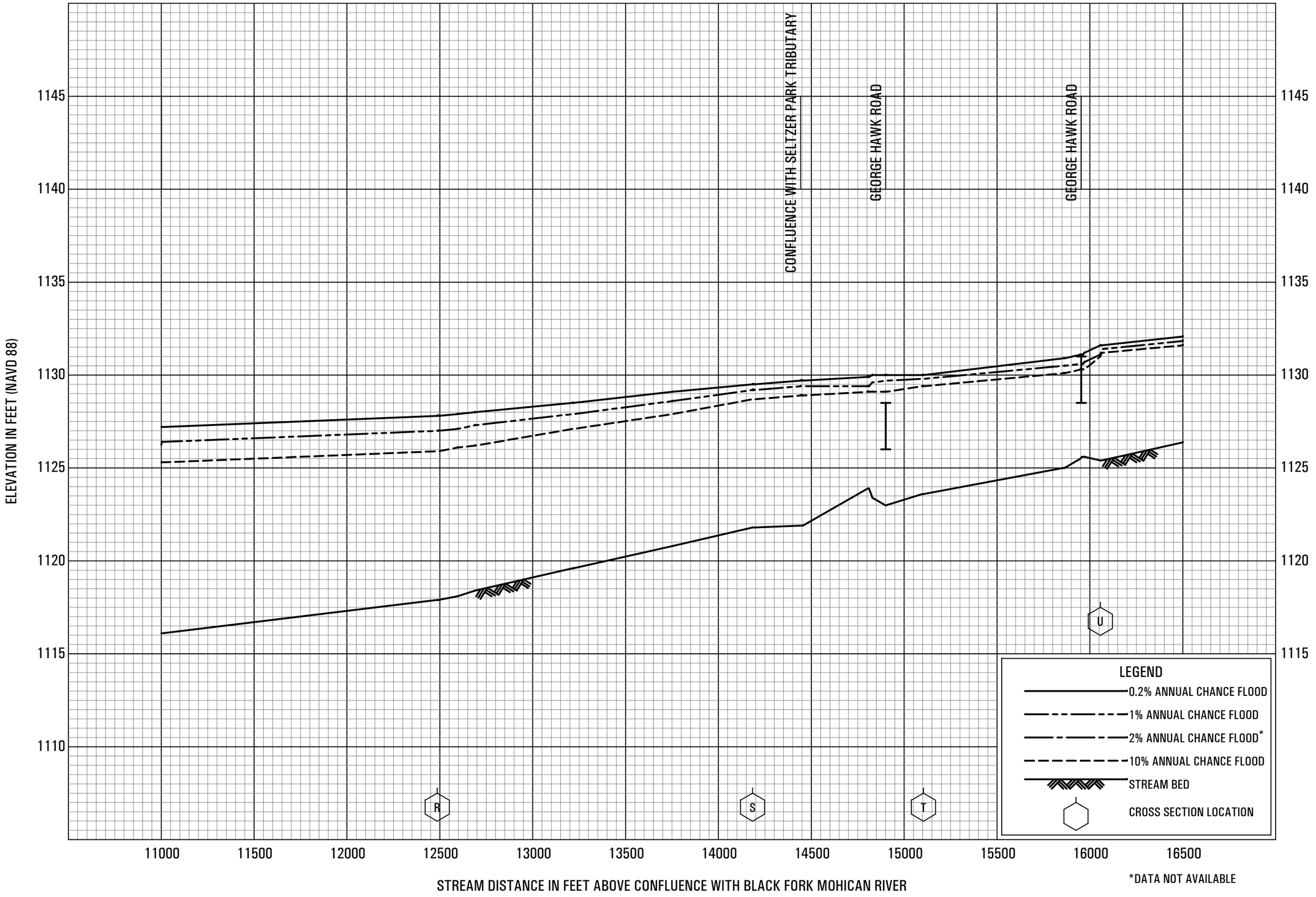
FLOOD PROFILES

SELTZER PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



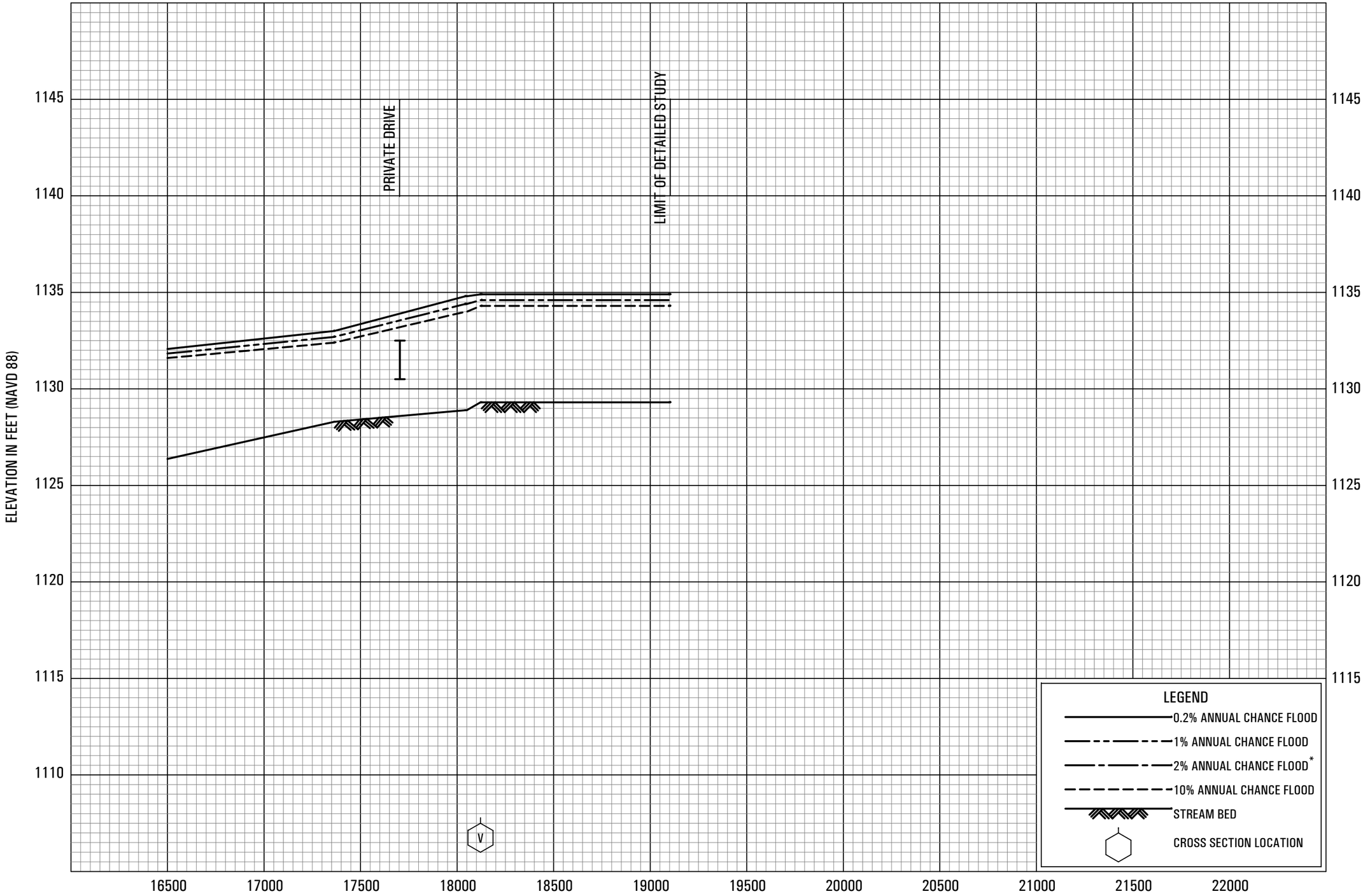
FLOOD PROFILES

SELTZER PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



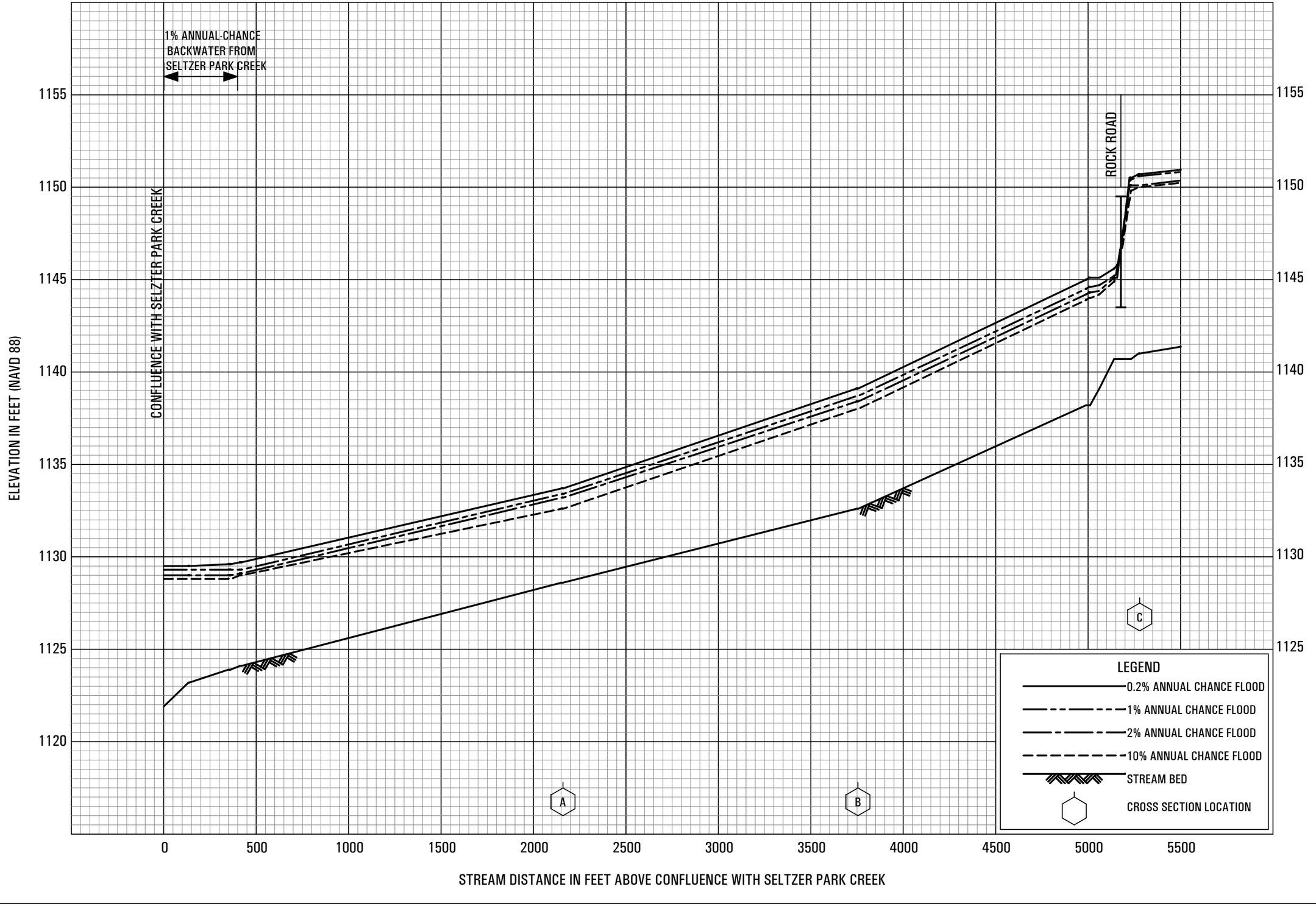
FLOOD PROFILES

SELTZER PARK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



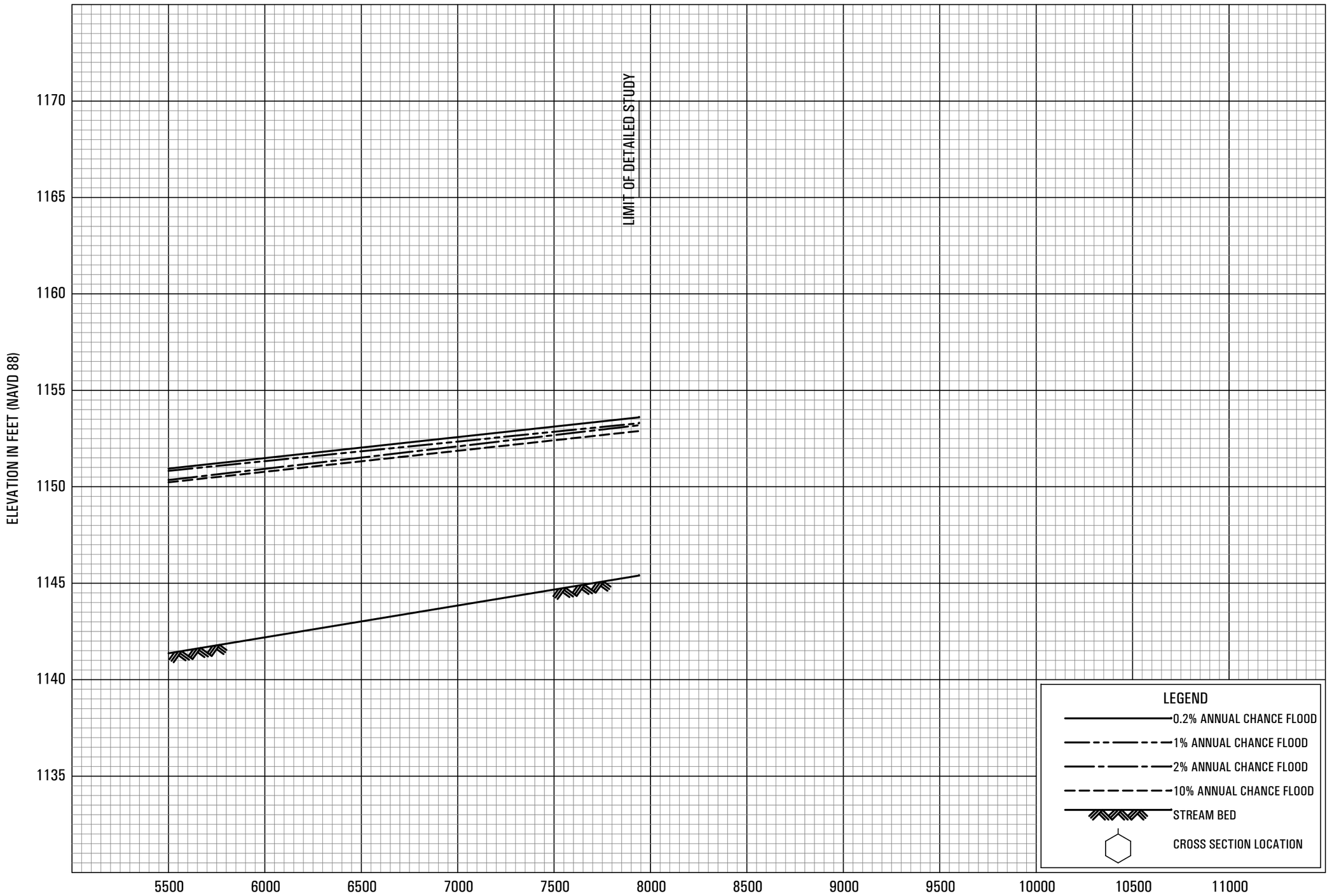
FLOOD PROFILES

SELTZER PARK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

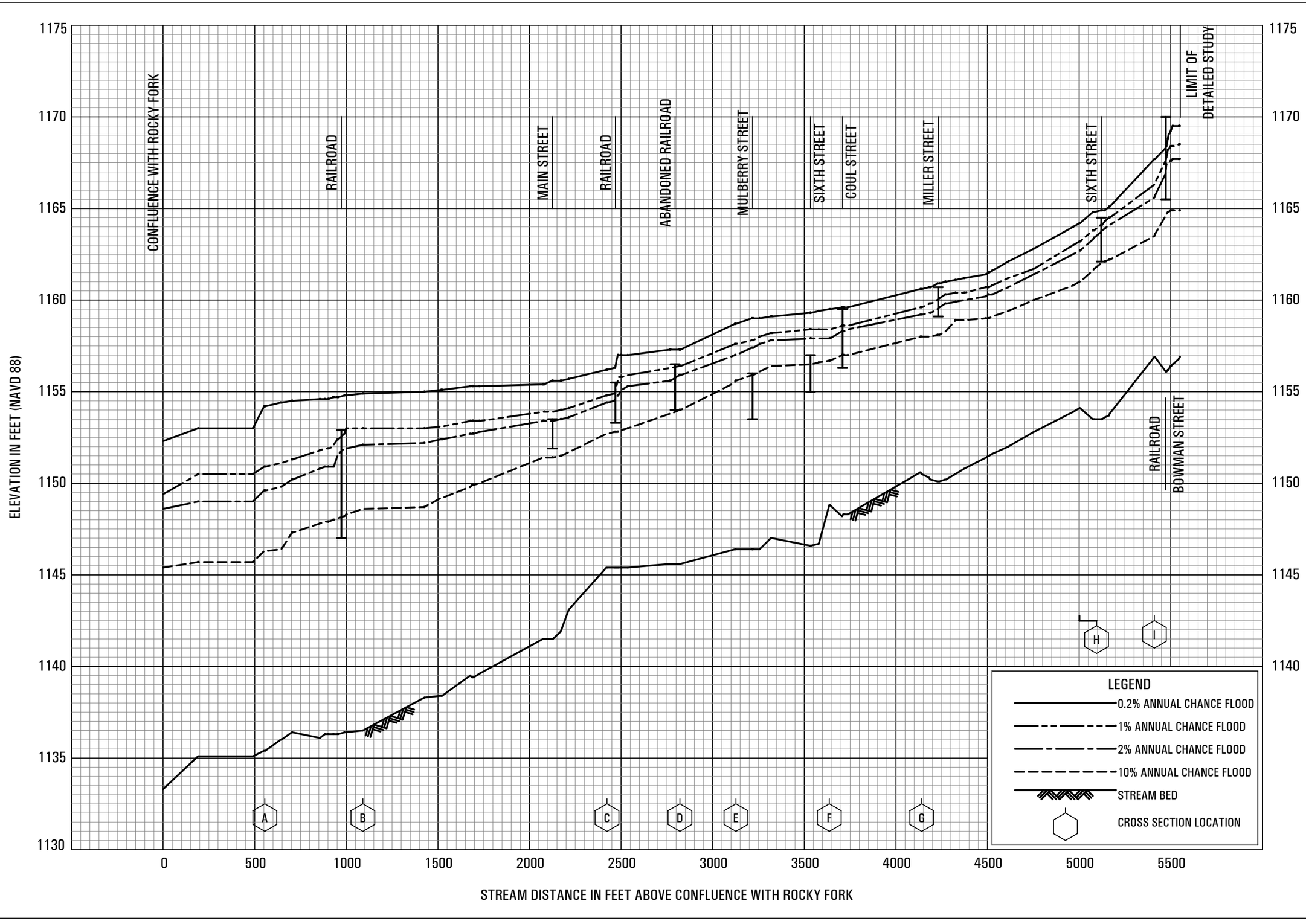
SELTZER PARK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

38P



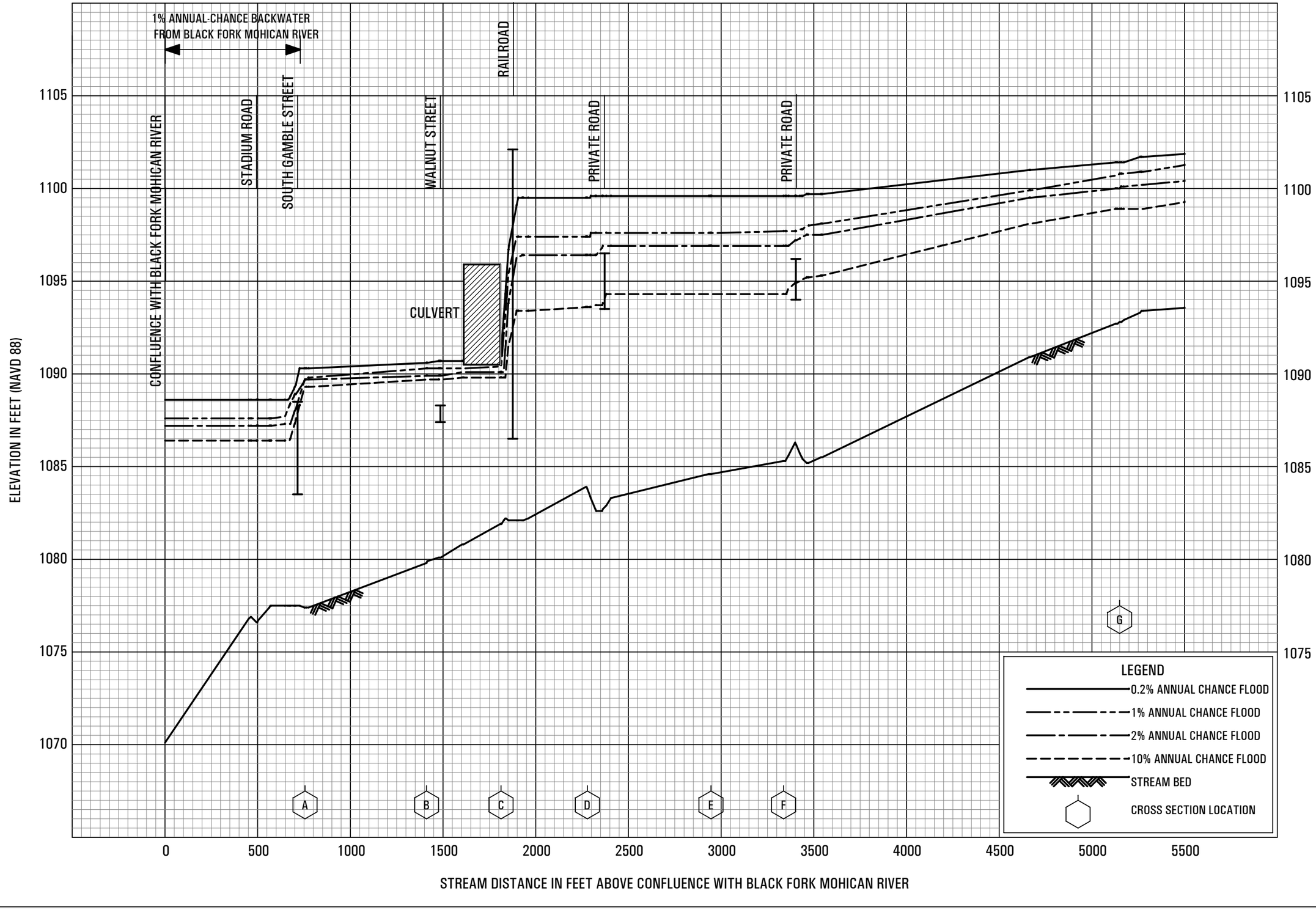
FLOOD PROFILES

TOUBY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



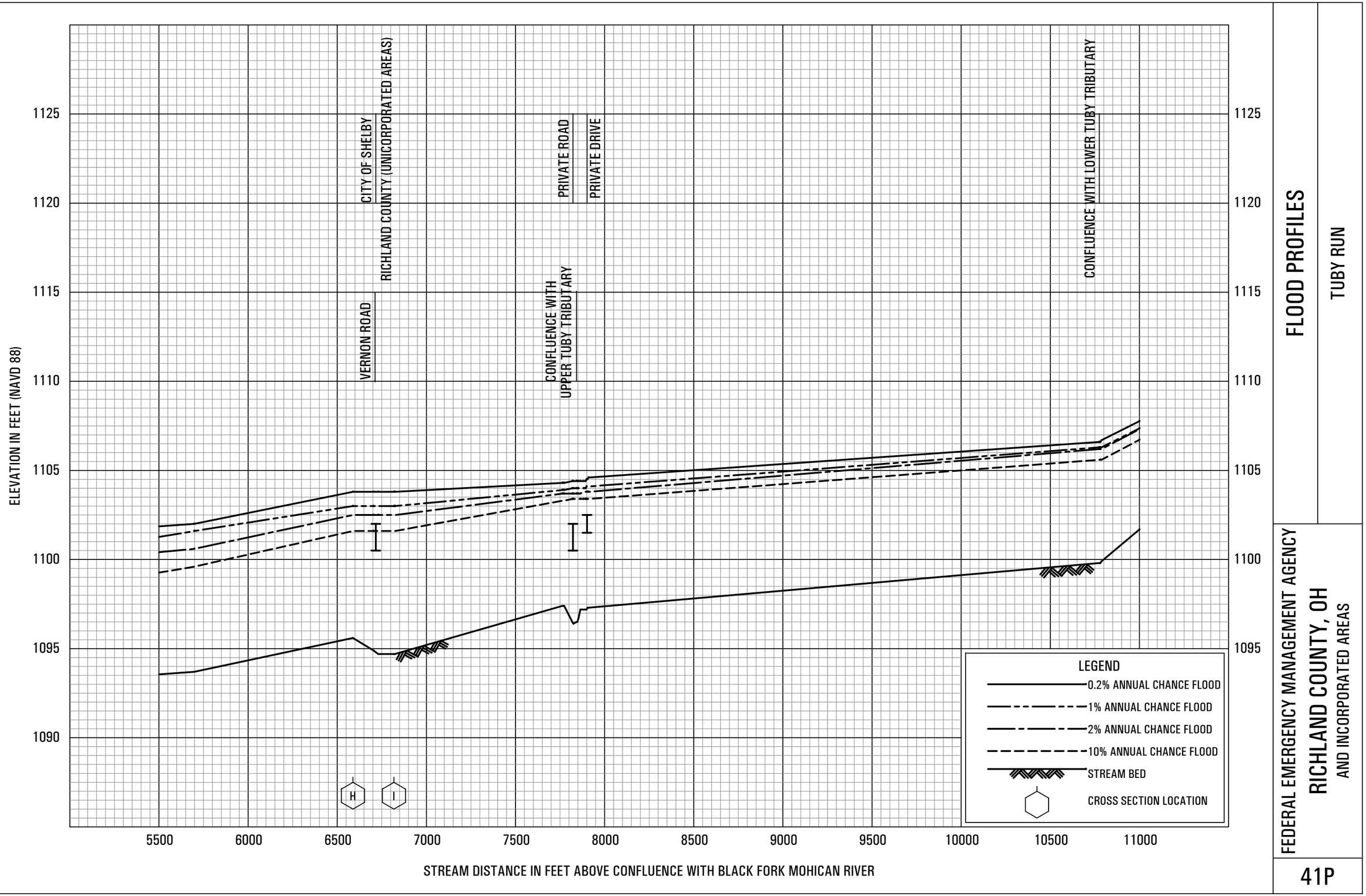
FLOOD PROFILES

TUBY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

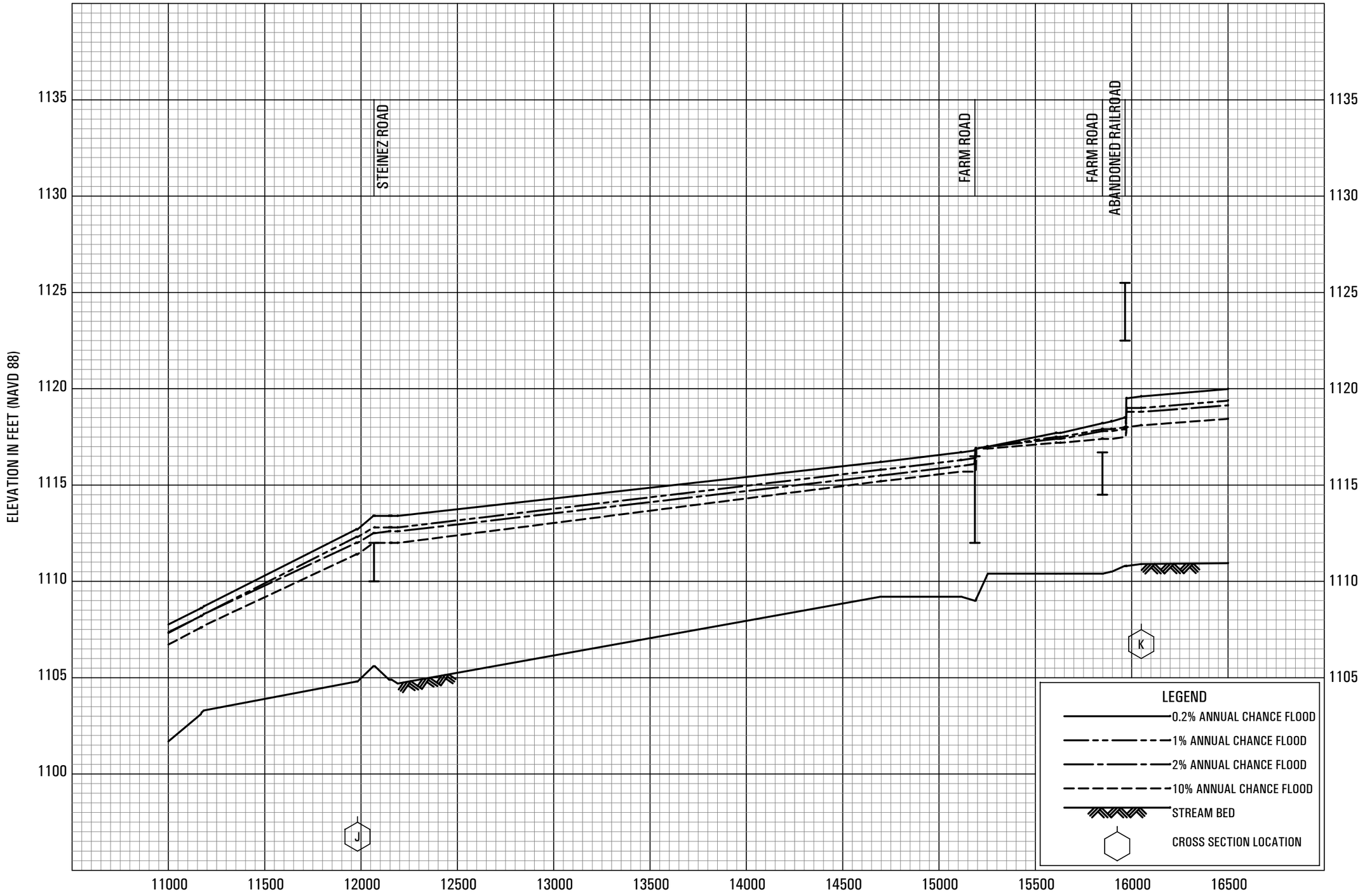
TUBY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

41P



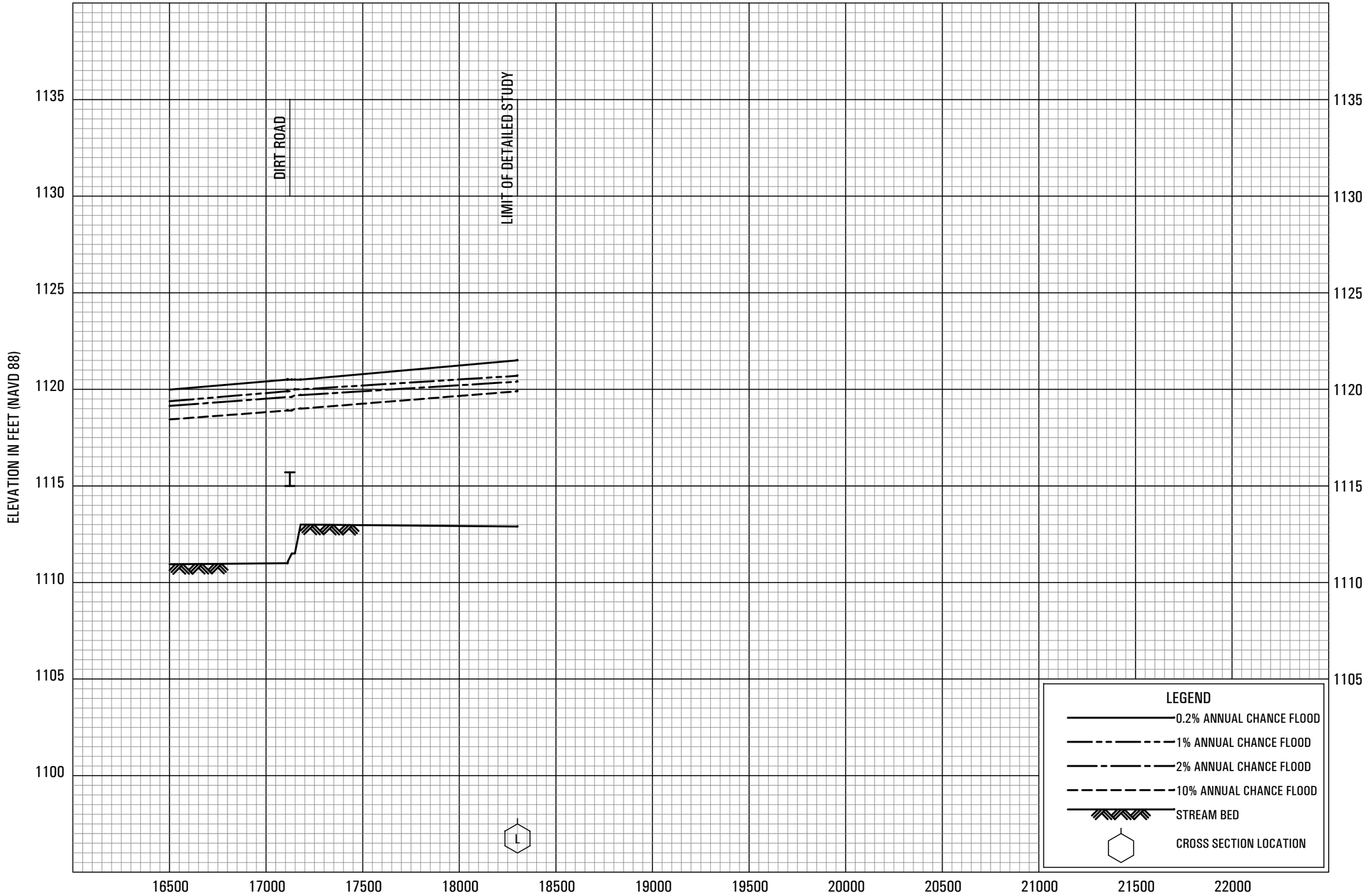
FLOOD PROFILES

TUBY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



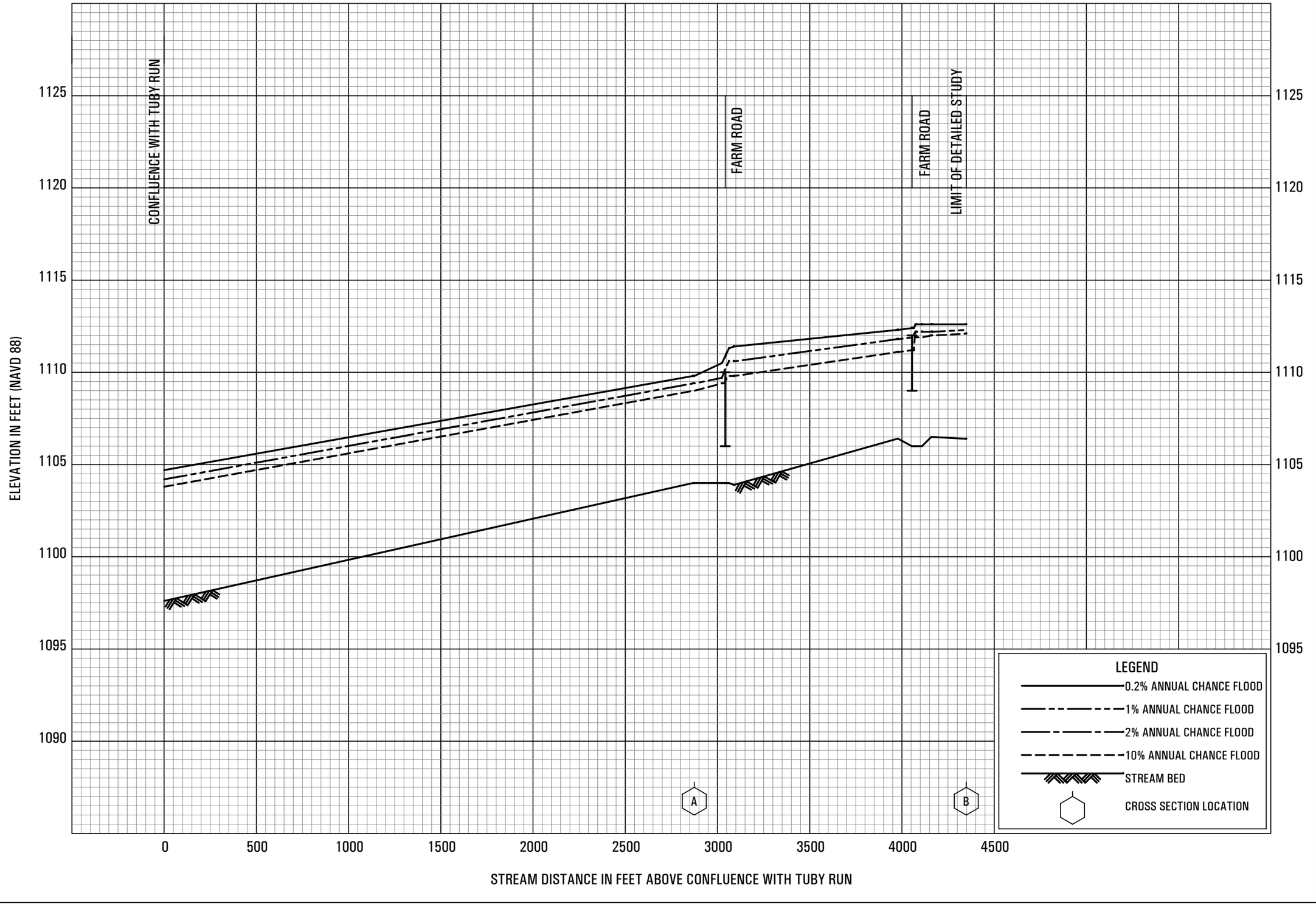
FLOOD PROFILES

TUBY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

UPPER TUBY TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS

ELEVATION IN FEET (NAVD 88)

1115
1110
1105
1100
1095
1090
1085
1080

CONFLUENCE WITH BLACK FORK MOHICAN RIVER
CITY OF SHELBY
RICHLAND COUNTY (UNINCORPORATED AREAS)
CITY OF SHELBY
CITY OF SHELBY
RICHLAND COUNTY (UNINCORPORATED AREAS)
WEIDNER ROAD
CONFLUENCE WITH WEST BRANCH TRIBUTARY
H
LIMIT OF DETAILED STUDY
STATE ROUTE 61
SOUTH GAMBLE STREET

A B C D E F G

0 1000 2000 3000 4000 5000 6000 7000 8000 9000

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH BLACK FORK MOHICAN RIVER

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

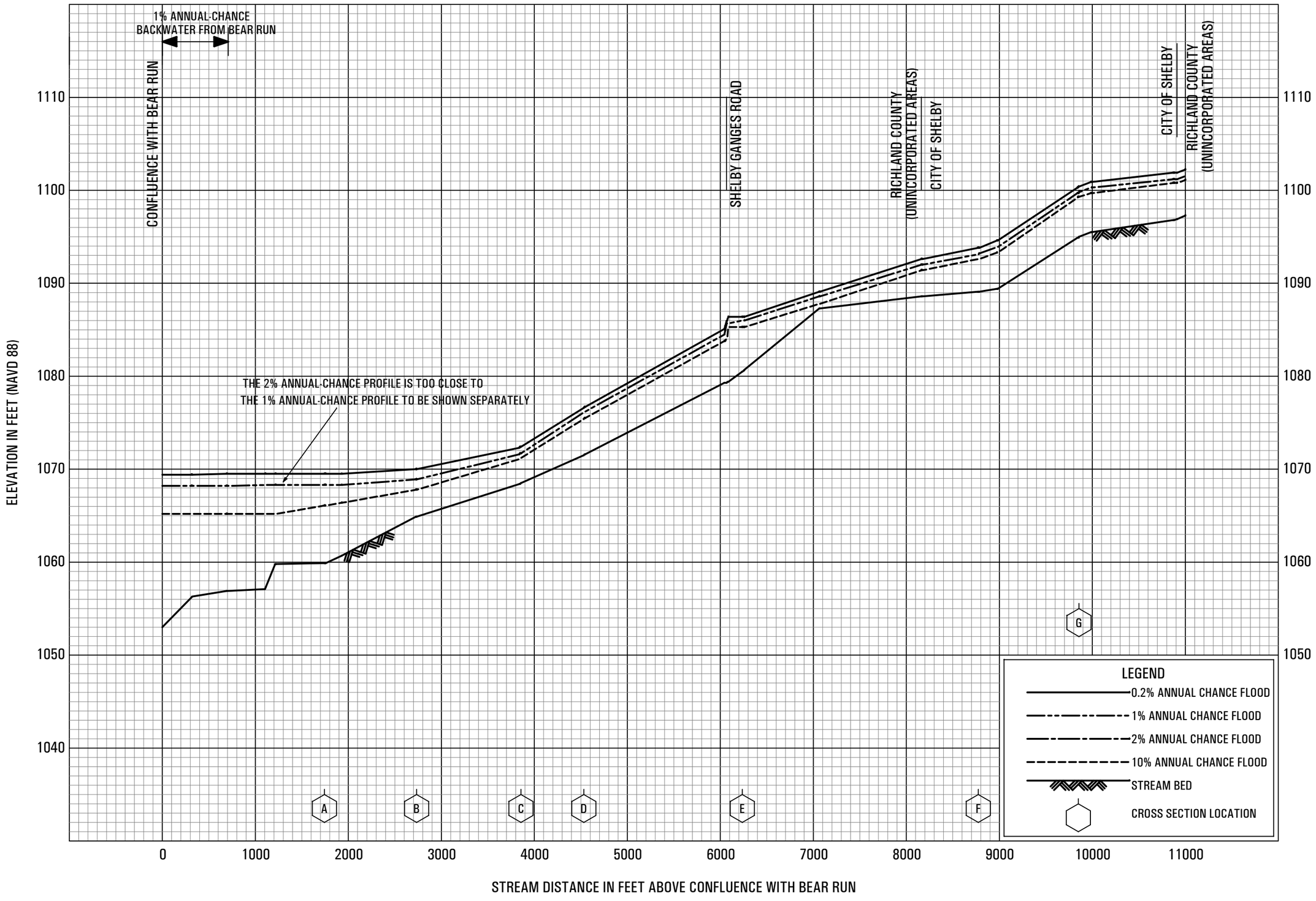
FLOOD PROFILES

WEST BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OHIO, AZ

AND INCORPORATED AREAS



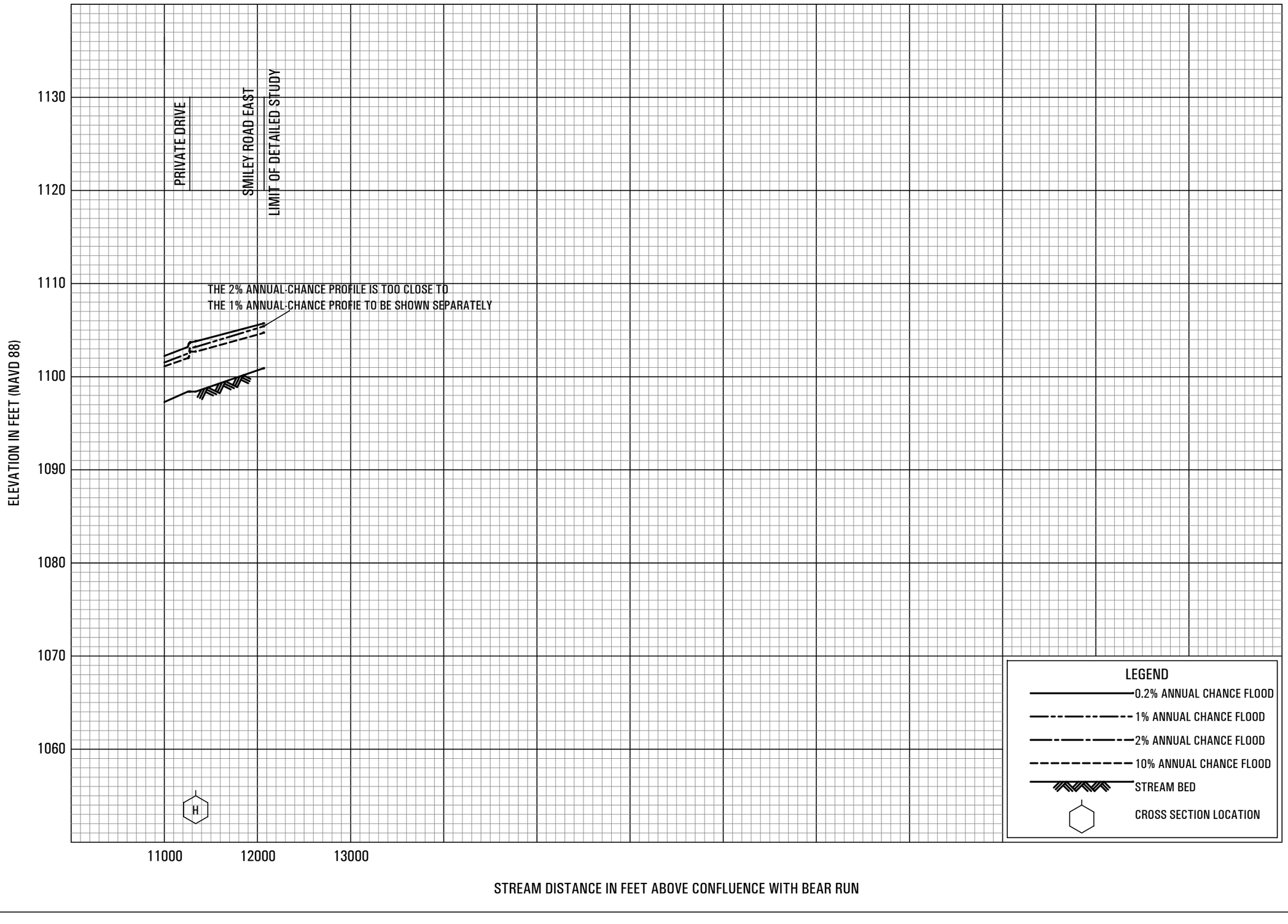
FLOOD PROFILES

WEST BRANCH BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH
AND INCORORATED AREAS

46P



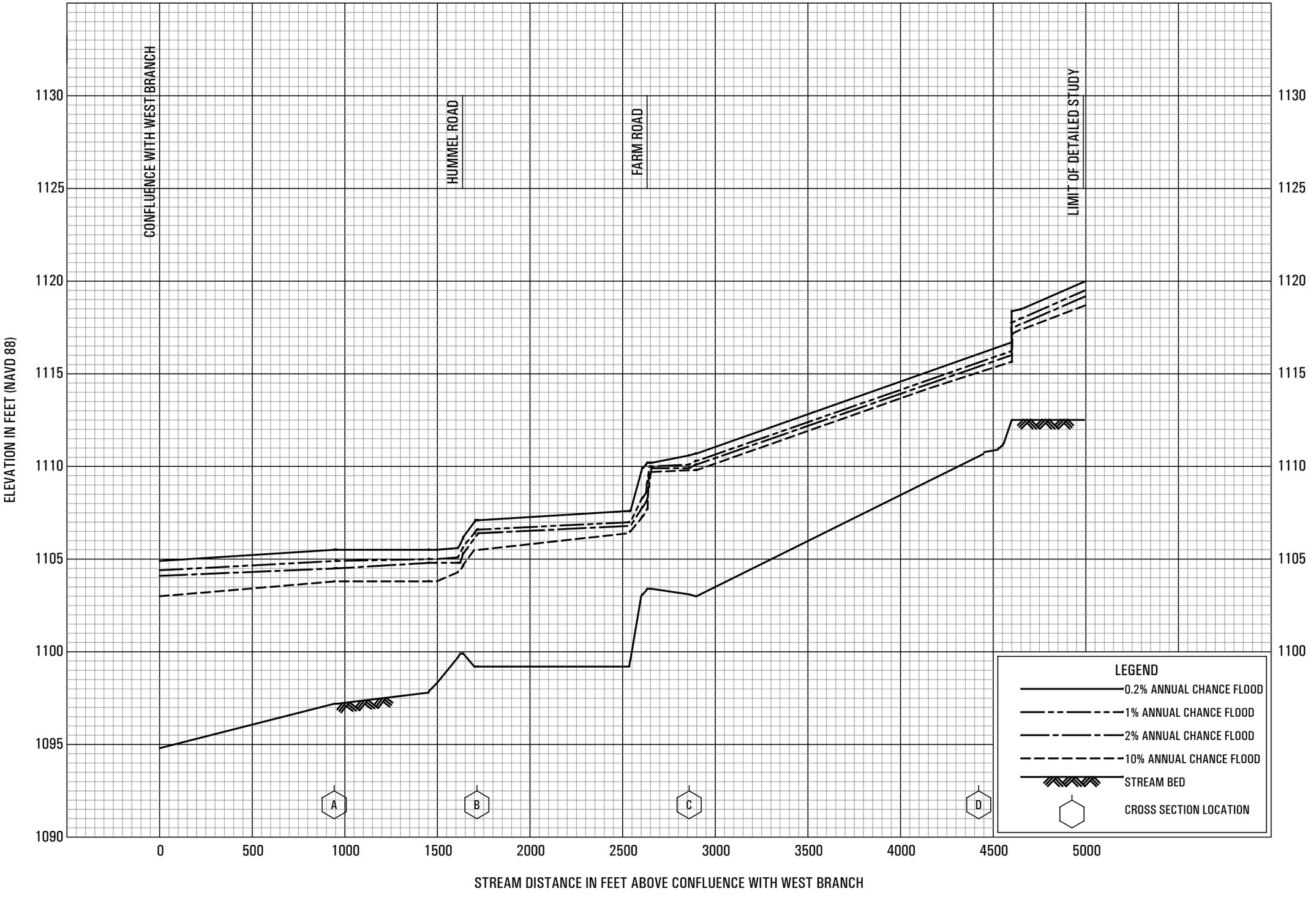
FLOOD PROFILES

WEST BRANCH BEAR RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORORATED AREAS



FLOOD PROFILES

WEST BRANCH TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, OH

AND INCORPORATED AREAS