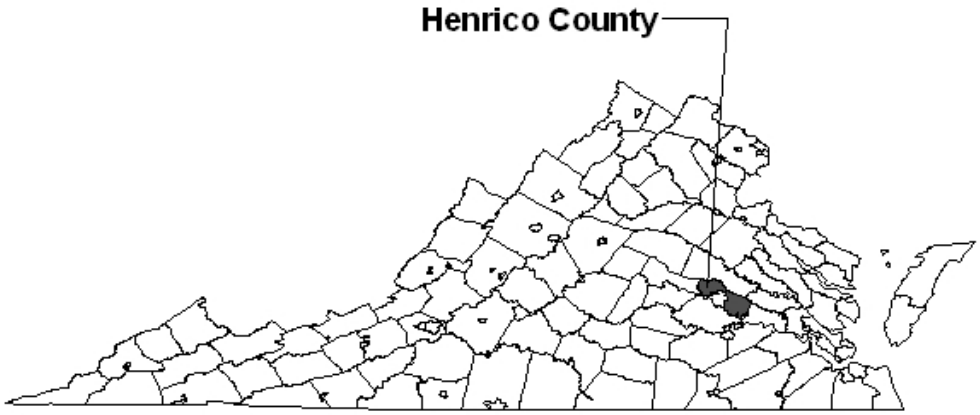
FLOOD INSURANCE STUDY

HENRICO COUNTY, VIRGINIA
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
HENRICO COUNTY UNINCORPORATED AREAS	510077



EFFECTIVE DATE:
December 18, 2007

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
51087CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Selected Flood Insurance Rate Map panels for the 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	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

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

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

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FLOOD INSURANCE STUDY
HENRICO COUNTY, VIRGINIA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates a previous FIS/Flood Insurance Rate Map (FIRM) for the unincorporated areas of Henrico County, Virginia. This information will be used by Henrico County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

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

1.2 Authority and Acknowledgments

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

The hydrologic and hydraulic analyses for the original Henrico County (Unincorporated Areas) study were performed by CH2M HILL, Inc., for the Federal Insurance Administration (FIA), under Contract Number H-3833. This work, which was completed in April 1977, covered all significant flooding sources in Henrico County. Hydraulic and hydrologic analyses for Tuckahoe Creek, Deep Run, Stoney Run, North Run, Thorpe Branch, Rocky Branch, and Hungary Creek were provided by the U.S. Army Corps of Engineers (USACE), Norfolk District, and were reviewed and updated by Dewberry, Nealon and Davis, under agreement with the FIA.

The hydrologic and hydraulic analyses for this study were performed by Michael Baker Jr. Inc., under contract to Henrico County for the Federal Emergency Management Agency (FEMA). This study was completed in June 2005 and covers all significant flooding sources in Henrico County.

1.3 Coordination

For the original Henrico County (Unincorporated Areas) study, the flooding sources studied by detailed and approximate methods were identified in meetings attended by Henrico County officials, and representatives of the Virginia State Water Resource Control Board, the FIA, and the Study Contractor (SC) in March and October 1975.

County officials and State and Federal agencies were contacted by the SC as the original study progressed. The following governmental organizations furnished information used in this study: USACE, Norfolk District; the Virginia State Water Control Board; the Virginia Department of Highways and Transportation; the U.S. Soil Conservation Service (SCS); and the U.S. Geological Survey (USGS).

An intermediate Consultation and Coordination Officer's (CCO) meeting was held in November 1976 to discuss work progress and coordination with the ongoing county master drainage study. This meeting was attended by Henrico County personnel, the consultant for the county comprehensive drainage study, the FIA, the Virginia State Water Control Board and the SC.

On July 27, 1977, results of the original study were reviewed at the final CCO meeting. This meeting was attended by Henrico County officials and personnel of the FIA, the State Water Control Board and the SC.

The results of the study were reviewed at the final CCO meeting held on December 15, 2005, and attended by representatives of FEMA and Henrico County. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the unincorporated areas of Henrico County, Virginia.

The April 1977 scope of detailed study included parts of the following sources: James River, Gillies Creek, Stony Run, Upham Brook, North Run, Hungary Creek, Rocky Branch, Thorpe Branch, Tuckahoe Creek, Deep Run and Stoney Run.

The flooding sources studied by detailed methods during the June 2005 work superseded all areas of the original scope and study and are as follows:

Stream	Limits of Detailed Study
Allens Branch	From its confluence with the Chickahominy River to a point approximately 250 feet (ft.) upstream of the Interstate (I) 295 Ramp
Chickahominy River	From just upstream of Creighton Road to a point approximately 0.4 mile (mi.) upstream of Shady Grove Road
Copperas Creek	From its confluence with Tuckahoe Creek to a point approximately 140 ft. upstream of Waterford Way East
Copperas Creek Tributary 2	From its confluence with Copperas Creek to a point approximately 0.4 mi. upstream of Copperas Lane
Deep Run	From its confluence with the James River to a point just upstream of I-64
Fourmile Creek	From its confluence with the James River to a point approximately 0.4 mi. upstream of Doran Road
Fourmile Creek Tributary 7	From its confluence with Fourmile Creek to a point approximately 1,000 ft. upstream of the confluence
Gillies Creek	From the Henrico County Boundary to a point approximately 0.5 mi. upstream of the railroad

Gillies Creek Tributary 1	From its confluence with Gillies Creek to a point approximately 280 ft. upstream of South Kalmia Avenue
Harding Branch	From its confluence with Tuckahoe Creek to a point approximately 0.4 mi. upstream of Park Terrace Drive
Harding Branch Tributary 1	From its confluence with Harding Branch to a point approximately 270 ft. upstream of Lauderdale Drive
Heckler Village Tributary 1	From its confluence with Gillies Creek to a point approximately 0.2 mi. upstream of Colwyck Drive
Heckler Village Tributary 2	From its confluence with Gillies Creek to a point approximately 0.3 mi. upstream of Winfield Terrace
Horsepen Branch	From its confluence with Upham Brook to a point approximately 340 ft. upstream of Devers Road
Hungary Creek	From its confluence with North Run to a point just upstream of the privately owned road that intersects with Lakefront Drive
James River	From a point approximately 4.1 mi. downstream of the confluence of Cornelius Creek
Jordans Branch	From the Henrico County Boundary to a point approximately 700 feet upstream of Monument Avenue
Little Tuckahoe Creek	From its confluence with Tuckahoe Creek to a point approximately 0.2 mi. upstream of the confluence
Meredith Branch	From its confluence with the Chickahominy River to a point approximately 600 ft. downstream of Broad Meadows Road
North Run	From its confluence with Upham Brook to a point approximately 0.2 mi. upstream of Mountain Road
Rocky Branch	From its confluence with North Run to a point approximately 800 ft. upstream of Stoneman Road
Rooty Branch	From a point approximately 320 ft. upstream of the first crossing of Cox Road to a point approximately 70 ft. downstream of the second crossing of Cox Road
Stoney Run	From its confluence with Deep Run to a point approximately 460 ft. upstream of Church Road
Stony Run	From the Henrico County Boundary to a point approximately 350 ft. downstream of the confluence of Stony Run Tributary 1
Thorpe Branch	From its confluence with North Run to a point approximately 1,360 ft. upstream of Impala Drive
Tributary A to Gillies Creek Tributary 1	From its confluence with Gillies Creek Tributary 1 to a point approximately 1,200 ft. upstream of Hawks Lane
Tributary A to Gillies Creek Tributary 1 Tributary	From its confluence with Tributary A to Gillies Creek Tributary 1 to a point approximately 1,830 ft. upstream
Tuckahoe Creek	From the Chessie System Railroad crossing upstream to the confluence of Little Tuckahoe Creek
Upham Brook	From a point approximately 0.8 mi. upstream of its confluence with the Chickahominy River to a point approximately 170 ft. downstream of Bethlehem Road

Approximate analyses, also known as limited detail analyses, were used to study all remaining flooding sources in Henrico County with 100 acres or greater contributing drainage area. The scope and methods of study were proposed to, and agreed upon, by FEMA and Henrico County, Virginia.

2.2 Community Description

Henrico County is bounded on the north by the Chickahominy River and on the south by the James River. The boundary of the two respective watersheds essentially divides the county in half. It is bordered on the north and east by Hanover County, on the south by the City of Richmond and Chesterfield County, on the west by Goochland County, and on the east by New Kent and Charles City Counties. Centrally located in the eastern half of Virginia, it comprises a total area of 238 square miles (sq. mi.) (Reference 1).

Henrico County, being one of the original eight shires, or counties, in Virginia, was formed in 1634 with its boundaries extending indefinitely westward from Charles City County. The settlement of Henrico County was established by Sir Thomas Dale in 1611. Early development of Henrico County is accredited to agricultural products and general farms.

Henrico County is a rapidly growing suburban county included in the Richmond metropolitan area. The population of Henrico County was 262,300 in 2000 and the increase in population from 1990 to 2000 was 20.4% (Reference 1). Henrico County's population was 217,881 in 1990; 180,735 in 1980 and 154,364 in 1970 (Reference 2).

Residential developments, particularly older neighborhoods, are concentrated around the edges of Richmond. Development since 1960 is primarily located in the northern and western areas of Henrico County. Most commercial development is relatively new and within several miles of the Richmond corporate limits.

The climate of Henrico County is pleasant, with warm, humid summers and generally mild but wet winters. Temperatures vary widely, averaging about 37°F in January and 78°F in July. Annual precipitation averages 44 inches and is distributed relatively uniformly throughout the year (Reference 3). Precipitation in the warm season is generally related to convectional activity while in the winter, precipitation is due to frontal activity. Occasional tropical storms bring heavy rainfall in the late summer and early fall.

The Fall Line, separating the Atlantic Coastal Plain and the Piedmont Plateau, divides Henrico County along a north-south line. Several soil types exist in the county. Most are deep and well-drained (Reference 3).

The county is flat to gently rolling with elevations ranging from zero to 340 feet (ft.). Plateaus are located in the northwest portion of the county and in the eastern portion of the county in the vicinity of Richmond International Airport. Steep slopes generally are found only in the bluffs along the rivers.

With a 25-mile border on the Chickahominy River on the north and 20 mi. on the James River below Richmond, Henrico has both navigable and sports fishing resources. In 1637 a port was established in Henrico County below the falls of the James which was included, first, in the Town of Richmond, 1742, and later the City of Richmond in 1782. The history and life of Henrico County is intimately related to that of Richmond, the county's seat of government.

The James River, on the lower boundary of the county, is the major watercourse. Originating in the Appalachian Mountains at the confluence of the Jackson and Cowpasture

Rivers, it flows generally in a southeasterly direction to the Chesapeake Bay, a distance of 340 mi. (Reference 4). The flood plain of the James River in this study reach varies from 2,100 to 5,700 ft. in width. Development on the flood plain is sparse with only minor residential development. Most flood plain areas consist of agricultural uses or woodlands. In the southern portion of the county, the James River is subject to tidal activity.

Numerous small streams flow through the county before discharging into the James and Chickahominy Rivers. Many of these are suburban streams with great flood potential because of the rapid development within their drainage areas. Flood plain development along these smaller streams consists of residential and agricultural uses and also woodlands.

2.3 Principal Flood Problems

James River:

Low-lying areas along the James River are subject to periodic flooding. The flood of May 1771 is considered the greatest in the James River basin since the settlement of Jamestown in 1607. One of the largest floods recorded in recent times occurred in June 1972 as a result of intense rainfall associated with tropical storm Agnes (Reference 5). Tropical storms are responsible for some of the larger floods experienced on the James River. Flooding from these storms almost always occurs in the period from May through November, which is the hurricane season. Large floods have occurred on the James River near Richmond as follows (References 6, 7, 8, 9, 10 and 11):

Date	Flow (cubic feet per second (cfs))	Estimated Recurrence Interval
November 1877	-	50 to 100 Years
March 1936	175,000	10 to 50 Years
August 1940	151,000	10 to 50 Years
September 1944	150,000	10 to 50 Years
August 1969	222,000	10 to 50 Years
June 1972	313,000	100 to 200 Years
October 1972	162,000	10 to 50 Years

Tuckahoe Creek Watershed:

Flood problems on Tuckahoe Creek, Little Tuckahoe Creek, Deep Run and Stoney Run are not serious and damage is slight. Flooding results either from intense short-duration rainfall over the area or from backwater from the James River. Flooding is also somewhat aggravated by the limited waterway openings in railroad and highway fills (Reference 12).

Some flooding of low-lying homes occurred during the June 1972 flood. Residential development of the area is now occurring, and, as the watershed is developed, there is a potential for aggravated flooding because of increased runoff and encroachment of flood plains.

Gillies Creek Watershed:

Flooding in the upper portion of the Gillies Creek watershed has gone almost unnoticed in the past, because the flood plain has been practically undeveloped (Reference 13).

Consequently, the flood problem is not serious and damage is slight. Flooding is aggravated by the limited waterway openings in railroad and highway fills. Many of the culverts are inadequate to pass the higher flood flows, thereby inundating the roadways and producing some backwater effects upstream.

Upham Brook Watershed:

The flooding problem in the Upham Brook watershed stems from the inability of the natural watercourse to contain all of the runoff which results from intense rainfall over the watershed. The problem has been partially alleviated by channel improvements by the City of Richmond and Henrico County on Jordans Branch, by Henrico County on Horsepen Branch, and by the Virginia Department of Highways on the upper portion of Upham Brook during construction of I-64. Removal of low-lying houses in the Capistrano Gardens area by Henrico County has practically eliminated the flood problem in this area. A flood problem still exists in the Bloomingdale area. Upstream improvements, made since the August 1969 flood, produce a more rapid concentration of runoff, thus tending to increase flood heights.

Flooding is also somewhat aggravated by the limited channel area at many of the numerous highway and other stream crossings in the watershed. Floodwaters pond up in back of many of the roadfills, and in some instances actually overtop the roadway (Reference 14).

North Run Watershed:

The flood problem in the North Run watershed is not serious and damage is slight. Flooding is caused by the inability of the main stream channels to contain all the water which results from heavy rainfall. Flooding is also somewhat aggravated by the limited waterway openings in railroad and highway fills. The flood problem can become serious unless appropriate controls continue to be exercised by Henrico County.

There is no record of significant flooding on North Run or its tributaries. Floods have undoubtedly occurred, but they have gone largely unnoticed due to the rural nature of the watershed and absence of vulnerable property on the flood plain (Reference 15).

2.4 Flood Protection Measures

There are no flood control improvements in the James River watershed which have a significant effect on the height of floods on the James River at Richmond. However, a channel improvement of the James River below Richmond reduces the major flood crest in Richmond. The project shortens the channel length by 10.8 mi. and thereby reduces the height of the 100-year flood by approximately 2 ft. at Richmond.

On smaller streams, various channel improvements have been made through-out the county. More improvements are planned, as will be delineated in Henrico County's comprehensive drainage plan.

The smaller urban streams being studied in this report have no flood control structures to impede the flow of storm water. Railroad and highway embankments in some areas tend to impound water during flood periods, decreasing peak flows downstream. Other than this, there are no flood protection structures located within the study area.

The Henrico County Code contains several sections relating to building on land which is subject to inundation. The county drainage engineer reviews all building plans to insure compliance with the code. Henrico County's building code is in compliance with the State of Virginia building code (Reference 16), which is in substantial compliance with the FEMA flood plain zoning requirements.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein 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 peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

In the original Henrico County (Unincorporated Areas) study, data from the USGS gaging station on the James River at Westham Bridge near Richmond (No. 20375000) were used to define the discharge-frequency relationships for the James River. The values of the 10-, 2-, 1- and 0.2-percent-annual-chance flood peak discharges, as obtained from a log-Pearson Type III distribution of annual peak flow data were provided by the Virginia State Water Control Board (Reference 17). Peak discharges for the 10-, 2- and 1-percent-annual-chance floods on Gillies Creek, Stony Run and Upham Brook were based upon an urban regional frequency procedure (Reference 18). Where applicable, peak flows were reduced due to routing behind railroads, highway embankments and dams. The magnitude of the 0.2-percent-annual-chance flood peak discharge for each stream studied in detail was estimated by straight-line extrapolation on a log-normal probability graph of peak flows up to the 1-percent-annual-chance event (Reference 19). Discharges for all other streams on which detailed studies were done were computed by the USACE, Norfolk District (Reference 20). Flows were developed after analysis of the rainfall and runoff characteristics of the watersheds, resulting in synthetic unit hydrographs. By applying appropriate rainfall runoff amounts to the unit hydrographs, the discharges were computed for any frequency flood. Flows at points upstream from reaches already studied by the USACE were reduced proportional to flows computed by the urban regional frequency procedure described above (Reference 18). In order to utilize data developed by the USACE, the 4-percent-annual-chance flood discharge was used instead of the 2-percent-annual-chance flood on Tuckahoe Creek and Deep Run.

For this study, following Henrico County requirements, peak discharges were obtained along the study reaches at all sections defining catchments with 100-acre increments in drainage, and at the confluence of tributaries. These subbasins were delineated using automated Geographical Information System (GIS) routines and a Digital Elevation Model (DEM) obtained from ortho-rectified aerial photography.

The rural or un-urbanized discharges were based on regression equations presented in an USGS report for estimating the magnitude and frequency of peak discharges of rural, unregulated streams for eight distinct physiographic regions statewide (Reference 21).

The peak discharges, calculated from regression equations for rural catchments were then increased to account for the impact of urbanization. For those watersheds affected by urbanization, the increase in peak discharge resulting from urbanization was estimated utilizing the methodology presented in an USGS Water Supply Paper on flood characteristics of urban watersheds in the United States (Reference 22).

In some cases, the delineation of all watersheds defined by drainage areas with multiples of 100 acres resulted in anomalous decreases in peak discharge in the downstream direction. This occurred because slopes calculated at frequent intervals along streams with mild upstream reaches, followed by a steep mid-reach or escarpment, and a flatter slope at the confluence with the mainstream channel valley, resulted in locally increasing slopes in the downstream direction. In these cases, the regression equations yield higher discharges in the mid-reaches followed by reduced discharges downstream, as the magnitude of the slope decreases. To avoid these slope anomalies, the Coastal Plain and Southern Piedmont area-only regression equations were used for the streams in Henrico County (Reference 21).

A comparison between the Southern Piedmont and Coastal Plain area-only regression equations and gaged data indicated that the area-only regression equations are applicable to rural watersheds in the vicinity of Henrico County (Reference 21).

The regression equations for the Southern Piedmont were adjusted for the impact of urbanization using a Basin Development Factor (BDF) (Reference 22), for comparison with the peak discharges estimated with *Bulletin 17B* methodology from the observed flow series at the Horsepen Branch and Jordans Branch gages for the same return periods. While these two gage sites are geographically within the Coastal Plain Physiographic Region, the basin and flood characteristics for these streams are more similar to the characteristics defining streams in the Southern Piedmont region. Based on the comparison, the regression equations are reasonable for estimating urban peak discharges to be used for the hydraulic modeling of the detailed study reaches.

Horsepen Branch and Jordans Branch are gaged streams with more than 10 years of record at the gages. Therefore, gage analysis was used instead of regression equations to estimate discharges along reaches of Horsepen Branch, Jordans Branch, and their tributaries. Rural discharges at the cross-sections marking 100-acre increments within these basins were

determined from the drainage area ratio raised to the region-wide power of 0.559, and then adjusted for urbanization within the catchment:

$$Q_x = 7.70 * A_x^{0.15} * (13 - BDF)^{-0.32} * \left(Q_g * \left(\frac{Ax}{Ag}\right)^{0.559}\right)^{0.82}$$

where Q_x and Q_g are the discharges, and A_x and A_g are the drainage areas, at the section and gaged site, respectively, and BDF is the development factor between 1 and 12.

Along the upstream-most portion of the Chickahominy River, there is no effective flooding information either in Henrico County or in the adjacent community. The upstream-most portion of the river that has been studied was for the Henrico County Letter of Map Revision (LOMR) dated January 10, 1997 (Case No. 96-03-151P). This LOMR shows that the 100-year discharge at Shady Grove Road is approximately 7,300 cubic feet per second (cfs). This discharge was used with the drainage area ratio methodology to estimate the 100-year discharge at the point of interest, 0.4 mile upstream of Shady Grove Road, which is the upstream limit of study for the effective analysis. Using the USGS quadrangle map, basins were delineated at both Shady Grove Road and the point of interest and the drainage areas were computed. This reach of the Chickahominy River falls in the Southern Piedmont region, thus the exponent of 0.559 from the area-only regression equation for it was used in the drainage area ratio equation, as shown below:

$$Q_1 = \frac{Q_2}{(DA_2/DA_1)^{0.559}}$$

where Q_1 and Q_2 are the discharges, and DA_1 and DA_2 are the drainage areas, at the point of interest and from the LOMR, respectively. Discharges for the 100-year event on Fourmile Creek and Fourmile Creek Tributary (also known as Fourmile Creek Tributary 7) were previously computed in the Henrico County LOMR dated October 12, 2001 (Case No. 01-03-057P). However, these discharges appear to be unreasonably high as compared to the regression and gage analyses. Therefore, revised discharges have been computed for these streams. The rural regression equations for the Coastal Plain Physiographic Region were used (Reference 21) and these discharges were adjusted for the effects of urbanization using a BDF of 2 (Reference 22).

Peak discharge-drainage area relationships for the streams studied in detail are shown in Table 1, Summary of Discharges.

3.2 Hydraulic Analyses

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

For the original Henrico County (Unincorporated Areas) study, cross-section data for Gillies Creek, Stony Run and Upham Brook were taken from topographic maps and verified by field measurement. Bridge elevation data and structural geometry were taken

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Allens Branch					
Above confluence with Rooty Branch	3.54	987	1,725	2,155	3,290
0.5 mile upstream of confluence with Rooty Branch	3.40	962	1,682	2,102	3,209
Just downstream of Fords Country Lane	3.18	923	1,616	2,020	3,085
Chickahominy River					
Below Upham Brook	90.9	5,900	8,400	9,700	13,800
Copperas Creek					
At Mouth	1.76	1,340	2,184	2,735	4,024
760’ downstream of Lauderdale Drive	1.65	1,290	2,104	2,636	3,880
100’ upstream of Lauderdale Drive	1.51	1,219	1,992	2,496	3,677
375’ downstream of Cambridge Drive	1.42	1,170	1,915	2,400	3,536
830’ upstream of Cambridge Drive	1.26	1,087	1,783	2,235	3,297
800’ below confluence with Copperas Creek Tributary 2	1.15	1,026	1,685	2,114	3,120
Above confluence with Copperas Creek Tributary 2	0.63	700	1,164	1,462	2,168
0.4 mile downstream of Church Road	0.49	603	1,006	1,265	1,879
0.6 mile downstream of Church Road	0.34	474	798	1,004	1,496
Copperas Creek Tributary 2					
At Mouth	0.39	522	876	1,102	1,639
180’ downstream of Ridgefield Parkway	0.32	454	764	963	1,434
Deep Run					
Above confluence of Stony Run	4.67	2,000	2,600[1]	2,850	3,600
Interstate Route 64	1.18	1,650	2,100[1]	2,350	2,800

[1] 4-Percent annual chance discharge

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Fourmile Creek					
At Mouth	19.82	1,429	2,368	2,923	4,428
Above confluence with Fourmile Creek Tributary 14	18.85	1,280	2,142	2,645	4,026
Above confluence with Bailey Creek	13.72	1,023	1,729	2,137	3,266
Above confluence with Fourmile Creek Tributary 11	12.51	968	1,639	2,026	3,099
0.3 miles downstream of New Market Road	10.93	893	1,516	1,875	2,871
Above confluence with Deerlick Branch	5.53	615	1,055	1,307	2,007
Fourmile Creek Tributary 7					
At Mouth	1.84	307	541	694	1064
100’ upstream of footbridge	1.81	304	536	687	1055
Gillies Creek					
Jenny Scher Road	14.3	3,200	5,800	7,100	11,000
Laburnun Avenue	6.5	1,700	3,200	3,800	5,900
950’ downstream of Laburnum Avenue	6.34	1,528	2,385	2,954	4,328
Above confluence with Heckler Village Tributary 1	4.99	1,324	2,077	2,575	3,779
Above confluence with Gillies Creek Tributary 1	2.86	949	1,506	1,870	2,755
Gillies Creek Tributary 1					
At Mouth	2.01	1,260	2,124	2,575	3,833
0.4 mile downstream of Oakleys Lane	1.86	446	755	938	1,425
0.2 mile downstream of Oakleys Lane	1.72	425	720	896	1,362
940’ upstream of Oakleys Lane	1.39	374	637	792	1,207
530’ downstream of Holly Avenue	0.46	317	522	652	973
Kalmia Avenue	0.38	283	469	586	876

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Harding Branch					
At Mouth	1.80	1,360	2,215	2,774	4,080
Dam	1.58	1,255	2,048	2,566	3,779
Above confluence with Harding Branch Tributary 1	1.21	1,059	1,738	2,180	3,216
710’ upstream of confluence with Harding Branch Tributary 1	1.09	992	1,631	2,047	3,022
30’ downstream of Church Road	1.02	949	1,562	1,960	2,895
0.2 miles downstream of Gayton Road	0.87	862	1,424	1,788	2,644
330’ downstream of Gayton Road	0.79	811	1,342	1,685	2,494
370’ upstream of Lauderdale Drive	0.49	599	1,000	1,257	1,867
410’ upstream of Park Terrace Drive	0.39	515	865	1,088	1,619
260’ upstream of Footbridge 3	0.24	297	517	652	986
Harding Branch Tributary 1					
At Mouth	0.24	385	652	821	1,226
Heckler Village Tributary 1					
At Mouth	1.22	569	918	1,143	1,694
Above confluence with Heckler Village Tributary 2	0.82	448	730	909	1,352
0.2 mile downstream of Colwyck Drive	0.67	399	652	813	1,211
Colwyck Drive	0.62	378	620	773	1,152
230’ upstream of Colwyck Drive	0.46	193	337	420	645
Heckler Village Tributary 2					
At Mouth	0.32	143	254	317	490
220’ downstream of Colwyck Drive	0.30	123	221	276	430
310’ upstream of Wynfield Terrace	0.16	73	134	168	264

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Horsepen Branch					
At Mouth	1.90	1,963	3,008	3,702	5,290
520’ downstream of I-64	1.80	1,897	2,907	3,576	5,108
380’ downstream of Bethlehem Road	1.66	1,808	2,770	3,405	4,860
0.2 mile upstream of Bethlehem Road	1.52	1,716	2,629	3,231	4,607
870’ downstream of West Broad Street	1.39	1,622	2,486	3,053	4,349
Above confluence with Horsepen Branch Tributary 3	1.00	1,335	2,044	2,505	3,558
540’ downstream of Engle Road	0.96	1,302	1,993	2,443	3,468
Above confluence with Horsepen Branch Tributary 1	0.58	959	1,467	1,793	2,532
Hungary Creek					
At Mouth	3.20	2,800	3,920	4,280	5,440
Richmond, Fredricksburg, and Potomac Railroad	2.28	2,200	3,150	3,450	4,435
Staples Mill Road	1.32	1,600	2,200	2,400	3,100
Sunburst Road	0.11	340	490	530	690
James River					
USGS Gage at Westham Bridge	6,758	131,000	232,000	290,000	475,000
Jordans Branch					
0.4 mile downstream of Interstate 64	3.56	2,366	3,850	4,632	6,876
Interstate 64	3.42	2,309	3,758	4,521	6,711
Railroad Yard	2.34	1,834	2,984	3,589	5,329
750 feet upstream of Railroad Yard	2.26	1,793	2,917	3,510	5,210
0.2 mile downstream of Staples Mill Road	1.83	1,577	2,567	3,088	4,584
Staples Mill Road	1.59	1,466	2,354	2,832	4,203
Broad Street	1.33	1,300	2,116	2,545	3,778
Markel Road	1.22	1,233	2,006	2,413	3,582
170 feet upstream of Markel Road	1.20	1,220	1,986	2,389	3,546
570 feet upstream of Fitzhugh Avenue[2]		0	740	1,129	2,247
110 feet downstream of Monument Avenue[2]		0	652	995	1,980

[2]All discharges reduced by 10-percent-annual-chance discharge, which is contained in the Willow Lawn Drive Culvert

$1.13^{0.92}$

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Meredith Branch					
At Mouth	3.99	2,250	3,609	4,507	6,593
300’ upstream of Road to Tidewater Quarry	3.79	2,179	3,498	4,370	6,395
Above confluence with Meredith Branch Tributary 3	3.56	2,095	3,367	4,207	6,159
430’ upstream of Echo Lake Dam	3.43	2,045	3,290	4,111	6,020
390’ downstream of Footbridge	3.28	1,986	3,197	3,996	5,854
70’ upstream of Footbridge	3.16	1,941	3,128	3,910	5,728
190’ downstream of confluence with Meredith Branch Tributary 4	3.00	1,881	3,033	3,792	5,558
Above confluence with Meredith Branch Tributary 4	2.33	1,603	2,598	3,251	4,774
750’ upstream of confluence with Meredith Branch Tributary 4	2.29	1,583	2,565	3,210	4,715
Above confluence with Meredith Branch Tributary 5	1.55	1,237	2,021	2,532	3,729
Above confluence with Meredith Branch Tributary 1	1.04	960	1,580	1,983	2,929
North Run					
At Mouth	17.04	8,325	11,160	12,500	20,050
Above confluence of Rocky Branch	12.48	6,600	9,375	10,225	16,000
Above confluence of Hungary Creek	6.30	4,080	5,800	6,350	8,500
Richmond, Fredericksburg, and Potomac Railroad	0.96	1,725	2,410	2,625	3,400
Rocky Branch					
At Mouth	2.46	2,750	3,825	4,175	5,360
Richmond, Fredericksburg, and Potomac Railroad	1.75	2,575	3,640	3,990	4,790
Stoneman Road	1.07	1,800	2,600	2,800	3,200
Rooty Branch					
500’ downstream of Nuckols Road	1.12	1012	1,663	2,085	3,079
340’ upstream of Nuckols Road	0.97	921	1,517	1,904	2,814
180’ downstream of dam	0.83	835	1,380	1,733	2,564

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Stoney Run					
At Mouth	2.70	1,600	2,100	2,350	2,800
Church Road	1.47	1,400	1,850	2,000	2,450
Stony Run					
At Mouth	4.80	1,400	2,600	3,200	4,900
Nine Mile Road	2.58	950	1,800	2,200	3,300
Thorpe Branch					
At Mouth	0.79	700	970	1,070	1,240
Hermitage Road	0.59	440	600	660	720
Warwick Road	0.35	230	320	350	38
Tributary A to Gillies Creek Tributary 1					
At Mouth	0.66	221	385	480	739
820’ upstream of Hawkes Lane	0.33	145	257	321	497
Tributary A to Gillies Creek Tributary 1 Tributary					
At Mouth	0.17	75	139	174	274
Tuckahoe Creek					
At Mouth	56.41	10,900	15,000[1]	16,500	21,000
Above confluence of Deep Run	42.75	9,500	12,900[1]	14,200	17,700
Upham Brook					
At Mouth	37.5	6,300	11,500	14,000	21,000
Interstate 95	32.7	7,000	12,900	15,700	24,000
Confluence of North Run	16.0	4,300	7,700	9,300	14,000
Confluence of Trumpet Branch	12.9	4,100	7,200	8,700	13,000
Confluence of Jordans Branch	6.8	2,200	4,100	5,000	7,800
Confluence of Horsepen Creek	4.2	1,600	2,900	3,500	5,400

[1] 4-Percent annual chance discharge

from cross-section information or by field measurement. Cross-section data for other streams studied in detail were provided by the USACE (Reference 20). Cross sections were located at close intervals upstream and downstream of bridges and culverts in order to compute the significant backwater effects of these structures. Roughness coefficients (Manning's "n" values) for all streams studied in detail were estimated by field inspection at each cross section. Roughness coefficients for the James River were adjusted slightly so that computed and actual flood elevations for the 1972 flood matched through calibration of the computer hydraulic model. Water-surface elevations (WSELs) of floods of the selected recurrence intervals were developed using the USACE HEC-2 step-backwater computer program. Starting WSELs for all streams studied in detail were determined by the slope-area method (Reference 23). WSELs above high roadway and railroad embankments were not determined by HEC-2 computer analysis. Rather, they were determined by computing culvert flow characteristics and by routing floods through the retention basin formed by the embankment (Reference 24). It was determined that certain bridges crossing streams studied by detailed methods would not be included in the analyses due to the minimal effects they would have on flood elevations. In these instances location was denoted on the profiles but bridge elevations were not shown. Flood boundaries for streams studied by approximate methods were taken from previous studies or by correlation with nearby detailed study streams, field reconnaissance, and engineering judgment.

For this study, the hydraulic model used is the USACE Hydraulic Engineering Center River Analysis System, version 3.0.1 (HEC-RAS). The county contains approximately 343 mi. of limited detail study streams and approximately 15 mi. of detailed study streams.

The downstream starting WSELs for all profiles in the HEC-RAS models were calculated using normal depth method with the exception of Gillies Creek and Rooty Branch. Gillies Creek ties into an existing detail study stream at the downstream end; therefore, the model started with a known WSEL from the previously effective Henrico County (Unincorporated Areas) FIS (Reference 25). Rooty Branch ties into a limited detail study stream at the downstream end; therefore, that model started with a known WSEL from the limited detail model.

The floodplain cross sections were placed at representative locations, approximately 500 ft. apart along the stream centerline. Cross section geometries were obtained from a combination of field survey and cross sections takeoffs based on topographic data provided by Henrico County. All structures along the streams and several channel cross sections for each stream were field surveyed. Surveyed channel sections were propagated upstream and downstream to non-surveyed cross section and blended with data from the topographic sources. All cross section overbank ground information was obtained from a Triangular Irregular Network (TIN) developed from the topographic data.

Manning's "n" values were estimated based on field inspection of stream channels and floodplain areas for the streams in Henrico County. GIS coverage of floodplain and channel "n" values was developed. This GIS coverage consists of "bands" of Manning's "n" values. These bands were developed using the field reconnaissance and the orthophotos provided by Henrico County. The purpose of the n-values "band" coverage is to allow the consistent application of Manning's "n" value estimates. Ineffective flow areas (e.g., extremely dense trees and underbrush, dense residential areas, large buildings, fenced areas) were modeled in HEC-RAS by using high Manning's "n" values to account for the ineffective areas.

Eleven historical flooding interviews were conducted with persons living or working along the detailed study streams, including four people who had been in the area for over 30 years. Only eight survey elevations were taken, as three of the interviewees had never seen the water out of the banks on their respective streams. Each of the high water marks taken represented an event that was less than or equal to the 10-percent-annual-chance event, making calibration of these marks difficult. Each of these marks was less than the 10-percent-annual-chance event in the detail study models. As a reasonability check, the mapped flood boundaries for each of the detail study streams were compared with the widths of the existing Zone A boundaries mapped on the previously effective FIRMs (Reference 25) where applicable. Each of the revised boundaries seemed to roughly have similar shapes and widths with the effective Zone A areas on the effective FIRM maps.

All streams not previously or newly studied in detail were studied with limited detailed methods from the confluence or limit of detailed study upstream to a point where the contributing drainage area was approximately 100 acres.

Starting conditions for the limited detail hydraulic models were set to normal depth using starting slopes calculated from the new topographic data or, where applicable, set to a known WSEL derived from either new detail or existing effective flood elevations. Floodplain cross sections were placed approximately 1,000 ft. apart along the stream centerline, where possible. Cross section geometries were taken from a combination of cross section takeoffs from the new topography and trapezoidal channels. Manning's "n" values were set at 0.045 for channels and from 0.06 to 0.14 for overbank areas, based on inspection of the aerial photography. No channel field survey or historical high-water marks were obtained for the limited detail streams in Henrico County. In addition, bridges were not included in the limited detail hydraulic models.

Several streams modeled by limited detailed methods included reaches that may be partially conveyed through storm drain systems. The additional conveyance of the storm drain systems was not included in the limited detailed analysis because of the lack of information available about the storm drains and also because of the substantial time and effort required to perform the analysis. Further, typical storm drain systems are designed to convey only the 10-percent-annual-chance-flood event, so it was assumed that the conveyance of the storm drain would be negligible compared to the overland flow from the 1-percent-annual-chance-flood event. However, along these reaches, the hydraulic models were adjusted to reflect an overland flow condition, rather than a channel flow condition. This adjustment was made by modifying the affected cross sections to remove the trapezoidal channel.

On the Digital Flood Insurance Rate Maps, the majority of the streams studied by limited detailed methods will be shown as Zone A (approximate) areas. However, some very small streams may not be shown at all.

While Base (1-percent-annual-chance) Flood Elevations (BFEs) for the Chickahominy River were available from the Hanover County effective FIS (Reference 26) for most of reach along the Henrico County boundary, the downstream-most reach of the river was not studied in either county; therefore, a limited detail model was constructed for this reach. While the change in drainage area between the downstream limit of study, just downstream of White Oak Swamp, and the location of the discharge in the effective study, just downstream of Upham Brook, is large, the effective 1-percent-annual-chance discharge of 9,700 cfs was used in the model. *Bulletin 17B* analysis of the gage downstream of

Henrico County, with a drainage area of 252 sq. mi., resulted in a lower 1-percent-annual-chance discharge of 8,130 cfs. The effective discharge, with a drainage area of 91 sq. mi., was obtained using a rainfall-runoff method. The effective discharge is within the 50- and 90-percent confidence interval of the newly computed discharge. Rainfall-runoff methods can overestimate discharges; therefore, both discharges were used in the hydraulic model to determine what effect the discharges would have on the computed WSEL. At the upstream-most cross section, the difference in WSEL was 0.4 ft. Because the difference in WSEL was less than 0.5 ft. and the effective discharge is within the 50- and 90-percent confidence interval of the new discharge, the effective discharge was used in the model.

Just as the downstream-most reach of the Chickahominy River was not studied in Hanover or Henrico Counties, neither was the upstream-most reach of the river. Therefore, this reach was also studied using limited detail methods. Discharges for this reach of the Chickahominy were calculated using information from the Henrico County Letter of Map Revision (LOMR) dated January 10, 1997 (Case No. 96-03-151P), as described in Section 3.1 Hydrologic Analyses. TIN information was available outside of Henrico County for all of the cross sections necessary for the model. A cross section interval of 1,000 ft. was used. Manning's "n" values of 0.045 and 0.129 were used for the channel and for the overbanks, respectively.

Although the majority of Fourmile Creek was previously unstudied, the Henrico County LOMR dated October 12, 2001 (Case No. 01-03-057P), established BFEs along a reach of Fourmile Creek and one of its tributaries. As outlined in section 3.1 Hydrologic Analyses, the discharges used in the LOMR were very high compared to the new discharges. Therefore, revised models were developed, using the new discharges, for Fourmile Creek and Fourmile Tributary 7. Cross sections were taken in approximately the same locations as the cross sections in the LOMR, with new elevation information for the overbanks being taken from the TIN. Only the bank-to-bank channel survey information from the LOMR was used in the new cross sections. Along Fourmile Creek, other small modifications were made to the new model. These changes included adjusting some of the bank station locations, adjusting ineffective flow areas, changing the Manning's "n" value at the Doran Road culvert, and changing the expansion and contraction coefficients at the downstream bridge cross section. In addition, a cross section was added to tie the new model into the detailed model immediately downstream. Finally, to further tie the new Fourmile Creek model into the downstream detailed model, the 10-, 2-, and 0.2-percent-annual-chance flood events and a floodway analysis were added.

As with the Chickahominy River, BFEs for all but the most-downstream reach of the James River were available from the Chesterfield County effective FIS (Reference 27). Limited detail methods were used to study that reach, which was unstudied in both counties. Because the drainage area did not increase significantly from the location of the effective discharge, at the Westham Gage, to the point of interest, just upstream of the confluence of Turkey Island Creek, the effective discharge of 290,000 cfs was used in the HEC-RAS model.

Some TIN information was available outside of the county boundary, along the centerline of the James River, but a majority of the topographic information outside of Henrico County was taken from the 1:24,000 scale USGS quadrangles. The USGS quadrangles also showed that along portions of the James River, and through its cutoffs, there was a shipping channel, which we assumed was deeper than the main river. Manning's "n" values of 0.045 for the channel and 0.06 for the overbanks were derived from values in the Chesterfield County effective FIS (Reference 27).

The Manning's "n" values for all streams studied in detail are shown below in Table 2.

Table 2. Manning's "n" Values

Stream	Channel "n"	Overbank "n"
Allens Branch	0.040-0.050	0.100-0.200
Chickahominy River	0.040-0.075	0.050-0.400
Copperas Creek	0.045-0.055	0.100-0.200
Copperas Creek Tributary 2	0.040-0.055	0.110-0.200
Deep Run	0.060	0.060
Fourmile Creek	0.045	0.100-0.200
Fourmile Creek Tributary 7	0.045	0.140
Gillies Creek	0.040-0.060	0.080-0.200
Gillies Creek Tributary 1	0.050	0.110-0.200
Harding Branch	0.035-0.055	0.060-0.200
Harding Branch Tributary 1	0.035-0.045	0.060-0.200
Heckler Village Tributary 1	0.035-0.050	0.100-0.200
Heckler Village Tributary 2	0.035-0.050	0.100-0.280
Horsepen Branch	0.035-0.050	0.100-0.200
Hungary Creek	0.045	0.045
James River	0.028-0.080	0.050-0.200
Jordans Branch	0.020-0.050	0.060-0.140
Meredith Branch	0.035-0.055	0.100-0.200
North Run	0.045-0.060	0.045-0.060
Rocky Branch	0.045	0.045
Rooty Branch	0.035-0.050	0.100-0.200
Stoney Run	0.060	0.100
Stony Run	0.040-0.050	0.080
Thorpe Branch	0.045	0.045
Tributary A to Gillies Creek Tributary 1	0.050	0.100-0.200
Tributary A to Gillies Creek Tributary 1 Tributary	0.050	0.110-0.200
Tuckahoe Creek	0.060-0.120	0.060-0.120
Upham Brook	0.055-0.140	0.050-0.150

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

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

3.3 Vertical Datum

All 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 used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD. The conversion factor for areas within Henrico County was found to be NGVD - 1.04=NAVD. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, or redelineated, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using the digital topographic base map provided by Henrico County, with a contour interval of 2 ft. (Reference 28). Both automated and manual delineation methods

were used. Topographic data for the floodplain models and delineation was developed using aerial photography flown in February of 1998 at a scale of 1"=100' and 2 ft. contours, with ASPRS accuracy standards for 1"=100' mapping (Reference 29).

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

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

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 base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 ft., 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 floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (see Table 3, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the WSEL of the base flood more than 1 ft. at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Allens Branch								
A	616	200	1,153	1.9	196.8	196.5[2]	197.5	1.0
B	964	160	1,066	2.0	197.1	197.1	198.1	1.0
C	1,381	140	827	2.6	197.9	197.9	198.9	1.0
D	1,847	170	1,063	2.0	199.1	199.1	200.1	1.0
E	2,201	140	904	2.4	199.6	199.6	200.6	1.0
F	2,539	120	740	2.9	200.3	200.3	201.2	0.9
G	2,885	85	569	3.8	201.0	201.0	202.0	1.0
H	3,422	78	541	3.9	202.7	202.7	203.6	0.9
I	3,896	120	752	2.8	204.2	204.2	205.2	1.0
J	4,356	93	568	3.7	205.3	205.3	206.2	0.9
K	4,970	137	923	2.3	207.2	207.2	208.2	1.0
L	5,465	105	678	3.1	208.3	208.3	209.2	0.9
M	6,143	270	1,676	1.3	209.7	209.7	210.7	1.0
N	7,239	64	460	4.4	213.7	213.7	213.7	0.0

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Chickahominy River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

ALLENS BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Copperas Creek								
A	427	620[2]	2,223	1.2	144.0	134.9[3]	135.9	1.0
B	1,324	110	368	7.4	144.0	138.0[3]	138.0	0.0
C	1,998	190	1,006	2.7	144.0	141.1[3]	141.3	0.2
D	2,541	150	1,054	2.6	144.0	142.7[3]	143.5	0.7
E	2,929	250	1,457	1.8	144.0	143.8[3]	144.7	0.9
F	3,216	215	1,252	2.1	144.5	144.5	145.4	1.0
G	3,583	230	1,645	1.6	147.7	147.7	148.6	0.9
H	3,970	220	1,652	1.5	148.1	148.1	149.1	1.0
I	4,474	270	2,074	1.2	150.2	150.2	151.2	1.0
J	4,930	175	1,288	1.9	150.5	150.5	151.5	1.0
K	5,221	175	1,088	2.2	150.7	150.7	151.7	1.0
L	5,596	200	1,285	1.9	151.4	151.4	152.4	1.0
M	6,161	95	659	3.4	152.3	152.3	153.3	1.0
N	6,686	90	407	5.5	153.8	153.8	154.7	0.8
O	7,116	130	653	3.2	157.2	157.2	158.1	0.9
P	7,622	25	126	11.6	160.7	160.7	160.8	0.1
Q	7,891	30	147	9.9	167.1	167.1	167.8	0.7
R	8,253	65	812	1.8	180.7	180.7	181.4	0.7
S	8,652	95	964	1.5	180.7	180.7	181.6	0.9
T	9,254	125	964	1.5	181.1	181.1	182.1	1.0
U	9,749	108	592	2.5	181.8	181.8	182.7	0.9

[1] Feet above mouth

[2] Computed without consideration of floodway effects from Tuckahoe Creek

[3] Elevation computed without consideration of backwater effects from Tuckahoe Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

COPPERAS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Copperas Creek (continued)								
V	10,359	95	276	5.3	186.4	186.4	186.5	1.1
W	10,805	80	403	3.1	190.5	190.5	191.3	0.8
X	11,223	48	221	5.7	192.5	192.5	193.5	1.0
Y	11,723	80	419	3.0	197.1	197.1	198.0	0.9
Z	12,304	31	167	6.0	200.1	200.1	201.0	1.0
AA	12,670	31	114	8.8	203.8	203.8	204.2	0.4
AB	12,968	25	103	9.7	208.6	208.6	209.1	0.5
AC	13,427	62	397	2.5	218.6	218.6	219.5	0.9
AD	13,723	38	204	4.9	219.3	219.3	220.2	0.9

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

COPPERAS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Copperas Creek Tributary 2								
A	3	21	129	8.5	160.0	159.6[2]	160.6	1.0
B	250	54	180	6.1	170.6	170.6	171.2	0.6
C	459	45	231	4.8	174.2	174.2	175.1	0.9
D	797	67	351	3.1	176.8	176.8	177.8	1.0
E	1,350	83	643	1.5	189.4	189.4	190.4	1.0
F	1,849	65	286	3.4	189.9	189.9	190.9	1.0
G	2,440	73	211	4.6	196.9	196.9	197.3	0.4
H	3,179	93	309	3.1	204.3	204.3	205.2	0.9
I	3,372	95	347	2.8	205.8	205.8	206.8	1.0

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Copperas Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

COPPERAS CREEK TRIBUTARY 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Deep Run								
A	3,200	689	9,407	0.7	144.0	138.6[2]	139.4[2]	0.8
B	5,680	762	6,941	0.9	144.0	138.8[2]	139.6[2]	0.8
C	7,595	256	2,944	2.0	144.0	143.7[2]	144.6[2]	0.9
D	9,830	424	4,065	1.5	146.1	146.1	147.0	0.9
E	11,010	391	3,175	1.9	146.1	146.1	147.0	0.9
F	11,510	139	680	9.1	146.5	146.5	147.2	0.7
G	12,510	201	1,630	3.9	151.1	151.1	152.0	0.9
H	15,610	413	3,314	1.9	153.4	153.4	154.3	0.9
I	16,510	425	3,382	1.9	153.8	153.8	154.8	1.0
J	17,040	230	1,403	2.0	154.1	154.1	155.1	1.0
K	18,270	250	1,451	2.0	155.3	155.3	156.3	1.0
L	19,420	230	1,015	2.8	157.1	157.1	158.0	0.9
M	20,170	226	866	3.3	159.7	159.7	160.7	1.0
N	20,860	270	1,063	2.7	162.3	162.3	163.3	1.0
O	21,730	190	816	3.5	165.6	165.6	166.6	1.0
P	22,250	165	953	3.0	167.5	167.5	168.4	0.9
Q	22,900	252	1,350	2.1	168.7	168.7	169.7	1.0
R	23,990	207	954	2.5	170.2	170.2	171.2	1.0
S	25,050	80[3]	386	3.4	171.9	171.9	172.7	0.8
T	25,598	220	2,119	0.6	180.8	180.8	180.8	0.0

[1] Feet above mouth

[2] Elevations computed without consideration of backwater effects from Tuckahoe Creek

[3] Floodway width changed due to use of more up-to-date topographic information

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

DEEP RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Fourmile Creek								
A	895	820	5,357	0.6	11.0	8.0[2]	9.0	1.0
B	2,473	1,305	9,384	0.3	11.0	8.3[2]	9.3	1.0
C	3,889	1,365	7,879	0.3	11.0	8.4[2]	9.4	1.0
D	4,844	800	5,762	0.4	11.0	8.5[2]	9.5	1.0
E	5,895	1,000	7,139	0.3	11.0	8.5[2]	9.5	1.0
F	6,936	595	4,573	0.5	11.0	8.6[2]	9.6	1.0
G	8,056	540	3,877	0.6	11.0	8.8[2]	9.8	1.0
H	9,378	365	2,167	1.0	11.0	9.0[2]	10.0	1.0
I	10,801	628	3,221	0.7	18.2	18.2	18.2	0.0
J	11,763	458	960	2.2	18.0	18.0	18.0	0.0
K	12,180	46	287	7.5	19.7	19.7	19.8	0.1
L	12,713	160	995	2.0	20.9	20.9	21.9	1.0
M	13,322	34	304	6.7	21.5	21.5	22.4	0.9
N	13,793	45	290	7.0	22.9	22.9	23.7	0.8
O	14,982	50	346	5.9	26.7	26.7	27.6	1.0
P	15,813	81	522	3.9	29.9	29.9	30.9	1.0
Q	16,419	73	406	5.0	31.9	31.9	32.9	1.0
R	16,930	175	836	2.4	34.3	34.3	35.3	1.0
S	17,500	220	1,449	1.4	35.5	35.5	36.4	0.9
T	18,184	80	441	4.6	36.1	36.1	37.1	1.0
U	18,714	200	674	3.0	40.3	40.3	40.8	0.5

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Tuckahoe Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Fourmile Creek (continued)								
V	19,394	260	1,089	1.7	43.2	43.2	44.0	0.8
W	20,262	385	994	1.9	45.6	45.6	46.6	1.0
X	21,535	100	622	3.0	52.3	52.3	52.4	0.1
Y	22,000	130	702	2.7	52.5	52.5	53.1	0.6
Z	23,126	160	673	2.8	54.9	54.9	55.9	1.0
AA	24,033	419	1,261	1.5	58.5	58.5	59.4	0.9
AB	24,870	329	853	2.2	61.5	61.5	62.5	1.0
AC	25,376	380	1,521	1.2	63.1	63.1	64.1	1.0
AD	25,837	259	999	1.9	63.8	63.8	64.8	1.0
AE	26,206	283	1,014	1.9	64.8	64.8	65.7	0.9
AF	26,793	168	579	2.3	66.4	66.4	67.4	1.0
AG	27,983	120	418	3.1	70.0	70.0	70.3	0.3
AH	28,761	267	717	1.8	72.5	72.5	73.5	1.0
AI	29,245	115	390	3.4	74.1	74.1	75.1	1.0
AJ	30,027	68	322	4.1	77.8	77.8	78.8	1.0
AK	30,863	395	1,078	1.0	80.0	80.0	81.0	1.0
AL	31,392	183	341	3.1	81.5	81.5	81.6	0.1
AM	31,732	203	795	1.4	84.9	84.9	85.0	0.1
AN	32,292	141	454	2.4	85.5	85.5	86.0	0.5
AO	32,847	130	384	2.8	88.7	88.7	89.6	0.9
AP	33,399	40	162	4.6	92.3	92.3	92.9	0.6

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Gillies Creek								
A	440	320[2]	1,757	4.0	45.6	45.6	46.6	1.0
B	1,395	107	723	6.4	49.3	49.3	50.1	0.8
C	3,400	130	701	6.6	60.7	60.7	60.8	0.1
D	3,975	70	549	8.4	65.0	65.0	66.0	1.0
E	4,500	53	477	9.6	73.3	73.3	73.3	0.0
F	5,400	66	793	5.8	79.0	79.0	79.9	0.9
G	6,380	47	471	9.8	84.1	84.1	84.5	0.4
H	8,415	210	1,781	2.6	92.1	92.1	93.1	1.0
I	9,765	133	749	6.1	96.5	96.5	97.1	0.6
J	10,715	260	1,755	2.2	101.2	101.2	102.2	1.0
K	11,685	380	2,483	1.5	108.4	108.4	108.4	0.0
L	12,192[3]	285	1,885	1.6	108.4	108.4	108.4	0.0
M	12,832	170	1,123	2.6	109.2	109.2	109.8	0.6
N	13,262	227	1,224	2.1	110.5	110.5	111.5	1.0
O	13,915	182	1,166	2.2	112.7	112.7	113.7	1.0
P	15,051	98	442	5.8	117.5	117.5	118.5	1.0
Q	15,437	162	844	3.1	120.7	120.7	121.6	0.9
R	15,650	159	863	3.0	121.9	121.9	122.9	1.0
S	16,332	130	909	2.8	125.2	125.2	126.2	1.0
T	16,872	287	1,622	1.6	126.9	126.9	127.8	0.9
U	17,506	142	628	3.0	128.7	128.7	129.3	0.6

[1] Feet above county boundary

[2] This width extends beyond county boundary

[3] Upstream flood hazard information is studied by detailed methods. These methods reflect more detailed and up-to-date stream channel configurations. As a result, the stream channel distances may not agree with the adjoining redelineated portion of the stream.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

GILLIES CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Gillies Creek Tributary 1								
A	1,808	96	372	2.5	128.3	125.8[2]	126.8	1.0
B	2,183	140	493	1.9	128.7	127.4[3]	128.4	1.0
C	3,422	27	175	5.1	135.4	135.4	136.4	1.0
D	3,705	19	117	7.7	136.5	136.5	137.1	0.6
E	4,578	250	1,202	0.8	139.2	139.2	140.1	0.9
F	5,096	275	1,048	0.8	139.4	139.4	140.4	1.0
G	5,552	59	211	3.8	139.7	139.7	140.7	1.0
H	5,931	63	262	3.0	141.6	141.6	142.6	1.0
I	6,480	29	206	3.8	143.0	143.0	143.8	0.8
J	6,922	34	248	3.2	145.6	145.6	146.0	0.4
K	7,406	40	181	3.6	146.0	146.0	146.7	0.7
L	7,857	55	277	2.4	148.6	148.6	149.4	0.8
M	8,198	45	196	3.3	149.5	149.5	150.3	0.8
N	8,650	76	303	2.2	150.9	150.9	151.7	0.8
O	8,904	40	198	3.0	152.9	152.9	153.2	0.3
P	9,112	19	58	10.0	153.5	153.5	153.5	0.0

[1] Feet above mouth

[2] Elevation computed without consideration of controlling effects of Gillies Creek

[3] Elevation computed without consideration of backwater effects from Gillies Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

GILLIES CREEK TRIBUTARY 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Harding Branch								
A	649	755	3,242	0.9	148.1	146.8[2]	147.7	0.9
B	1,244	365	1,770	1.6	148.1	147.5[2]	148.2	0.7
C	1,779	260	1,011	2.7	148.9	148.9	149.2	0.3
D	2,248	230	1,132	2.5	152.0	152.0	152.7	0.7
E	2,979	411	4,968	0.5	166.0	166.0	166.5	0.5
F	4,604	283	1,968	1.0	167.9	167.9	168.1	0.2
G	5,191	66	416	4.9	167.9	167.9	168.1	0.2
H	5,487	45	294	7.0	168.8	168.8	169.1	0.3
I	5,985	69	282	7.3	173.3	173.3	173.8	0.5
J	6,246	84	309	6.6	178.3	178.3	178.4	0.1
K	6,591	92	657	3.0	183.2	183.2	184.2	1.0
L	7,145	44	294	6.7	184.0	184.0	184.7	0.7
M	7,489	35	180	9.9	186.2	186.2	187.0	0.8
N	7,711	34	265	6.8	188.7	188.7	189.6	0.9
O	8,387	34	192	8.8	192.9	192.9	193.5	0.6
P	8,675	55	489	3.5	202.7	202.7	203.7	1.0
Q	9,070	55	303	5.6	203.1	203.1	203.7	0.6
R	9,674	35	180	9.4	208.2	208.2	208.3	0.1
S	10,416	55	202	6.2	214.7	214.7	214.8	1.1
T	10,729	100	394	3.2	217.4	217.4	218.4	1.0
U	11,074	74	187	6.7	221.9	221.9	222.9	1.0
V	11,819	408	1,979	0.6	238.7	238.7	238.7	0.0

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Tuckahoe Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HARDING BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Harding Branch (continued)								
W	12,711	140	672	1.6	238.7	238.7	238.7	0.0
X	13,256	55	261	2.5	240.5	240.5	240.7	0.2

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HARDING BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Harding Branch Tributary 1								
A	127	289	322	2.6	167.9	154.9[2]	155.9	1.0
B	457	179	125	6.6	167.9	159.3[2]	159.3	0.0
C	1,007	50	279	2.9	170.9	170.9	171.8	0.9

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Harding Branch

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HARDING BRANCH TRIBUTARY 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Heckler Village Tributary 1								
A	357	100	280	4.1	110.0	109.9[2]	109.9	0.0
B	939	434	8,007	0.1	137.5	137.5	137.6	0.1
C	1,785	370	5,288	0.2	137.5	137.5	137.6	0.1
D	2,695	281	2,786	0.3	137.5	137.5	137.6	0.1
E	3,505	80	348	2.2	137.5	137.5	137.6	0.1
F	3,904	32	106	7.3	140.8	140.8	140.8	0.0
G	4,335	30	181	2.3	144.5	144.5	144.6	0.1
H	4,664	30	200	2.1	144.9	144.9	145.1	0.2
I	4,893	20	97	4.3	145.0	145.0	145.3	0.3

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Gillies Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HECKLER VILLAGE TRIBUTARY 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Heckler Village Tributary 2								
A	343	104	68	4.7	137.5	127.8[2]	127.8	0.0
B	765	41	66	4.8	137.5	136.1[2]	136.1	0.0
C	1,103	35	134	2.1	141.0	141.0	141.0	0.0
D	1,453	14	32	8.6	141.6	141.6	141.6	0.0
E	2,094	23	144	1.9	146.3	146.3	147.2	0.9
F	2,680	25	58	4.7	148.3	148.3	148.6	0.3
G	2,935	14	23	7.3	152.0	152.0	152.0	0.0
H	3,225	14	40	4.2	155.7	155.7	155.9	0.2
I	3,750	9	42	4.0	158.2	158.2	159.0	0.8
J	4,159	81	175	1.0	158.5	158.5	159.4	0.9

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Heckler Village Tributary 1

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HECKLER VILLAGE TRIBUTARY 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Horsepen Branch								
A	97	124	775	4.8	173.7	165.2[2]	166.2	1.0
B	617	30	487	7.6	173.7	172.9[2]	173.2	0.3
C	1,055	34	449	8.3	173.7	173.6[2]	174.4	0.8
D	1,318	53	744	4.8	175.2	175.2	176.0	0.8
E	2,129	40	567	6.3	182.0	182.0	182.9	0.9
F	2,557	78	439	8.2	183.9	183.9	183.9	0.0
G	2,792	80	635	5.6	186.8	186.8	187.8	1.0
H	3,109	100	755	4.5	189.7	189.7	190.0	0.3
I	3,588	55	429	7.9	189.7	189.7	190.6	0.9
J	3,984	130	807	4.2	193.4	193.4	194.1	0.7
K	4,451	170	1,174	2.8	194.4	194.4	195.0	0.6
L	4,938	66	387	8.3	194.3	194.3	195.3	1.0
M	5,553	100	674	4.8	199.3	199.3	199.4	0.1
N	5,987	136	921	3.3	200.5	200.5	201.4	0.9
O	7,119	126	974	2.5	205.1	205.1	206.1	1.0
P	7,363	100	670	3.7	205.1	205.1	206.1	1.0
Q	7,722	100	551	4.4	205.8	205.8	206.7	0.9
R	8,158	64	371	6.6	206.7	206.7	207.6	0.9
S	8,513	60	290	8.4	207.9	207.9	208.9	1.0
T	8,816	36	213	8.4	211.6	211.6	211.6	0.0
U	9,132	70	297	6.0	215.6	215.6	215.7	0.1
V	9,294	68	336	5.3	217.5	217.5	218.5	1.0

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Upham Brook

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HORSEPEN BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Hungary Creek								
A	700	117	588	7.2	174.4	174.4	174.9	0.5
B	1,100	81	540	7.8	176.1	176.1	176.7	0.6
C	3,000	140	787	5.1	182.7	182.7	183.4	0.7
D	4,350	200	1,197	3.2	187.5	187.5	188.2	0.7
E	5,000	333	1,751	2.1	188.0	188.0	188.7	0.7
F	5,717	161	599	6.1	188.7	188.7	189.3	0.6
G	6,700	165	702	5.1	191.9	191.9	192.5	0.6
H	7,612	39	532	2.1	203.4	203.4	203.4	0.0
I	9,253	211	689	2.4	206.6	206.6	206.6	0.0
J	10,020	255	1,780	0.9	208.0	208.0	208.3	0.3
K	10,868	241	1,393	1.7	208.2	208.2	208.4	0.2
L	11,578	188	1,897	1.3	214.3	214.3	215.2	0.9
M	12,988	156	779	2.1	215.0	215.0	215.8	0.8
N	14,088	280	2,594	0.6	224.1	224.1	225.1	1.0
O	14,848	265	1,348	1.2	224.1	224.1	225.1	1.0
P	15,748	84	222	5.4	228.1	228.5	228.1	0.0
Q	16,676	104	243	4.9	234.1	234.1	235.1	1.0
R	17,078	45	239	2.2	239.4	239.3	239.6	0.2

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

HUNGARY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
James River								
A	92.15[1]	560/260	25,820	9.3	18.0	18.0	18.7	0.7
B	92.58[1]	2,160/560	48,230	6.0	18.9	18.9	19.6	0.7
C	93.05[1]	2,850/470	58,900	4.9	19.6	19.6	20.2	0.6
D	93.35[1]	2,650/910	53,240	5.4	19.8	19.8	20.4	0.6
E	93.73[1]	1,920/1,510	47,570	6.1	20.1	20.1	20.7	0.6
F	94.55[1]	1,960/450	50,390	5.8	20.9	20.9	21.5	0.6
G	95.10[1]	2,450/350	59,760	4.9	21.5	21.5	22.2	0.7
H	95.65[1]	1,280/310	35,090	8.3	21.6	21.6	22.2	0.6
I	96.17[1]	2,180/1,800	48,420	6.0	22.5	22.5	23.2	0.7
J	96.77[1]	1,780/1,360	49,770	7.3	23.1	23.1	23.8	0.7
K	97.27[1]	1,850/730	49,500	5.9	23.8	23.8	24.7	0.9
L	97.88[1]	1,160/320	36,840	7.9	24.6	24.6	25.4	0.8
M	98.28[1]	850/330	34,570	8.4	25.6	25.6	26.3	0.7
N	519,700[3]	850/40	33,330	8.7	25.8	25.8	26.5	0.7
O	520,980[3]	1,000/90	40,730	7.1	26.6	26.6	27.3	0.7
P	522,420[3]	1,000/215	38,510	7.5	26.7	26.7	27.4	0.7
Q	523,880[3]	1,000/355	34,510	8.4	26.7	26.7	27.4	0.7
R	525,040[3]	950/405	33,290	8.7	26.9	26.9	27.6	0.7
S	527,840[3]	1,000/395	35,450	8.2	28.0	28.0	28.4	0.4
T	531,880[3]	1,000/115	34,620	8.4	29.0	29.0	29.4	0.4
U	533,540[3]	1,100/520	38,870	7.5	30.0	30.0	30.1	0.1
V	534,660[3]	1,250/700	40,520	7.2	30.1	30.1	30.7	0.6

[1] Miles above Chesapeake Bay
[2] Total width/width within county limits
[3] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

JAMES RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
James River (continued)								
W	535,880[1]	1,450/855[2]	46,930	6.2	30.6	30.6	31.3	0.7
X	536,840[1]	1,600/1030[2]	48,400	6.0	30.8	30.8	31.4	0.6
Y	538,180[1]	1,800/885[2]	55,435	5.2	31.0	31.0	31.7	0.7
Z	539,450[1]	2,000/410[2]	58,295	5.0	31.0	31.0	31.7	0.7
AA	541,570[1]	2,250/75[2]	64,895	4.5	31.6	31.6	32.3	0.7
AB	543,450[1]	2,800/70[2]	68,840	4.2	31.8	31.8	32.6	0.8
AC	544,710[1]	3,150/50[2,3]	67,165	4.3	32.3	32.3	33.1	0.8
AD	110.99[4]	1,635[5]	29,792	9.7	120.4	120.4	120.6	0.2
AE	111.73[4]	2,320[5]	41,877	6.9	125.5	125.5	126.4	0.9
AF	113.35[4]	2,200[5]	48,212	6.4	134.0	134.0	134.9	0.9
AG	114.82[4]	3,450[5]	62,638	4.6	138.8	138.8	139.8	1.0
AH	116.95[4]	3,280[5]	78,477	3.7	143.0	143.0	143.8	0.8
AI	117.27[4]	3,666[5]	80,203	3.6	143.2	143.2	144.2	1.0

[1] Feet above mouth
[2] Total width/width within county limits
[3] Width of floodway extends to landside toe of levee/floodwall to prohibit encroachment upon the levee/floodwall
[4] Miles above mouth
[5] This width extends beyond county boundary

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

JAMES RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Jordans Branch								
A	3,104	222	1,610	2.9	160.9	160.9	161.8	0.9
B	4,112	269	1,570	3.0	163.0	163.0	163.9	0.9
C	6,111	57	929	3.8	181.5	181.5	181.6	0.1
D	6,575	49	670	5.2	181.7	181.7	181.9	0.2
E	7,103	80	983	3.6	184.6	184.6	184.9	0.3
F	8,091	79	1,021	3.0	185.4	185.4	185.8	0.4
G	8,755	67	715	4.3	185.5	185.5	186.2	0.7
H	9,525	86	732	3.9	188.8	188.8	189.4	0.6
I	10,097	68	529	5.4	189.3	189.3	190.3	1.0
J	10,770	63	494	5.7	191.1	191.1	191.9	0.8
K	12,429	48	443	5.4	199.8	199.8	200.0	0.2
L	12,604	130	174	6.5	201.9	201.9	201.9	0.0
M	12,945	227	421	2.7	205.2	205.2	205.2	0.0
N	13,339	175	233	4.9	206.3	206.3	206.3	0.0
O	13,628	110	213	5.3	206.9	206.9	207.0	0.1
P	13,920	120	546	2.1	207.0	207.0	207.5	0.5
Q	14,224	200	453	2.2	207.0	207.0	207.5	0.5
R	14,454	129	273	3.6	207.1	207.1	207.6	0.5
S	14,782	218	369	2.7	207.7	207.7	207.9	0.2
T	15,052	218	484	2.1	207.9	207.9	208.1	0.2

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

JORDANS BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Little Tuckahoe Creek								
A	39,500	1,079/70	7,109	1.5	150.0	150.0	150.8	0.8

[1] Feet above Railroad
[2] Width/Width within Corporate Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE TUCKAHOE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Meredith Branch								
A	25	283	2,559	1.8	186.0	185.4[2]	186.4	1.0
B	577	260	2,215	2.0	190.6	190.6	191.5	0.9
C	891	280	3,284	1.3	191.1	191.1	191.9	0.8
D	1,295	250	2,303	1.9	191.2	191.2	192.1	0.9
E	2,992	330	5,972	0.7	205.8	205.8	206.7	0.9
F	3,792	360	6,493	0.7	205.8	205.8	206.8	1.0
G	4,117	340	4,568	0.9	205.8	205.8	206.8	1.0
H	4,483	300	5,020	0.8	205.9	205.9	206.8	0.9
I	5,024	356	5,747	0.7	206.1	206.1	207.1	1.0
J	5,474	341	4,839	0.8	206.1	206.1	207.1	1.0
K	6,155	220	2,210	1.8	206.0	206.0	207.0	1.0
L	6,400	208	1,789	2.2	206.3	206.3	207.2	0.9
M	6,925	170	1,541	2.5	207.0	207.0	207.8	0.8
N	7,442	170	1,147	3.4	208.1	208.1	208.9	0.8
O	8,041	165	1,288	3.0	210.7	210.7	211.3	0.6
P	8,545	200	1,571	2.4	212.5	212.5	213.2	0.7
Q	9,013	205	1,460	2.2	213.5	213.5	214.4	0.9
R	9,389	210	1,564	2.1	214.4	214.4	215.3	0.9
S	9,887	200	1,151	2.8	216.3	216.3	216.7	0.4
T	10,394	170	685	4.7	219.6	219.6	219.6	0.0
U	10,919	140	980	3.3	223.6	223.6	223.6	0.0
V	11,286	150	1,298	2.5	224.7	224.7	224.9	0.2
W	11,698	160	1,295	2.5	225.1	225.1	225.9	0.8

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Chickahominy River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

MEREDITH BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Meredith Branch (continued)								
X	12,060	155	1,118	2.3	226.4	226.4	226.8	0.4
Y	12,380	170	1,067	2.4	227.1	227.1	227.6	0.5
Z	12,871	150	1,052	2.4	228.4	228.4	229.2	0.8
AA	13,583	140	900	2.2	230.3	230.3	231.1	0.8

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

MEREDITH BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
North Run								
A	900	370	2,652	4.7	121.1	121.1	122.0	0.9
B	1,300	235	2,630	4.7	122.0	122.0	122.5	0.5
C	2,100	276	3,222	3.9	122.5	122.5	123.2	0.7
D	2,432	165	1,809	6.9	122.5	122.5	123.2	0.7
E	3,400	273	4,045	3.1	133.8	133.8	133.8	0.0
F	3,992	300	3,340	3.7	134.1	134.1	134.1	0.0
G	4,820	280	2,045	6.1	134.2	134.2	134.3	0.1
H	5,905	270	3,057	4.0	141.5	141.5	141.7	0.2
I	6,980	200	1,872	6.2	142.9	142.9	143.1	0.2
J	8,230	180	2,045	5.9	146.2	146.2	146.4	0.2
K	9,380	130	1,798	6.9	148.7	148.7	149.0	0.3
L	10,780	130	1,717	6.0	151.8	151.8	152.5	0.7
M	11,530	190	2,479	3.8	153.0	153.0	153.8	0.8
N	12,430	130	1,717	5.5	153.8	153.8	154.7	0.9
O	13,080	150	1,818	5.2	154.9	154.9	155.9	1.0
P	14,330	160	2,039	4.7	160.5	160.5	161.5	1.0
Q	15,880	140	1,491	6.4	161.9	161.9	162.9	1.0
R	17,350	240	2,281	4.2	164.0	164.0	165.0	1.0
S	18,105	180	1,608	6.0	165.0	165.0	165.7	0.7
T	18,780	140	1,306	7.4	166.1	166.1	167.0	0.9
U	20,180	130	1,200	8.2	170.6	170.6	171.1	0.5
V	20,980	140	1,141	8.7	173.4	173.4	174.0	0.6
W	22,980	160	1,507	4.2	178.3	178.3	178.9	0.6

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

NORTH RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
North Run (continued)								
X	24,460	393	2,939	2.1	181.9	181.9	182.2	0.3
Y	25,230	350	2,268	2.7	182.1	182.1	182.3	0.2
Z	26,280	215	1,433	4.2	182.7	182.7	183.2	0.5
AA	27,455	300	1,929	3.1	183.9	183.9	184.5	0.6
AB	28,255	300	8,006	3.0	184.5	184.5	185.1	0.6

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

NORTH RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Rocky Branch								
A	400	107	950	4.4	150.1	147.5[2]	148.3	0.8
B	1,000	242	4,315	1.0	163.0	163.0	163.8	0.8
C	1,600	362	6,331	0.7	163.0	163.0	163.8	0.8
D	3,650	145	545	7.3	174.1	174.1	174.8	0.7
E	4,470	100	596	6.6	178.7	178.7	179.6	0.9
F	6,175	153	863	4.6	183.2	183.2	184.0	0.8
G	7,443	309	3,449	0.8	200.0	200.0	201.0	1.0
H	8,772	202	1,636	2.0	201.8	201.8	202.8	1.0
I	9,702	101	355	9.0	203.0	203.0	203.7	0.7
J	10,562	170	586	4.8	210.6	210.6	210.6	0.0
K	11,262	100	447	6.3	212.5	212.5	213.5	1.0

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from North Run

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

ROCKY BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Rooty Branch								
A	7,159	139	523	4.0	220.5	220.5	221.5	1.0
B	7,338	211	703	3.0	221.3	221.3	221.8	0.5
C	7,665	109	657	3.2	228.6	228.6	229.4	0.8
D	8,221	145	916	2.1	230.7	230.7	231.7	1.0
E	8,536	150	824	2.3	231.6	231.6	232.6	1.0
F	8,899	127	798	2.2	232.9	232.9	233.8	0.9
G	9,071	148	765	2.3	233.0	233.0	234.0	1.0
H	9,279	269	1,430	1.2	233.1	233.1	234.1	1.0

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

ROOTY BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Stoney Run								
A	1,310	59	230	10.2	154.5	154.5	155.4	0.9
B	2,840	106	865	2.7	163.8	163.8	164.8	1.0
C	4,740	170	449	5.2	171.4	171.4	171.7	0.3
D	5,640	220	1,264	1.9	174.9	174.9	175.9	1.0
E	6,400	85	376	5.3	176.4	176.4	177.4	1.0
F	7,370	175	735	2.7	181.6	181.6	182.6	1.0
G	7,900	270	1,175	1.7	182.7	182.7	183.7	1.0
H	8,360	108	423	4.7	183.7	183.7	184.6	0.9
I	8,910	87	410	4.9	188.1	188.1	189.9	0.9
J	9,460	75	363	5.5	192.5	192.5	193.4	0.9
K	10,230	223	661	3.0	200.6	200.6	200.7	0.1
L	10,630	52	251	8.0	202.9	202.9	203.9	1.0

[1] Feet above confluence with Deep Run

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

STONEY RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Stony Run								
A	120	60	489	5.7	76.9	76.9	77.7	0.8
B	700	73	500	5.6	81.7	81.7	82.3	0.6
C	1,100	70	386	7.3	85.6	85.6	86.2	0.6
D	1,920	83	703	4.0	93.2	93.2	93.2	0.0
E	2,885	56	404	6.9	99.3	99.3	99.4	0.1
F	3,640	170	1,066	2.6	103.4	103.4	103.7	0.3
G	4,260	188	787	3.6	104.6	104.6	105.3	0.7
H	5,130	193	862	3.2	108.2	108.2	109.1	0.9

[1] Feet above county boundary

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

STONY RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Thorpe Branch								
A	1,200	36	130	7.7	148.6	148.6	149.6	1.0
B	2,600	81	420	2.2	169.6	169.6	170.4	0.8
C	3,000	45	161	5.3	169.9	169.9	170.6	0.7
D	3,500	54	136	5.8	173.2	173.2	173.6	0.4
E	4,500	90	309	2.1	181.4	181.4	182.4	1.0
F	5,220	30	75	8.8	185.1	185.1	185.4	0.3
G	6,160	55	165	4.0	192.9	192.9	193.9	1.0
H	6,600	40	230	2.2	197.6	197.6	197.7	0.1
I	7,480	30	48	7.3	199.5	199.5	199.7	0.2
J	8,530	30	81	4.3	204.3	204.3	204.5	0.2
K	8,865	18	71	4.9	205.3	205.3	206.3	1.0

[1] Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

THORPE BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Tributary A to Gillies Creek Tributary 1								
A	59	53	239	2.0	145.4	144.3[2]	145.3	1.0
B	523	40	175	2.8	145.6	145.6	146.5	1.0
C	801	60	230	2.1	146.6	146.6	147.4	0.8
D	988	60	165	2.9	148.9	148.9	149.2	0.3
E	1,255	60	245	1.3	149.8	149.8	150.6	0.8
F	1,497	80	264	1.2	150.0	150.0	151.0	1.0
G	1,876	45	99	3.3	151.4	151.4	151.9	0.5
H	2,170	24	108	3.0	153.5	153.5	154.4	0.9
I	2,503	23	120	2.7	154.1	154.1	155.0	0.9
J	2,760	19	72	4.4	154.6	154.6	155.4	0.8
K	3,319	19	81	4.0	157.5	157.5	157.6	0.1

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Gillies Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY A TO GILLIES CREEK TRIBUTARY 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Tributary A to Gillies Creek Tributary 1 Tributary								
A	171	26	70	2.5	149.6	147.6[2]	148.6	1.0
B	428	26	44	4.0	149.6	149.6[2]	149.6	0.0
C	817	26	48	3.6	152.9	152.9	153.0	0.1
D	1,148	48	50	3.5	156.1	156.1	156.1	0.0
E	1,496	42	62	2.8	158.8	158.8	158.8	0.0
F	1,834	50	92	1.9	159.7	159.7	159.8	0.1

[1] Feet above mouth

[2] Elevation computed without consideration of backwater effects from Tributary A to Gillies Creek Tributary 1

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY A TO GILLIES CREEK TRIBUTARY 1 TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Tuckahoe Creek								
A	800	506/490	6,238	2.6	143.0	133.4[3]	134.2	0.8
B	2,650	838/838	9,958	1.6	143.0	133.9[3]	134.7	0.8
C	4,800	574/80	8,554	2.0	143.0	134.2[3]	135.0	0.8
D	7,300	347/70	5,343	3.2	143.0	134.8[3]	135.6	0.8
E	9,550	856/453	11,107	1.6	143.0	135.4[3]	136.2	0.8
F	11,150	527/244	6,550	2.7	143.0	135.7[3]	136.5	0.8
G	12,320	1,204/730	19,910	0.9	144.0	138.6[3]	139.4	0.8
H	17,020	1,138/650	14,735	1.0	144.0	138.7[3]	139.5	0.8
I	20,250	1,195/708	11,928	1.2	144.0	139.5[3]	140.3	0.8
J	24,700	781/190	7,746	1.8	144.0	141.1[3]	141.0	0.8
K	29,050	568/568	6,052	2.3	144.5	142.9[3]	143.7	0.8
L	33,050	839/470	7,427	1.4	146.9	146.9	147.7	0.8
M	36,850	1,036/300	7,565	1.4	148.6	148.6	149.4	0.8

[1] Feet above Railroad
[2] Width/Width within Corporate Limits
[3] Elevations computed without consideration of backwater effects from the James River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

TUCKAHOE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (NAVD)	WITHOUT FLOODWAY (NAVD)	WITH FLOODWAY (NAVD)	INCREASE
Upham Brook								
A	4,420	2,292	25,938	0.5	99.6	99.6	100.6	1.0
B	5,800	1,313	11,680	1.2	99.8	99.8	100.8	1.0
C	8,160	1,420	14,090	1.0	102.3	102.3	103.3	1.0
D	12,580	1,440	9,027	1.6	104.9	104.9	105.8	0.9
E	14,505	1,314	13,932	1.1	113.4	113.4	113.7	0.3
F	15,410	1,105	10,728	1.5	113.5	113.5	113.8	0.3
G	17,895	337	2,616	6.0	114.0	114.0	114.3	0.3
H	20,300	310	4,780	1.9	122.1	122.1	123.0	0.9
I	22,860	528	6,522	1.4	123.2	123.2	124.1	0.9
J	25,550	714	5,507	1.6	126.1	126.1	127.1	1.0
K	28,660	227	1,678	5.2	130.0	130.0	130.8	0.8
L[2]	31,055	170	1,863	4.7	139.0	139.0	139.8	0.8
M	35,100	200	2,337	2.1	157.1	157.1	158.1	1.0
N	36,795	95	785	6.4	159.1	159.1	159.9	0.8
O	37,755	138	1,374	3.6	162.9	162.9	163.8	0.9
P	39,205	379	5,526	0.9	173.7	173.7	174.6	0.9
Q	40,608	200	2,649	1.3	181.4	181.4	182.3	0.9
R	41,703	130	1,199	2.9	182.2	182.2	183.1	0.9
S	43,608	276	1,782	2.0	186.5	186.5	187.4	0.9
T	45,368	123	948	3.7	191.0	191.0	191.9	0.9
U	46,258	172	1,283	2.7	193.1	193.1	194.0	0.9
V	47,408	142	926	3.8	195.7	195.7	196.7	1.0

[1] Feet above mouth

[2] Floodway located outside of Henrico County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

FLOODWAY DATA

UPHAM BROOK

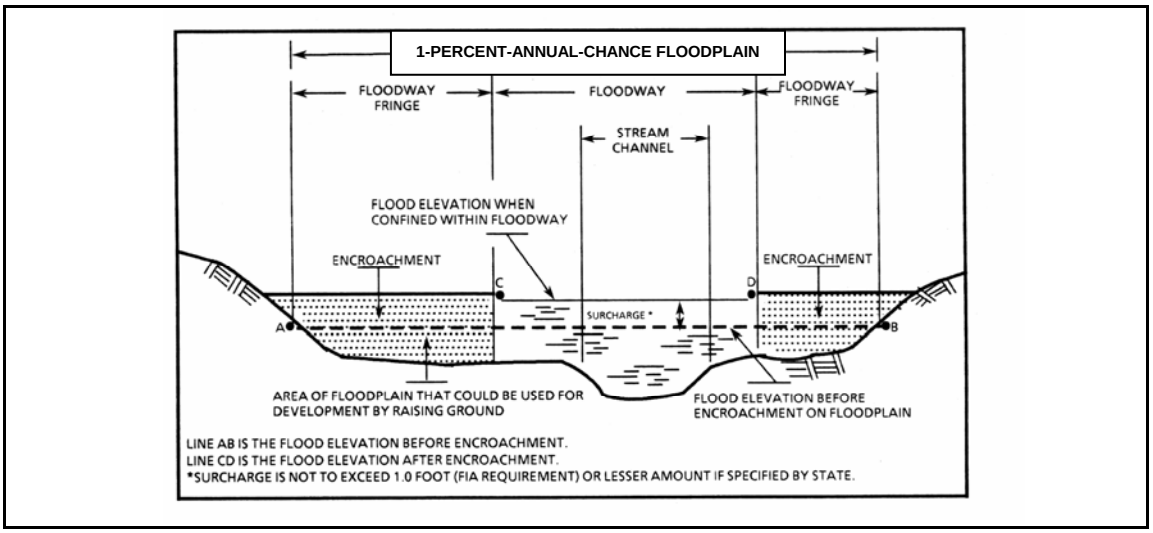

Figure 1. Floodway Schematic

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 rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

Zone AE

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

Zone AH

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

Zone AO

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

Zone AR

Zone AR is the flood insurance risk zone that corresponds to an area of special flood hazard formerly protected from the base flood event by a flood-control system is being restored to provide protection form the 1-percent-annual-chance or greater flood event.

Zone A99

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

Zone V

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

Zone VE

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

Zone X

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

Zone X (Future Base Flood)

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

Zone D

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

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use 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 countywide FIRM presents flooding information for the entire geographic area of Henrico County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 4, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Henrico County Unincorporated Areas	11/22/1974	5/14/1976	2/4/1981	None

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VIRGINIA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

The original FIS for Henrico County (Unincorporated Areas) was published by FEMA on February 4, 1981 (Reference 25). This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

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, 615 Chestnut Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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BACKWATER EFFECTS FROM CHICKAHOMINY RIVER

CONFLUENCE WITH CHICKAHOMINY RIVER

ELEVATION IN FEET (NAVD)

250
240
230
220
210
200
190
180
170
160

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500

STREAM DISTANCE IN FEET ABOVE MOUTH

A B C D E F G H I J K L M

LEGEND

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

FLOOD PROFILES

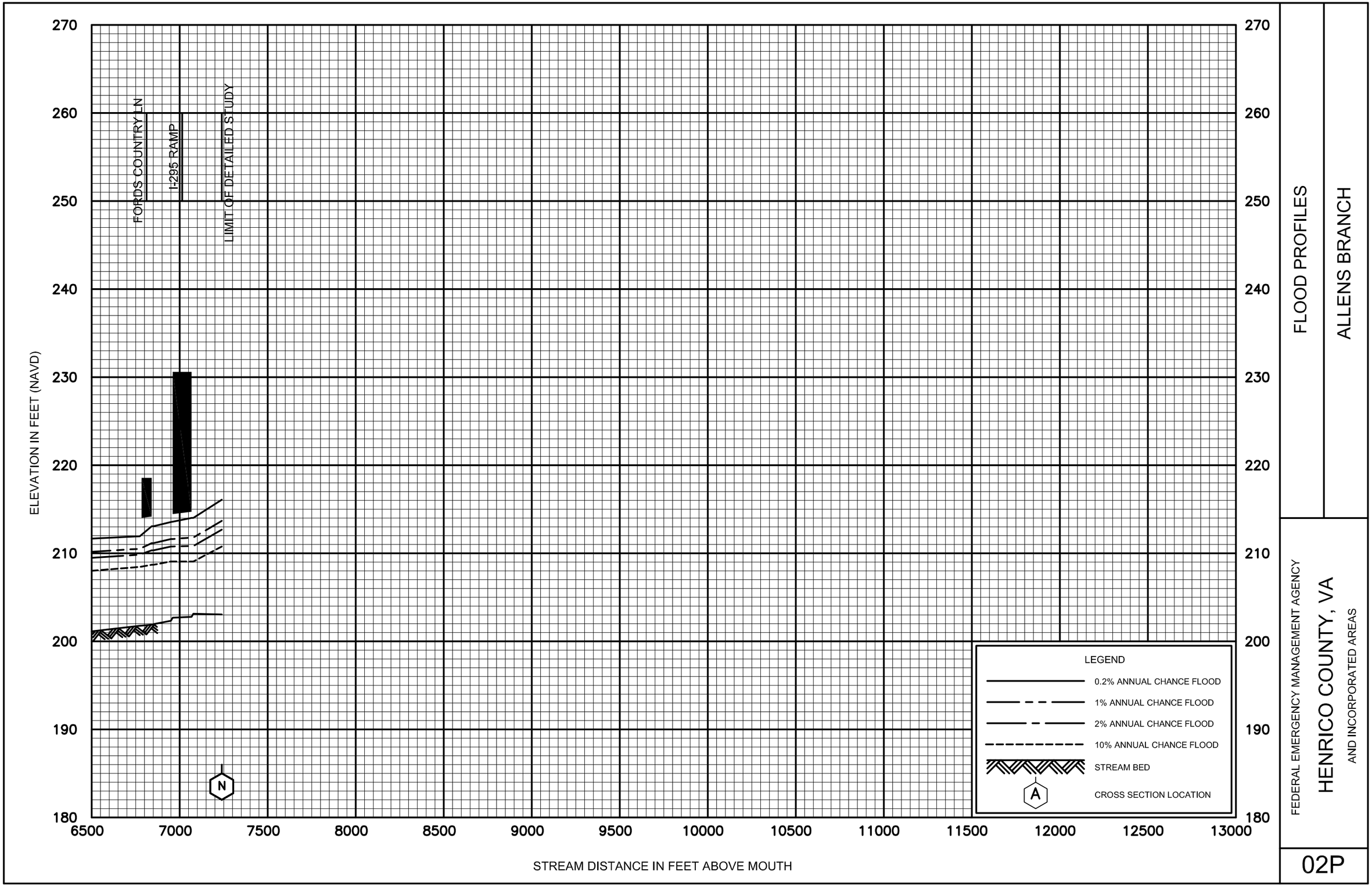
ALLENS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

01P



FLOOD PROFILES

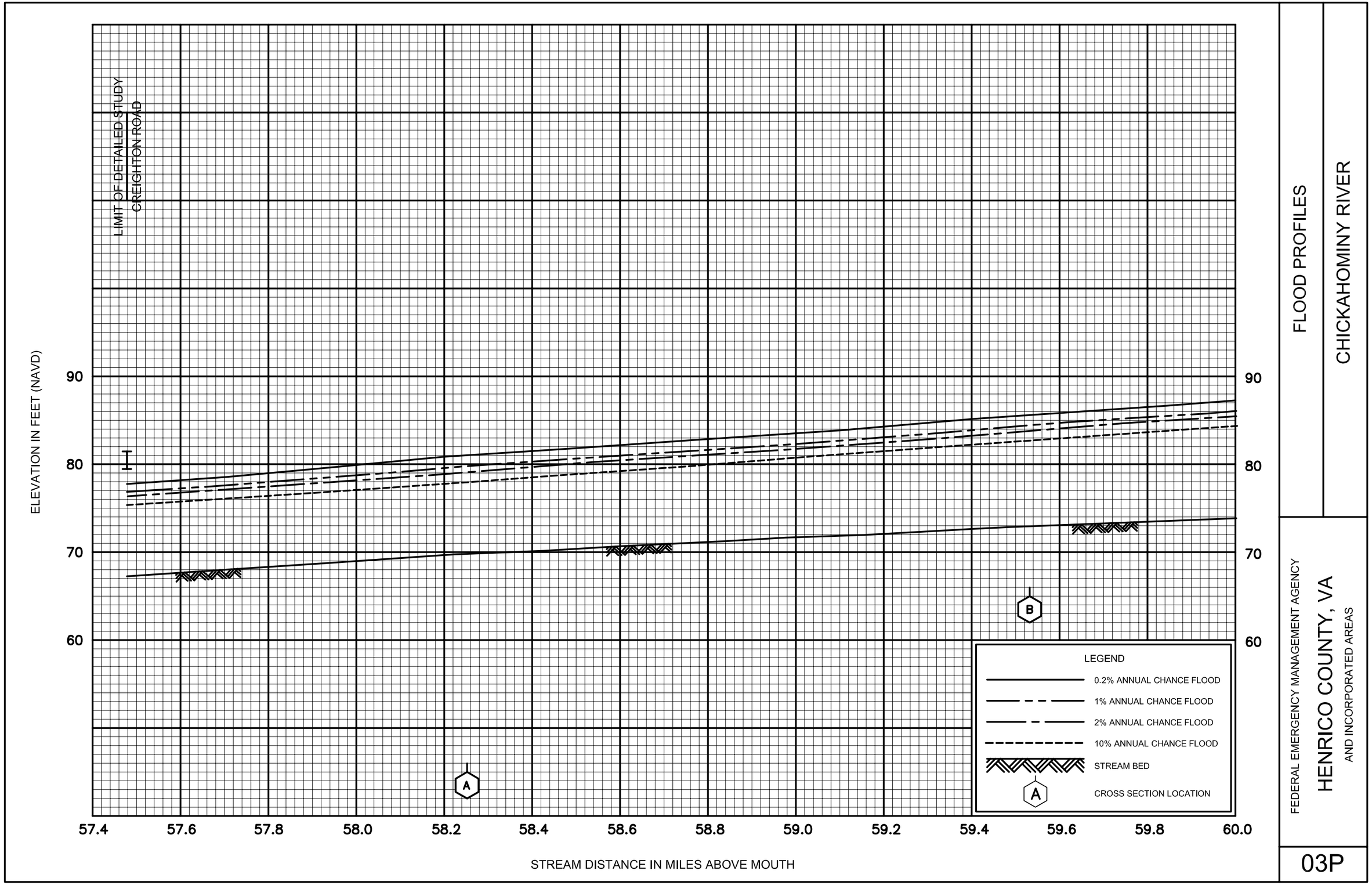
ALLENS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

02P



FLOOD PROFILES

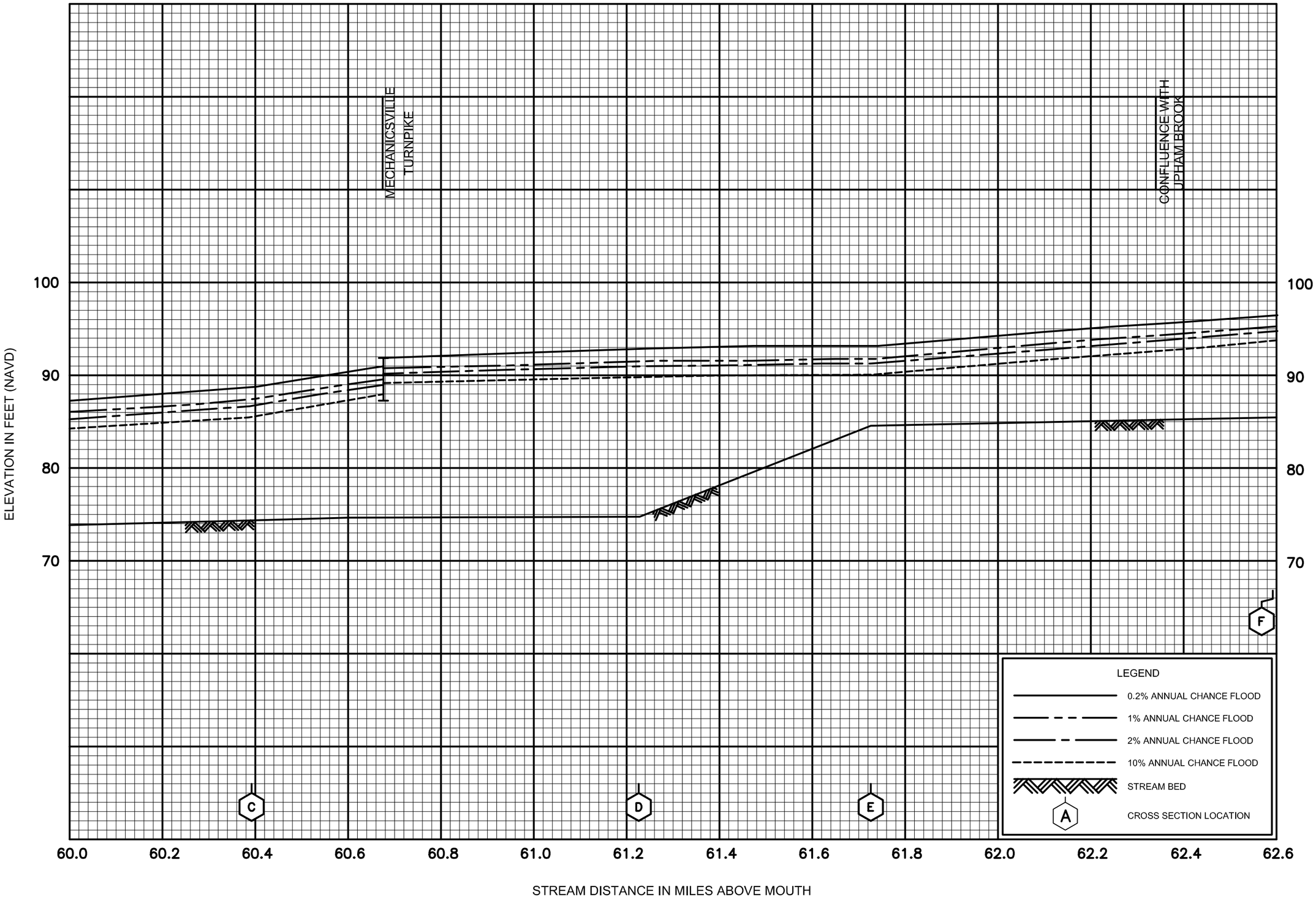
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

03P



FLOOD PROFILES

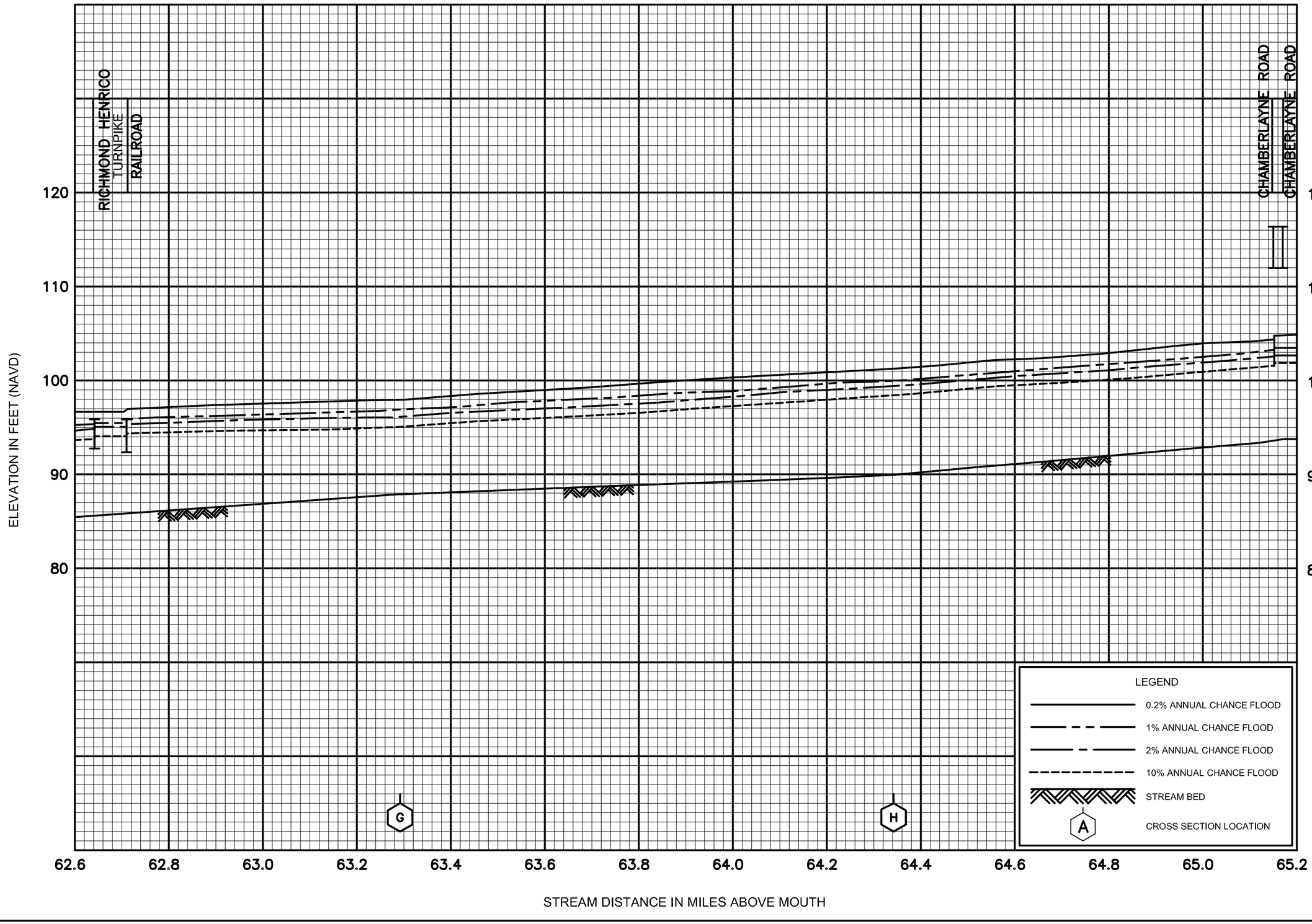
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

04P



FLOOD PROFILES

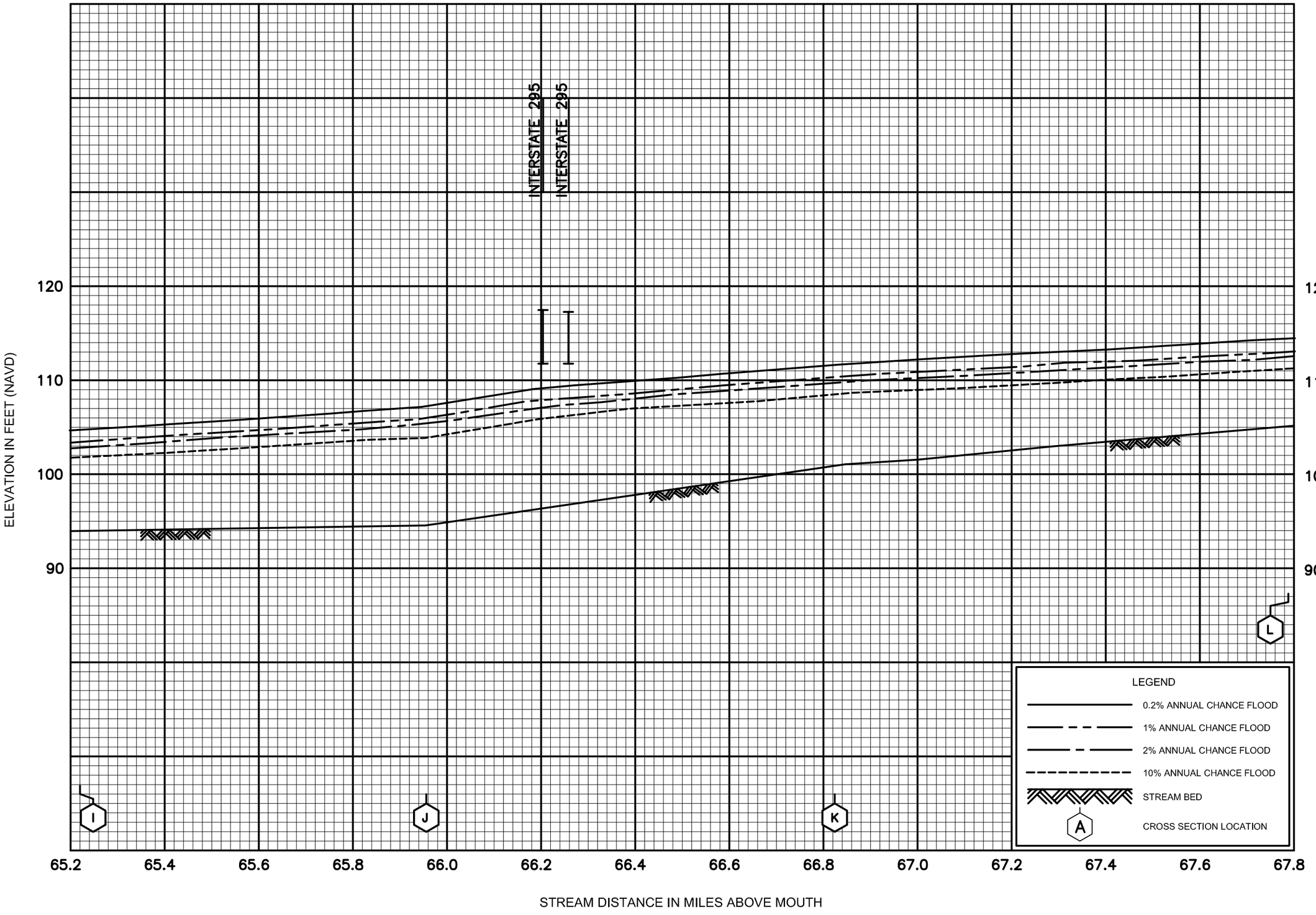
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

05P



FLOOD PROFILES

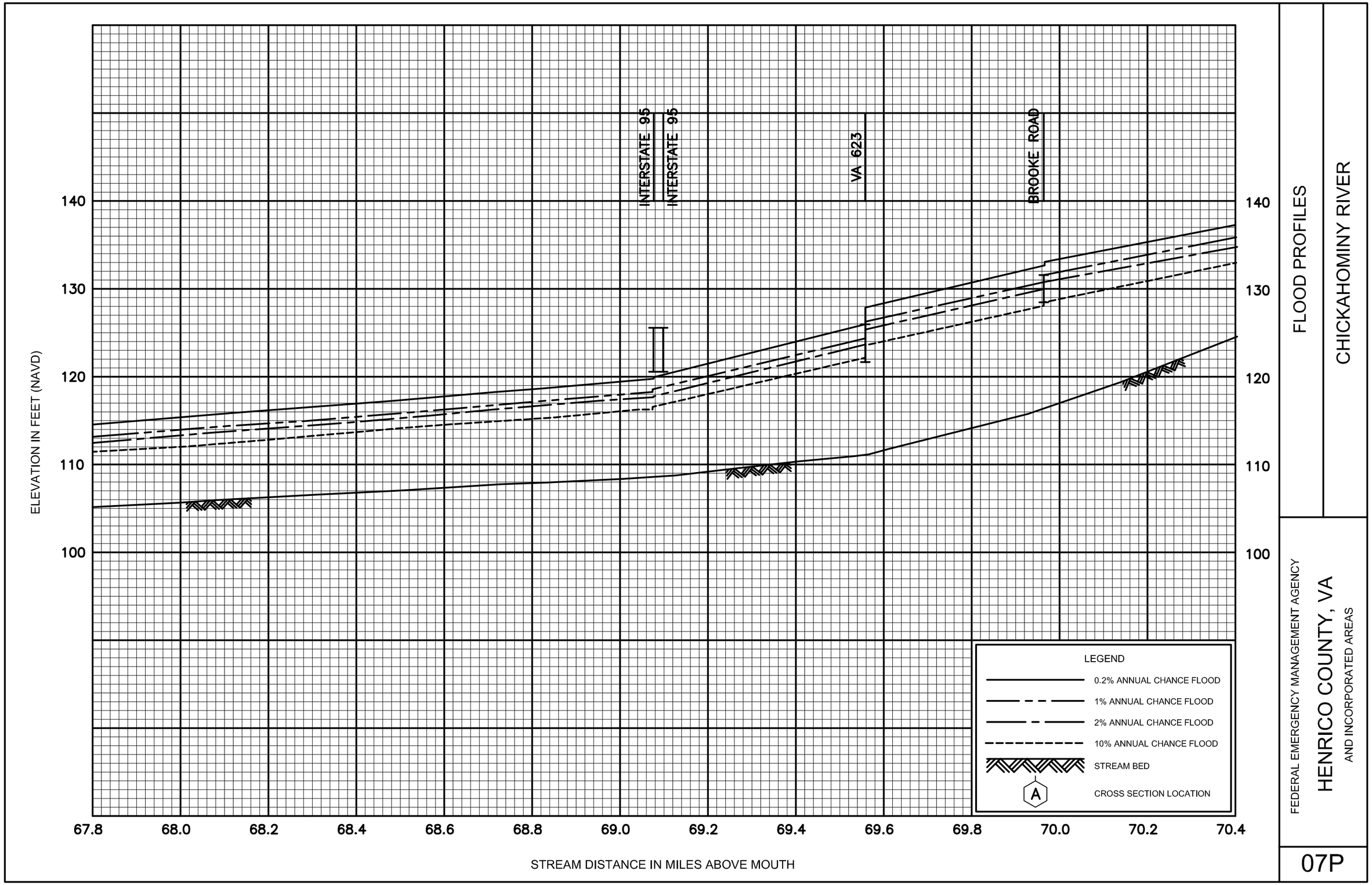
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

06P



FLOOD PROFILES

CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

07P

ELEVATION IN FEET (NAVD)

180
170
160
150
140
130
120

KELLIPE ROAD

OLD WASHINGTON HWY

CHICKAHOMINY DAM

M N O P Q R

LEGEND

0.2% ANNUAL CHANCE FLOOD

1% ANNUAL CHANCE FLOOD

2% ANNUAL CHANCE FLOOD

10% ANNUAL CHANCE FLOOD

STREAM BED

A CROSS SECTION LOCATION

70.4 70.6 70.8 71.0 71.2 71.4 71.6 71.8 72.0 72.2 72.4 72.6 72.8 73.0

STREAM DISTANCE IN MILES ABOVE MOUTH

FLOOD PROFILES

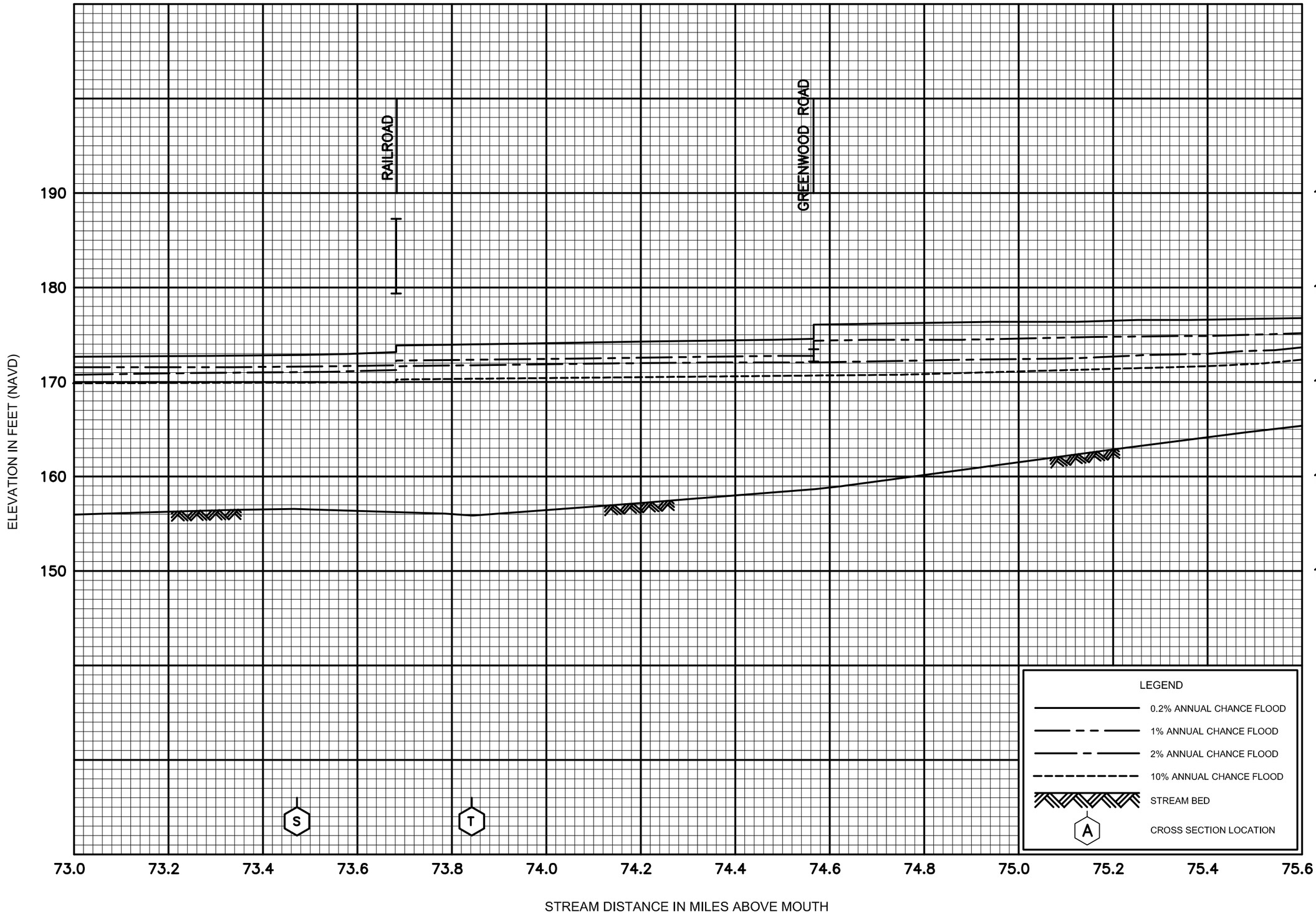
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

08P



FLOOD PROFILES

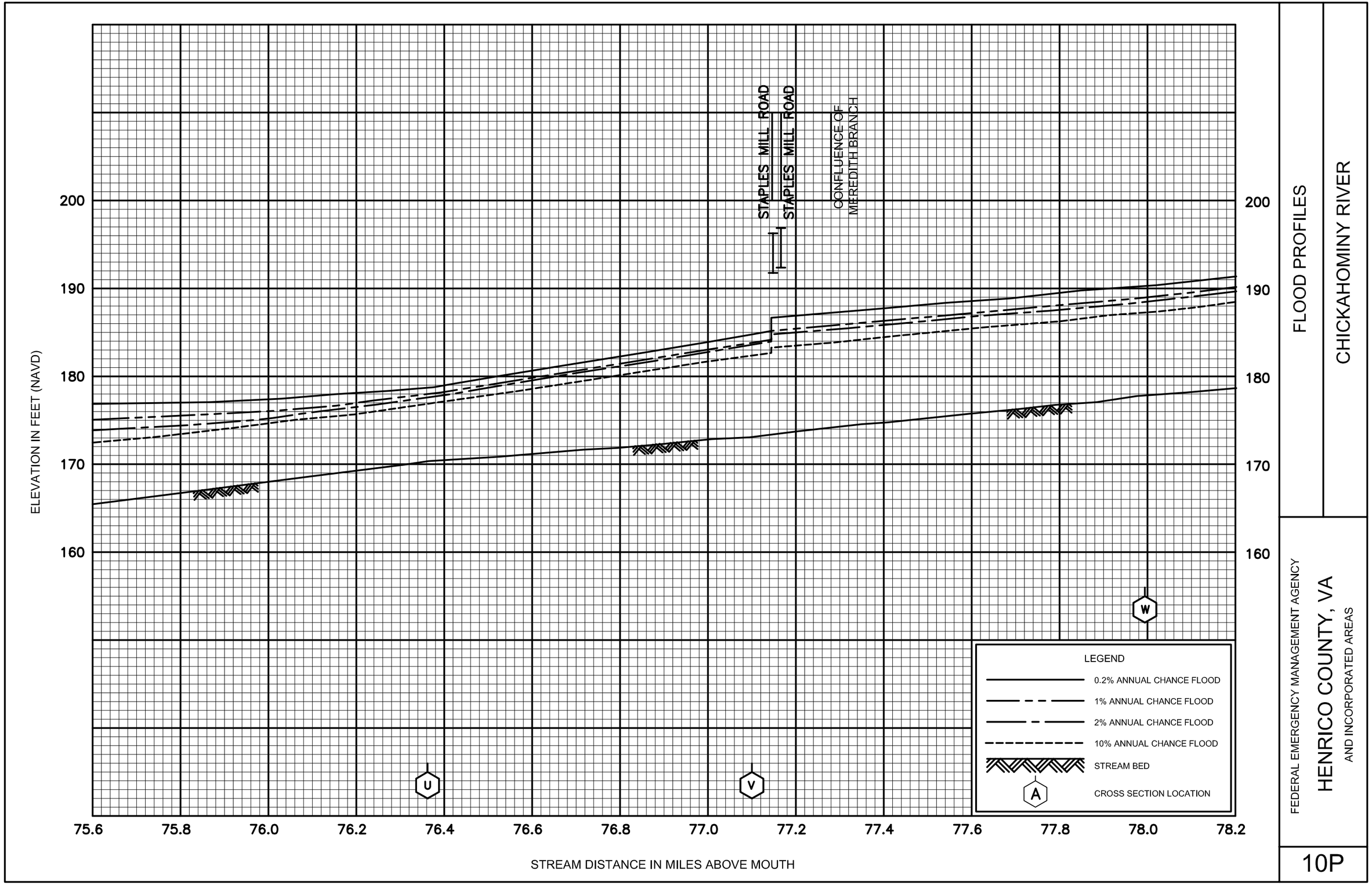
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

09P



FLOOD PROFILES

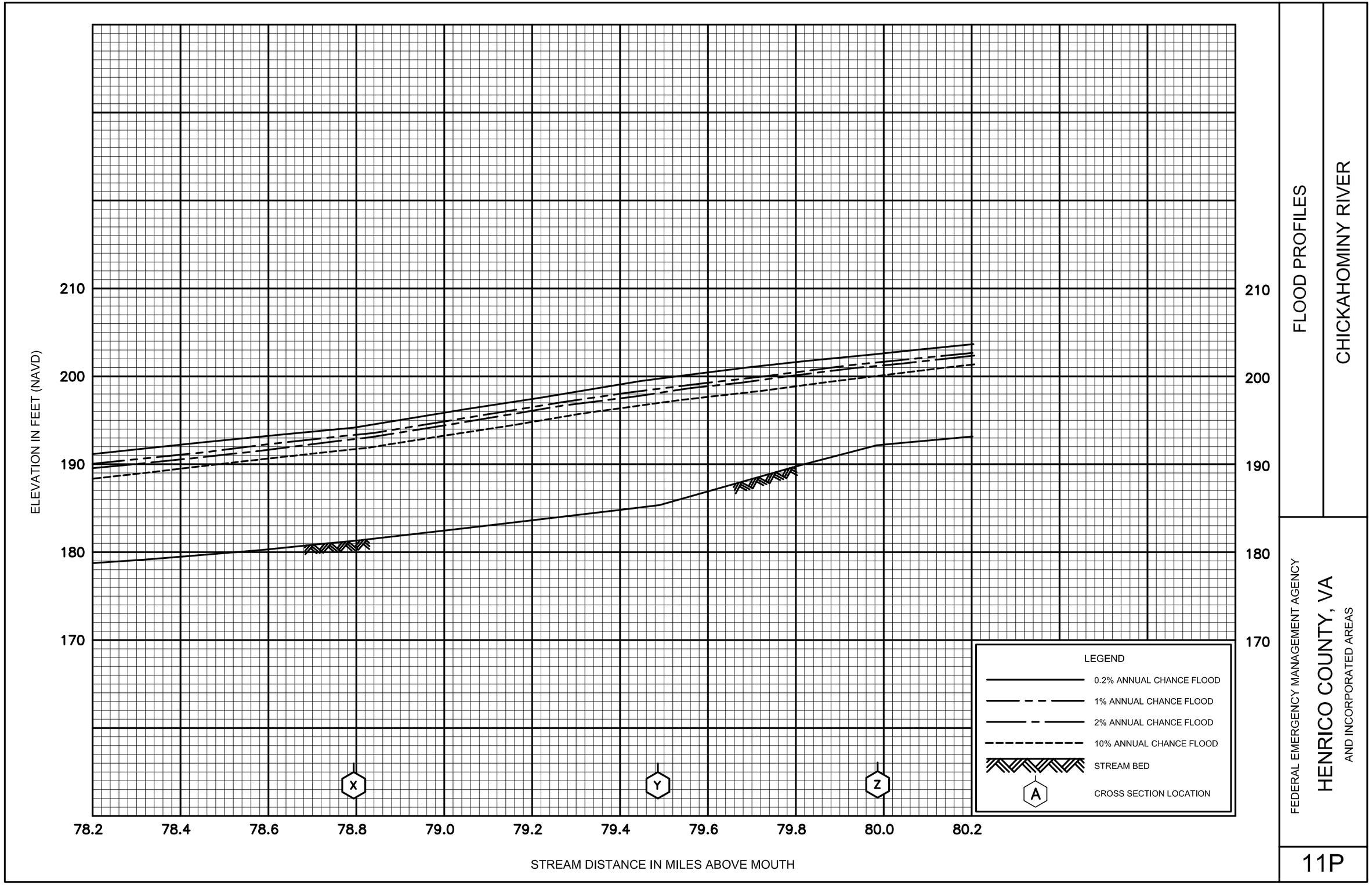
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

10P



FLOOD PROFILES

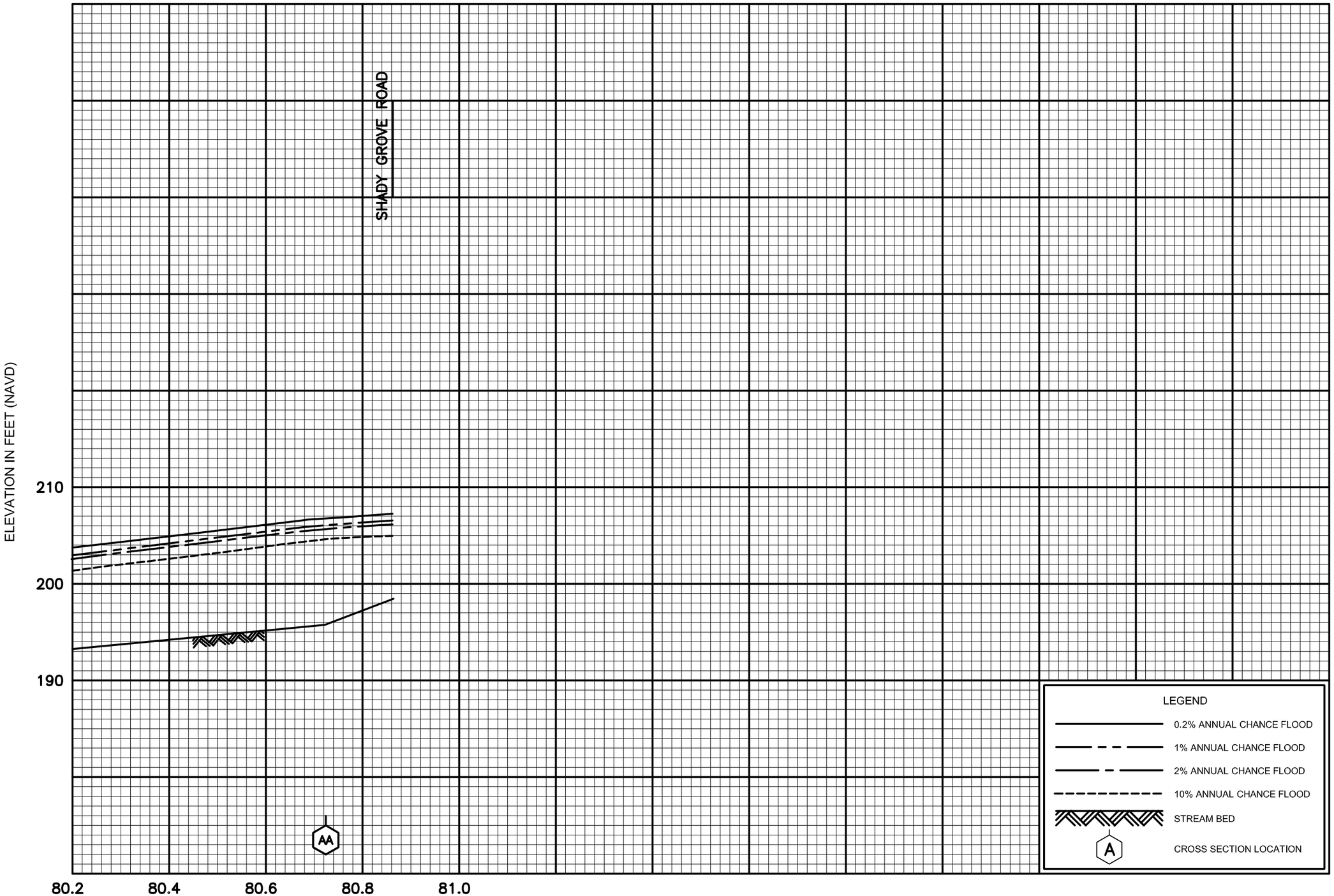
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

11P



FLOOD PROFILES

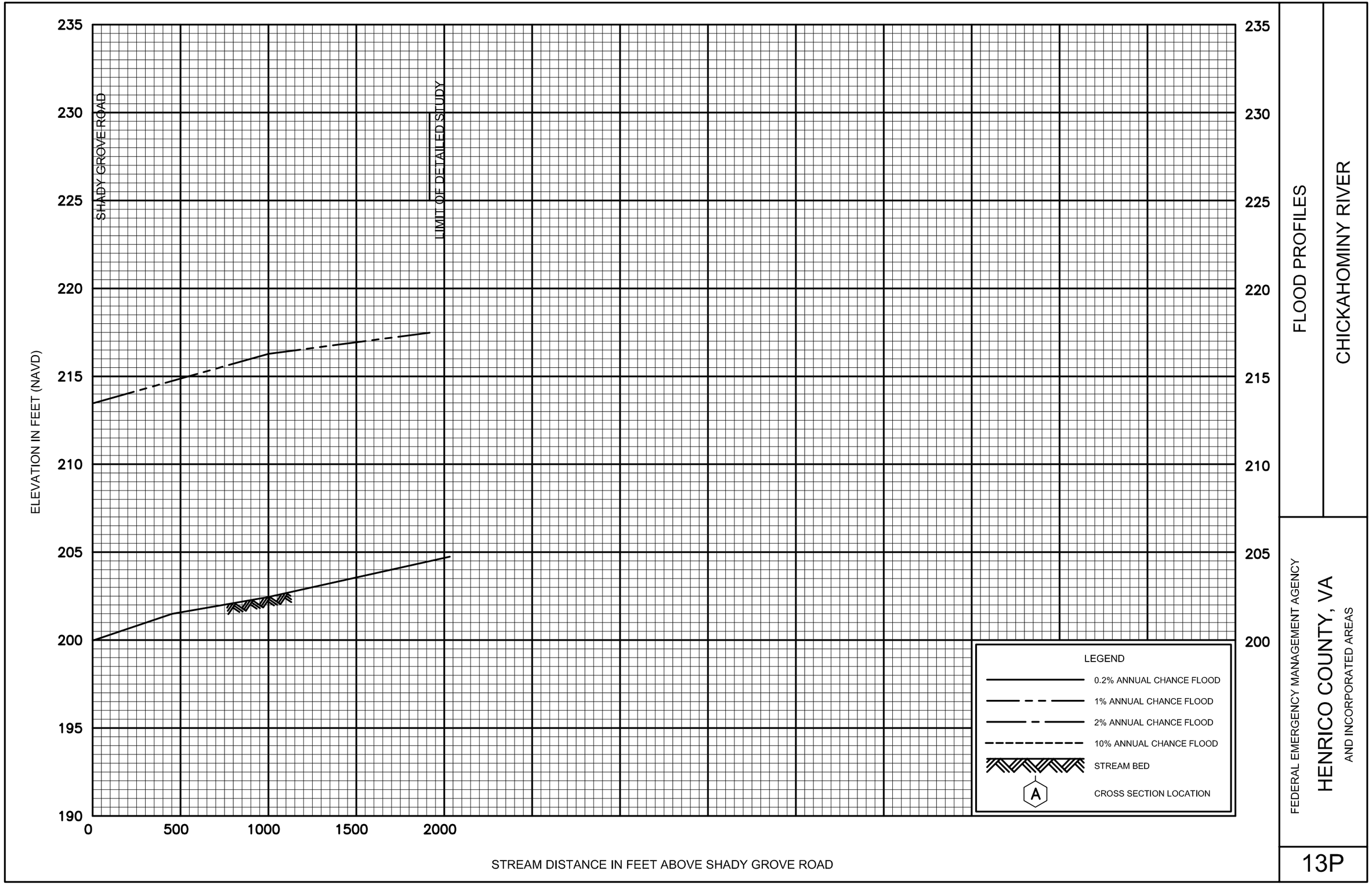
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

12P



FLOOD PROFILES

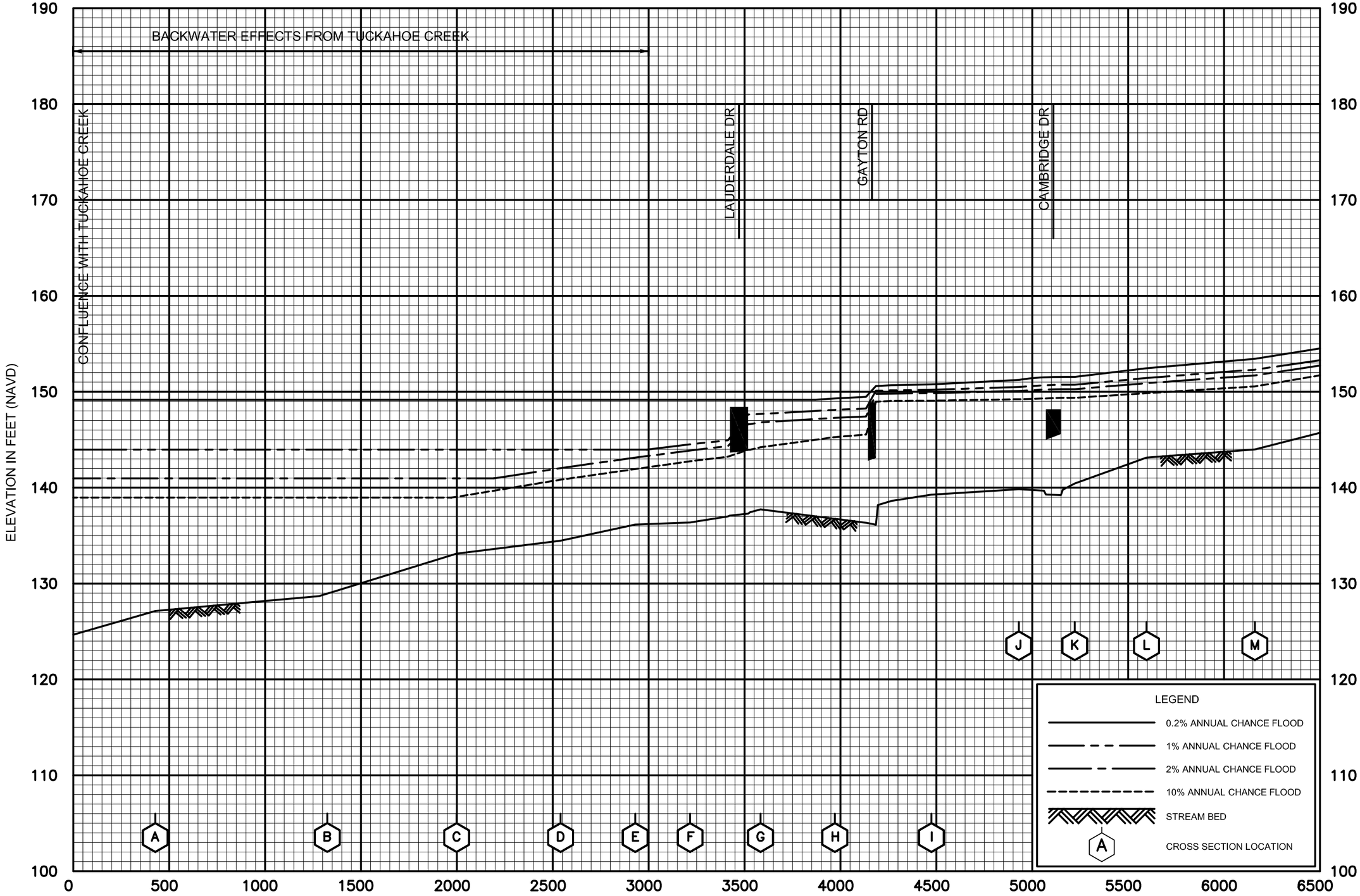
CHICKAHOMINY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

13P



FLOOD PROFILES

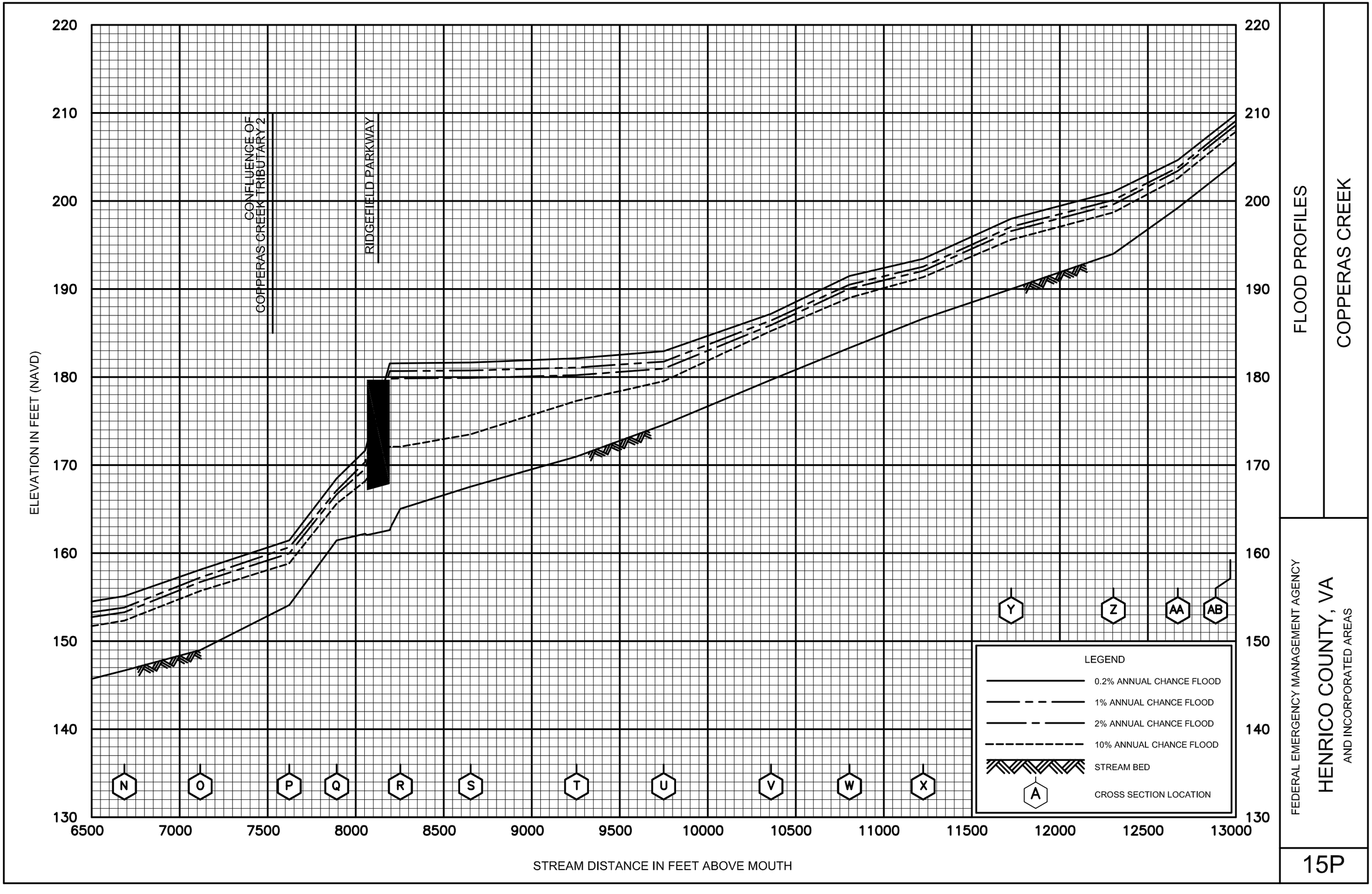
COPPERAS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

14P



FLOOD PROFILES

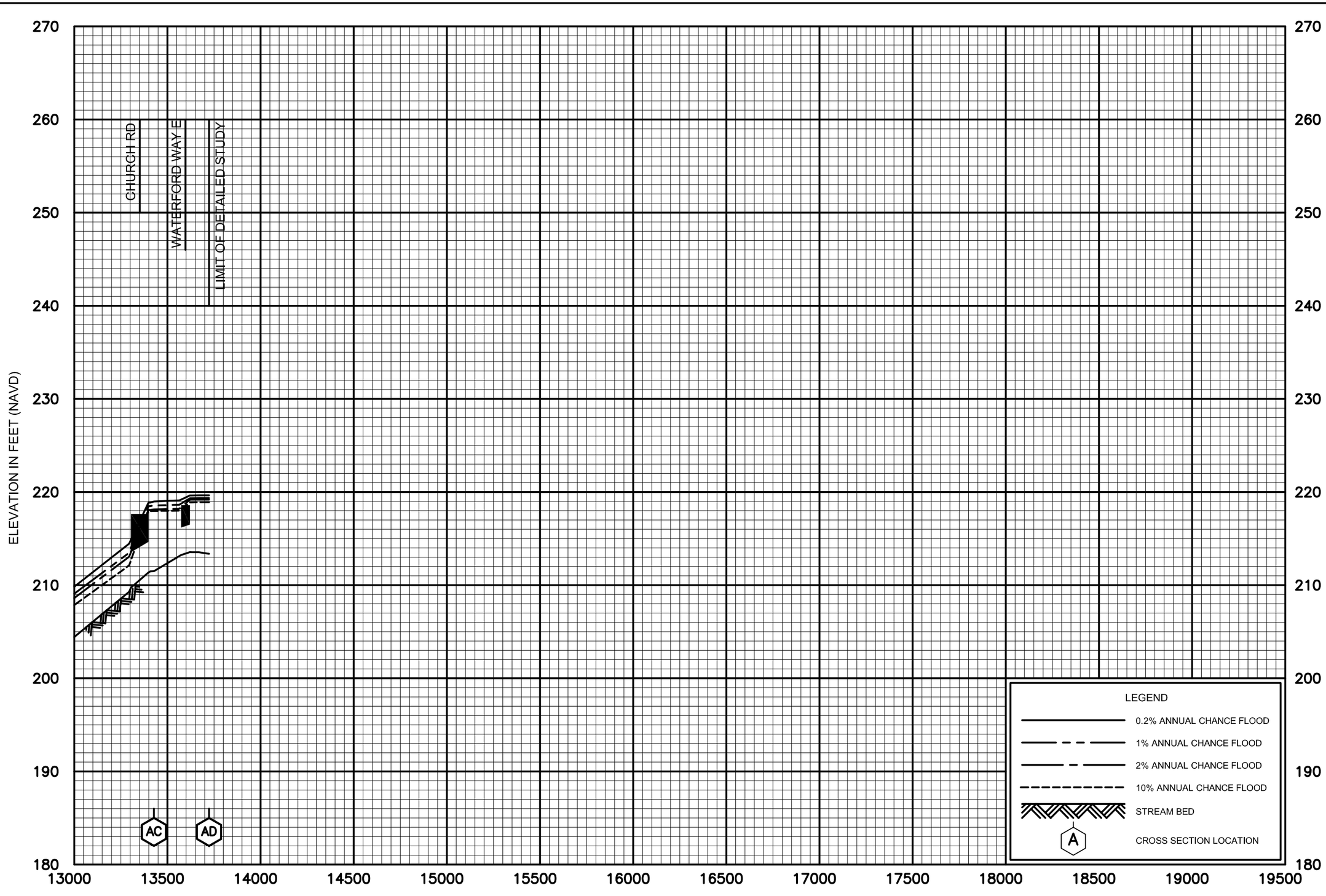
COPPERAS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

15P



FLOOD PROFILES

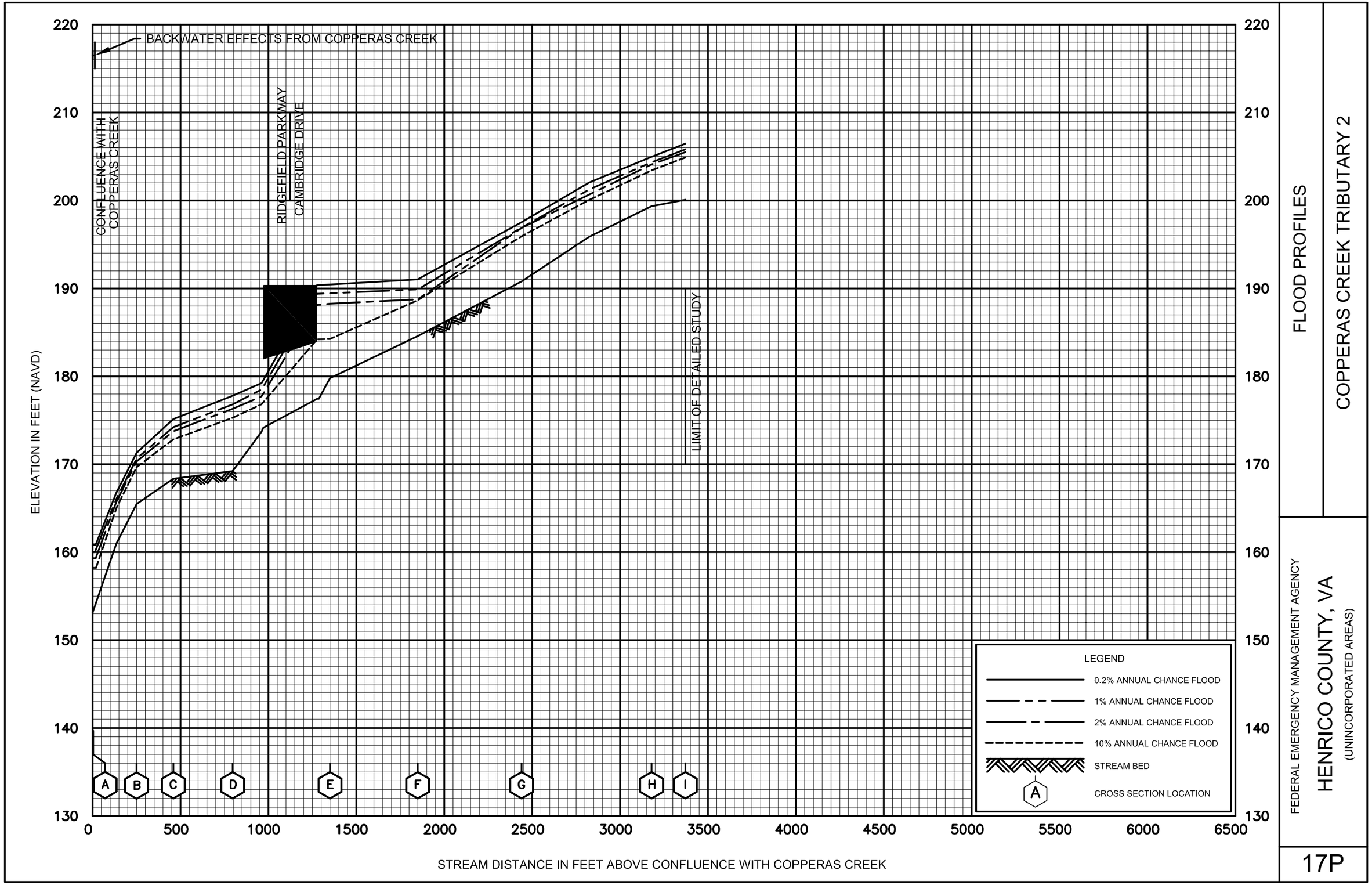
COPPERAS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

16P



FLOOD PROFILES

COPPERAS CREEK TRIBUTARY 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

(UNINCORPORATED AREAS)

17P

BACKWATER EFFECTS FROM JAMES RIVER

CONFLUENCE WITH TUCKAHOE CREEK

PATTERSON AVENUE

PUMP ROAD

ELEVATION IN FEET (NAVD)

160
150
140
130
120
110

0 1 2 3 4 5 6 7 8 9 10 11 12

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE MOUTH

A B C D

LEGEND

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

FLOOD PROFILES

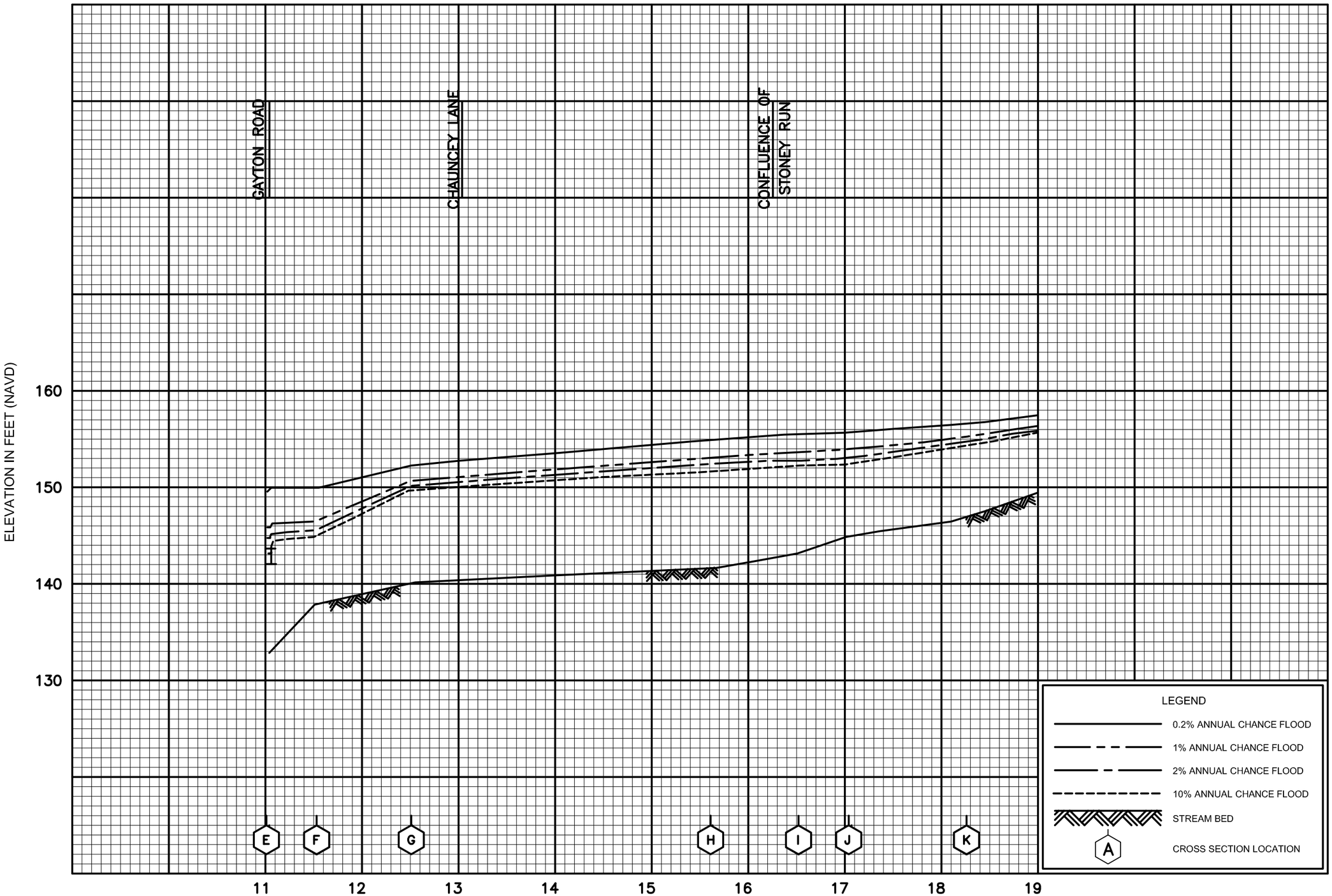
DEEP RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

18P



FLOOD PROFILES

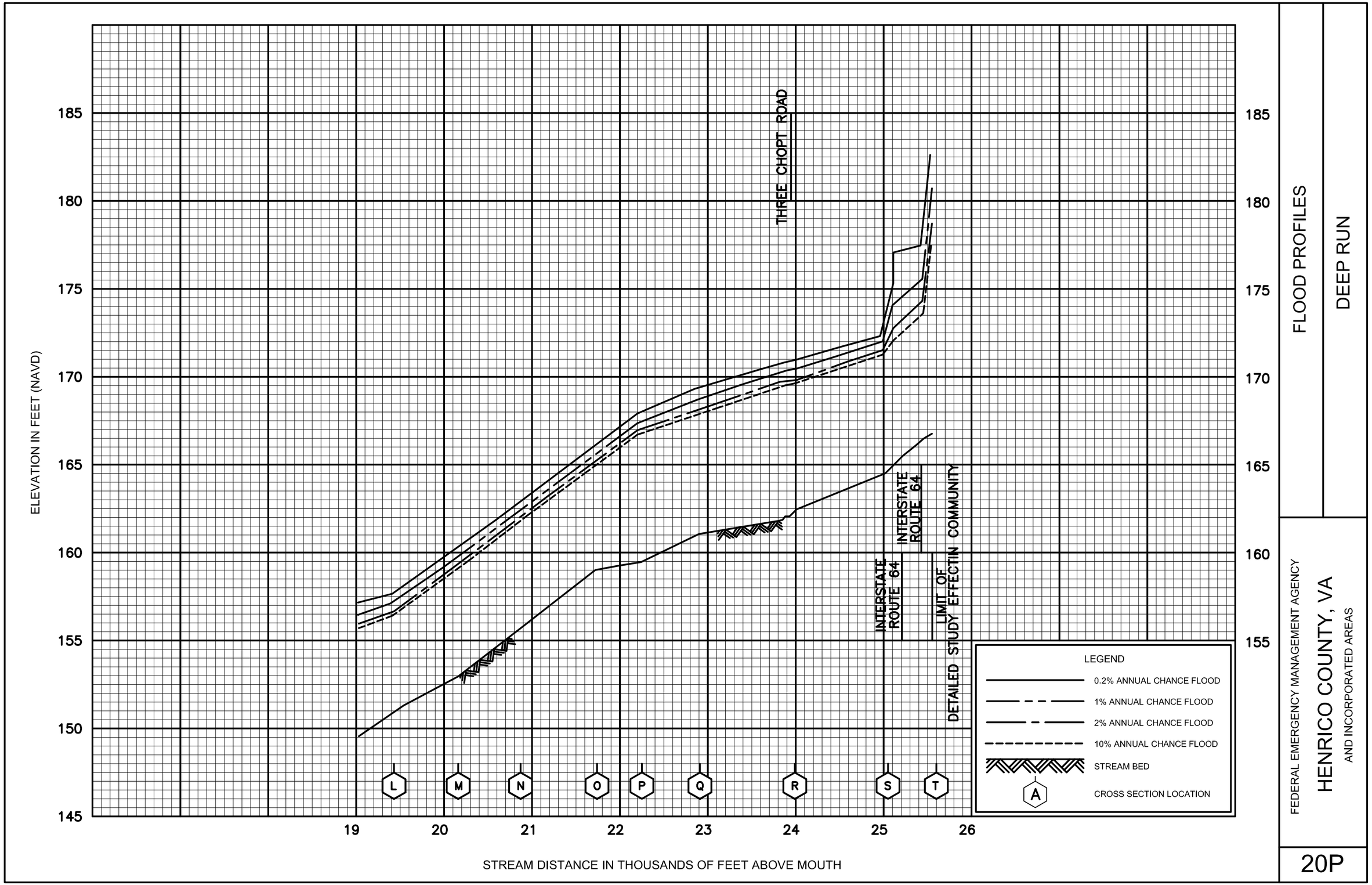
DEEP RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

19P



FLOOD PROFILES

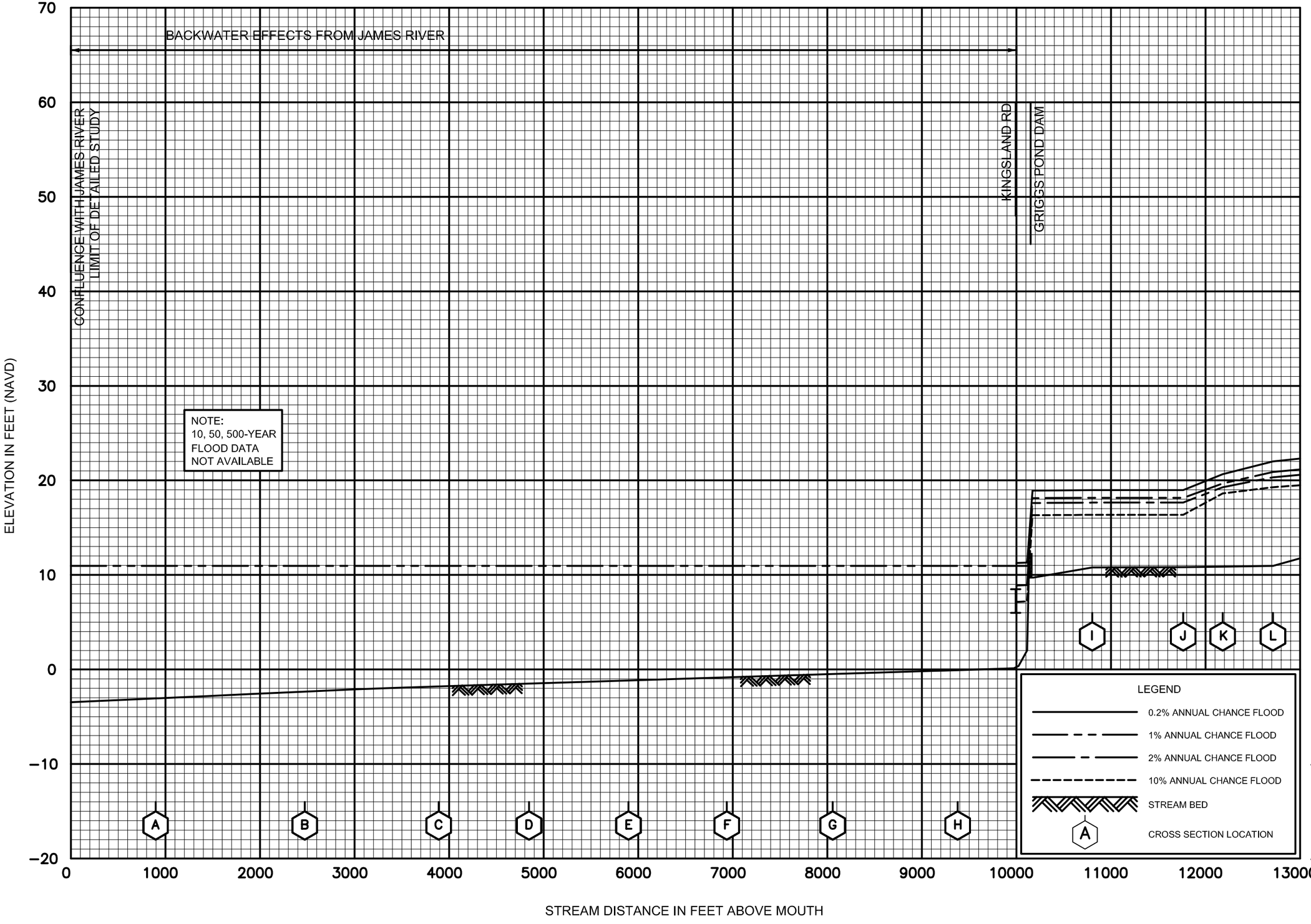
DEEP RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

20P



FLOOD PROFILES

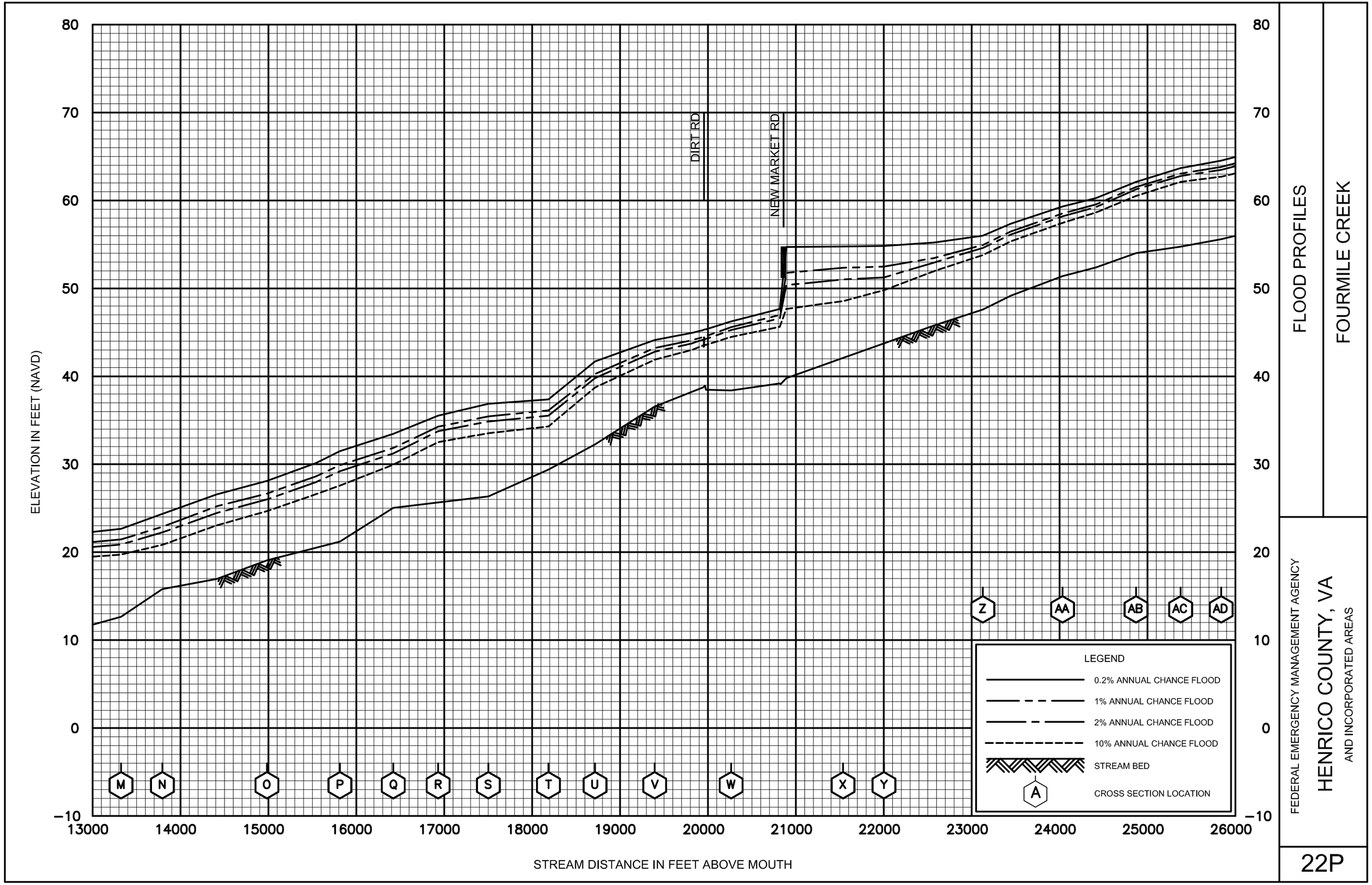
FOURMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

21P



FLOOD PROFILES

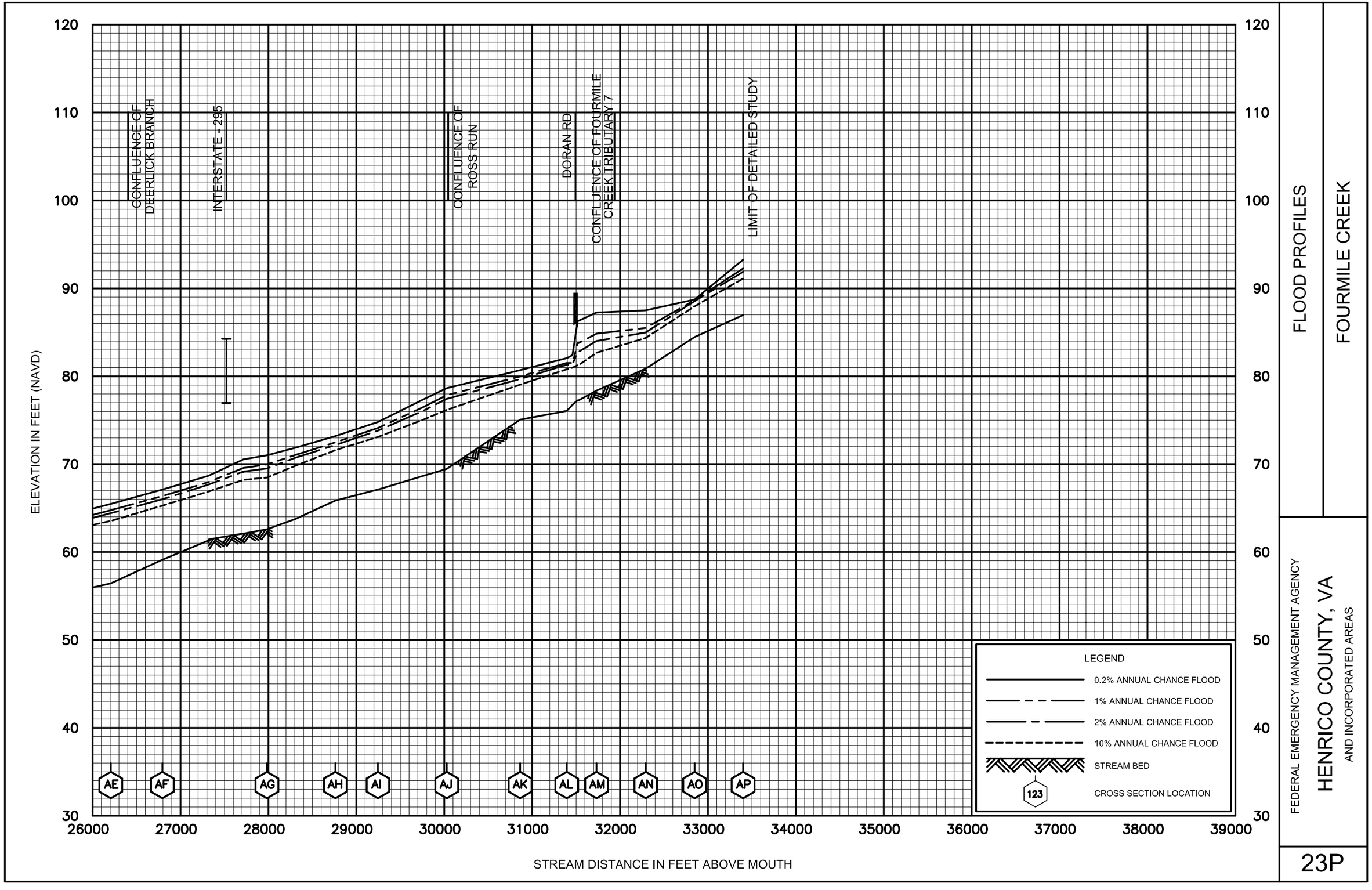
FOURMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

22P



FLOOD PROFILES

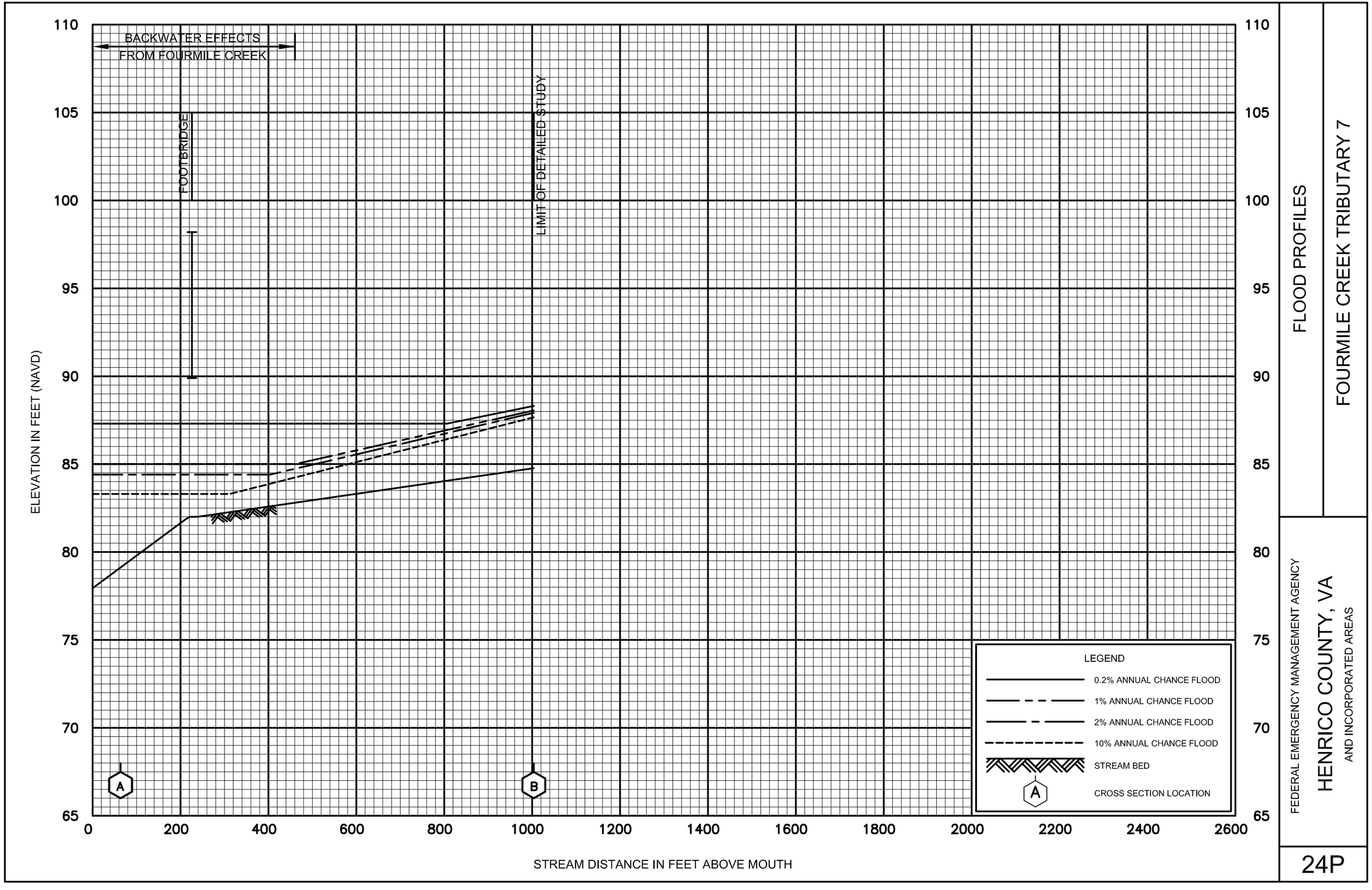
FOURMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

23P



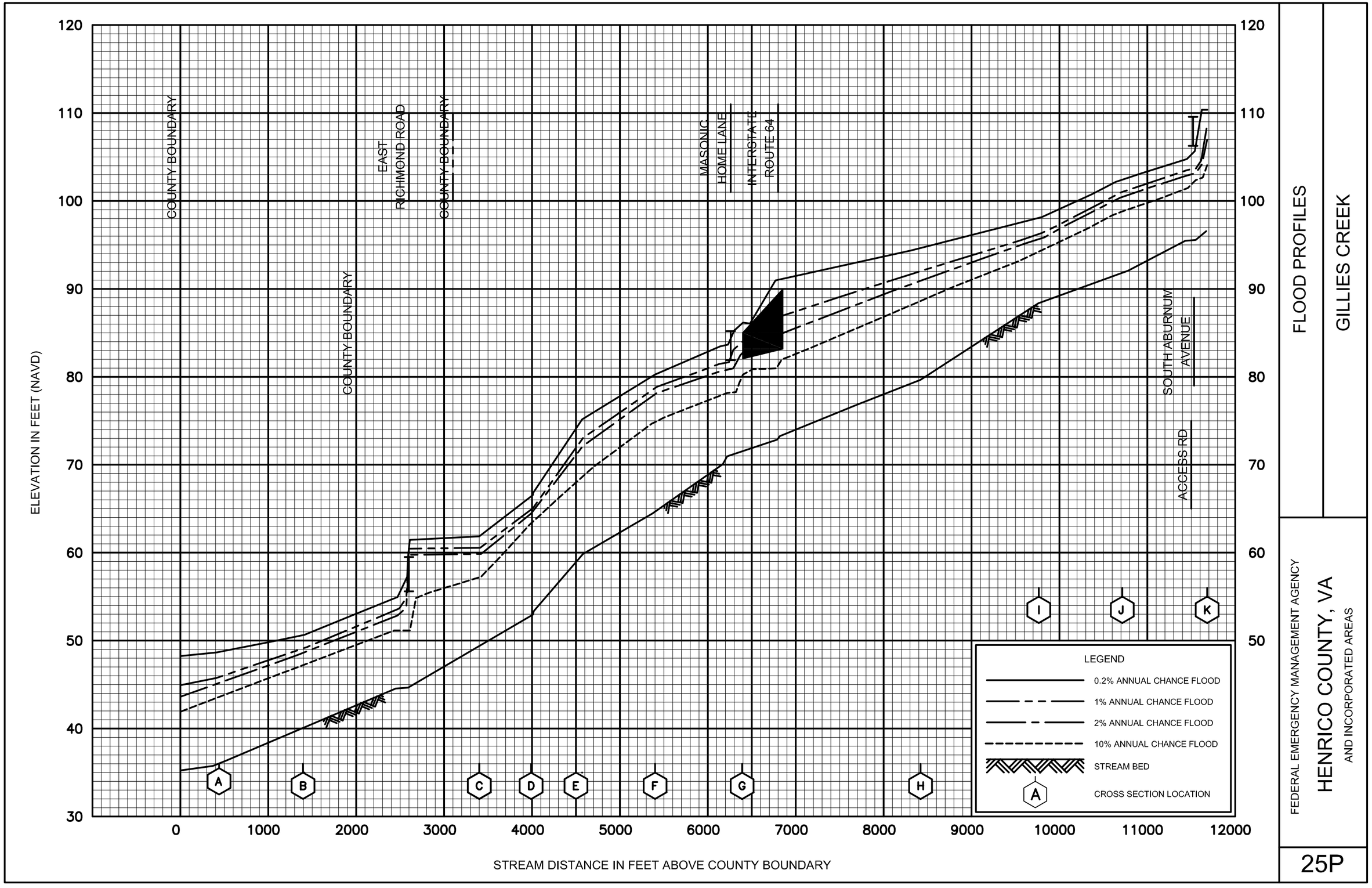
FLOOD PROFILES

FOURMILE CREEK TRIBUTARY 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS



FLOOD PROFILES

GILLIES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

25P

UPSTREAM FLOOD HAZARD INFORMATION IS STUDIED BY DETAILED METHODS. THESE METHODS REFLECT MORE DETAILED AND UP-TO-DATE STREAM CHANNEL CONFIGURATIONS. AS A RESULT, THE STREAM CHANNEL DISTANCES MAY NOT AGREE WITH THE ADJOINING REDELINEATED PORTION OF THE STREAM.

CONFLUENCE OF HECKLER VILLAGE TRIBUTARY 1

RAILROAD

CONFLUENCE OF GILLIES CREEK TRIBUTARY 1

LIMIT OF DETAILED STUDY

ELEVATION IN FEET (NAVD)

160
150
140
130
120
110
100
90
80
70

12000 12500 13000 13500 14000 14500 15000 15500 16000 16500 17000 17500 18000 18500

STREAM DISTANCE IN FEET ABOVE COUNTY BOUNDARY

L M N O P Q R S T U

LEGEND

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

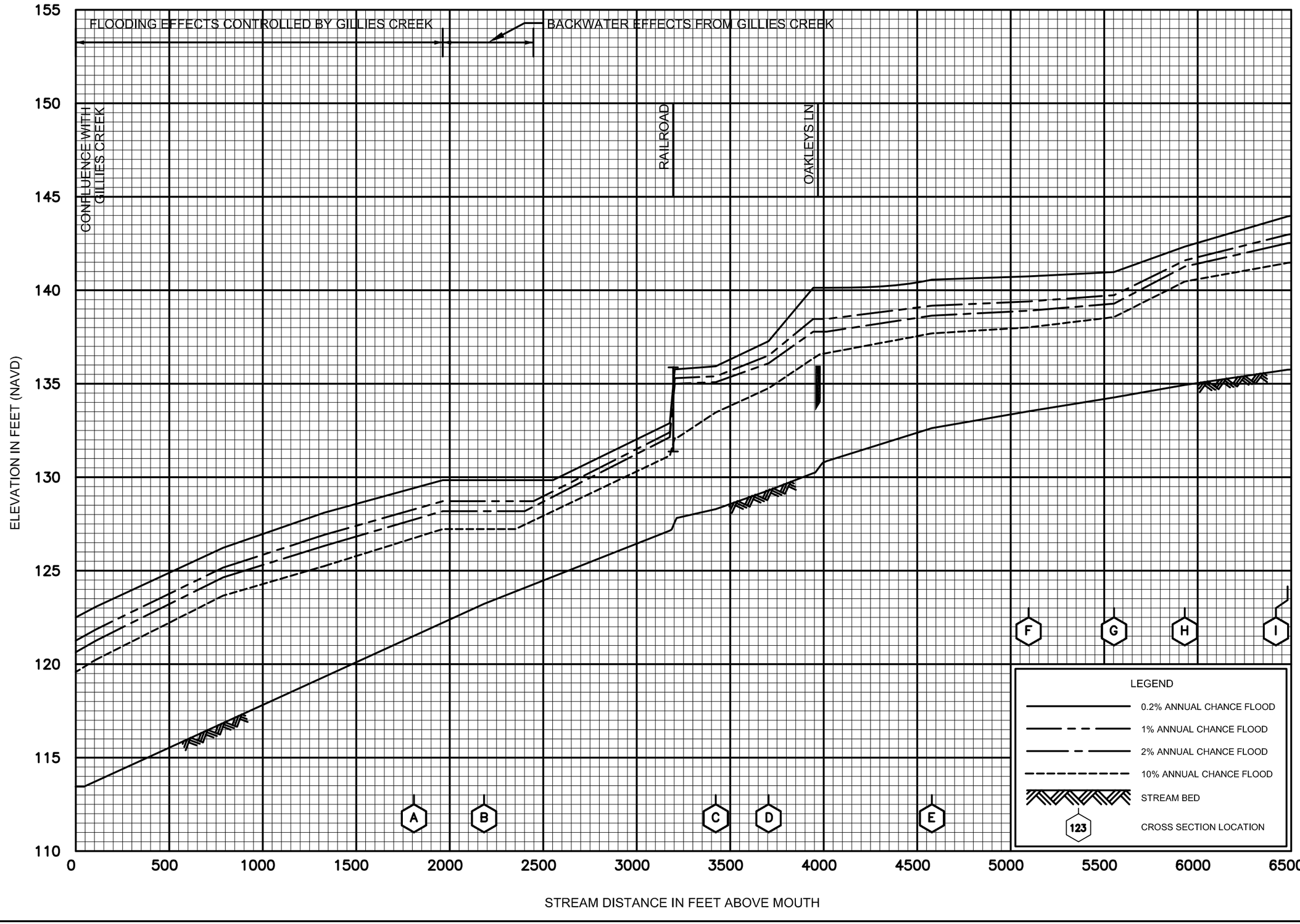
FLOOD PROFILES

GILLIES CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS



FLOOD PROFILES

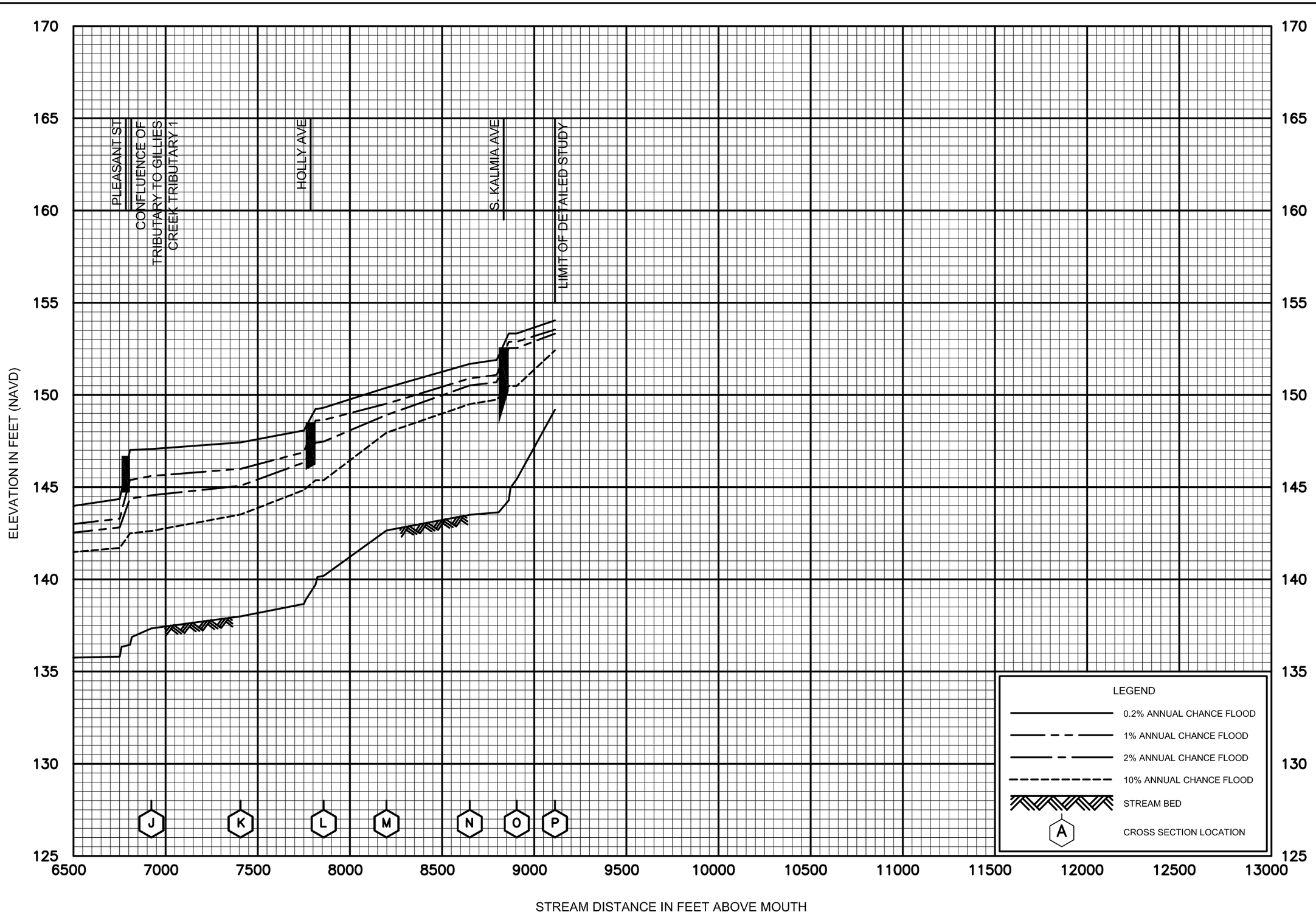
GILLIES CREEK TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

27P



FLOOD PROFILES

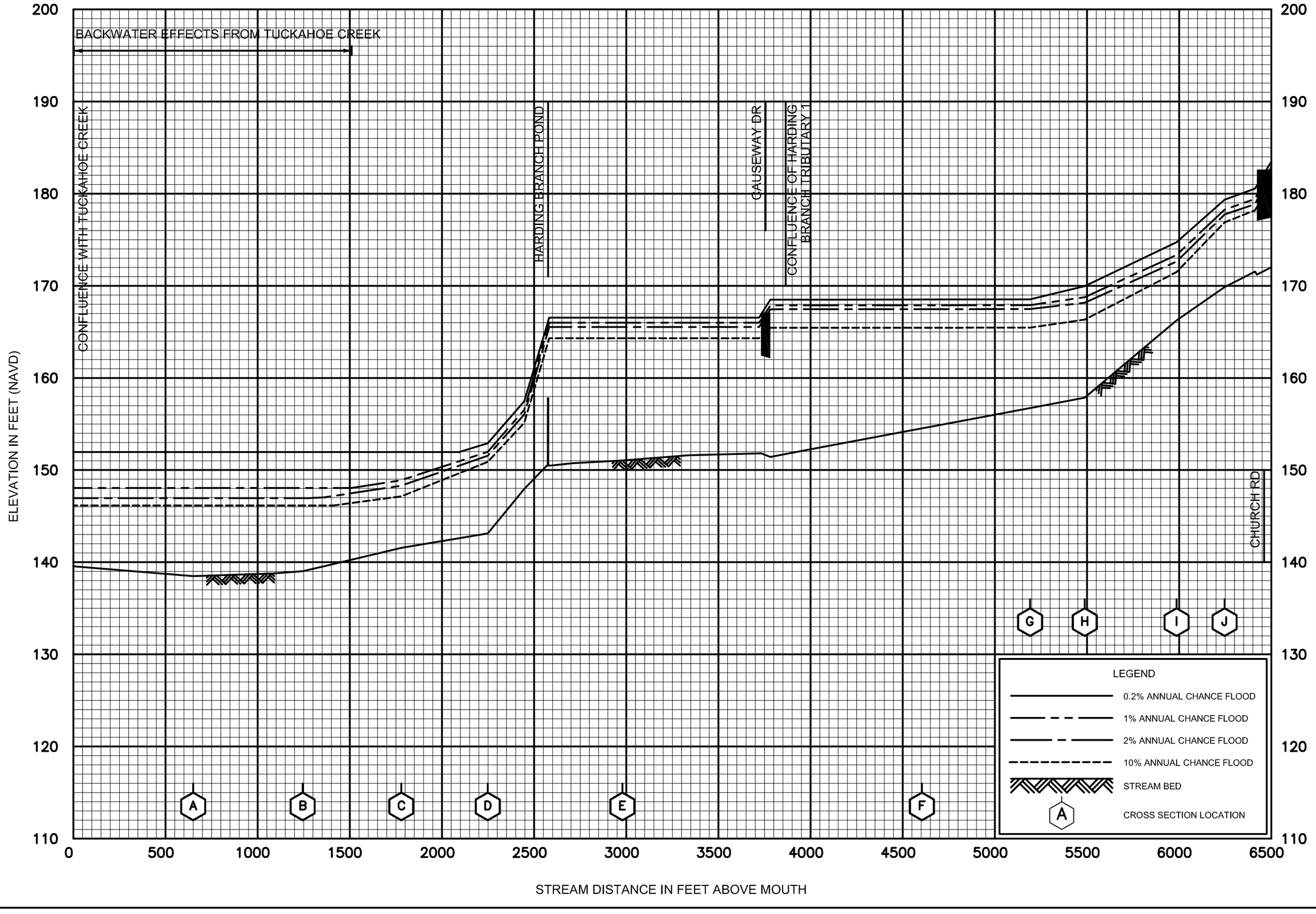
GILLIES CREEK TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

28P



FLOOD PROFILES

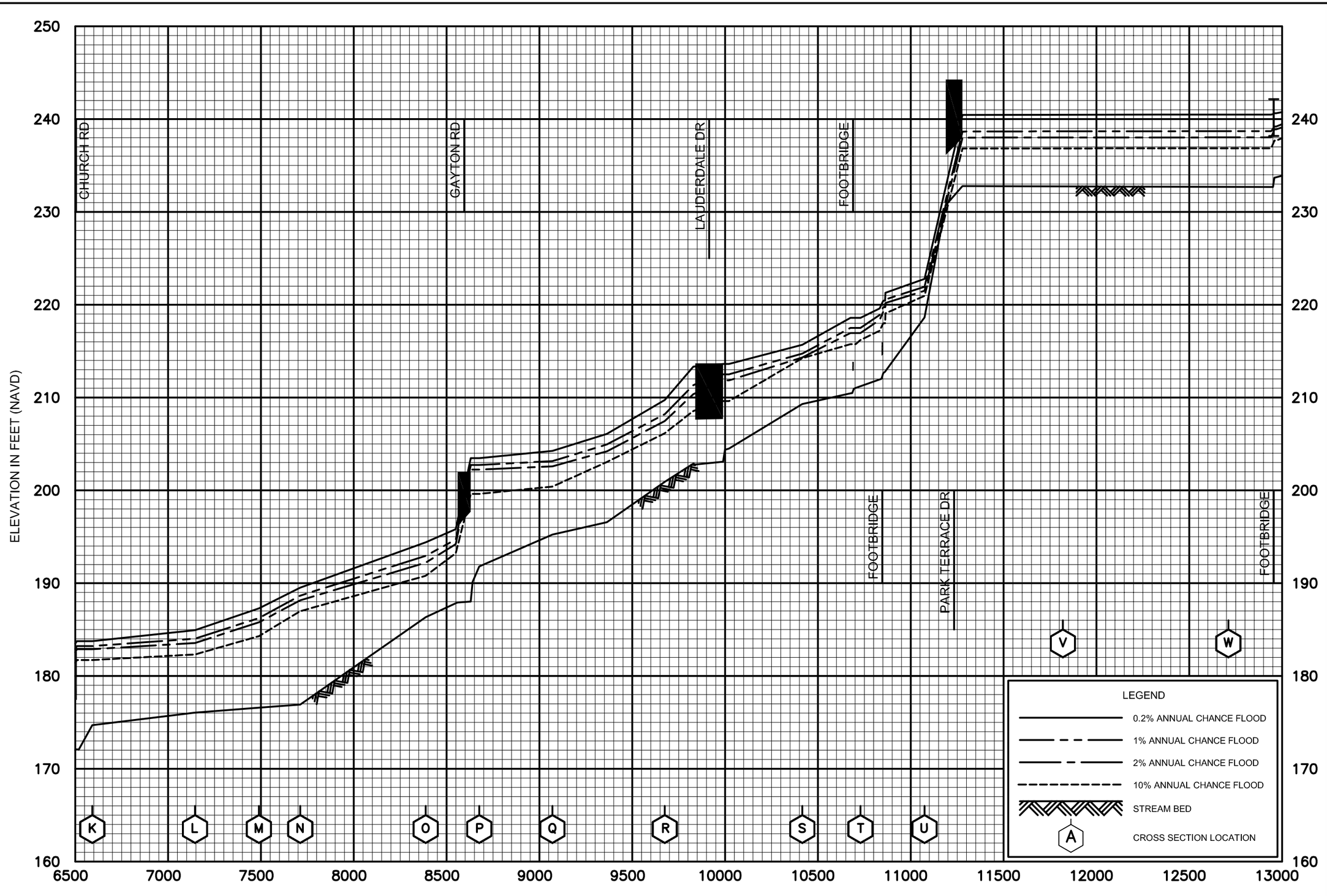
HARDING BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

29P



FLOOD PROFILES

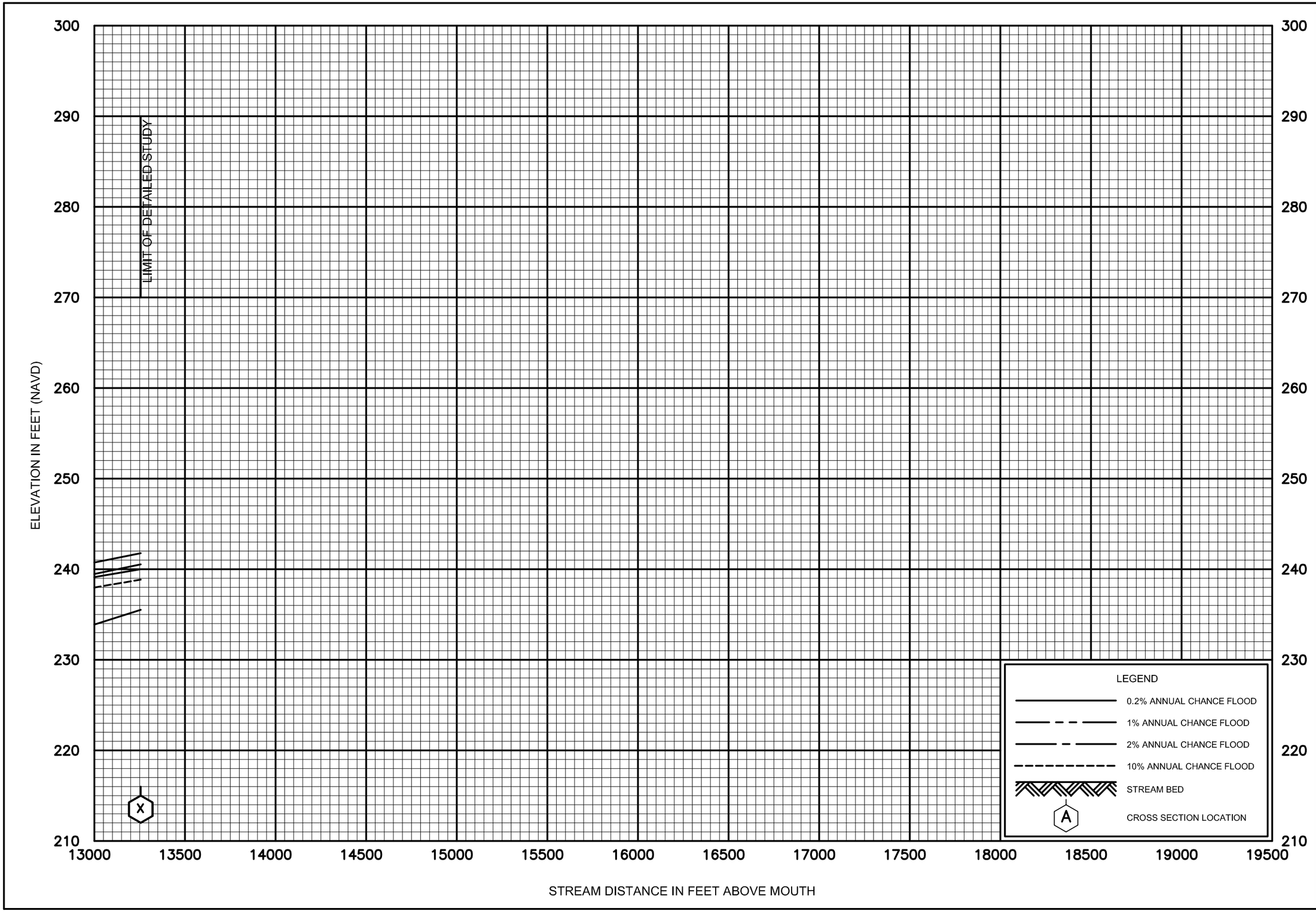
HARDING BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

30P



FLOOD PROFILES

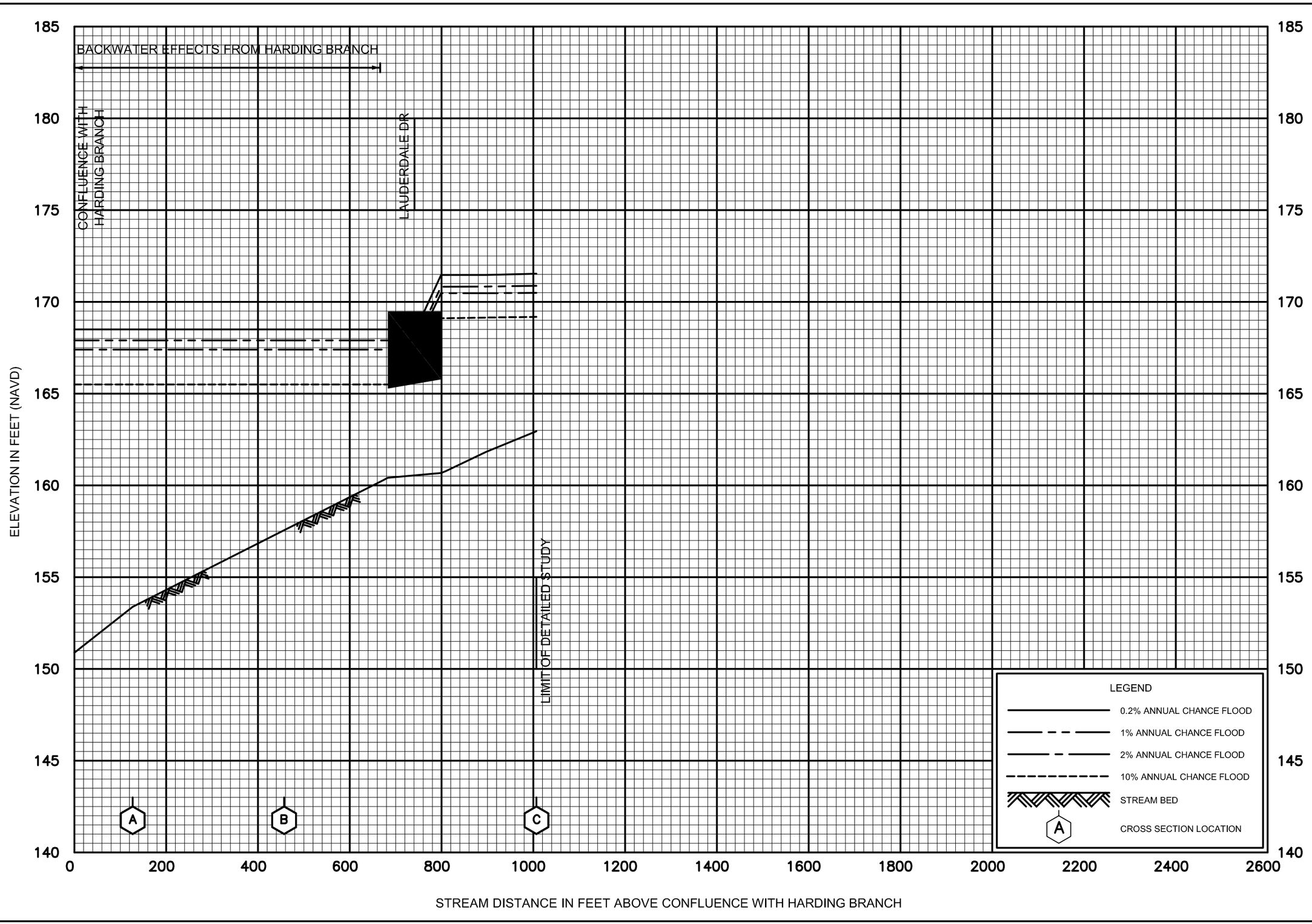
HARDING BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

31P



FLOOD PROFILES

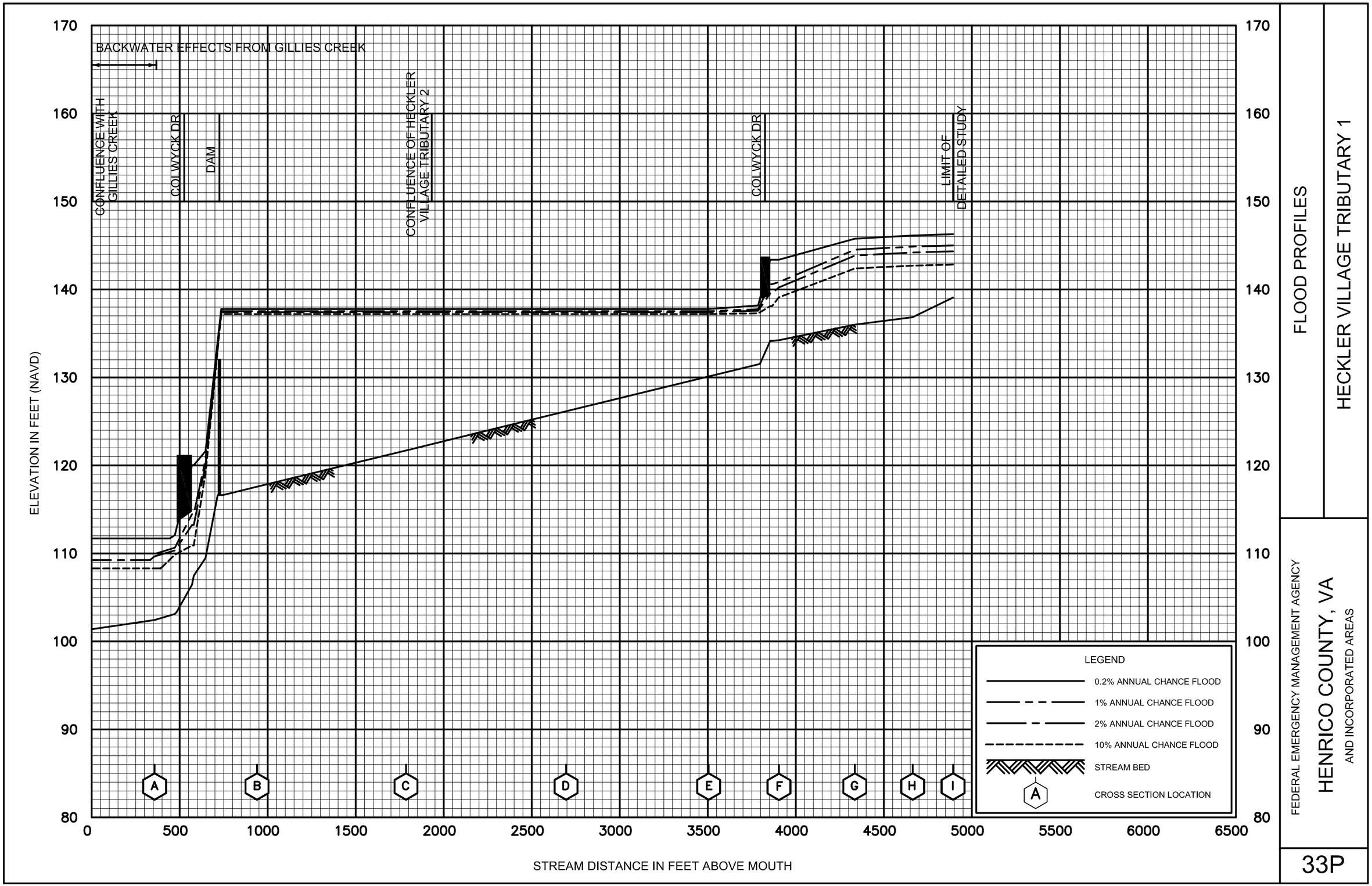
HARDING BRANCH TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

32P



FLOOD PROFILES

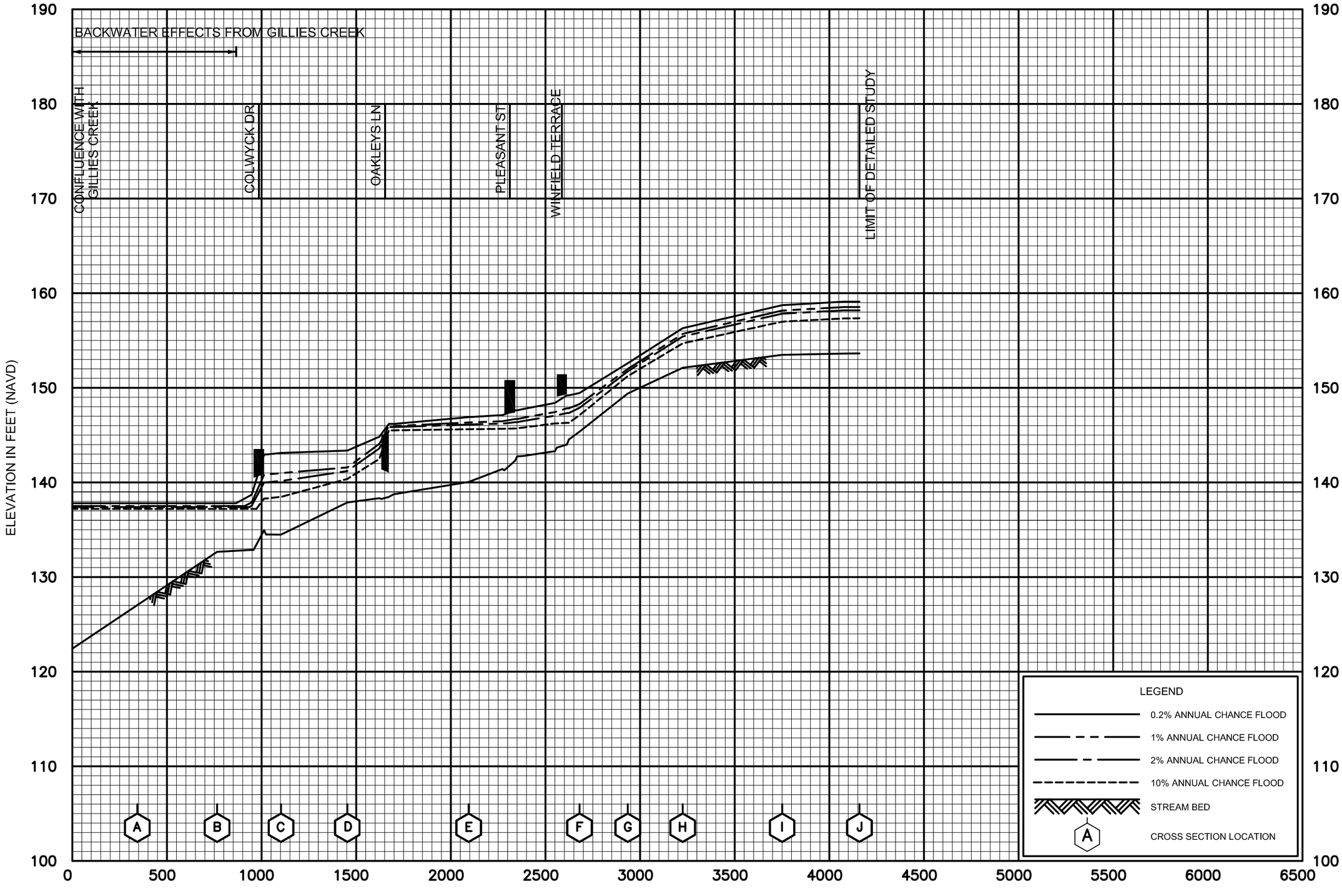
HECKLER VILLAGE TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

33P



FLOOD PROFILES

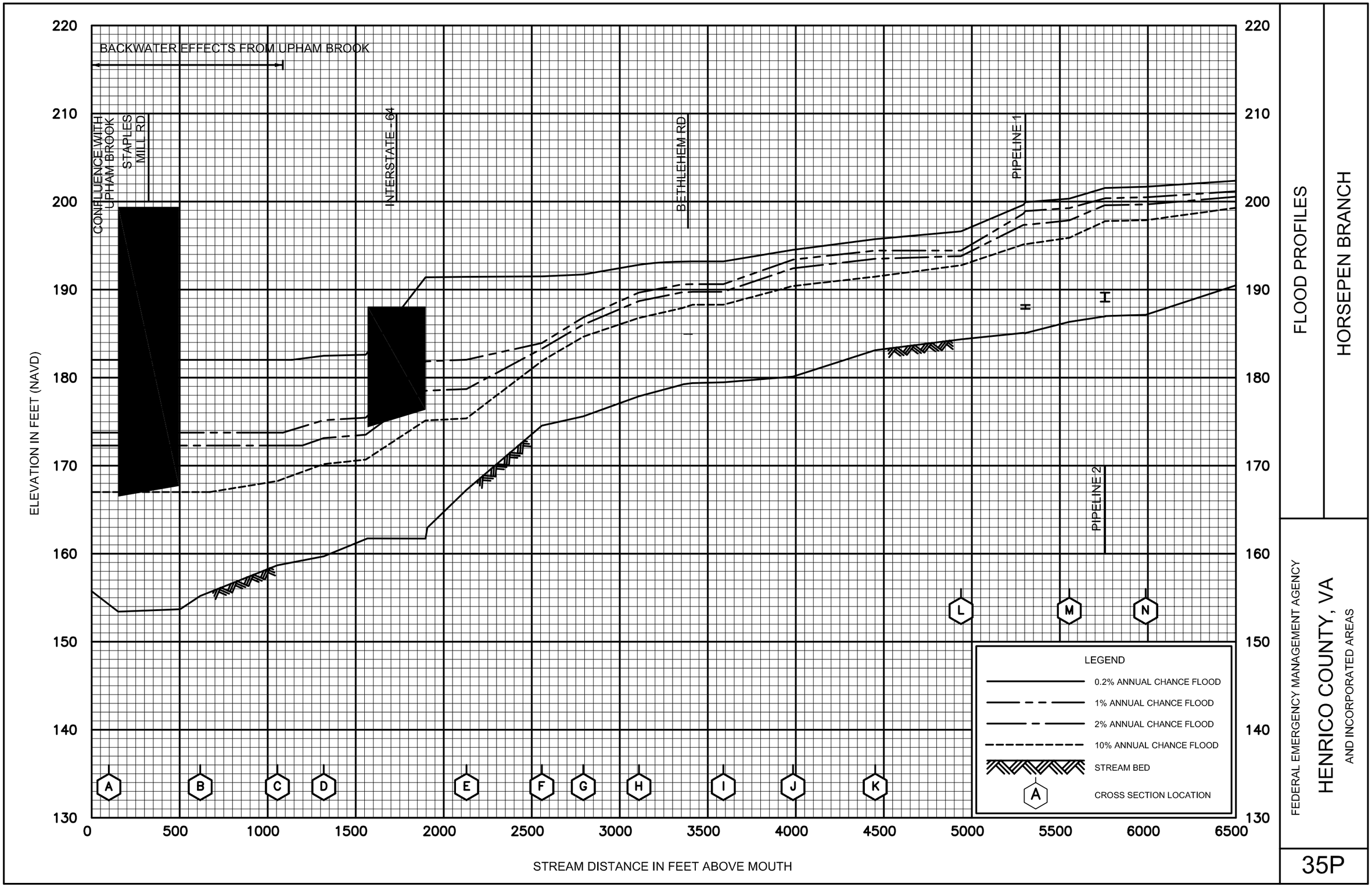
HECKLER VILLAGE TRIBUTARY 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

34P



FLOOD PROFILES

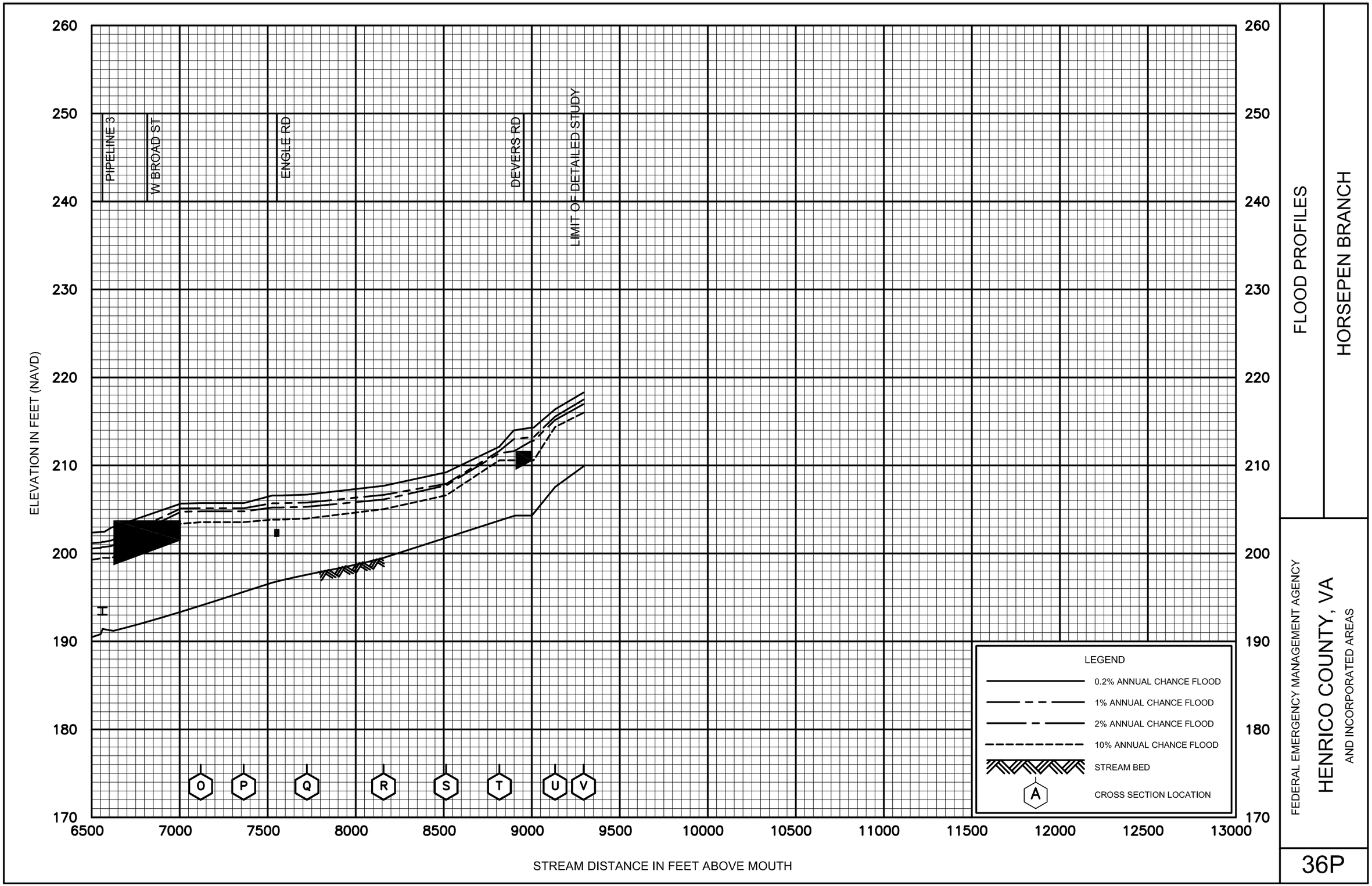
HORSEPEN BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

35P



FLOOD PROFILES

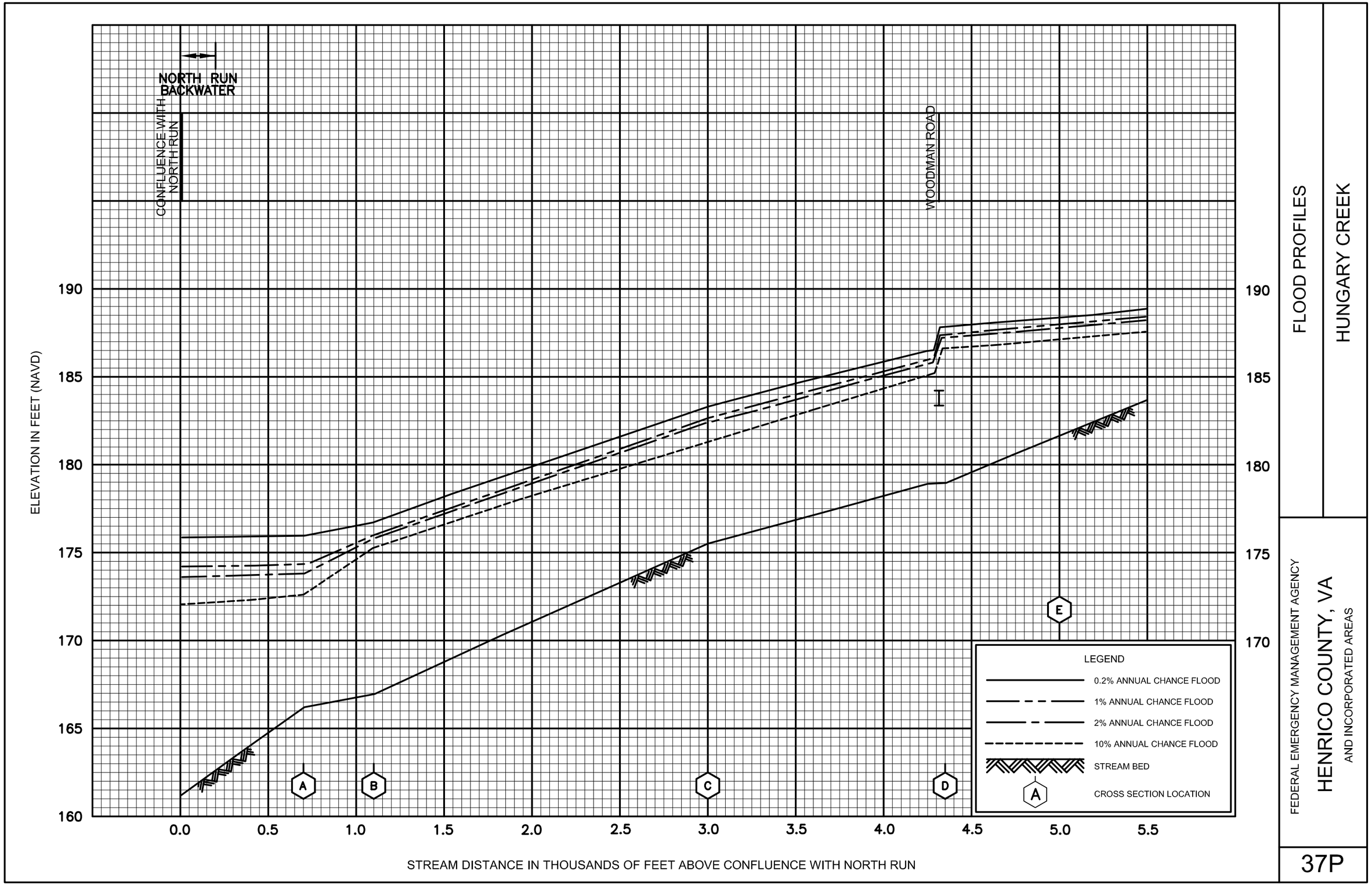
HORSEPEN BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

36P



FLOOD PROFILES

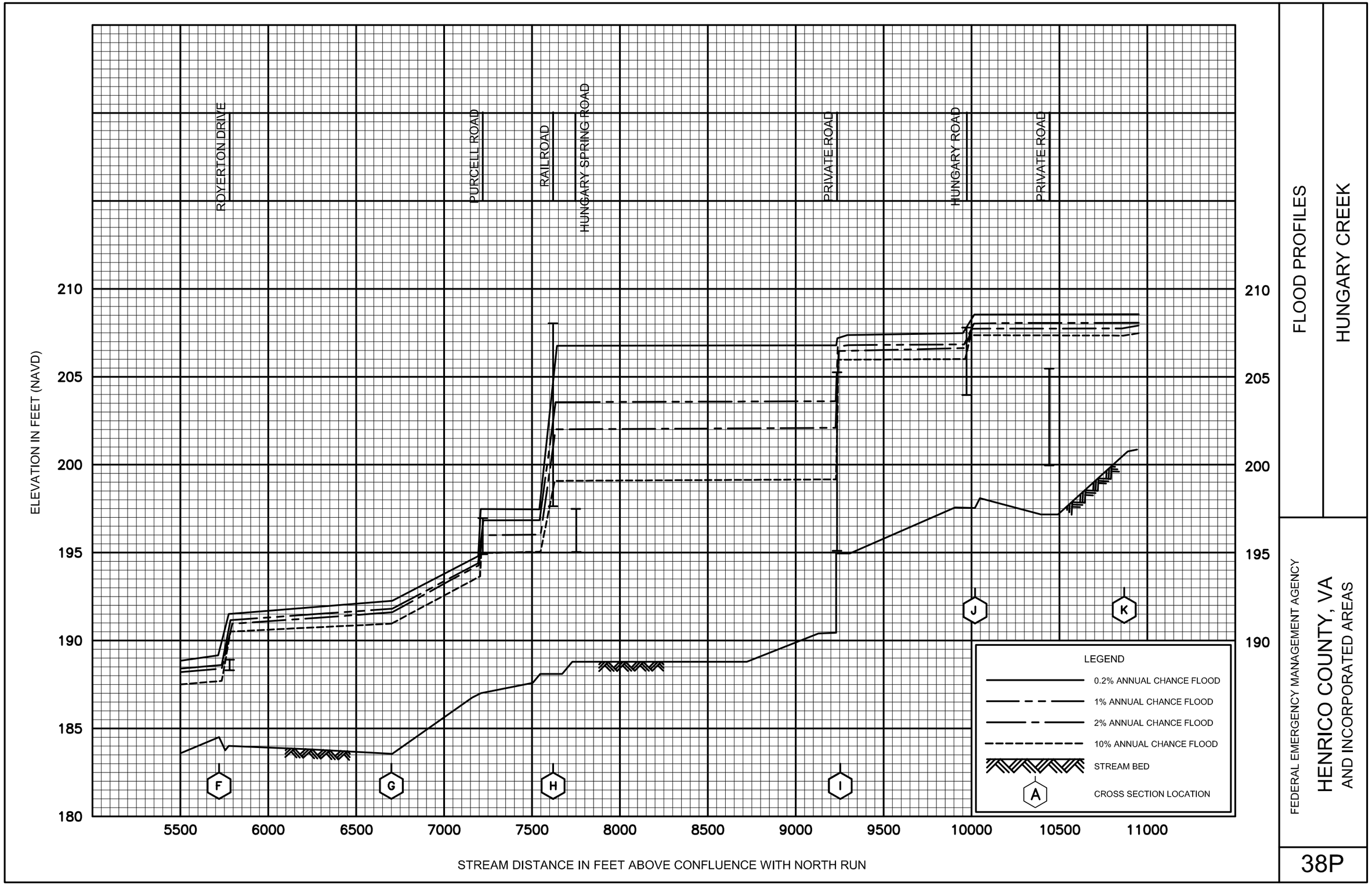
HUNGARY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

37P



FLOOD PROFILES

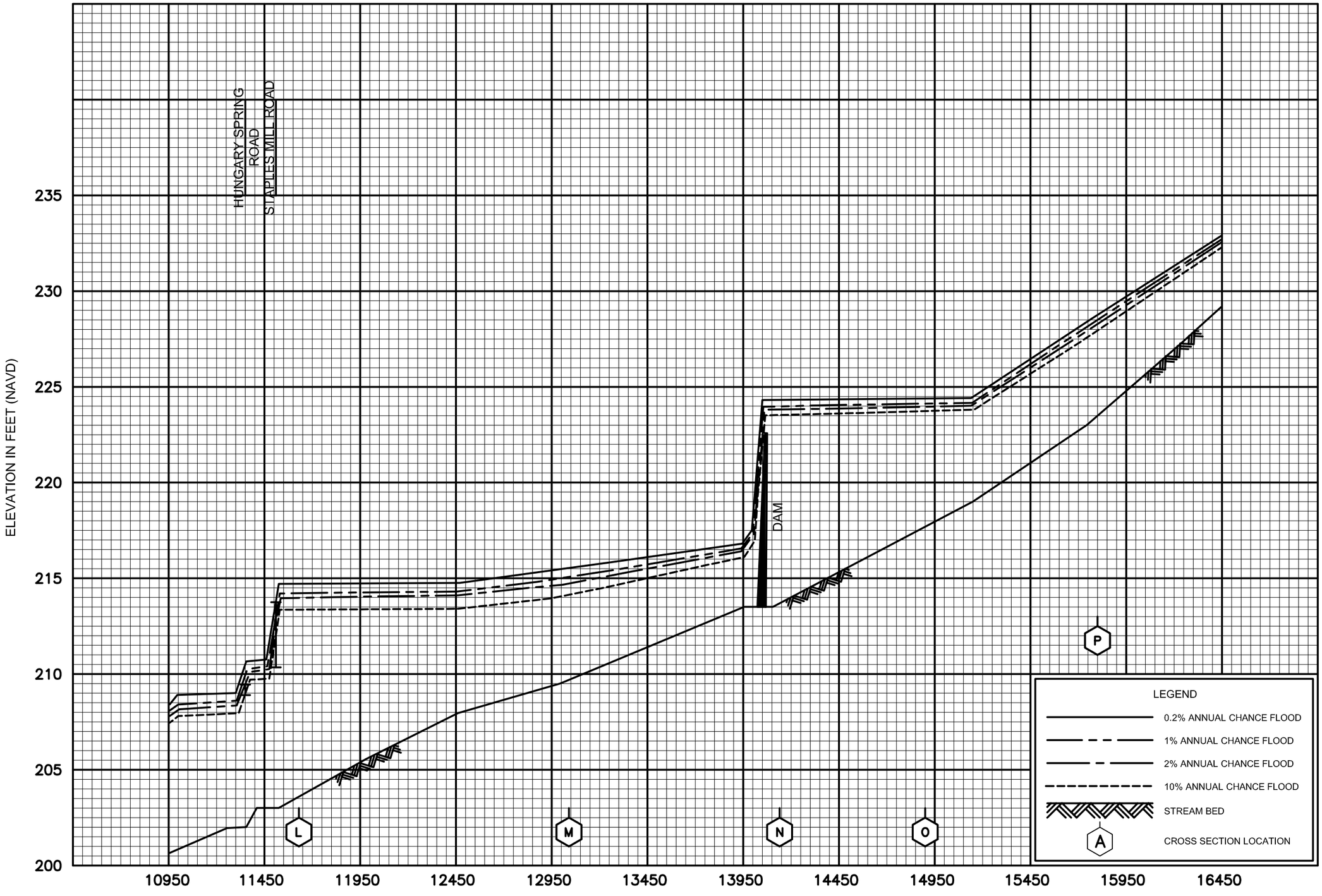
HUNGARY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

38P



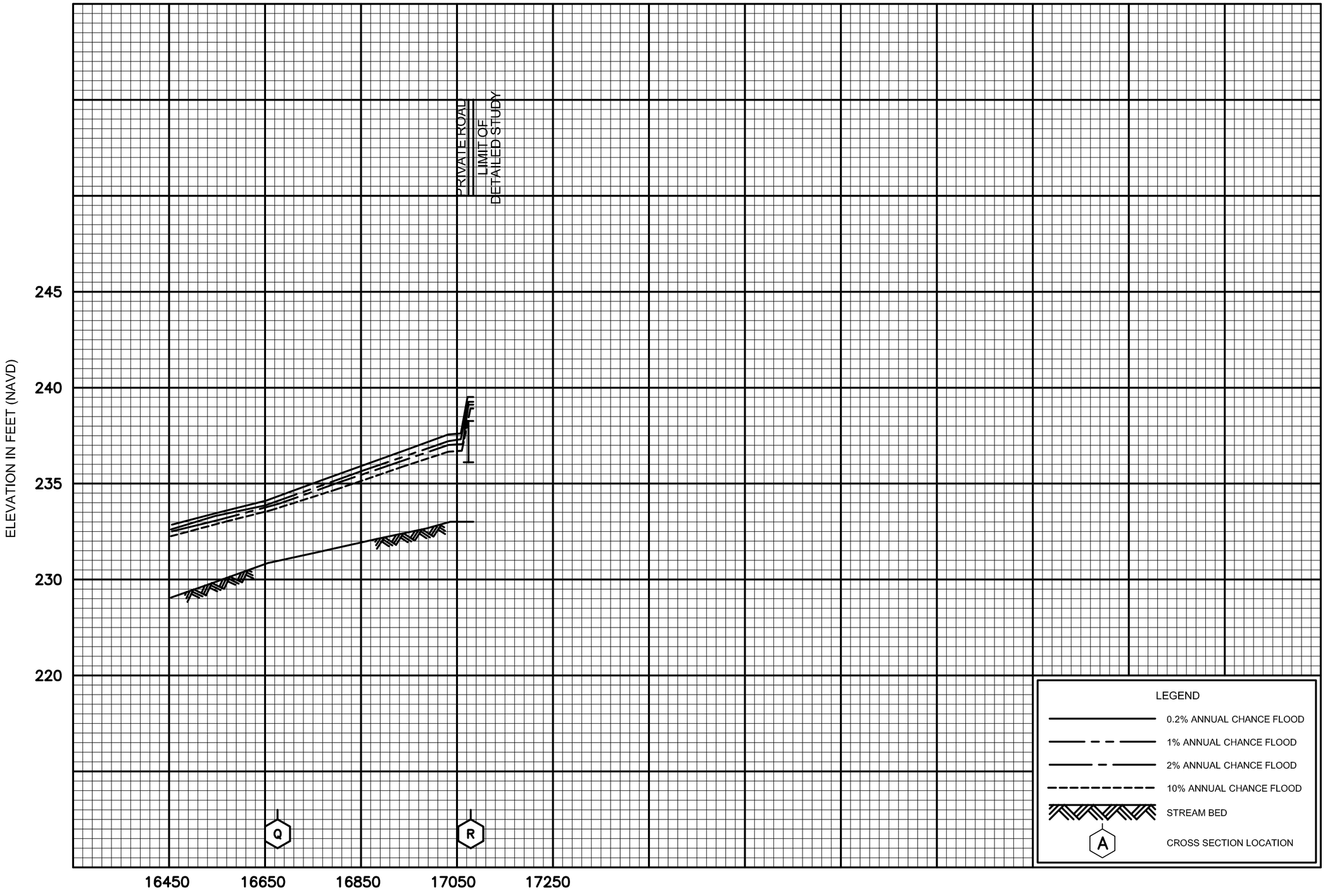
FLOOD PROFILES

HUNGARY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA
AND INCORPORATED AREAS

39P



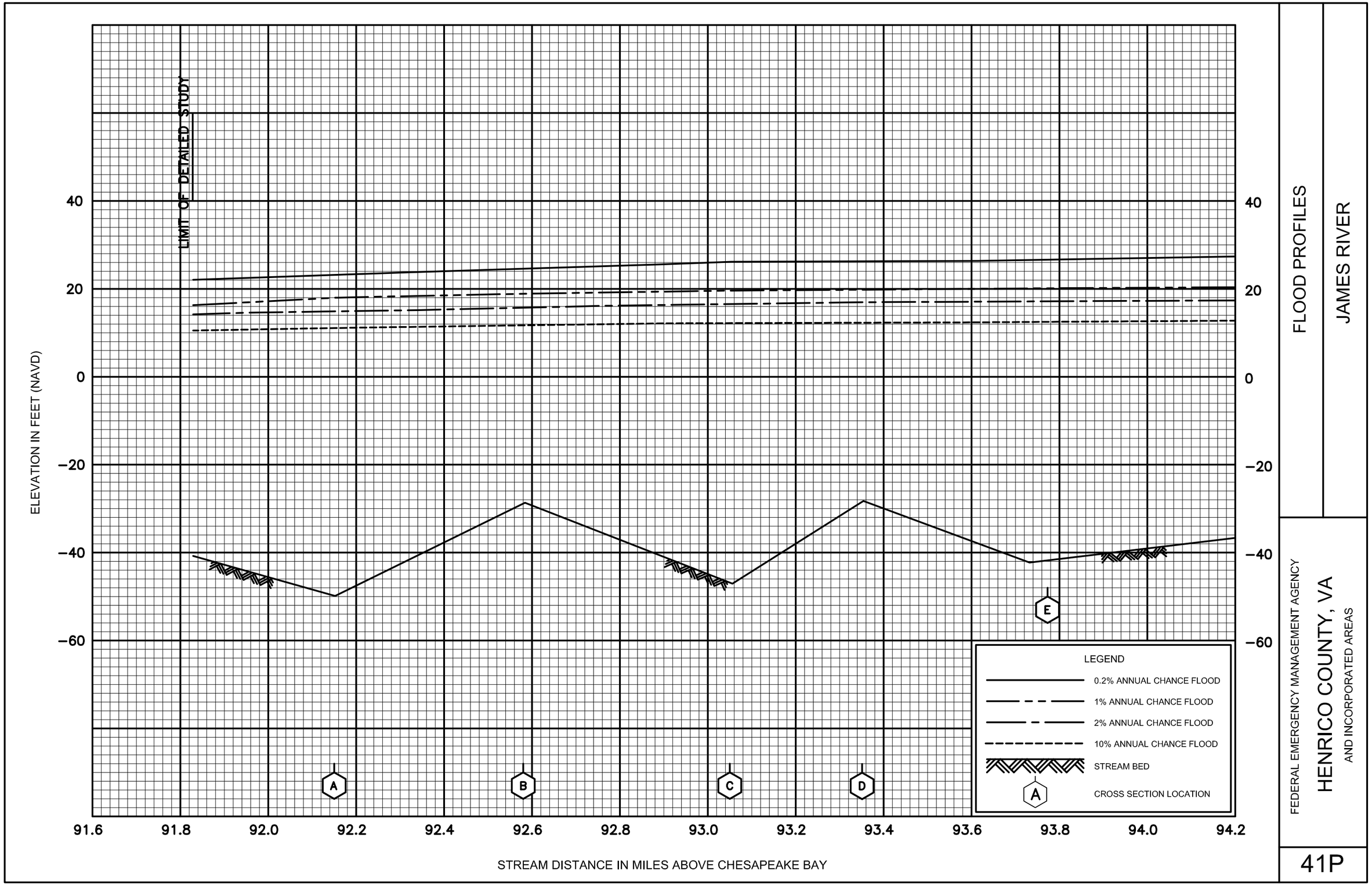
FLOOD PROFILES

HUNGARY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA
AND INCORPORATED AREAS

40P



FLOOD PROFILES

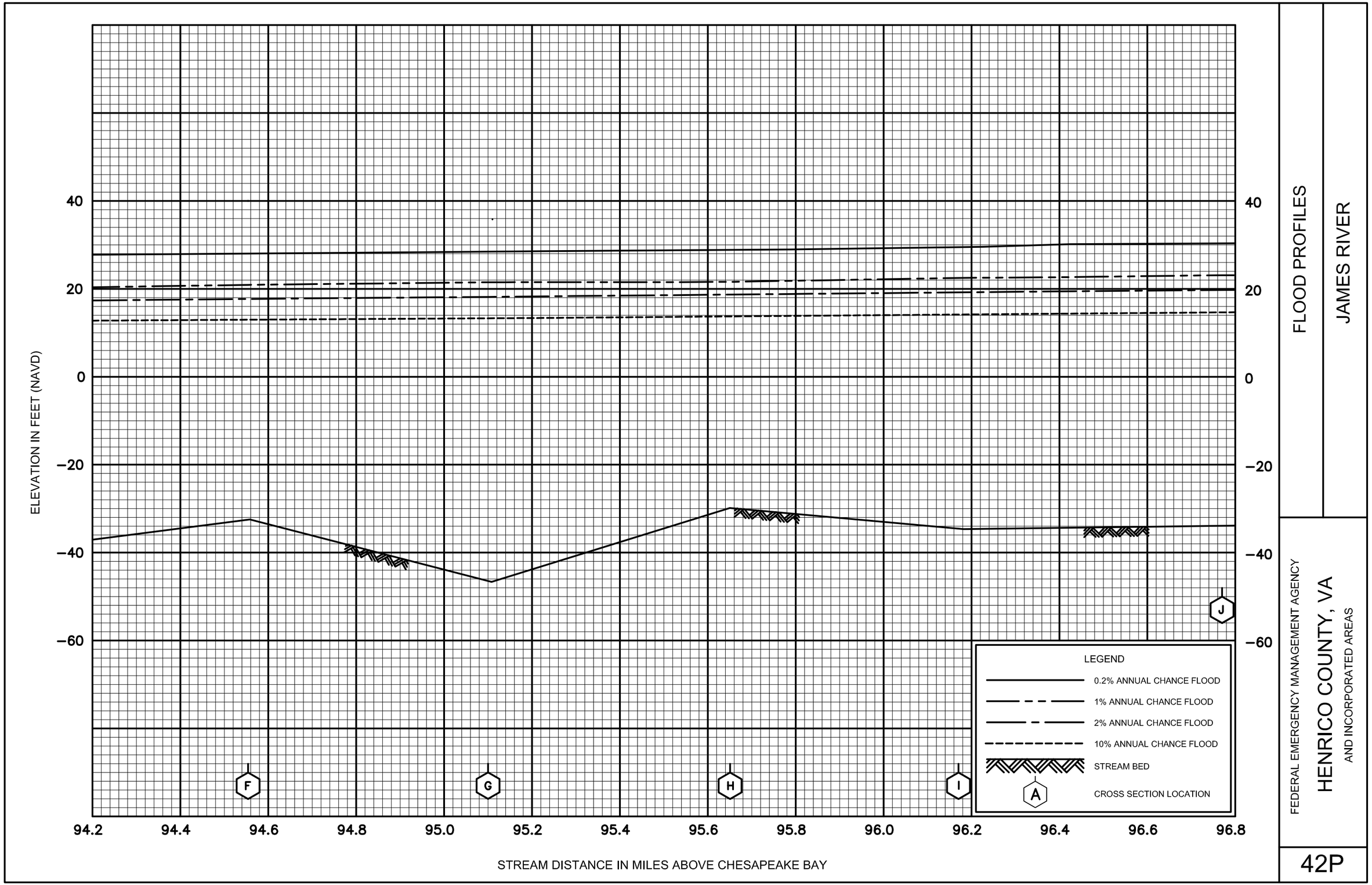
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

41P



FLOOD PROFILES

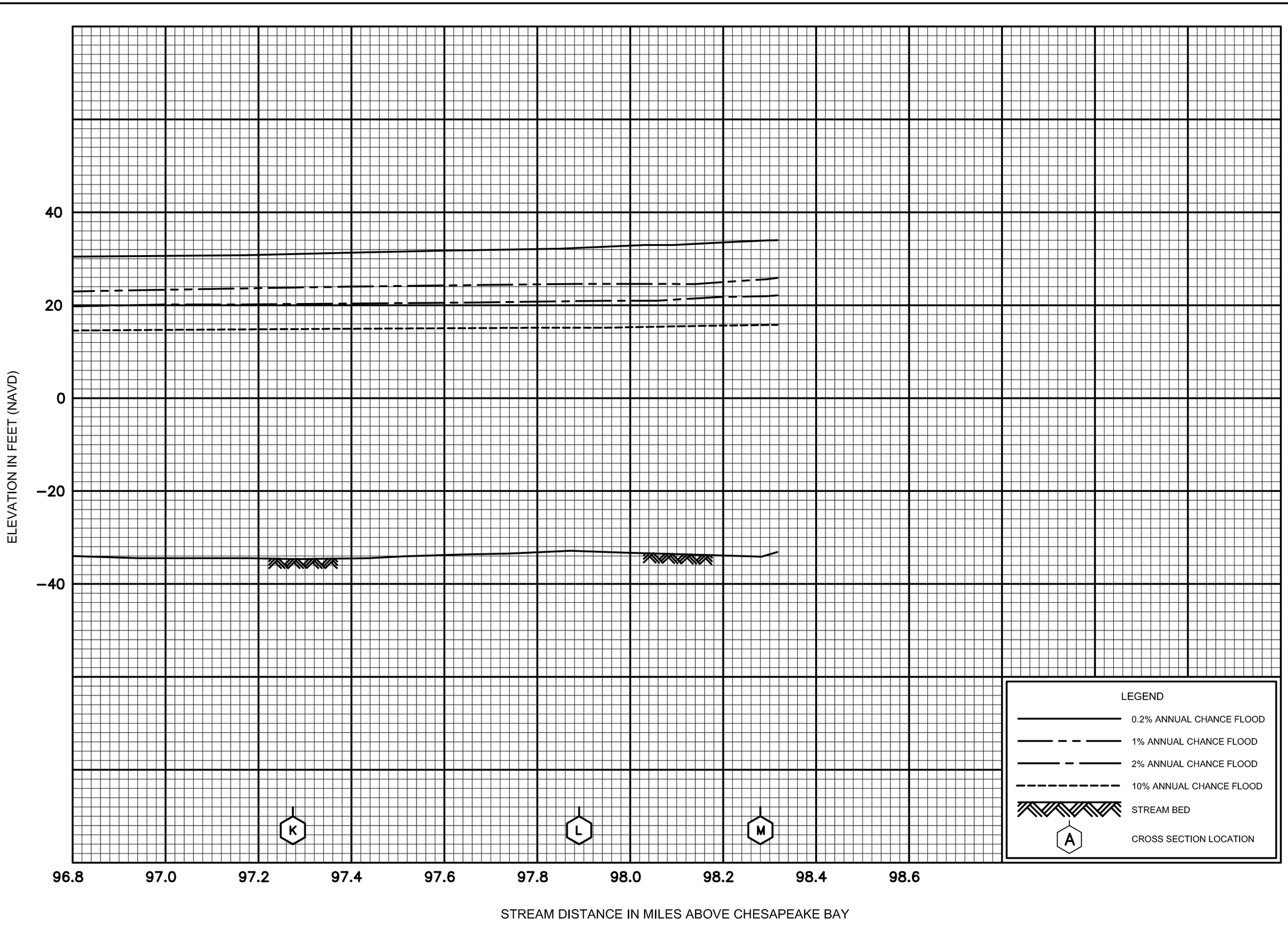
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

42P



FLOOD PROFILES

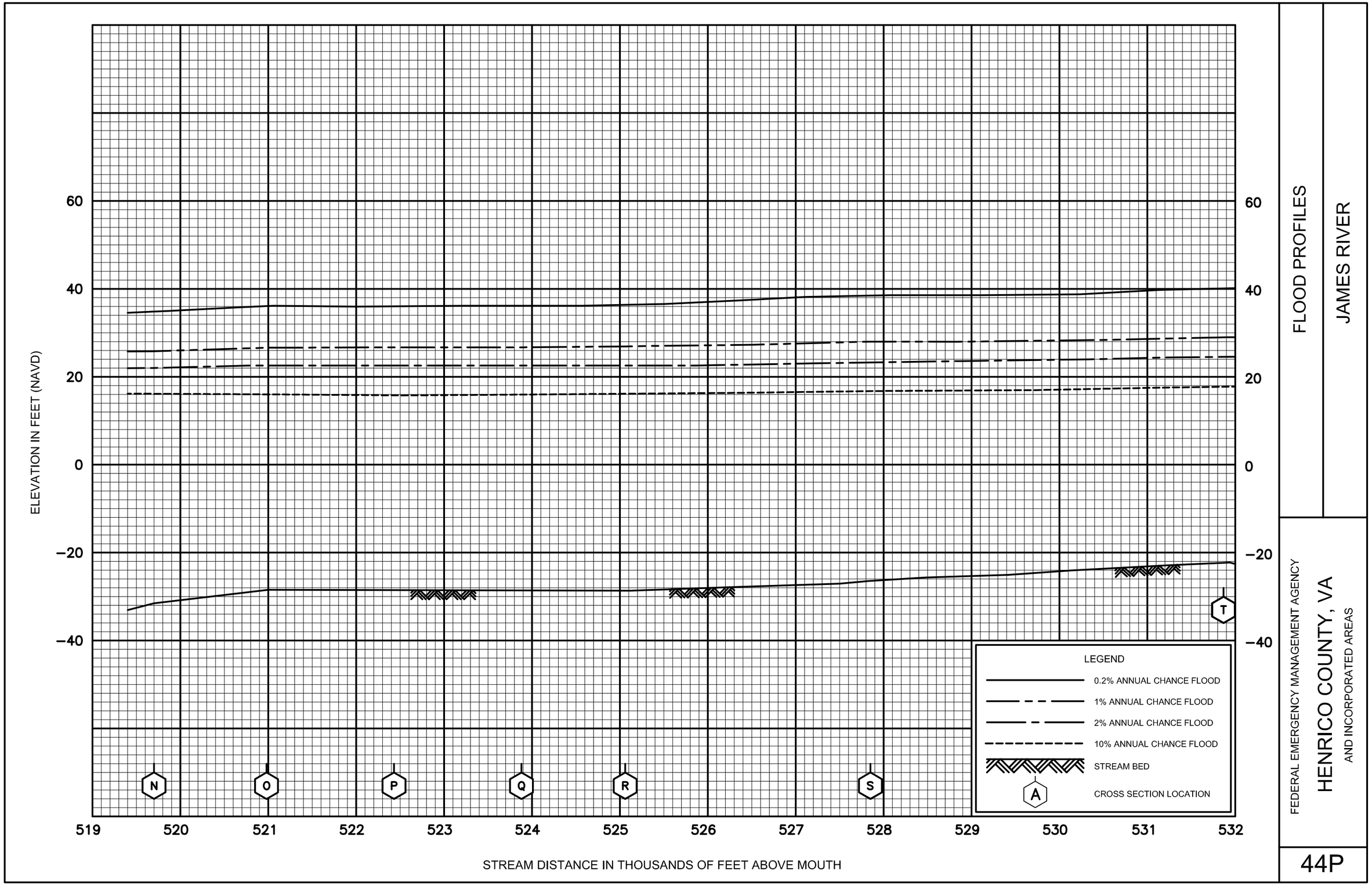
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

43P



FLOOD PROFILES

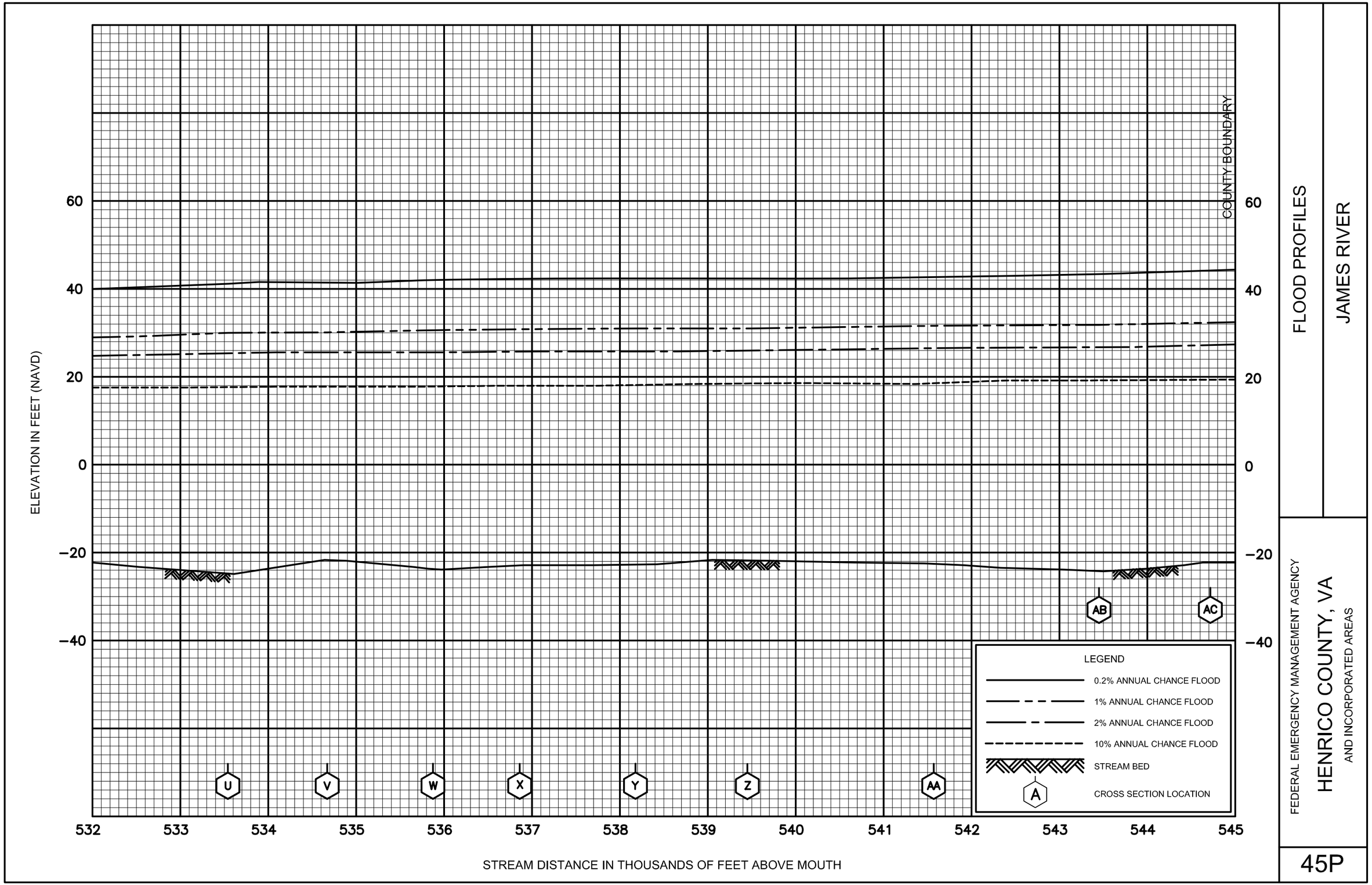
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

44P



FLOOD PROFILES

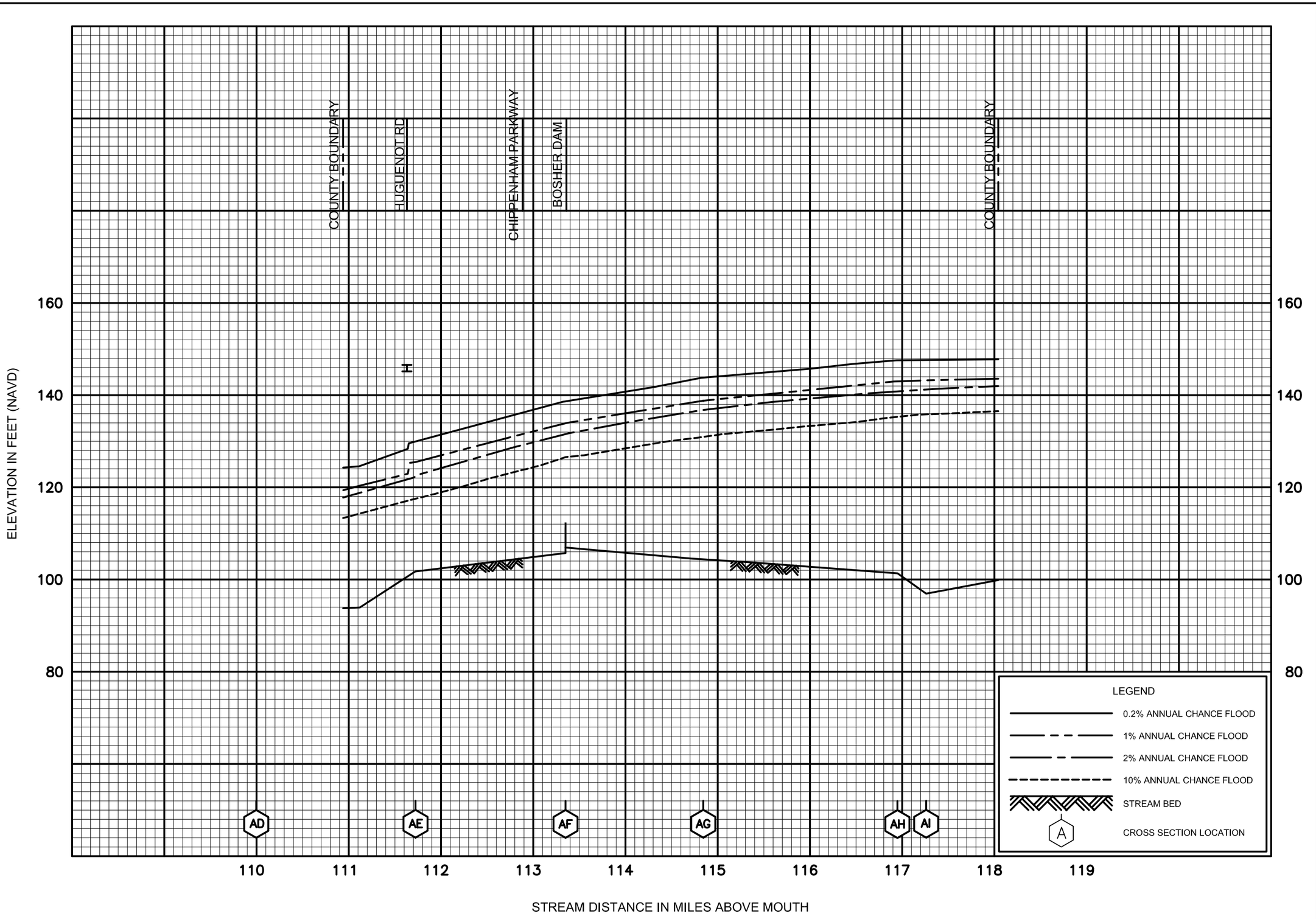
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

45P



FLOOD PROFILES

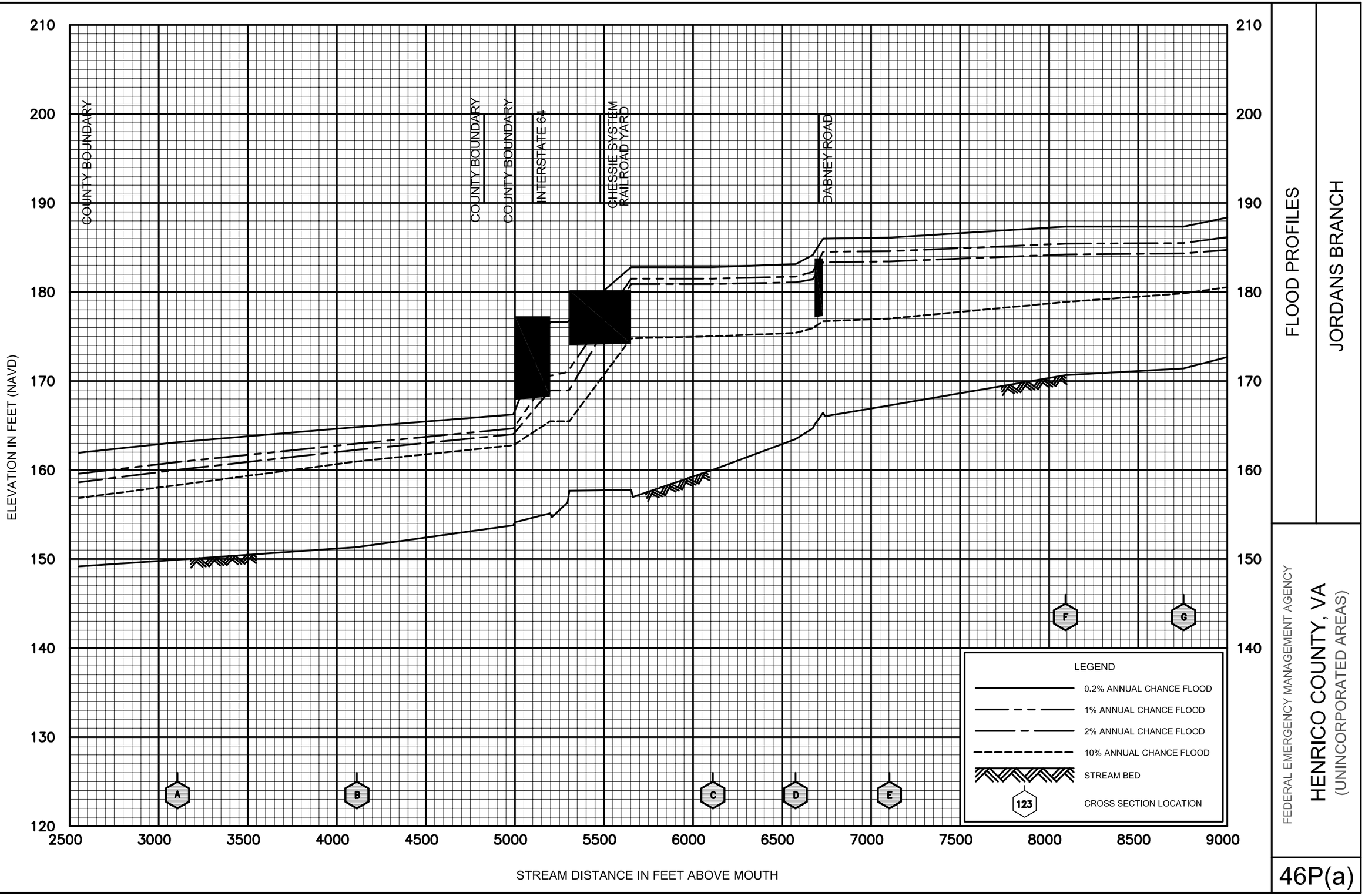
JAMES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

46P



FLOOD PROFILES

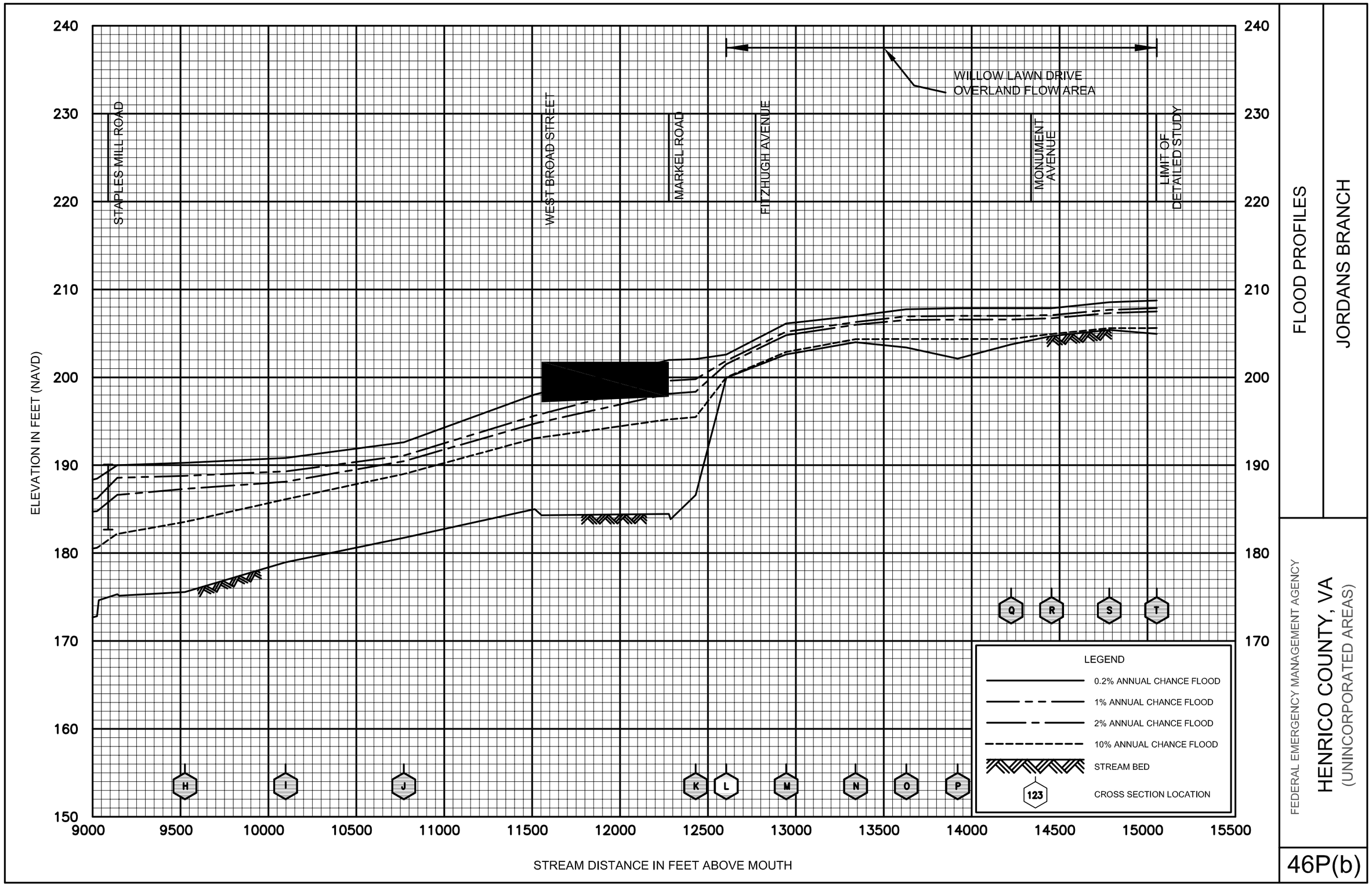
JORDANS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

(UNINCORPORATED AREAS)

46P(a)



FLOOD PROFILES

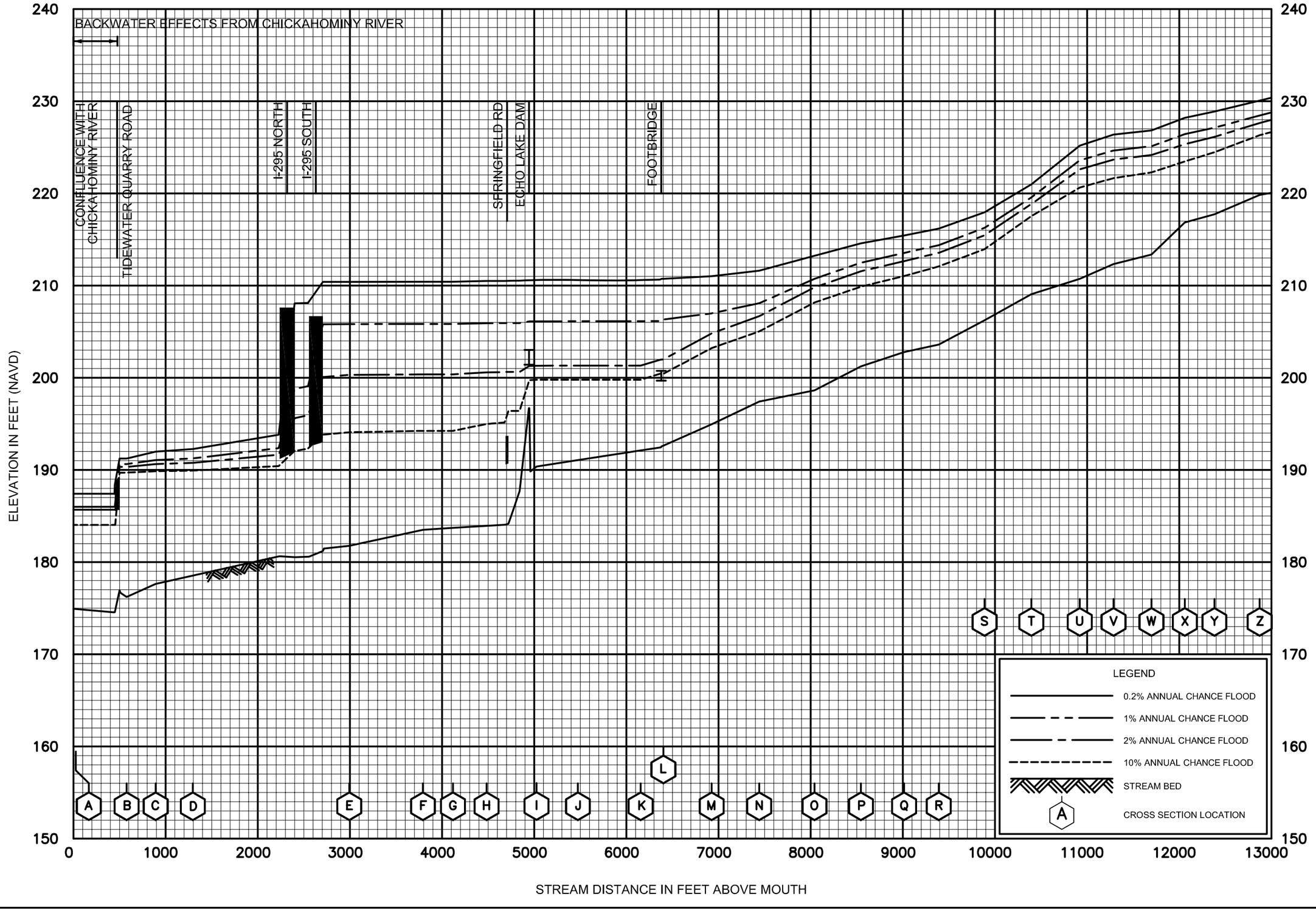
JORDANS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

(UNINCORPORATED AREAS)

46P(b)



FLOOD PROFILES

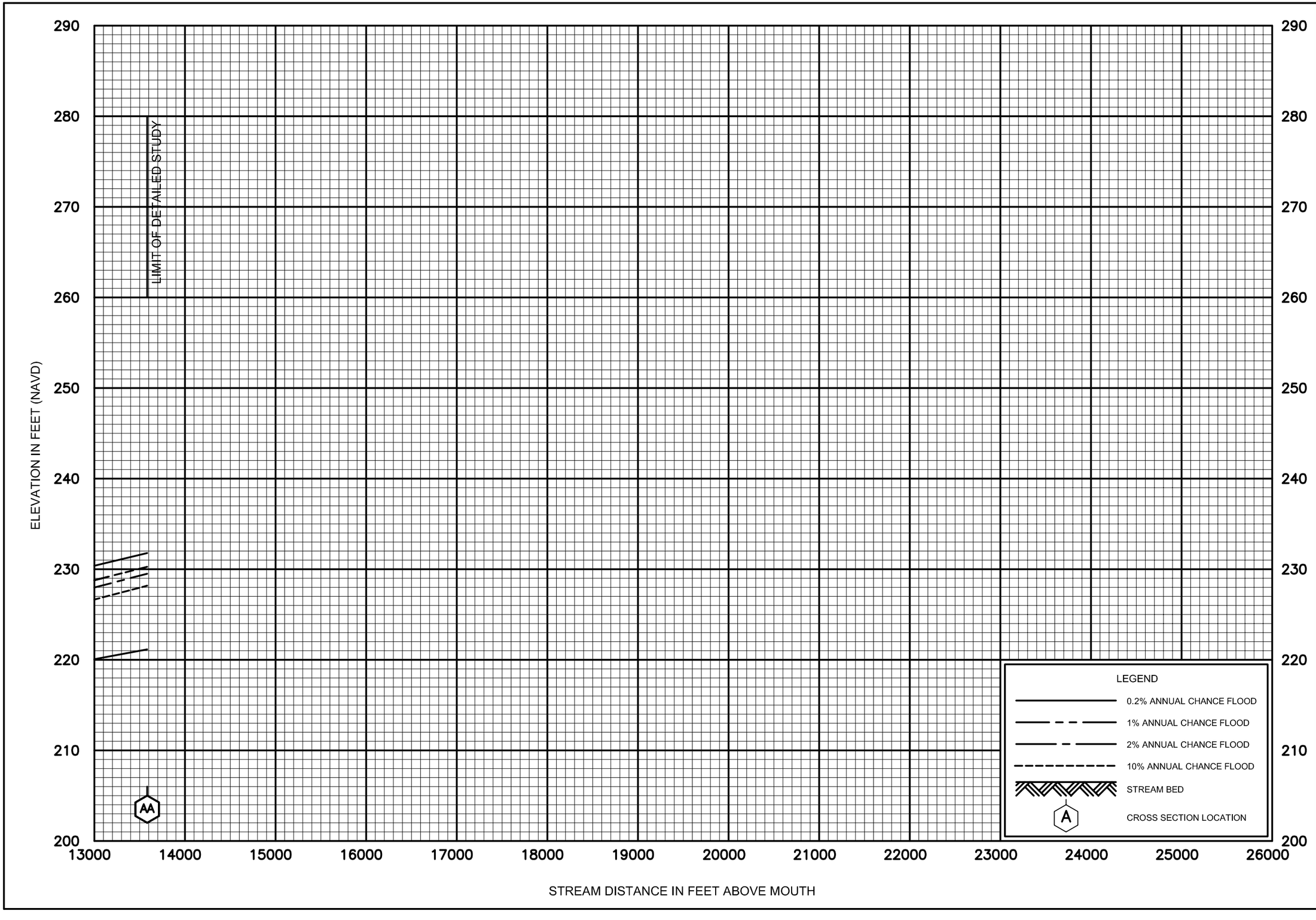
MEREDITH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

47P



FLOOD PROFILES

MEREDITH BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

48P

FLOODING CONTROLLED BY UPHAM BROOK

CONFLUENCE WITH UPHAM BROOK

HILLIARD AVENUE

OLD RICHMOND-ASHLAND CARLINE

LAKESIDE BOULEVARD

LAKESIDE DAM

CONFLUENCE OF THORPE BRANCH

CONFLUENCE OF ROCKY BRANCH

ELEVATION IN FEET (NAVD)

160
150
140
130
120
110
100

0 1 2 3 4 5 6 7 8 9 10 11

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE MOUTH

A B C D E F G H I J K L

LEGEND

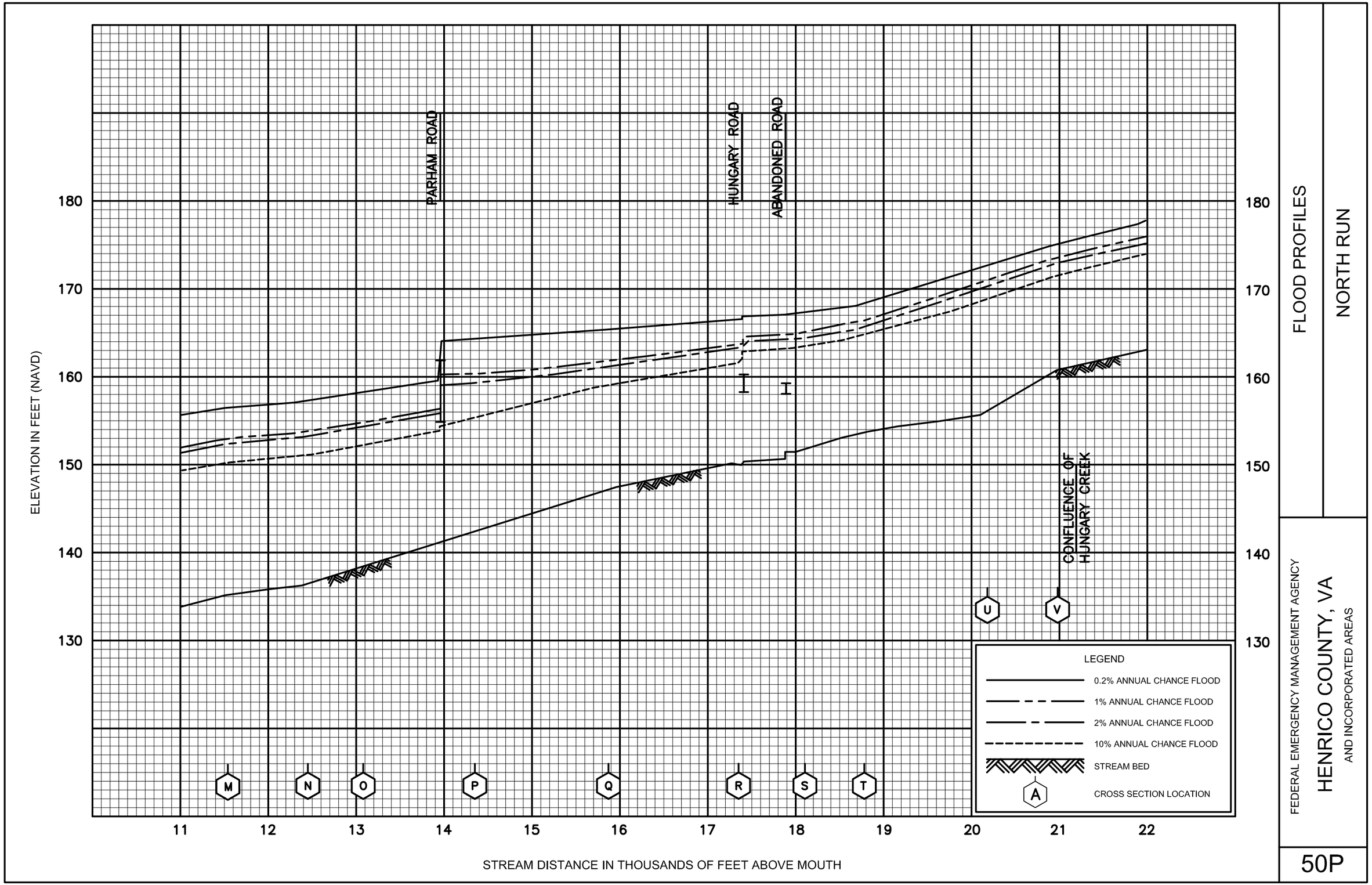
- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

FLOOD PROFILES

NORTH RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA
AND INCORPORATED AREAS



FLOOD PROFILES

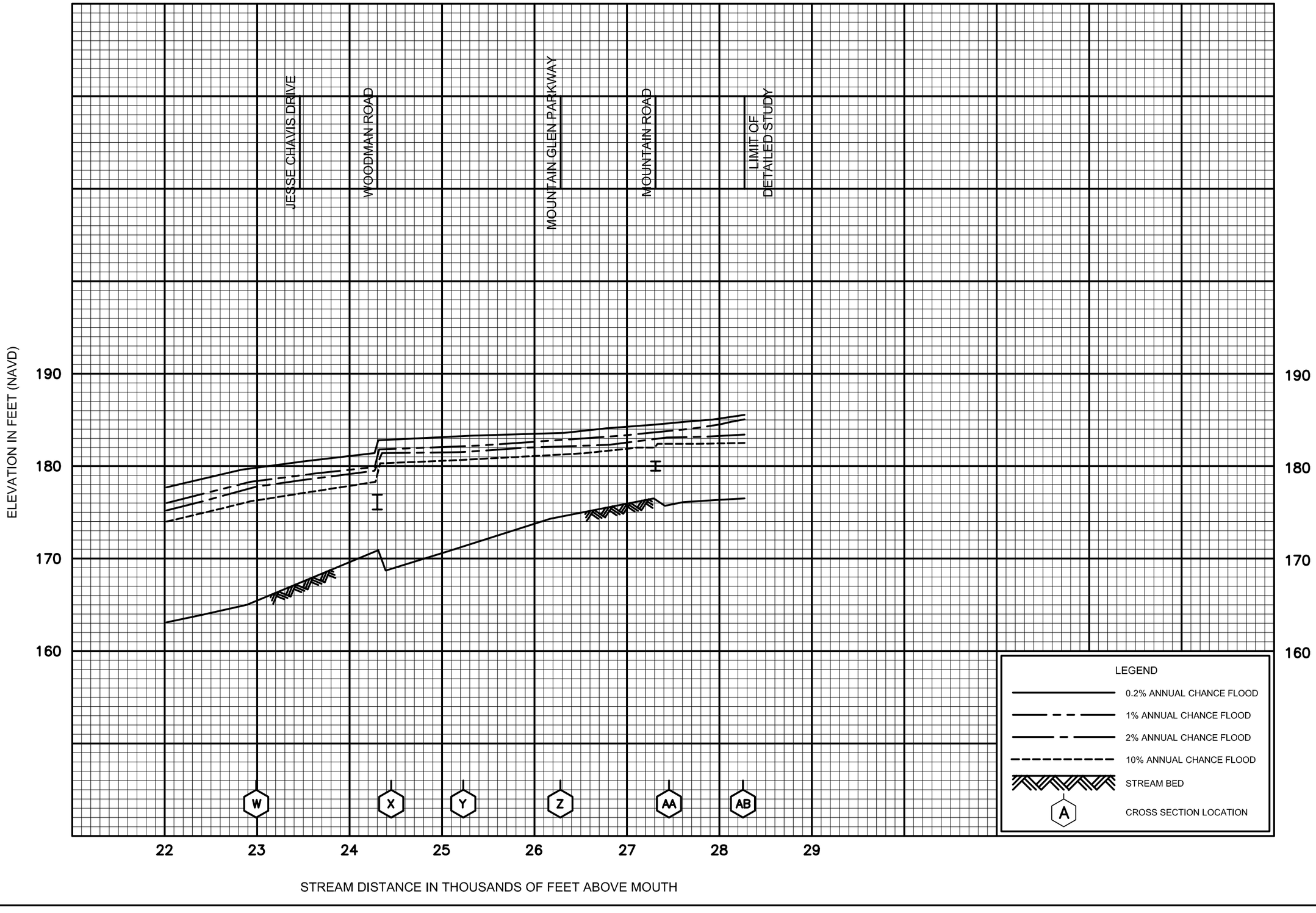
NORTH RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

50P



FLOOD PROFILES

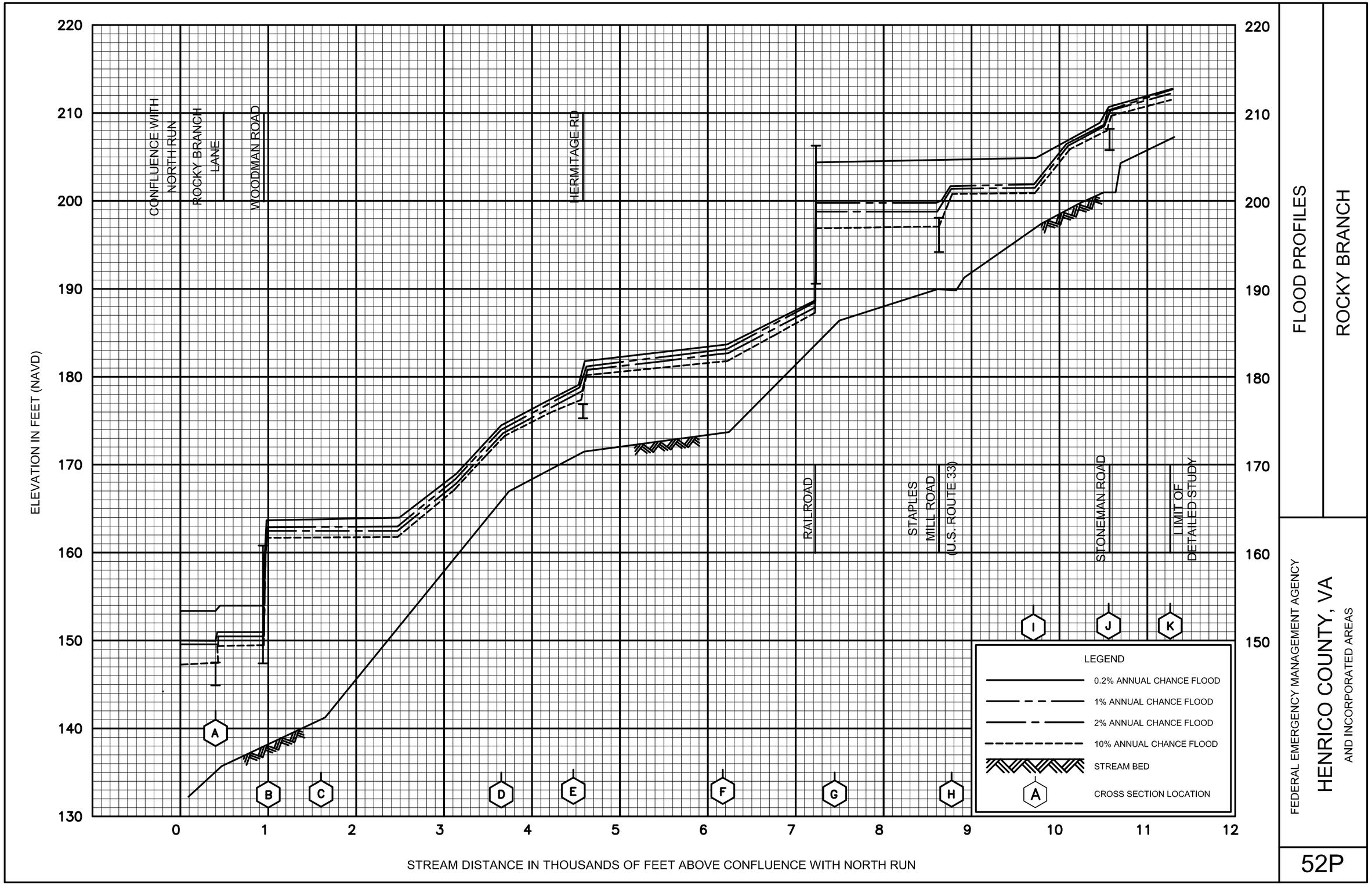
NORTH RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

51P



FLOOD PROFILES

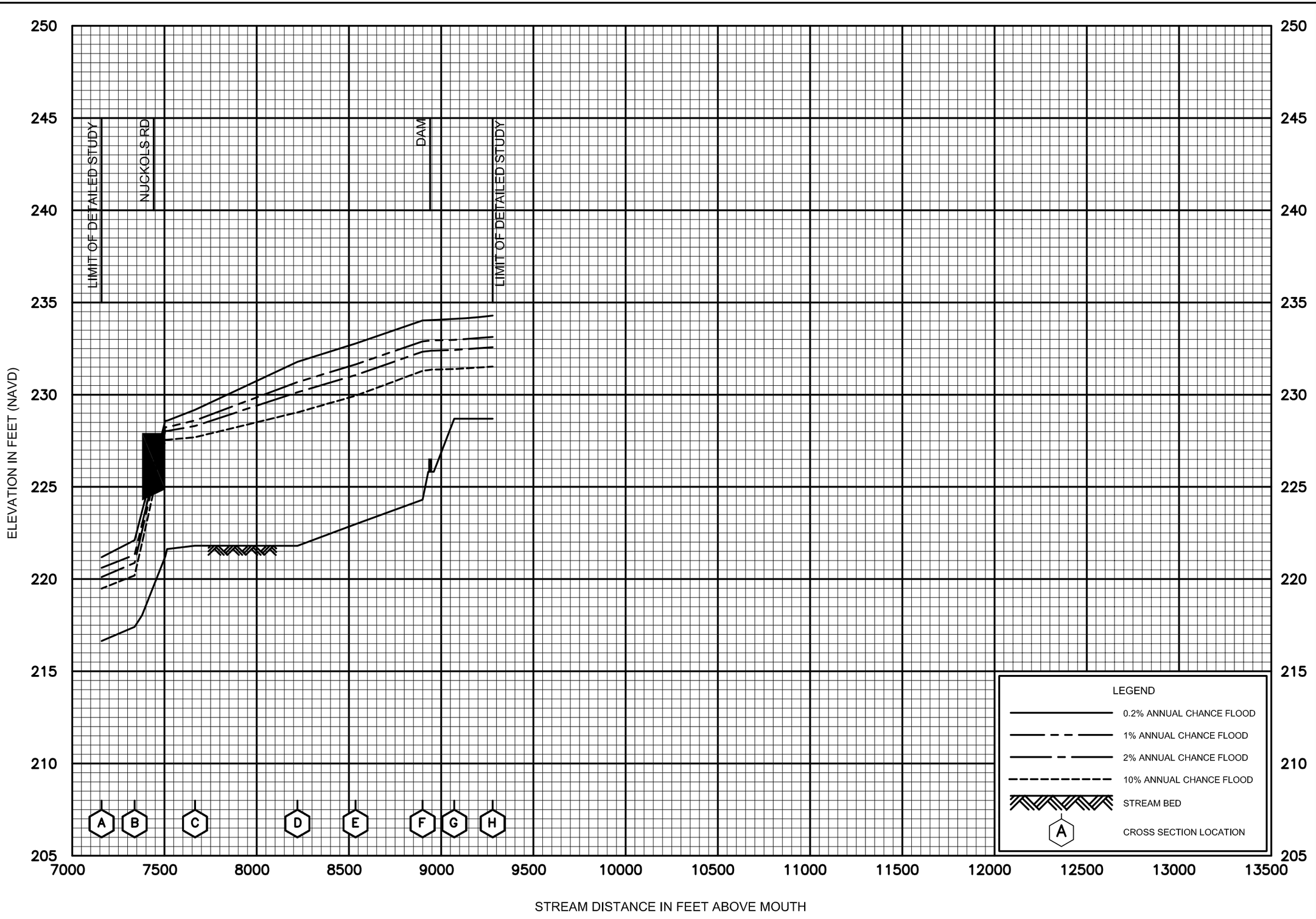
ROCKY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

52P



FLOOD PROFILES

ROOTY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

53P

DEEP RUN BACKWATER

CONFLUENCE WITH DEEP RUN

FALCON BRIDGE DRIVE

ELEVATION IN FEET (NAVD)

175
170
165
160
155
150
145
140

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH DEEP RUN

A B C

LEGEND

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

FLOOD PROFILES

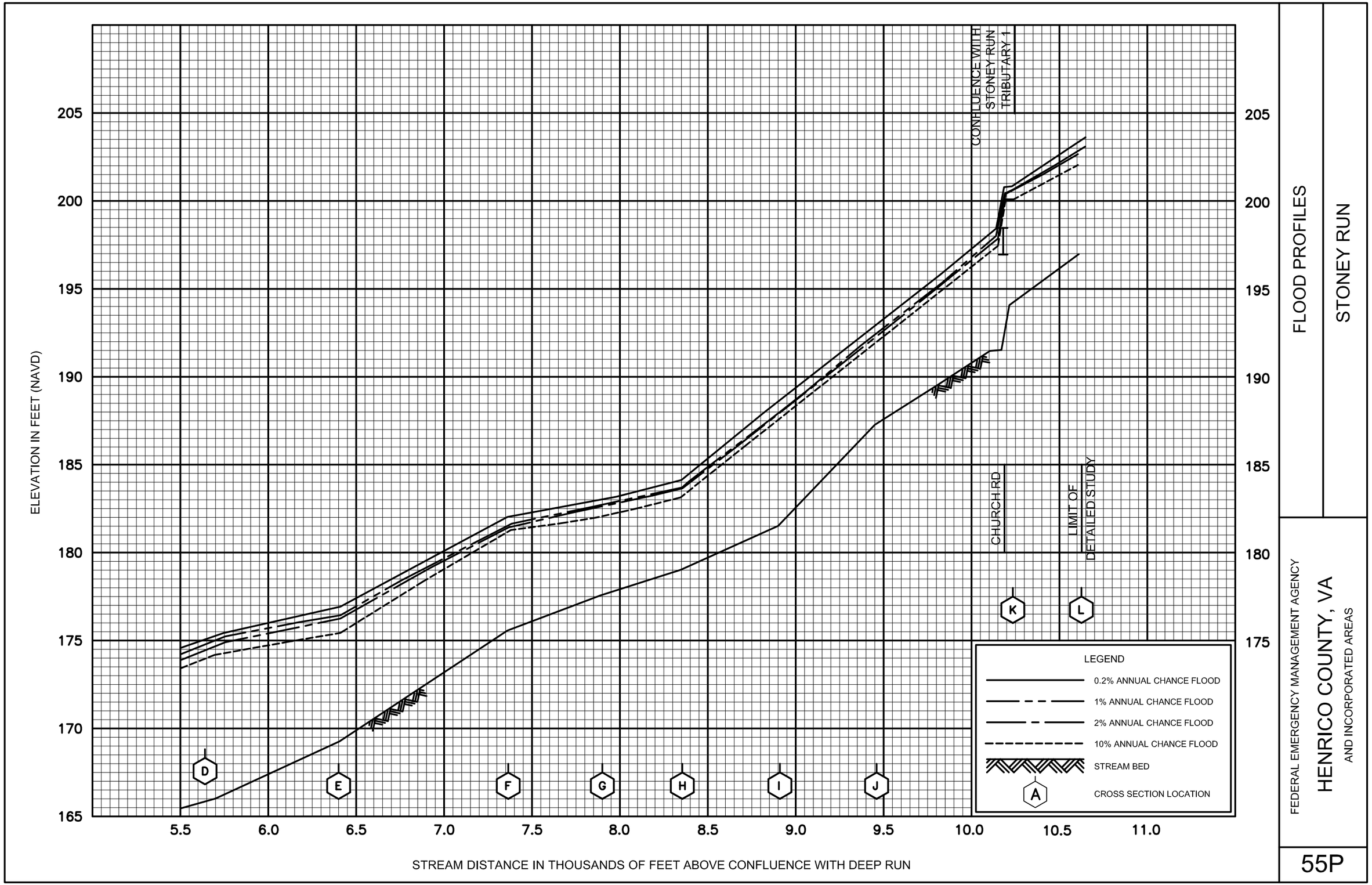
STONEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

54P



FLOOD PROFILES

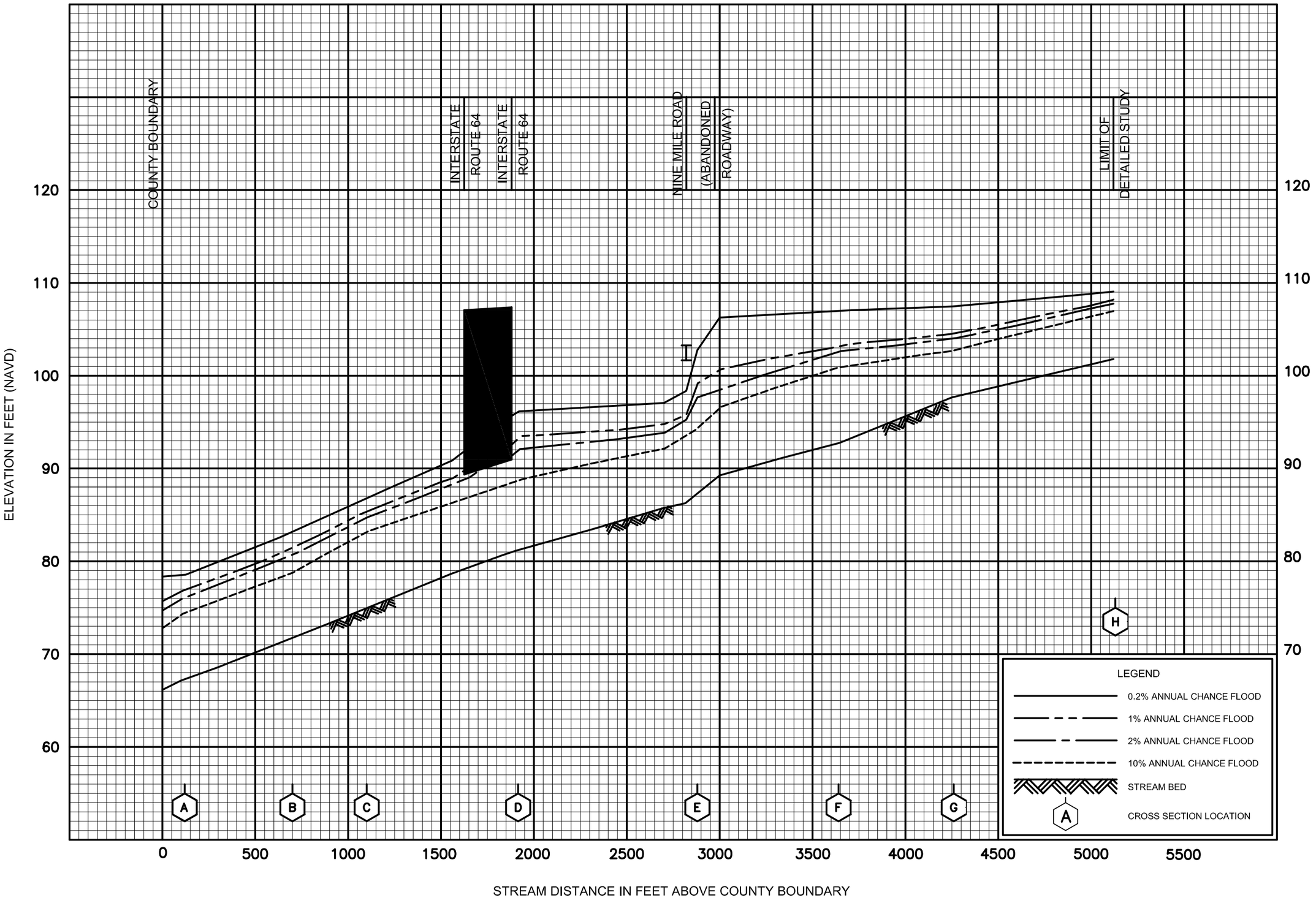
STONEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

55P



FLOOD PROFILES

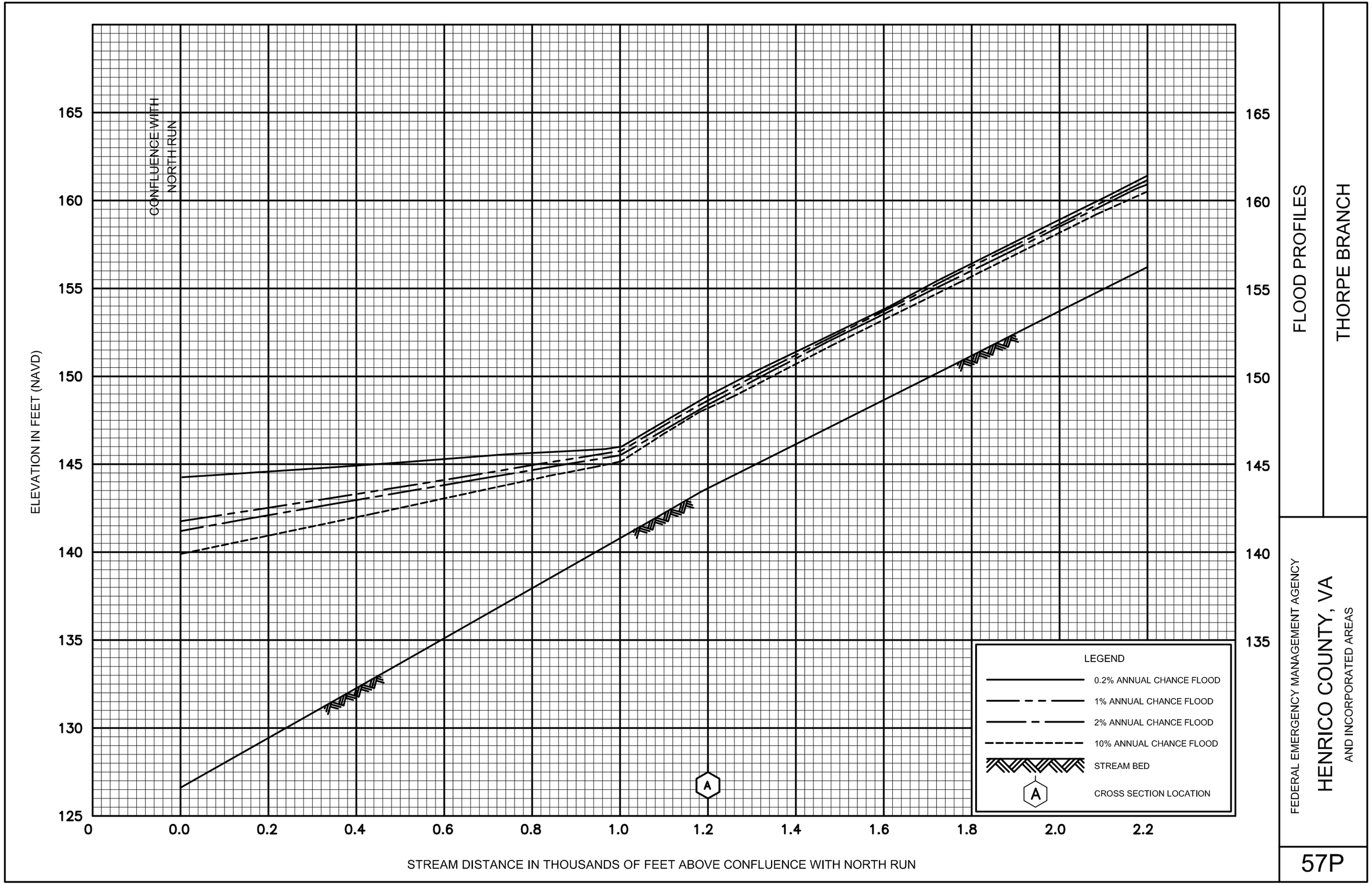
STONY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

56P



FLOOD PROFILES

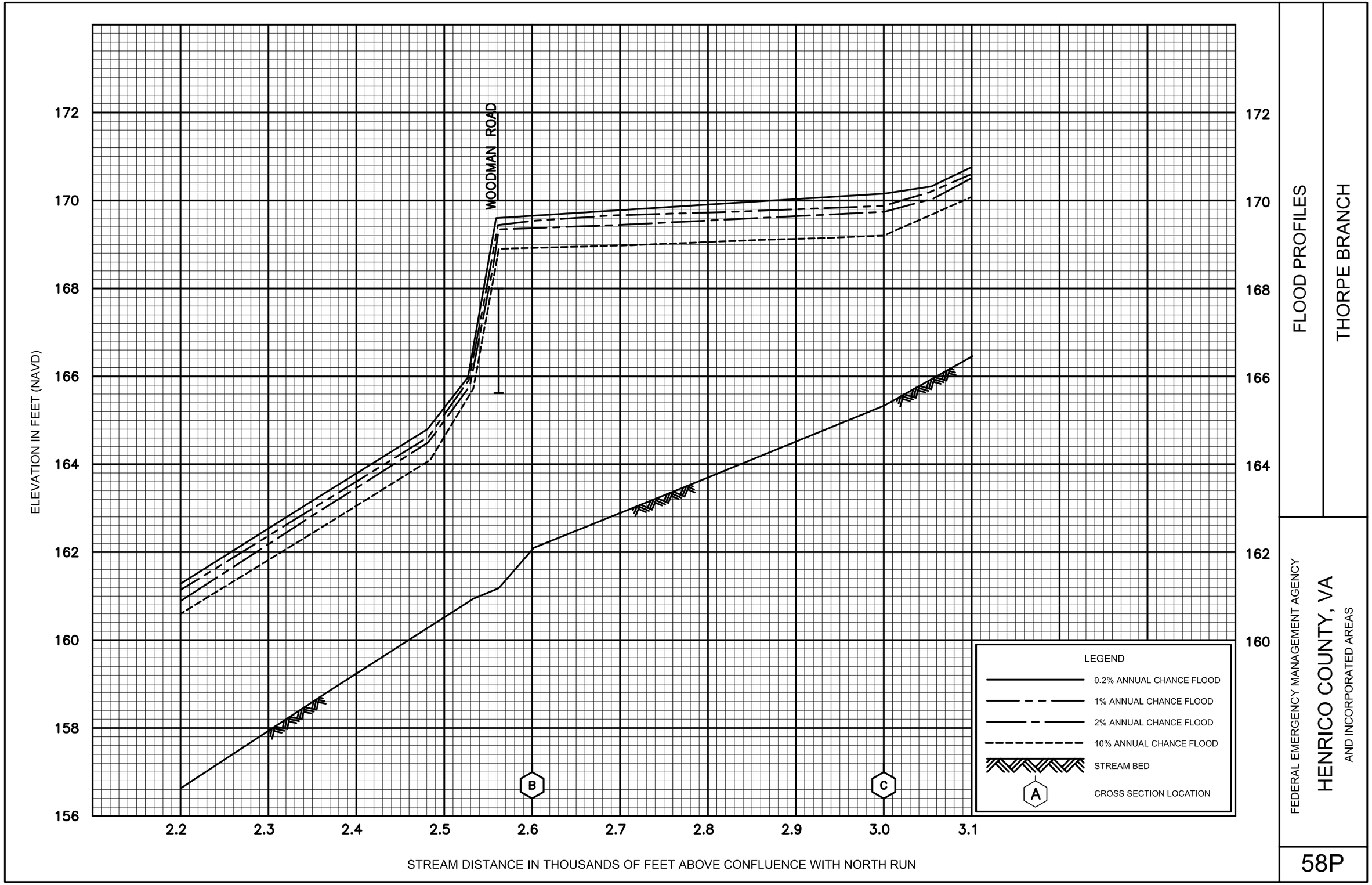
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

57P



FLOOD PROFILES

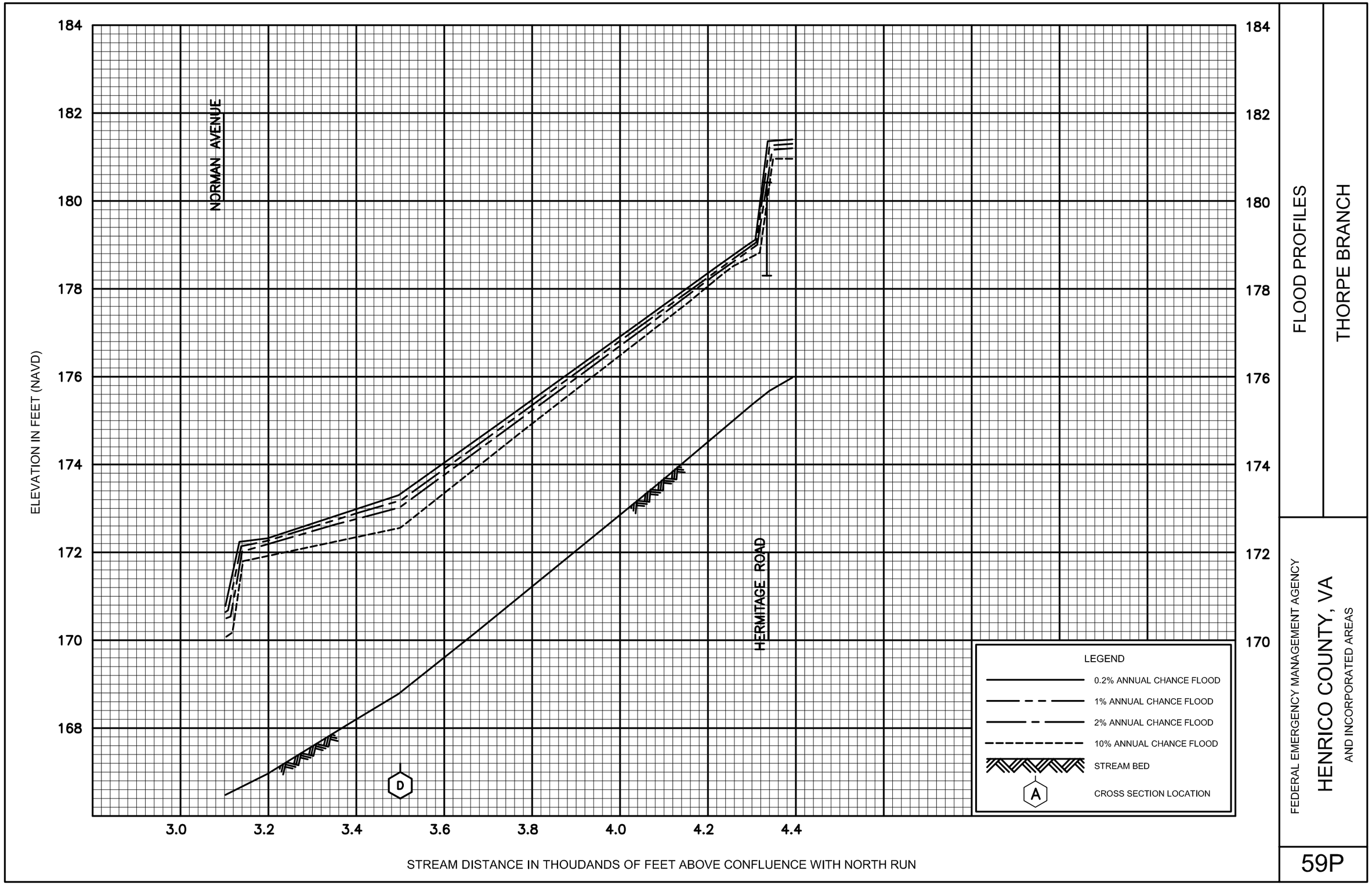
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

58P



FLOOD PROFILES

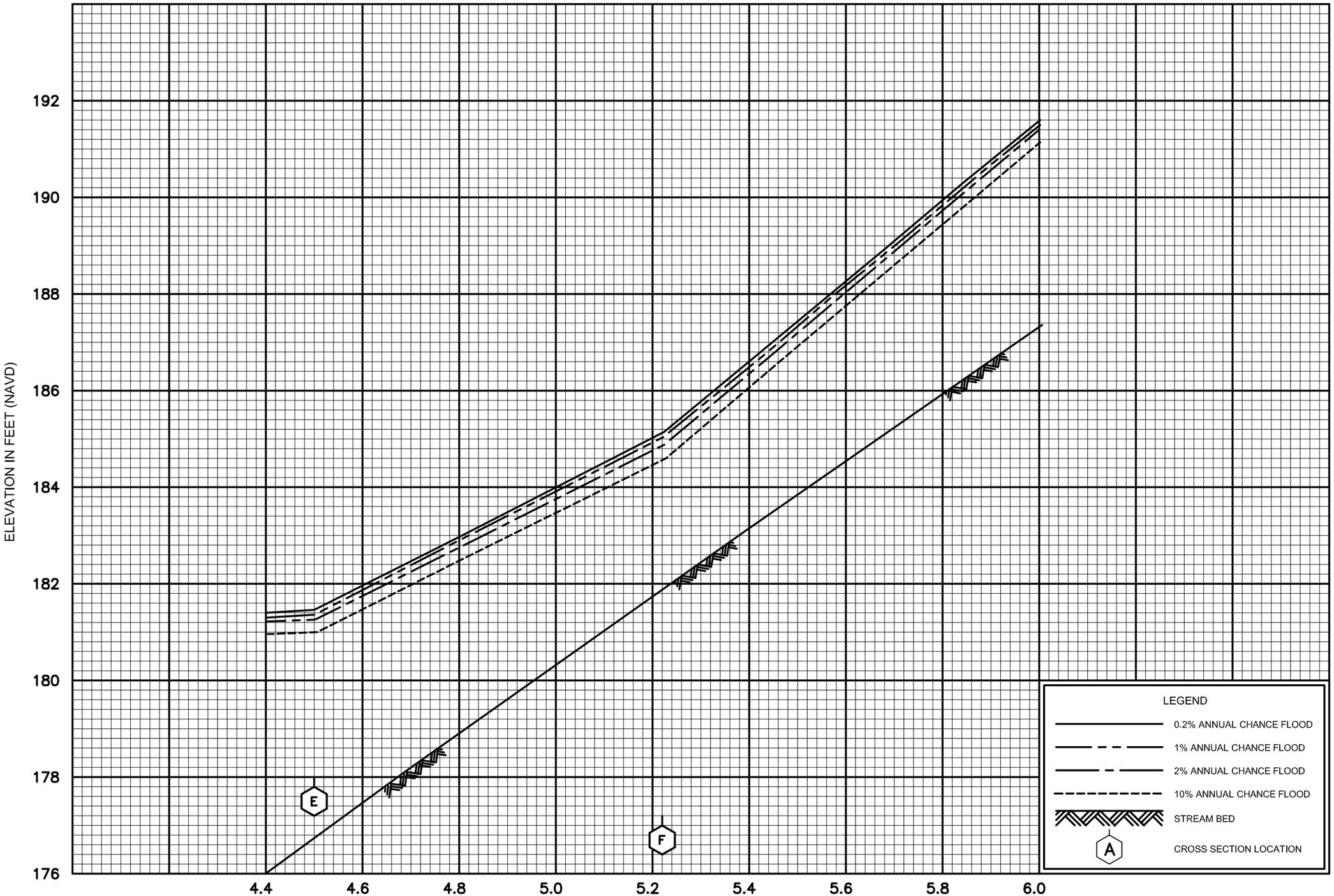
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

59P



FLOOD PROFILES

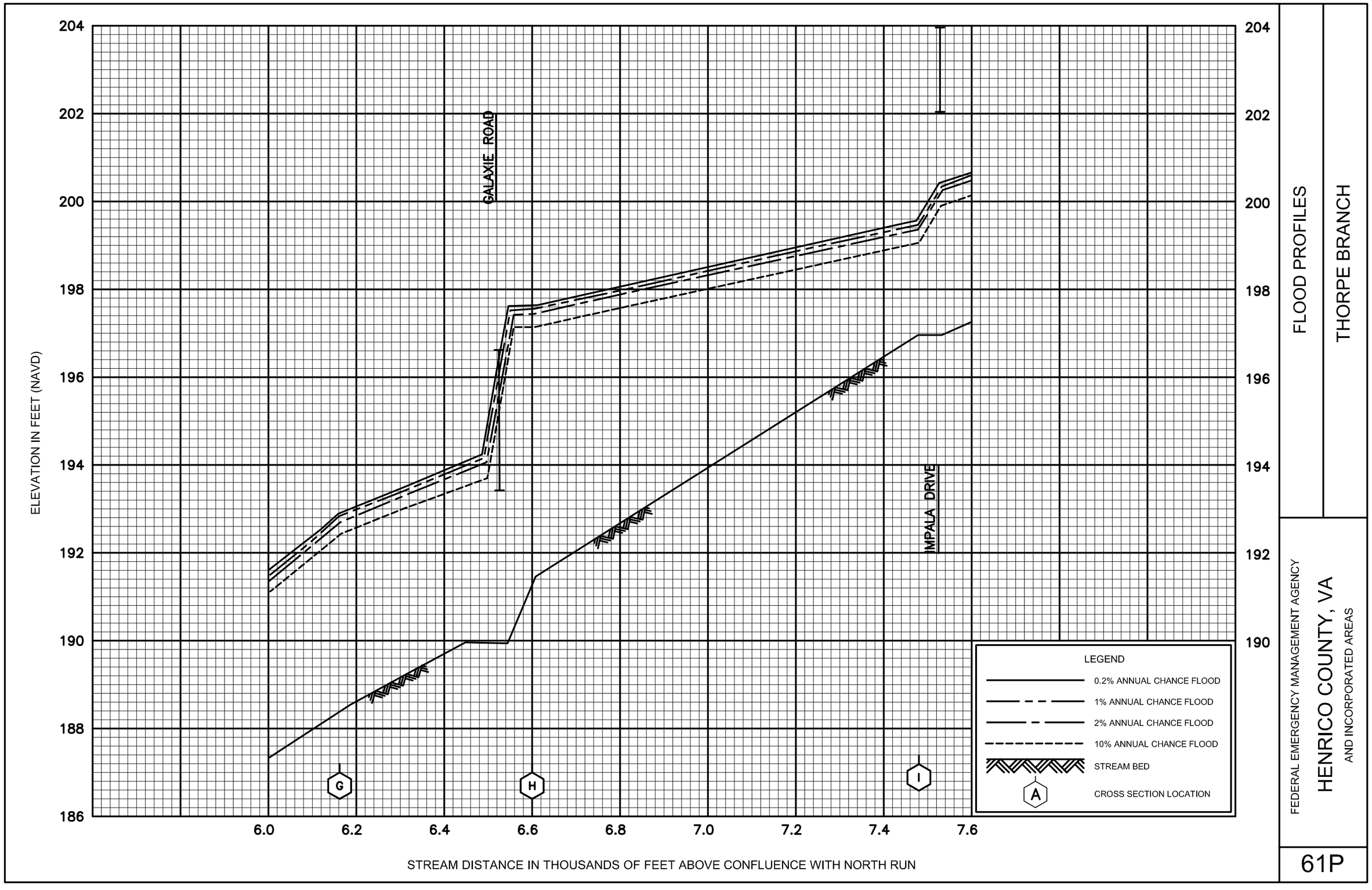
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

60P



FLOOD PROFILES

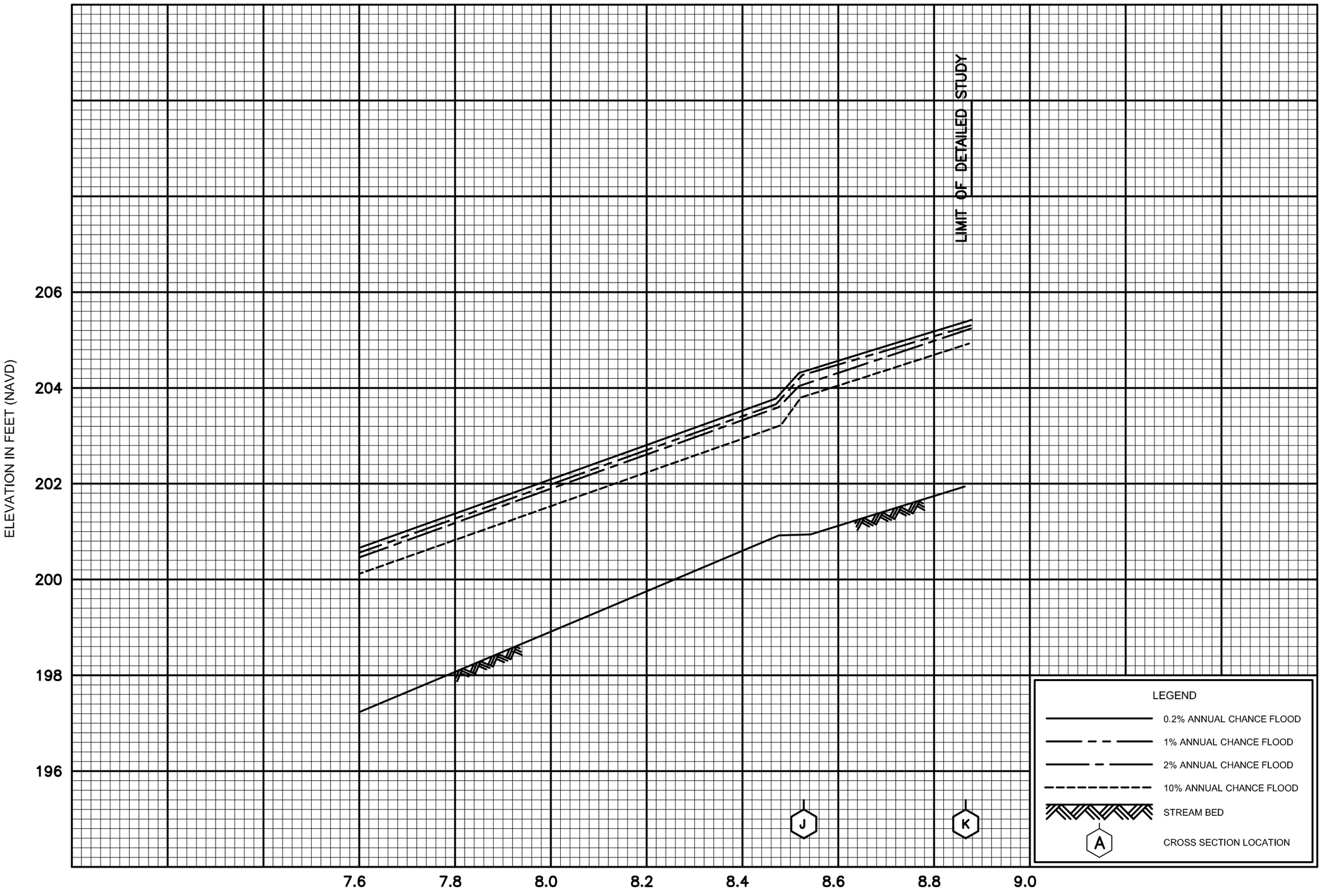
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

61P



FLOOD PROFILES

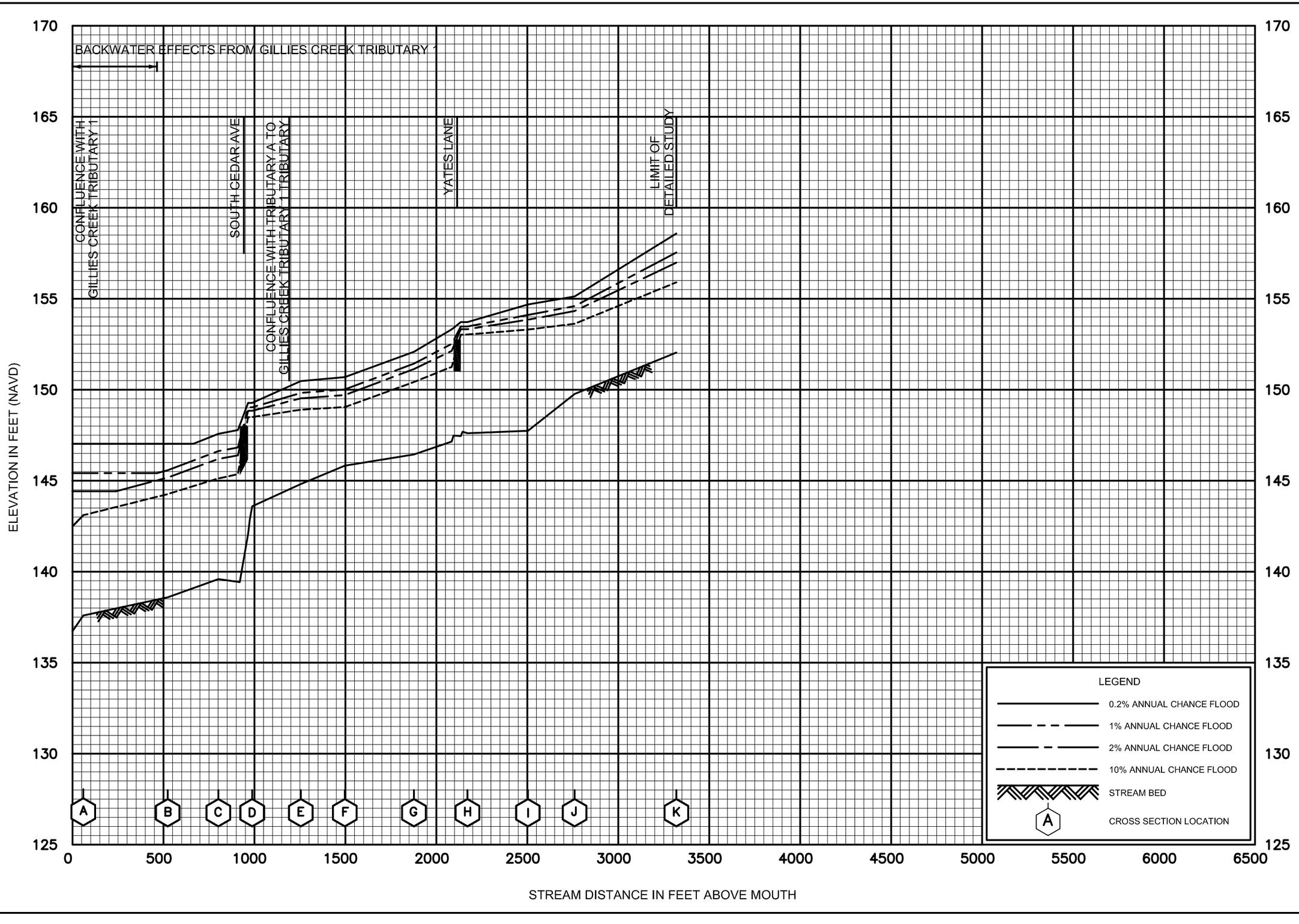
THORPE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

62P



FLOOD PROFILES

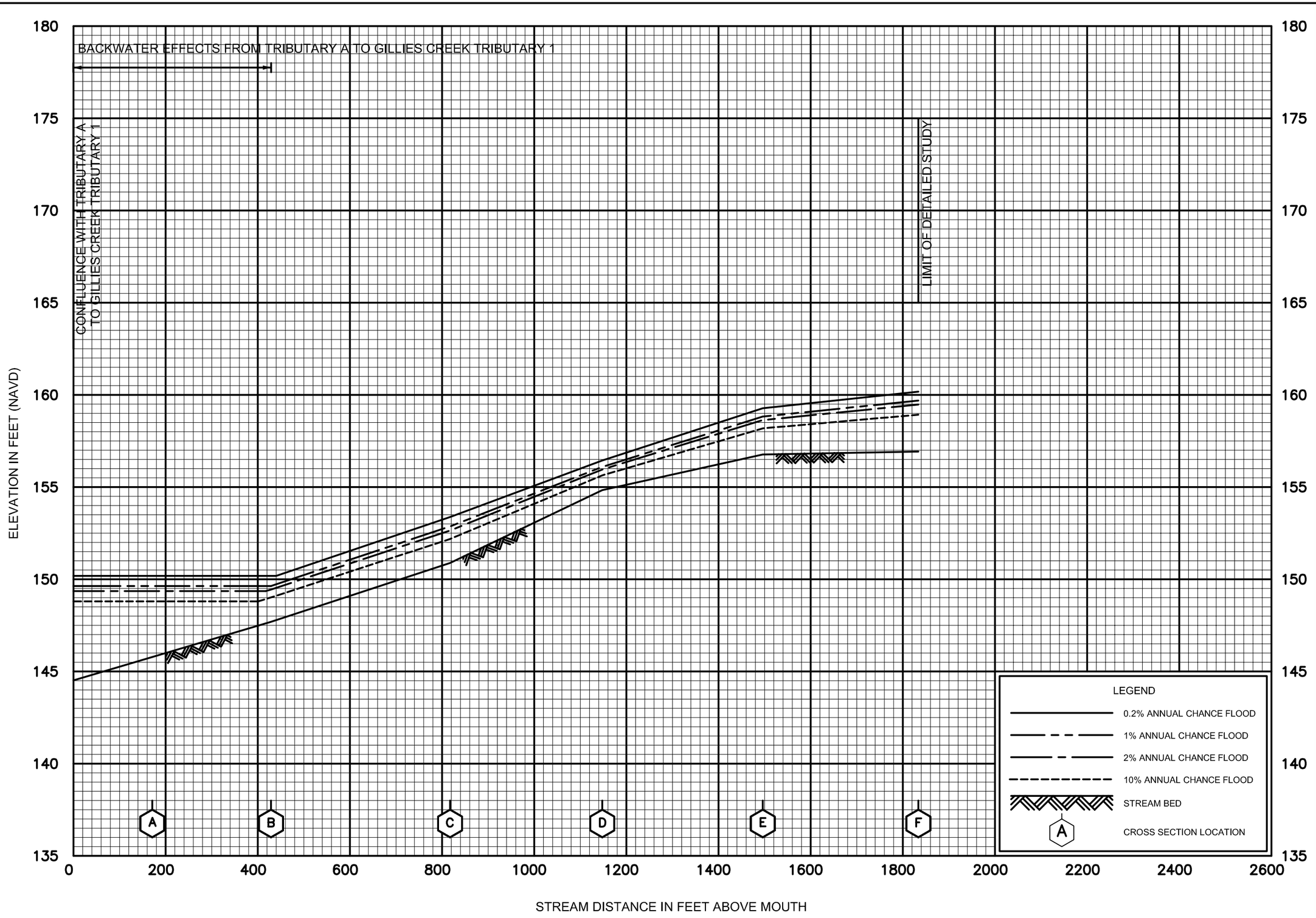
TRIBUTARY A TO GILLIES CREEK TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

63P



FLOOD PROFILES

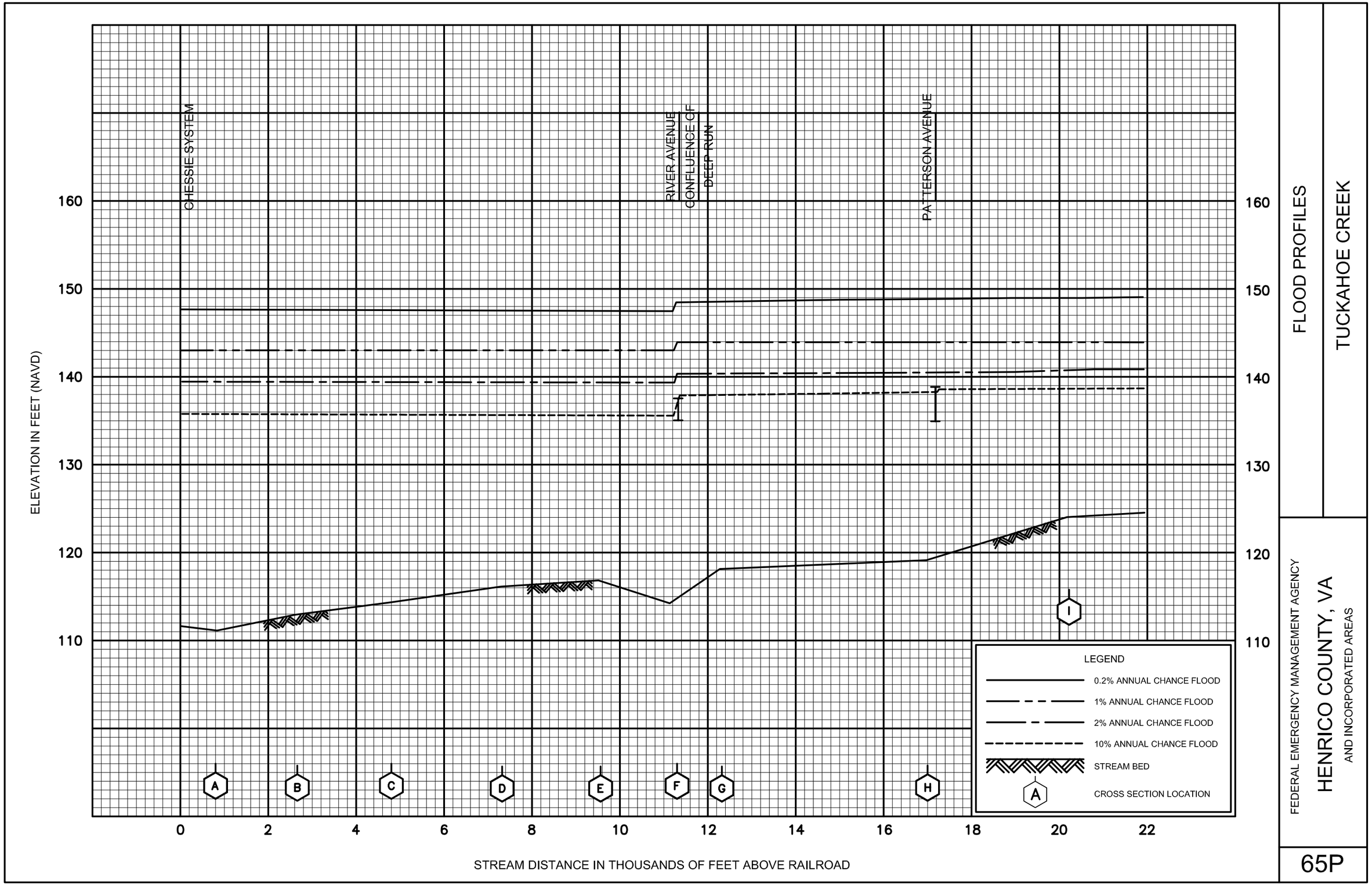
TRIBUTARY A TO GILLIES CREEK TRIBUTARY 1 TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

64P



FLOOD PROFILES

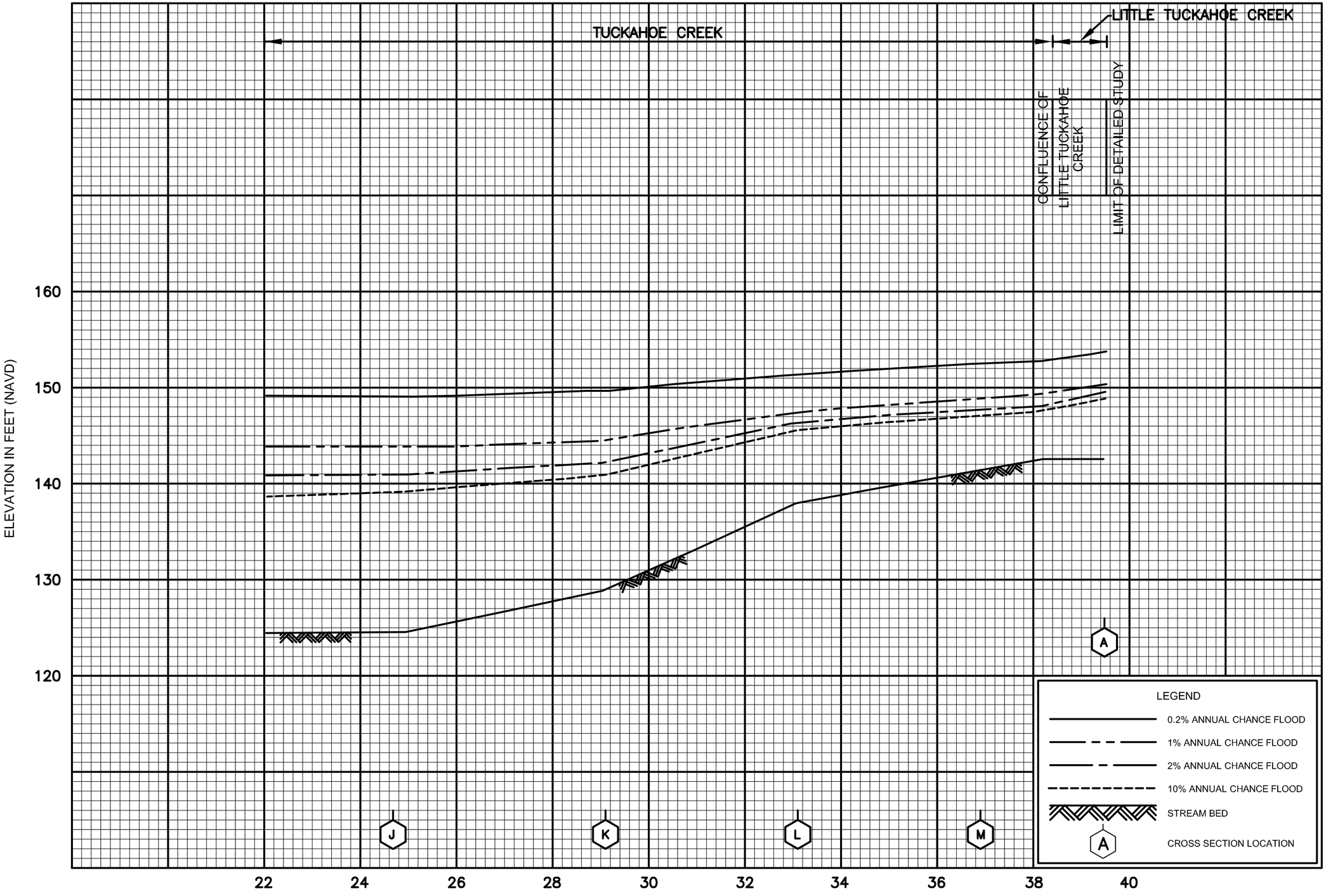
TUCKAHOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

65P



FLOOD PROFILES

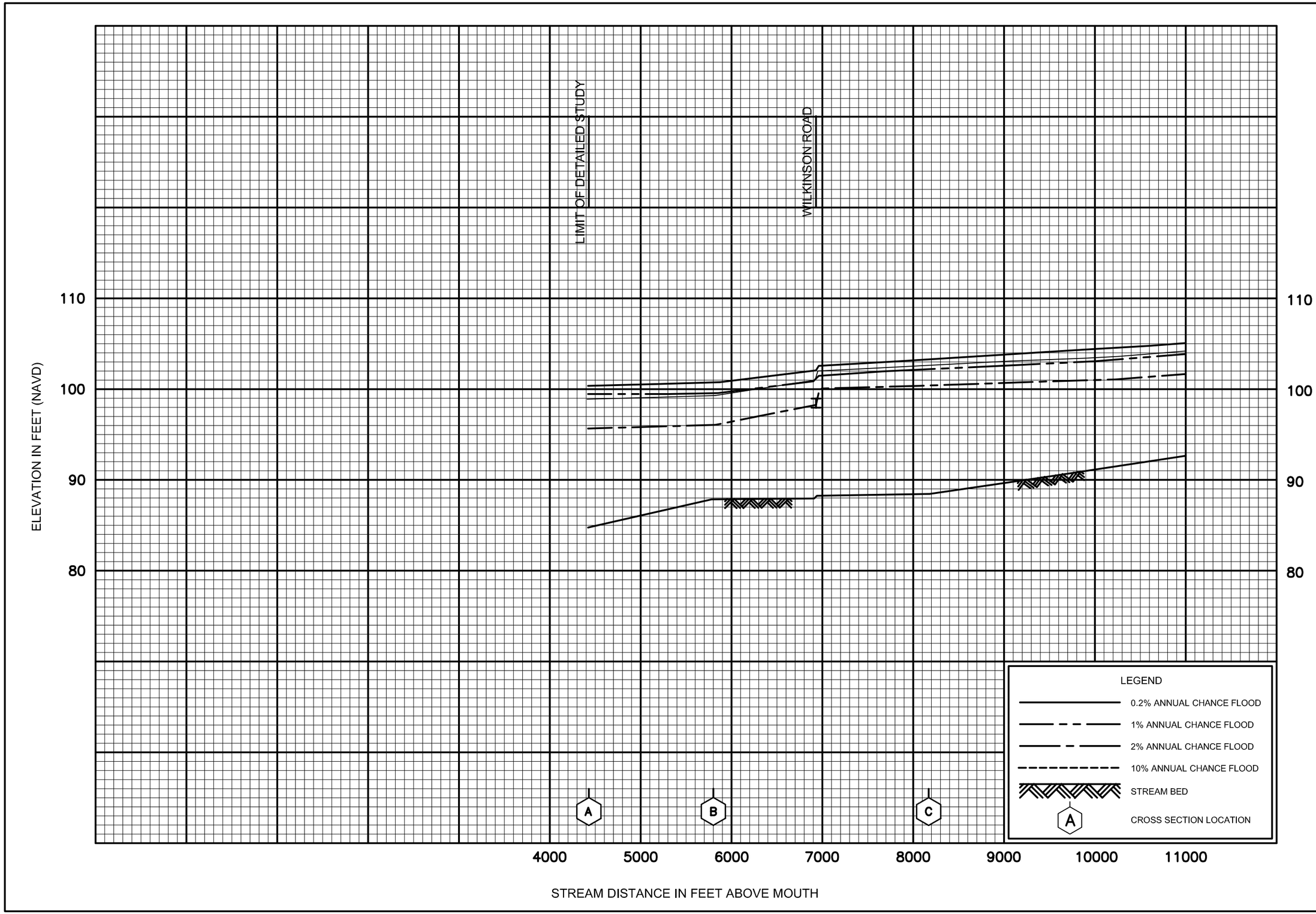
TUCKAHOE CREEK / LITTLE TUCKAHOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

66P



FLOOD PROFILES

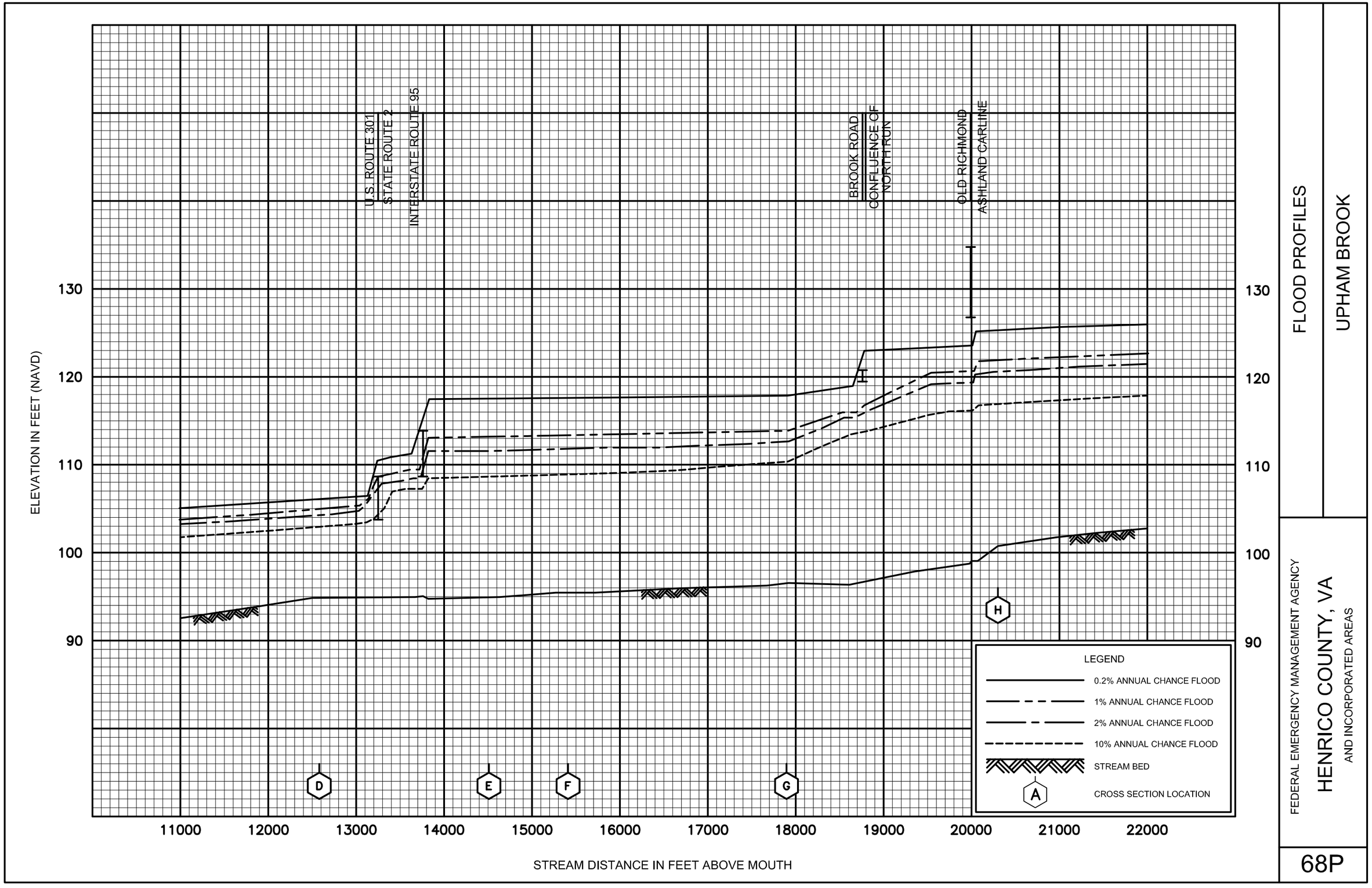
UPHAM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

67P



FLOOD PROFILES

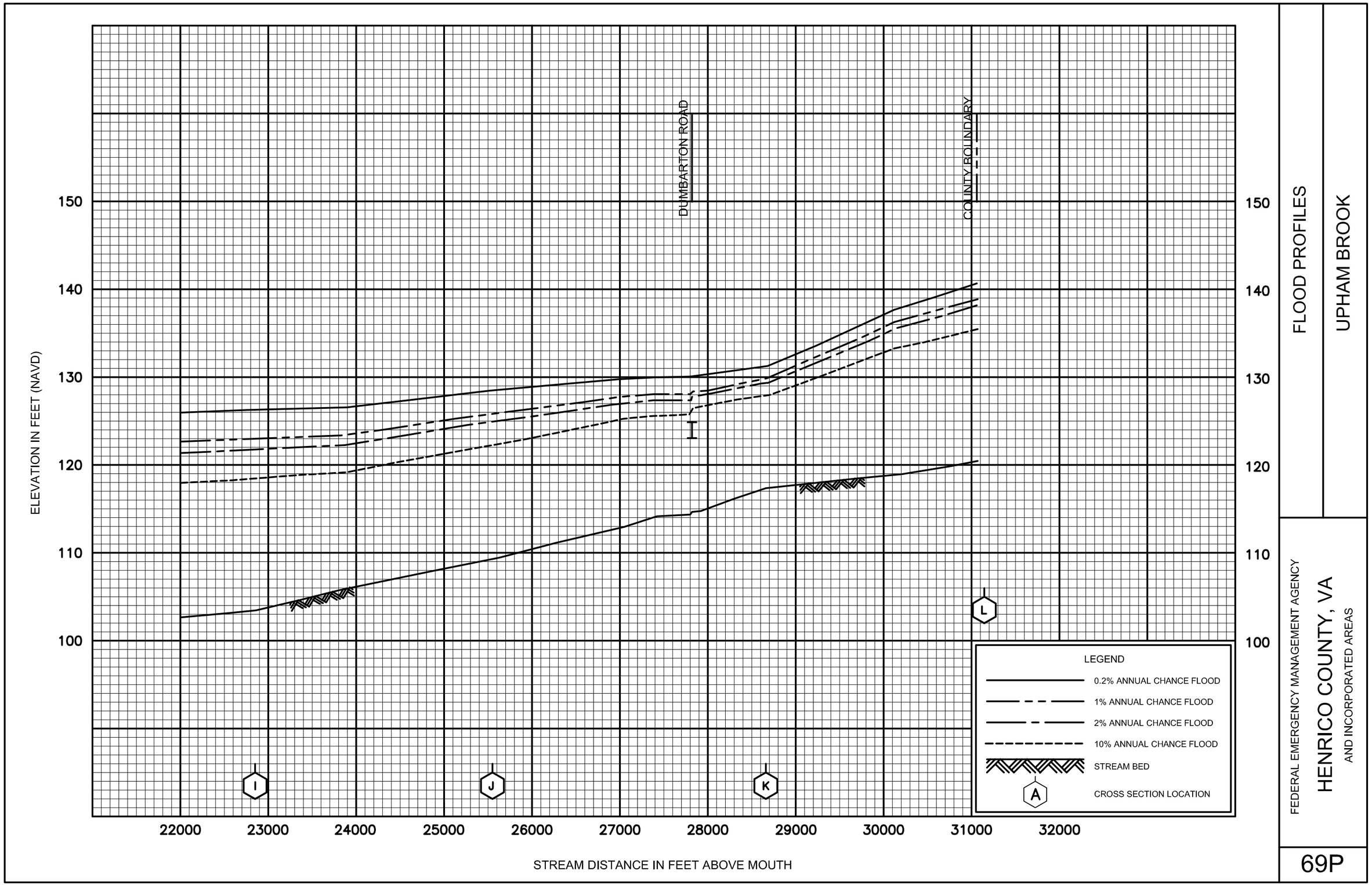
UPHAM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

68P



FLOOD PROFILES

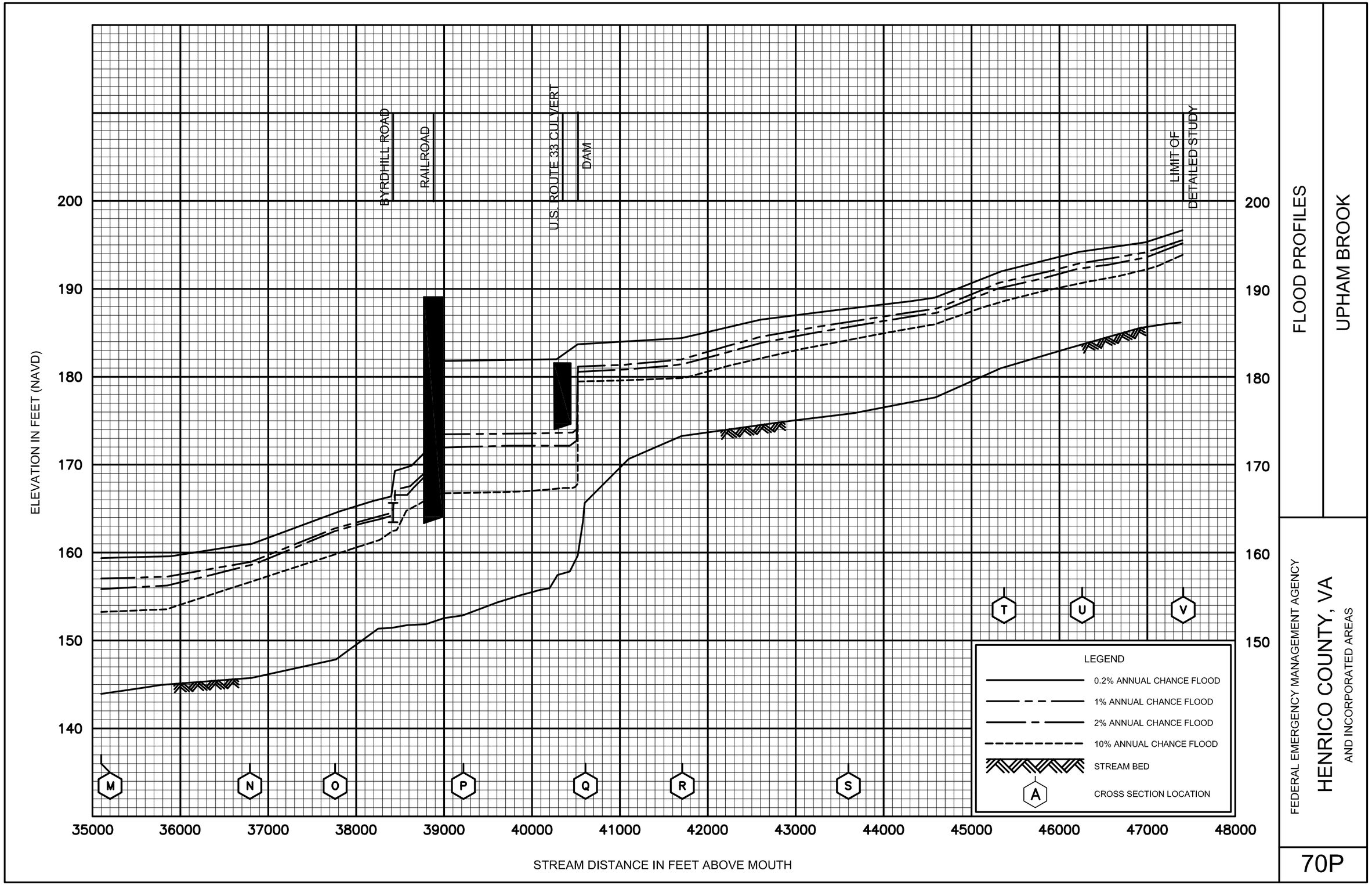
UPHAM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

69P



FLOOD PROFILES

UPHAM BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

HENRICO COUNTY, VA

AND INCORPORATED AREAS

70P