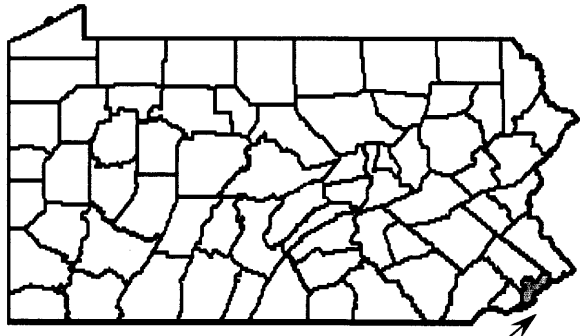
FLOOD INSURANCE STUDY

CITY OF PHILADELPHIA, PENNSYLVANIA

PHILADELPHIA COUNTY



CITY OF PHILADELPHIA

REVISED:
January 17, 2007

Federal Emergency Management Agency

COMMUNITY NUMBER – 420757V000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

Flood Insurance Rate Map panels for this community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood insurance risk zone designations have been changed as follows:

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

The Federal Emergency Management Agency (FEMA) may revise and republished part of all of this FIS report 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. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current Flood Insurance Study report components.

Initial Flood Insurance Study Effective Date:	December 1978 (FIS report); June 15, 1979 (Flood Insurance Rate Map)
Flood Insurance Study Revised:	May 29, 1981 (Flood Insurance Rate Map only) March 19, 1982 (Flood Insurance Rate Map only) February 19, 1992 August 2, 1996 January 17, 2007

TABLE OF CONTENTS

TABLE OF CONTENTS- (continued)

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY
CITY OF PHILADELPHIA, PENNSYLVANIA

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 City of Philadelphia, Pennsylvania.

This information will be used by the City of Philadelphia 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

This countywide FIS has been prepared in a countywide FIS format. Information on the authority and acknowledgements for the City of Philadelphia for this countywide FIS, as compiled from the previously original FIS and the subsequent FIS revisions (References 1-3), is shown below:

City of Philadelphia: (December 1978 FIS)	The hydrologic and hydraulic analyses for this study were prepared by the U.S. Army Corps of Engineers (USACE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-19-74, Project Order No. 18, and Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 60, with Amendment No. 3. The work was completed in December 1976. The Flood Insurance Rate Map (FIRM) was completed on June 15, 1979.
City of Philadelphia: (February 19, 1992 revised FIS)	The hydrologic and hydraulic analyses for Poquessing Creek were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-89-E-2994, Project Order No. 2. Task Letter No. 89-6. The work was completed in February 1990.

City of Philadelphia: (August 2, 1996 revised FIS)	The updated hydrologic and hydraulic analyses for the Schuylkill River, which was studied for its entire length within the city, were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-92-E-3842, Project Order No. 2. This work was completed in February 1994. The digital base mapping information was provided by the Pennsylvania Department of Transportation (PennDOT), Cartographic Information Division, 912 Transportation and Safety Building, Harrisburg, Pennsylvania, 17120. However, these were not PennDOT approved files; PennDOT retains the master files. These files were compiled by PennDOT at a scale of 1:24,000 from U.S. Geological Survey (USGS) 7.5-Minute quadrangle maps on a stable base. The base mapping files were modified in and around the floodplains to match detailed data for the Schuylkill River derived from aerial photography flown in March 1991 that was provided by the USACE, Philadelphia District. Additional base mapping information was added in and around the other floodplain areas within the city to match the previously compiled FIS. The digital FIRM was produced in Universal Transverse Mercator coordinates referenced to the North American Datum of 1927 and the Clarke 1866 spheroid.
City of Philadelphia: (This revision)	The hydrologic and hydraulic analyses for Byberry Creek and Tributary to Poquessing Creek were prepared by the USACE for FEMA under Inter-Agency Agreement No. EMW-2001-IA-0223. The work was completed September 2002. In addition, floodplain boundaries for all other flooding sources in the city were re-delineated using more detailed topographic data than that used in the August 2, 1996, FIS. The digital base mapping information for this revision was provided by the City of Philadelphia Water Department Information Systems & Technology Division, 1101 Market St., 4th Floor, Philadelphia PA 19107. The digital FIRM was produced in Pennsylvania State Plane (south) coordinates referenced to the North American Datum of 1983 and National Geodetic Vertical Datum of 1929 (NGVD29).

1.3 Coordination

For the original December 1978 FIS report, and June 15, 1979, FIRM (herein referred to as the 1979 FIS), the initial Consultation Coordination Officer (CCO) meeting was held on November 26, 1974 with local officials, the USACE (the study contractor), and FEMA, to explain the nature and purpose of the FIS, and to identify the streams to be studied by detailed methods. The final CCO meeting was held on February 4, 1977 with representatives from the community, the study contractors, and FEMA to review the results of the studies.

For the August 2, 1996 FIS revision, an initial CCO meeting was held on May 30, 1991, and was attended by representatives of the city, the USACE, and FEMA. A final meeting was held on March 6, 1995, and was attended by representatives of the city, the USACE, and FEMA.

The results of the study were reviewed at the final Consultation Coordination Officer (CCO) meeting held on November 29, 2005, and attended by representatives of the City of Philadelphia. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Philadelphia County, Pennsylvania including the incorporated area of the City of Philadelphia. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through the City of Philadelphia.

For the 1979 FIS, the flooding sources listed in Table 1, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM.

Table 1- Flooding Sources Studied By Detailed Methods

Byberry Creek	Schuylkill River
Cobbs Creek	Tacony Frankford Creek
Darby Creek	Tributary to Poquessing Creek
Delaware River	Walton Run
Indian Creek	Wissahickon Creek
Pennypack Creek	Wooden Bridge Run
Poquessing Creek	

In the February 19, 1992 FIS revision, Poquessing Creek was restudied by detailed methods for its entire length within the city. The restudy of Poquessing Creek was performed to reflect six areas in the study area containing fill or development not reflected in the original 1979 FIS.

In the August 26 1996 FIS revision, the Schuylkill River was restudied by detailed methods for its entire length within the city.

For this revision, Byberry Creek and a Tributary to Poquessing Creek were studied by detailed methods. Byberry Creek was studied for approximately 1.2 miles upstream of Woodhaven Road and the Tributary to Poquessing Creek was studied for its entire length (approximately 1.5 miles) within the city. In addition, the floodplain boundaries for all other flooding sources within the city were re-delineated using more detailed topographic data.

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

2.2 Community Description

Founded in 1682, the City of Philadelphia is situated at the confluence of the Delaware and Schuylkill Rivers. Once the second largest city in the English speaking world (during colonial times), it has now lost some of its preeminence in terms of population. In the bicentennial year of 1976, it ranked as the fourth largest city in the United States with a population of 1,950,098, falling below the two million mark for the first time since the 1940s. Despite this reduction, the city is still densely populated with little acreage available for future development except in the southwest (2,090 acres), the northeast (1,883 acres), and Upper Roxborough (132 acres). Serving originally as the capital of the fledgling nation, and an innovative leader in the areas of political and social experimentation, city planning, culture, commerce, seaport development, shipbuilding, transportation, industry, engineering, science and medicine, Philadelphia still plays an important role in most of these areas. However, the city retains its predominately residential character along with the provincial and ethnic variety derived from its many component neighborhoods.

The climate of the Philadelphia area is a moderate one due to the effect of the Appalachian Mountains to the west and the Atlantic Ocean to the east. Temperatures rarely rise above 100 degrees Fahrenheit (°F) or fall below O°F. The highest temperature ever recorded was 106°F and the lowest, -11°F; but, average temperatures range between 76.6°F and 33.l°F. Average annual precipitation is 41.18 inches.

The City of Philadelphia is subject to flooding at various times by the following streams and rivers: Byberry Creek, Cobbs Creek, Darby Creek, the Delaware River, Indian Creek, Pennypack Creek, Poquessing Creek, the Schuylkill River, Tacony Frankford Creek, Tributary to Poquessing Creek, Walton Run, Wissahickon Creek, and Wooden Bridge Run.

Byberry Creek, a tributary to Poquessing Creek, also flows in a southeasterly direction from the grounds of the Philadelphia State Hospital through mostly residential areas, some parkland, and finally through the grounds of the Torresdale Frankford Country Club before emptying into Poquessing Creek. The terrain of the floodplain, relatively flat in the vicinity of the hospital, is gently sloping for the rest of its course and has only a slight gradient. The ground cover of the floodplain varies from grassy flatlands to wooded areas.

Cobbs Creek, a tributary to Darby Creek, also forms a portion of the western boundary between the City of Philadelphia and Delaware County. The stream flows for most of its length in a southerly direction through Cobbs Creek Park and then for a short reach through residential areas near its confluence with Darby Creek. The terrain of the upper and middle reaches of the creek is moderately sloping parkland covered with trees and grass, while that of the lower reach is relatively flat and is characterized by brush.

Darby Creek, a tributary to the Delaware River, forms a portion of the western corporate boundary between the City of Philadelphia and Delaware County. This portion of the creek flows in a southwesterly direction through a basically industrial area, which nevertheless includes Mount Lawn Cemetery and the Tinicum Wildlife Preserve. The terrain is characterized by marshland and tidal flats.

The Delaware River flows in a southwesterly direction and forms the boundary between the Commonwealth of Pennsylvania and the State of New Jersey. The floodplains along the Philadelphia side of the Delaware River are largely flat with sparse vegetation consisting of grass, trees, weeds, and marshgrass, and a multiplicity of activities. Port and industrial facilities dominate the area; however, other important facilities and installations are also

located along the river. These include a water treatment plant, sewage disposal facilities, the House of Correction, the Frankford Arsenal, a marina, Fort Mifflin, Tinicum Wildlife Preserve, and Philadelphia International Airport.

Indian Creek, a tributary to Cobbs Creek, flows in a southerly direction with most of its course contained within Morris and Cobbs Creek Parks. The overbanks are characterized by moderate to steep slopes covered with trees and brush.

Pennypack Creek, a tributary of the Delaware River, flows in a southeasterly direction through Pennypack Park for most of its length, passing through the grounds of the House of Correction in the lowest reach of the creek. The floodplain is generally confined within a heavily wooded valley having moderate to steep slopes. The slopes gradually diminish until the valley opens out onto the tidal flats and marshland which precede Pennypack Creek's confluence with the Delaware River.

Poquessing Creek, a tributary to the Delaware River, flows in a southeasterly direction through parklands and some residential areas while forming the boundary between the City of Philadelphia and Bucks County. Within the limits of Philadelphia County, the floodplains of Poquessing Creek are characterized by a gently sloping terrain. Overbanks are wooded and overgrown with brush for much of the stream's length, except for an occasional stretch of meadow and for the tidal flats which mark its confluence with the Delaware River.

The Schuylkill River, a tributary to the Delaware River, flows in a southeasterly direction forming a portion of the upper boundary between the City of Philadelphia and Montgomery County, Pennsylvania. The upper reach flows over Flat Rock Dam past the industrial waterfront of Manayunk and the confluence of Wissahickon Creek. From this point, both sides of the Schuylkill River are lined with parkland for approximately four miles terminating with the Philadelphia Art Museum on the east bank and the Philadelphia Zoo on the west bank. For the next two miles the river passes through an area of mixed character, with center city residential and commercial use predominating on the east bank, and university and civic facilities occupying most of the west bank. Industrial and refinery operations line most of the final five miles of rivercourse with a sewage treatment plant occupying the western shore of its confluence with the Delaware River.

The terrain of the floodplains of the Schuylkill River is characterized by very steep slopes in the upper reaches, but these slopes gradually decrease as the river passes through Fairmount Park and become quite flat in the industrial and refining area and at the confluence of the Schuylkill and Delaware Rivers. Flooding along the Schuylkill River occurs during all seasons of the year with the main flood season being spring. Spring floods are generally the result of a combination of heavy rains and snow melt. Summer and fall floods are generally the result of widespread heavy rainfall.

Tacony Frankford Creek, a tributary of the Delaware River, flows in a southeasterly direction through Tacony Creek Park for about half of its course, passing the Friends and Parkview Hospitals, a golf course, and then after a short reach of residential area, enters a heavily industrialized area where much of the stream is channelized between floodwalls. The floodplains of those portions within the city limits are characterized by gentle to moderate slopes which are largely wooded, becoming broad and flat with little vegetation in the lower reaches.

Walton Run, a tributary to Byberry Creek, flows in an easterly direction through an area containing the North Philadelphia Airport and industrial parkland. The floodplains are, at

first, open and virtually flat in the vicinity of the airport and industrial parks, but then wooded and gently sloping for the remainder of their course.

Wissahickon Creek, a tributary to the Schuylkill River, flows in a southeasterly direction meandering first through the relatively flat land of the Morris Arboretum and past Chestnut Hill College before entering the confines of the steeply sloping Wissahickon Valley. The creek flows for almost its entire length through this valley which is part of the Fairmount Park System. At the mouth of the Wissahickon Creek, there is a water treatment plant on the north bank and a clover leaf leading to City Line Avenue and East River Drive on its south bank. Vegetation is characterized by grass and some trees in the Morris Arboretum and upper reaches and by a dense and naturally wooded area throughout the length of the valley.

Wooden Bridge Run, a tributary to Pennypack Creek, flows in a southerly direction from North Philadelphia Airport through industrial parkland and some residential areas down through Pennypack Park to the Pennypack Creek. The terrain of the floodplain forms a gently sloping valley merging after about two miles with the Pennypack Valley. It is generally wooded with occasional stretches of meadow.

2.3 Principal Flood Problems

All streams considered in this study pose varying degrees of risk to important residential, industrial, and commercial areas and public facilities within the City of Philadelphia. In addition to susceptibility from fluvial flood events caused by runoff from general rainfall, the City of Philadelphia is also subject to tidal flooding on the Delaware River and the lower reaches of its tributaries caused by extreme high tides, hurricane activity, and tropical storms. Portions of the study area are also susceptible to coincident conditions of high tides and fluvial flooding. The extent of this risk is illustrated by certain major historical storms described below.

The Flood of June 22-23, 1972

Spawned by Hurricane Agnes, the June 1972 flood was, according to records of the USGS, the second largest flood occurring on the Schuylkill River at Philadelphia. A maximum discharge of 103,000 cubic feet per second (cfs) and an elevation of 20.39 feet were recorded at the USGS gage just upstream of Fairmount Dam at Philadelphia. This flood has an approximate recurrence interval of 50 years at Philadelphia, Pennsylvania.

In terms of property damage, however, it may well have been the worst flooding caused by the Schuylkill River to the Philadelphia area and was almost certainly the most destructive flood ever suffered by the Schuylkill River Basin as a whole. This was due to the amount of development and investment that has occurred in the floodplains of the Schuylkill River Basin during the years intervening between this flood and the maximum flood of record in 1869.

According to figures compiled in the "Post-Flood Report, Hurricane Agnes, June 22-23, 1972," by the USACE, Philadelphia District, damages to the Philadelphia area exceeded $8,500,000, while in the Schuylkill River Basin as a whole, they exceeded $148,000,000 (Reference 4).

Reports from the "Philadelphia Evening Bulletin" indicated that a total of forty-six persons lost their lives in Pennsylvania. Three persons were drowned in the Philadelphia area.

Originating over the Gulf of Mexico, Agnes lost its status as a hurricane soon after marking land and moved as an apparently diminishing threat up through the southern states with its course veering to follow the Atlantic coast line. It was preceded, however, by frontal activity which soaked Pennsylvania and the Mid-Atlantic regions with a week of steady rainfall that left the soil saturated and the streams brimming. It was at this inopportune moment that Agnes, recharged by its contact with the Atlantic Ocean, turned inland and collided with the stalled frontal system over central Pennsylvania. This resulted in a tropical downpour and flooding. Property damage was immense, and approximately 200,000 persons were left homeless in the basin.

Some idea of the impact of the flooding at Philadelphia can be gained by incidents reported in the "Philadelphia Evening Bulletin."

Manayunk was hard hit by the flood with some houses swept away and all of its factories closed, leaving approximately 1,000 workers temporarily unemployed. Manayunk's Main Street and River Road were so deeply flooded that they had to evacuated and guarded against looting. Industry in Conshohocken was also temporarily closed down by the flooding. Further downstream, Boat House Row, was partially inundated as well as some homes and industries, such as the Philadelphia Electric Company, which were located near the river.

With respect to transportation, its disruption was not excessive. In addition to the closing of the River Drives, which usually occurs with floods, a portion of the Expressway was inundated at 30th Street and the Vine Street Extension closed between 30th Street with maximum flooding of 5 feet occurring at 23rd Street.

The Flood of August 1955

The greatest flood on the Delaware River at Philadelphia occurred in August of 1955 with an estimated discharge of 325,000 cfs. This flood has an approximate recurrence interval of 150 years at Trenton, New Jersey.

While the threat and the damage to Philadelphia from the surging waters of the Delaware was indeed substantial, it should be seen in the perspective of the catastrophic flooding which occurred in the upper reaches of the Delaware River Basin, as well as most of the northeastern United States.

The genesis of this flood began with the entry of Hurricane Connie in North Carolina on August 12th, followed closely by Hurricane Diane on August 17th. Both hurricanes followed courses over the northeastern United States, concentrating their torrential downpours predominantly over minor streams in steeply sloping valleys. The saturated soil and brimming reservoirs left by Hurricane Connie set the stage for the disastrous flash flooding that accompanied the subsequent onslaught of Hurricane Diane. Over one hundred lives were lost in Pennsylvania and close to two hundred throughout the northeastern portion of the United States. Approximately 114 million dollars of damages occurred in Pennsylvania alone; together with several thousand persons left homeless.

Damages to the City of Philadelphia, while relatively minor when seen in this overall perspective, were still substantial. One life was lost in Philadelphia by electrocution. No records of dollar damages could be found for the city itself. Nevertheless, the following evidence of flooding was reported in the "Philadelphia Evening Bulletin:"

August 19th - Flooding of a portion of Eastwick near Buist Avenue to depth of ten feet over Cobbs Creek's banks and 400 evacuated by boat.

Flooding of 4 feet on Richmond Street and evacuation in Kensington - caused by back up of he Delaware River into sewers.

B&O Railroad Station area flooded to depth of 3 feet by the Schuylkill River.

Portions of East and West River Drives flooded by the Schuylkill River.

August 20th - Wissahickon Drive flooded between Ridge and Wissahickon Avenues, in addition to Schuylkill River Drives.

Delaware Avenue covered from Fairmount to Spruce by 3 feet of water.

August 21st - Back up of the Delaware River into Tacony Frankford Creek causes flooding of 2 feet near Frankford Arsenal and disruption of traffic.

The Greater Philadelphia area (including Bucks County and Camden) was found to have millions of dollars of damage. Fifty miles of shoreline (mostly in Bucks County) were flooded to a depth of 3-15 feet. Three thousand people were forced from their homes with hundreds being evacuated from rooftops and trees.

The Flood of October 1903

The second largest flood on the Delaware River at Philadelphia, occurring on October 11, 1903, had an estimated discharge of 300,000 cfs. This flood has an approximate recurrence interval of 100 years at Trenton, New Jersey. No lives were lost in this flood; however, the dollar damages to the City of Philadelphia were estimated at the time as being about one half million dollars (1903 values). An idea of the flood's impact can be gained from accounts contained in the "Philadelphia Evening Bulletin" -- Having destroyed nearly all bridges above Trenton, the swollen Delaware River swept down upon Philadelphia carrying the debris of such devastated towns as Easton, where houses were swept away in the flood. On one occasion, backed up by the wind, the river flooded the cellars of warehouses and factories along Delaware Avenue from Spring Garden Street to Greene Street. For the most part, however, the torrent was contained within its banks, battering piers and topping pilings at its crest, while covering Delaware Avenue with wind-driven spray, pools of water and debris. Damage to the Delaware Avenue area was heavy. In northeast Philadelphia, the backing up of Tacony Frankford Creek by the Delaware River resulted in the flooding of the grounds of the Frankford Arsenal.

In addition to the Delaware River, the Schuylkill River was also at flood stage with a crest reported by the newspaper to be fifteen feet above normal, together with a flow of four feet over Flat Rock Dam. While flooding of the banks must have occurred in many areas, damages were only reported to the mills located at the falls of the Schuylkill River.

The Flood of October 4, 1869

The greatest known flooding of Philadelphia by the Schuylkill River occurred October 4, 1869, with a discharge of 135,000 cfs and a maximum elevation of 22.74 feet. This flood has an approximate recurrence interval of 100 years at Philadelphia, Pennsylvania.

Despite the extraordinary dimensions of this flood, little is known about either its origin or its impact. Information that is readily available comes from copies of the "Philadelphia Evening Bulletin." News of the flood focused on the Philadelphia area probably because all rail and telegraph connections were cut with other parts of the flooded river basin.

Two canal boatmen were drowned when their canal boat was overturned in the Manayunk area. Property damages were estimated to be a million dollars for the Manayunk area alone (1869 values). Contributing to the debris carried by this swollen river were great quantities of lumber from the Philadelphia Lumber Yards, ice from the Pennsylvania Ice and Coal Company, innumerable barrels and hogsheads, canal boats, numerous freight cars and every other movable object from the Pennsylvania Rail Yards. Bridges and railroad hitherto considered out of reach of any flood were either damaged or destroyed. The Valley of the Wissahickon Creek was stripped bare of shrubbery by the scouring action of its swollen creek. The Schuylkill River Valley was covered by a vast expanse of water that submerged, without a ripple, the Flat Rock Dam near Manayunk and passed eleven feet of water over the Fairmount Dam. Submerged also were the adjacent boat houses up to their roofs along with the Philadelphia Water Works and Gas Works. Thus, Philadelphia was for a time deprived of gas and potable water along with milk and other food stuffs supplied to the city by the Philadelphia/Reading and Norristown Railroads.

An editorial printed in the "Philadelphia Evening Bulletin" of October 5, 1869, commented that one lesson to be learned from this flood was the tendency of floods to become larger and more destructive as river basins became more developed resulting in loss of protective vegetation from their slopes and the encroachment of structures on their floodplains. It warned of the need to take this tendency into account when building new structures or planning such development in the future. This warning issued over a hundred years ago is only now beginning to be taken seriously.

2.4 Flood Protection Measures

The Flat Rock Dam and the Fairmount Dam, both on the Schuylkill River, are not flood control structures and, therefore, will have little affect on the flooding potential of this river. Channelization of Tacony Frankford Creek has been taken into account in calculations for this study. Engineering studies have been performed to study various methods of flood control. Such measures have not been included in the calculations for this FIS due to their tentative nature. There are no other flood protection measures planned or under construction which would affect flooding sources within the City of Philadelphia.

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 1979 FIS, the hydrologic analysis for all streams studied in detail, except the Delaware River which is tidal, and the Schuylkill River, included an analysis of historic storms and development of a rainfall runoff model of each individual drainage basin using the USACE's HEC-1 Flood Hydrograph Computer Program (Reference 5). The HEC-1 program was used in conjunction with recorded precipitation data to model historic events (Reference 6). Hypothetical rainfall distributions were developed for the 10-, 4-, and 1-percent-annual-chance events using the National Weather Service Technical Paper Number 40 (Reference 7). The rainfall runoff models were then used to determine the peak flow and hydrograph for each frequency event at various index locations.

The log-Pearson Type III method was used to develop discharge-frequency curves from the historical flood records at each gage location in the City of Philadelphia (Reference 8). See Table 1, "Stream Gage Information," for the location and period of record for each gage. The USACE Regional Frequency Study was also used to develop peak flow frequency curves at each gage from adopted regional parameters (Reference 9). A standard project storm was developed using criteria developed by the USACE (Reference 10).

Final discharge-frequency curves were computed from composite analysis of stream flow gage records, the rainfall runoff model, regionalized discharge-frequency data, and the USACE's Standard Project Flood. The flooding source and associated gage location and number are provided in Table 2, "Stream Gage Information."

Table 2- Stream Gage Information

Flooding Source and Gage Location	Gage Number	Period of Record
BYBERRY CREEK		
At Grant Avenue	01465795	1964-Present
Below Chalfont Drive	01465790	1965-Present
COBBS CREEK		
At dam above Main Street	01475550	1964-Present
Below confluence with Indian Creek	01475540	1964-1973
City Line Avenue	01475530	1964-Present
PENNYPACK CREEK		
Below Verree Road	01467045	1964-Present
At Pine Road	01467042	1964-1970
POQUESSING CREEK		
Above Interstate Route 95	01465798	1965-Present
Above confluence of Byberry Creek	01465780	1964-1970
At Trevose Road	01465770	*
SCHUYLKILL RIVER		
At Fairmont Dam	01473980	1964-Present
TACONY FRANKFORD CREEK		
Above Torresdale Avenue	01467089	1965-1970
At City Limits	01467086	1965-1970
WALTON RUN		
Below Decatur Road	01465785	1964-Present
WISSAHICKON CREEK		
At dam above Wissahickon Drive	01473980	1965-Present
At dam above Bells Mill Road	01473950	1965-1970
WOODEN BRIDGE RUN		
At dam above Conrail	01467050	1965-1970

*data not available

In the 1979 FIS, as directed by FEMA, the discharges used for the Schuylkill River were those developed in conjunction with the FISs for the Townships of Lower Merion and Whitemarsh, Montgomery County, Pennsylvania (References 11 and 12). Recorded flood flow frequency data for the Schuylkill River were based on statistical analyses of discharge records covering a forty-nine year period at the Pottstown gaging station and a forty-four year period at the Philadelphia gaging station, both operated by the USGS. The analysis followed the standard log-Pearson Type III method as outlined by the Water Resources Council Bulletin Number 15 (Reference 14).

In the 1979 FIS, tidal elevation frequency relationships for the Delaware River were prepared by the USACE, Philadelphia District, and tidal elevations were interpolated from the frequency curves for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods at the mouth of the Poquessing, Pennypack, Tacony Frankford, and Darby Creeks, and the Schuylkill River (Reference 15).

The storm drainage system for the City of Philadelphia was considered in the hydrologic analyses of the streams studied in the 1979 report. However, the accelerated runoff effect from sewered areas would be attenuated during major events by local ponding at catch basins and adjacent streets and by natural channel networks receiving runoff from these areas. Since observed discharge hydrographs reflect the aggregate basin runoff characteristics of a large percent of the study area, it was concluded that any changes in runoff characteristics brought about by storm sewer networks are reflected in the observed hydrograph from which unit hydrograph parameters and loss rate determinations were derived.

In the February 19, 1992 FIS, the peak discharge-frequency relationships for floods of the selected recurrence intervals for Poquessing Creek were determined from analysis of current available gage data from six USGS stream gages within the study area. This analysis was performed using methodology described in "Guidelines for Determining Flood Flow Frequency, Bulletin 17B" (Reference 16).

In the August 2, 1996 FIS, gage analysis for the Schuylkill River was computed by using the computer program HECWRC, which utilizes procedures outlined in Bulletin 17B (Reference 16).

For this revision, the six USGS gages analyzed in the February 19, 1992 FIS (in conjunction with a gage in the Pennypack Creek watershed) were again analyzed with an additional decade of peak discharge records using the computer program HEC-FFA, which utilizes procedures outlined in Bulletin 17B (Reference 16). The resultant frequency-discharge values at the gages were then combined to produce drainage area-discharge relationships for each of the selected recurrence intervals throughout the Poquessing Creek watershed. These relationships were then used to establish peak discharges at key locations along Byberry Creek and a Tributary to Poquessing Creek, both of which drain sub areas of Poquessing Creek.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 3, "Summary of Discharges."

Table 3- Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
BYBERRY CREEK					
At USGS gage 01465795	7.13	1,800	3,300	4,100	6,900
At Walton Run	5.11	1,500	2,700	3,400	5,800
Above Walton Run	2.50	800	1,300	1,700	2,800
Below tributary (above hospital access road #2)	1.48	760	1,160	1,340	1,830
Above tributary	0.46	300	475	560	785
COBBS CREEK					
At USGS Gage 01475550	22.00	5,000	8,800	11,200	19,000
Below Naylor Creek	16.94	3,700	6,700	8,400	15,500
Below Indian Creek	10.32	3,200	5,400	6,600	10,500
At USGS Gage 01475530	4.78	1,400	2,600	3,300	6,200
DARBY CREEK					
Below Cobbs Creek	62.20	10,800	20,000	26,000	45,900
At Cobbs Creek	39.70	7,200	13,300	17,000	31,300
INDIAN CREEK					
At Cobbs Creek	4.30	1,000	1,800	2,300	4,100
At Sherwood Road	2.09	600	1,000	1,300	2,400
PENNYPACK CREEK					
Above Sandy Run	47.14	5,600	10,200	14,000	28,000
At USGS Gage 01467045	42.80	4,800	9,600	13,000	26,000
At USGS Gage 01467042	37.90	4,500	9,000	12,000	23,600
POQUESSING CREEK					
At USGS Gage 01465798	21.40	5,630	8,940	10,600	15,500
At USGS Gage 01465780	13.20	2,820	4,230	4,940	6,870
TRIBUTARY TO POQUESSING CREEK					
At downstream corporate limits	3.40	1,260	1,870	2,150	2,900
At confluence with unnamed tributary	1.78	840	1,320	1,550	2,150
Below Byberry Road	1.19	620	1,000	1,170	1,640
Below Septa crossing	0.68	400	640	760	1,070
SCHUYLKILL RIVER					
At Fairmont Dam	1893.00	74,000	110,000	128,000	171,000
Upstream of confluence with Wissahickon Creek	1690.00	62,900	93,700	109,000	146,000
TACONY FRANKFORD CREEK					
At USGS Gage 01467089	33.80	8,800	14,500	17,500	27,100
At USGS Gage 01467086	16.20	4,800	8,200	10,000	15,600
WALTON RUN					
At USGS Gage 01465785	2.17	800	1,300	1,700	2,800
WISSAHICKON CREEK					
At Henry Avenue	64.00	6,600	11,900	15,000	25,200
At Rex Road	53.60	6,000	10,900	13,800	24,500
At upstream corporate limits	46.80	5,400	10,000	12,800	21,700
WOODEN BRIDGE RUN					
At USGS Gage 01467084	3.35	1,500	2,300	2,800	4,400

The Stillwater elevations for the 10-, 2-, 1- and 0.2-percent-annual-chance flood have been determined for the Delaware River and are summarized in Table 4, "Summary of Stillwater Elevations."

Table 4- Summary of Stillwater Elevations

	ELEVATION (feet NGVD 29*)			
Flooding Source and Location	10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
DELAWARE RIVER				
At Darby Creek	7.4	9.0	9.8	11.8
At the Schuylkill River	7.5	9.1	9.9	12.0
At Philadelphia Tide Gage	7.6	9.2	10.0	12.1
At Pennsauken Creek	7.7	9.3	10.1	12.3
At Frankford Creek	7.8	9.3	10.1	12.3
At Pennypack Creek	8.0	9.6	10.3	12.6
At Poquessing Creek	8.1	9.7	10.4	12.8

* NGVD 29 = National Geodetic Vertical Datum of 1929

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.

Cross Sections

In the 1979 FIS, cross sections for the backwater analysis for all non-tidal streams studied in detail were field-surveyed (Reference 17). Cross sections were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures in the highly urbanized areas.

In the February 19, 1992, FIS, additional cross sections were field surveyed and added to the original hydraulic model for Poquessing Creek at six locations where fill or development had occurred since the preparation of the 1979 FIS.

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

Water Surface Elevations

In the 1979 FIS, water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USACE's HEC-2 step-backwater computer program (Reference 18).

For the August 2, 1996 FIS, water-surface elevations of floods of the selected recurrence intervals for the Schuylkill River were computed using the USACE HEC-2 step-backwater computer program (Reference 18).

This revision includes the determination of water surface profiles for Tributary to Poquessing Creek, as well as a 1.2 mile upstream extension of water-surface profiles of Byberry Creek. The water-surface elevations of floods were computed using the USACE HEC-RAS River Analysis System computer program (Reference 19).

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

Starting Water Surface Elevations

In the 1979 FIS, starting water-surface elevations for Pennypack Creek, Tacony Frankford Creek, the Schuylkill River, and Darby Creek were obtained from coincident conditions of tidal flood events on the Delaware River and fluvial flood events on the respective tributaries (Reference 15).

In the February 19, 1992, FIS, the starting water-surface elevation for Poquessing Creek was obtained from critical depth computations. The backwater effect of the Delaware River was superimposed on the lower reaches of the Poquessing Creek profiles, thus producing the final water-surface profiles.

The 1-year tide elevation at the Ben Franklin tide gage (near the confluence of the Schuylkill and Delaware Rivers), 5.2 feet National Geodetic Vertical Datum of 1929 (NGVD 29), was used as the starting water-surface elevation for all frequency runs. This elevation is appropriate, in part, for two reasons: (1) the large size of the concerned drainage basins (i.e., the Delaware and Schuylkill Rivers) makes coincidental flooding unlikely, and (2) the Schuylkill River is tidal up to the Fairmount Dam (approximately 8 miles upstream from its mouth).

For this revision, starting water-surface elevations for the analysis of the Tributary to Poquessing Creek were developed using normal depth computations. Starting water-surface elevations for the Byberry Creek analysis were taken from the previous downstream backwater analysis.

For the remaining streams studied in detail, starting water-surface elevations were obtained from backwater computations of their respective main stems. Profiles are not shown for the Delaware River because it is subject to tidal flooding.

Roughness Factors

In the 1979 FIS, channel roughness factors (Manning's "n" values) for these computations were determined by field inspection of floodplain areas and reference to "Design of Roadside Drainage Channels" (Reference 20). Roughness values for the main channels of all streams studied in detail range from 0.018 to 0.060; those for over bank areas range from 0.035 to 0.145.

For the August 2, 1996 FIS, channel roughness factors for the Schuylkill River were chosen by engineering judgment and were based on inspection of aerial photography and field observations made during helicopter flights over the river and floodplain areas (Reference 21). Manning's "n" values ranged from 0.025 to 0.028 for the main channel to 0.030 to 0.060 for over bank areas.

Roughness factors used in the hydraulic models were chosen by relating field observations and aerial photographs of the stream corridor to information included in the "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains" (Reference 22). Manning's "n" values ranged from 0.030 to 0.040 for the main channels and 0.075 to 0.110 for the over bank areas.

Digital Terrain Model

For the August 2, 1996 FIS, a Digital Terrain Model (DTM) was developed for the entire Schuylkill River study reach upstream of Passyunk Avenue in Philadelphia (Reference 23). The DTM was developed from aerial photography flown in March 1991 (Reference 21). The DTM was developed to produce a surface, or more precisely a Triangulated Irregular Network (TIN). The TIN is accurate to within a 4-foot contour interval although individual spot elevations can be determined within 1 foot. The TIN provides a data base from which an unlimited number of cross sections can be taken throughout the study area for insertion into a hydraulic model.

No DTM was developed downstream of Passyunk Avenue, Philadelphia, because this area is a low-lying tidal plain. Along this reach the topography would produce no significant hydraulic control sections as the area contains only high level bridges. Additional sections along this reach would have minimal effect on the calculated flood elevations. Furthermore, this reach is dominated by the 1-percent-annual-chance flood elevations of the Delaware River, thus small changes in the flood elevations of the Schuylkill River would not affect the final floodplain mapping of this area. Several sensitivity analyses were run on both the natural and floodway HEC-2 models to verify that additional sections downstream of Passyunk Avenue would not significantly affect the results of the hydraulic analysis. These analyses showed that regardless of the number of sections along this downstream reach, the estimated flood elevations remained constant, within a few tenths of a foot, and that the floodway could be consistently placed at the river banks.

The original TIN contained no information below the water surface. Water depths along the Schuylkill River are deep enough that including the channel geometry in the cross sections is necessary for an accurate hydraulic analysis. To avoid limiting the number and location of cross sections modeled to those places where channel sections were available, the existing TIN was supplemented with topographic information below the water surface using CHANNEL, a software application developed for use in the ARC/INFO computer system (Reference 24). Given river channel geometries (cross sections) at distinct but known locations and an existing TIN lacking information within the river banks, CHANNEL enables the user to create a complete topographic surface (including the river's channel). For this study, river channel information was taken from various sources including field surveys, dredging surveys, and existing cross sections developed using HEC-2 (References 18, 25, and 26). The accuracy of the information contained by the original TIN beyond the river banks is unaffected by this process. National Map Accuracy Standards are not guaranteed for by this new surface between the river banks. However, given the generally shallow depths of the Schuylkill River along the study reach relative to the expected flood depths

(except in the far downstream reaches in the City of Philadelphia where recent channel surveys were used) the generated channel topography is well within acceptable accuracy tolerances for an HEC-2 hydraulic analysis.

For the August 2, 1996 FIS, Schuylkill River cross sections were taken from the TIN using CROSS, another software application developed for use in the ARC/INFO system (Reference 27). Knowing the location and orientation of required cross sections, CROSS retrieves elevation information from the TIN surface and supplies cross sections in HEC/GR format. The CROSS program also assigns each section a number corresponding to its location along the river centerline. This number is set equal to the variable SECNO (X1 record, field 1) when the HEC-2 sections are compiled.

The CROSS program includes a filter that limits the number of points selected from the surface. Unnecessarily large numbers of points per cross section lead to excessively large HEC-2 data files that produce results indistinguishable from a model that has filtered sections. The filter allows cross sections to be represented with significantly fewer points by eliminating extraneous points, i.e., those points that if deleted do not change the essential aspects of a given cross section. The filter samples points at a specified interval and retains only those points necessary to reflect "major" breaks in grade based on changes in surface slope (also defined by the user). Cross sections for this analysis were taken with a sampling interval of 10 feet. The defining break in grade was set at 5%: i.e., points that when connected to adjacent points resulted in segments differing in slope by less than 5% were eliminated. Numerous comparisons were made between filtered and non-filtered sections to verify that the CROSS routine was producing accurate representations of the sections by capturing all essential features.

For the August 2, 1996 FIS, the first two sections of the Schuylkill River HEC-2 hydraulic model, sections 3200 and 10250, are in areas where no DTM was developed (Reference 18). Therefore, these two sections, section A and B, as identified on the FIRM, were taken unchanged from the HEC-2 model used in the previous study (Reference 28).

For this revision, a DTM of the Tributary to Poquessing Creek and Byberry Creek corridors was provided by the City of Philadelphia (Reference 29). The DTM was originally published in March 1996. The DTM produced a TIN accurate to within a 2-foot contour interval. The TIN was the source of all cross sections used in the preparation of the hydraulic models.

The hydraulic analyses for this study are 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. However, the blockage of bridge or culvert waterway openings during a period of storm water runoff could result in the flooding of areas outside those within the flood delineation lines.

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

All elevations shown in this FIS report and on the FIRM are referenced to NGVD 29. It is important to note that adjacent communities may be referenced to NAVD 88. This may result in differences in BFEs across the corporate limits between the communities. Elevation reference marks used in this study, and their descriptions, are shown on the maps. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD29 and NAVD 88, 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
Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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, 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 for all stream studied by detailed methods except the Schuylkill River, Poquessing Creek, Tributary to Poquessing Creek, and Byberry Creek using mapping furnished by the City of Philadelphia enlarged to a scale of 1:4,800 (References 30 and 31). Applicable spot elevations were converted to USGS mean sea level datum using a conversion of +5.71 feet. This data was supplemented with topographic contour data compiled from USGS topographic maps at a scale of 1:24,000 with 10- and 20-foot contour intervals; elevations established by USACE field surveys: and, elevations compiled from PennDOT mapping (References 32 and 33).

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

In the February 19, 1992, FIS, the 1- and 0.2-percent-annual-chance floodplain boundaries for Poquessing Creek were interpolated using USGS topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 32).

In the August 2, 1996 FIS, an ARC/INFO software application, DFIRM, was developed to automate the production of the digital flood boundaries for the Schuylkill River (Reference 34). Input to DFIRM included, in part, the location and orientation of the modeled river valley cross sections in reference to a given surface, the water elevation to be mapped at each cross section, and a TIN of the study area. DFIRM compiled a new surface representing the flood elevations throughout the study reach. The flood surface was assigned an elevation at each cross section and changed linearly between adjacent sections. The intersection of the land surface (the original TIN) with the generated flood water elevation surface was equal to the flood boundary.

In the August 2, 1996 FIS, the 1- and 0.2-percent-annual-chance floodplains for the Schuylkill and Delaware Rivers in the area previously known as the Philadelphia Naval Base were interpolated using topographic maps at a scale of 1"=600', with a contour interval of 1 foot, provided by the Department of the Navy, Northern Division of the Naval Facilities Engineering Command (Reference 35).

For this revision, DRAS, an application similar to DFIRM, was used to produce digital flood boundaries for Byberry Creek and Tributary to Poquessing Creek using a TIN provided by the City of Philadelphia. Conversion of the local datum to NAVD 88 was accomplished using a conversion of +4.61 feet, as directed by the City of Philadelphia, Water Department, Information Systems & Technology Division. The data for these flooding sources referenced to NAVD 88 was then converted to NGVD 29 by using a conversion factor of +1.01 feet, as directed by USACE-Philadelphia District, in order to conform to the rest of the City.

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 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The 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 5, 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.

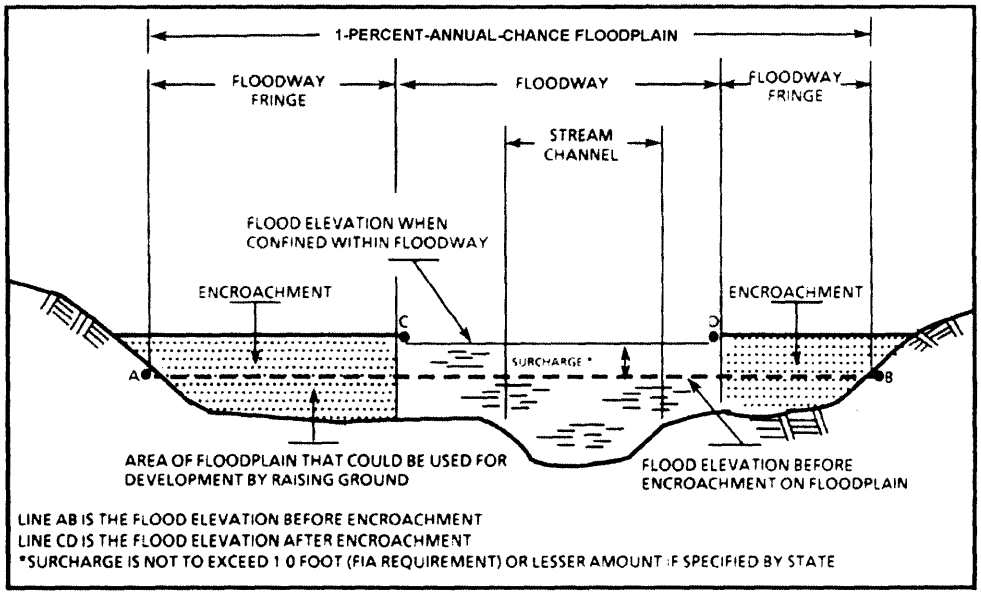
Floodways were calculated for all streams studied in detail in this report except for the Delaware River, Darby Creek, and the lower portion of Cobbs Creek. The 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations on the Delaware River are the result of tidal flooding only. Since the floodway concept is applicable only to fluvial flooding, backwater computations to determine floodway limits are not appropriate. The original floodplain on the lower portion of Cobbs Creek has been covered with an extensive landfill, which would cause sheet flow over a wide area. The upper portion of Darby Creek within the corporate limits is affected by the same landfill, and the lower portion is a tidal flooding area. The lower portion also flows through the Tinicum Wildlife Preserve, in which development is prohibited.

Portions of the floodway widths for Poquessing Creek, Cobbs Creek, and the Schuylkill River extend beyond the corporate limits of the City of Philadelphia.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 5 for certain downstream cross sections of Pennypack Creek, Poquessing Creek, the Schuylkill River, Wissahickon Creek, and Wooden Bridge Run are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

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

Figure 1- Floodway Schematic



5.0 INSURANCE APPLICATIONS

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

Zone A

Zone A is the flood insurance 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 base (1-percent-annual-chance) flood elevations (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 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 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Byberry Creek								
A	200	110	940	4.4	27.2	26.9[2]	27.9	1.0
B	1,200	140	1,660	2.5	32.3	32.3	33.2	0.9
C	2,800	230	2,360	1.7	35.2	35.3	36.0	0.8
D	4,900	210	1,460	2.8	38.4	38.4	38.5	0.1
E	8,800	190	1,250	3.3	45.7	45.7	45.8	0.1
F	11,350	130	1,080	3.5	52.7	52.7	53.7	1.0
G	13,950	130	1,360	2.7	60.3	60.3	61.1	0.8
H	16,100	240	1,680	2.0	62.2	62.2	62.8	0.6
I	20,600	110	550	3.1	72.1	72.1	72.8	0.7
J	23,158	50	250	6.2	88.24	87.84	88.84	1
K	23,336	50	230	6.9	89.14	89.04	89.44	0.4
L	23,571	50	240	6.6	90.44	90.44	90.54	0.1
M	23,703	80	490	3	93.94	93.94	93.94	0
N	23,964	40	200	7.5	94.14	94.14	94.24	0.1
O	24,270	200	690	2.1	96.64	96.64	96.64	0
P	24,466	90	280	5.2	97.34	97.34	97.74	0.4
Q	24,667	80	310	4.7	97.34	97.34	97.74	0.4
R	24,936	100	310	4.6	97.64	97.64	98.44	0.8
S	25,069	100	210	6.5	100.14	100.14	100.14	0
T	25,094	40	150	9.2	100.64	100.64	100.74	0.1
U	25,227	30	170	8.3	101.44	101.44	102.34	0.9
V	25,373	70	390	3.6	102.84	102.84	103.74	0.9
W	25,601	80	380	3.6	103.14	103.14	104.14	1
X	25,877	50	230	6	103.94	103.94	104.74	0.8
Y	25,947	40	190	7.4	104.94	104.94	105.14	0.2
Z	26,081	60	290	4.8	105.84	105.84	106.04	0.2

[1] Feet above confluence with Poquessing Creek

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

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

BYBERRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Byberry Creek (continued)								
AA	26,246	40	140	9.6	106.11	106.11	106.31	0.2
AB	26,293	70	260	5.2	107.41	107.41	108.11	0.7
AC	26,402	30	160	8.6	107.91	107.91	108.11	0.2
AD	26,566	30	170	8	108.41	108.41	109.21	0.8
AE	26,696	60	260	5.3	109.41	109.41	110.21	0.8
AF	26,840	40	140	9.8	110.11	110.11	110.31	0.2
AG	27,003	60	300	4.5	111.61	111.61	112.51	0.9
AH	27,091	50	240	2.4	114.41	114.41	114.51	0.1
AI	27,277	30	90	5.9	114.51	114.51	114.61	0.1
AJ	27,520	30	110	5	115.01	115.01	115.71	0.7
AK	27,807	30	70	7.8	117.11	117.11	117.31	0.2
AL	27,919	90	270	1.6	120.01	120.01	120.01	0
AM	28,152	110	180	2.5	120.21	120.21	120.21	0
AN	28,344	30	60	7.7	120.91	120.91	120.91	0
AO	28,549	40	70	6.1	123.31	123.31	123.31	0
AP	28,791	30	70	6.6	125.41	125.41	125.41	0
AQ	29,101	50	120	3.8	127.01	127.01	127.01	0
AR	29,396	40	190	1.7	132.41	132.41	132.41	0
AS	29,448	60	270	1.2	132.41	132.41	132.41	0
AT	29,481	40	250	1.2	132.51	132.51	132.51	0
AU	29,676	20	120	2.6	132.51	132.51	132.51	0
AV	29,895	30	100	3.1	132.61	132.61	132.71	0.1
AW	30,155	40	90	3.4	133.21	133.21	133.41	0.2
AX	30,433	30	40	7.1	136.51	136.51	136.51	0

[1] Feet above confluence with Poquessing Creek

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

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

BYBERRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Cobbs Creek								
A	2,500	360/310[2]	4,850	2.3	22.8	22.8	23.8	1.0
B	4,830	540/70[2]	3,270	3.4	24.8	24.8	25.6	0.8
C	6,750	210/140[2]	2,650	4.2	28.8	28.8	29.8	1.0
D	8,375	310/80[2]	4,620	2.4	31.4	31.4	32.3	0.9
E	10,625	160/80[2]	2,290	4.6	33.1	33.1	34.1	1.0
F	12,935	320/270[2]	3,880	2.7	35.5	35.5	36.3	0.8
G	14,960	260/200[2]	3,250	3.0	38.8	38.8	39.7	0.9
H	17,840	290/230[2]	2,860	3.3	41.2	41.2	41.8	0.6
I	21,245	170/140[2]	1,850	4.9	50.5	50.5	51.0	0.5
J	24,620	360/80 [2]	3,365	2.5	55.2	55.2	56.0	0.8
K	26,930	120/40[2]	760	10.5	59.3	59.3	59.8	0.5
L	29,525	310/40[2]	2,530	3.0	68.1	68.1	68.8	0.7
M	31,860	150[3]	1,380	5.5	74.5	74.5	74.7	0.2
N	33,540	320/120[2]	3,270	2.1	86.8	86.8	87.6	0.8
O	34,965	290/250 [2]	1,660	4.0	88.0	88.0	88.6	0.6
P	37,235	250/170[2]	1,130	5.1	93.5	93.5	94.1	0.6
Q	39,760	190/60[2]	1,350	3.5	114.1	114.1	115.0	0.9
R	42,735	230/70[2]	1,050	3.2	127.9	127.9	128.9	1.0

[1] Feet above confluence

[2] Width \ width within Philadelphia County

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

COBBS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Indian Creek								
A	1,650[1]	190	550	3.9	93.0	93.0	93.0	0.0
B	5,300[1]	40	180	9.0	133.4	133.4	134.1	0.7
C	7,950[1]	60	160	8.8	173.8	173.8	173.9	0.1
Pennypack Creek								
A	1,112[2]	140	1,370	10.3	10.3	10.2 [3]	10.7	0.5
B	6,537[2]	250	3,660	3.8	18.3	18.3	19.1	0.8
C	9,975[2]	220	3,250	4.3	20.5	20.5	21.4	0.9
D	13,037[2]	230	2,540	5.5	29.5	29.5	30.3	0.8
E	15,162[2]	260	2,350	6.0	31.8	31.8	32.5	0.7
F	19,150[2]	490	4,840	2.9	39.4	39.4	40.1	0.7
G	23,275[2]	700	6,210	2.2	48.5	48.5	49.3	0.8
H	25,065[2]	270	2,980	4.6	50.8	50.8	51.3	0.5
I	26,420[2]	260	3,260	4.2	52.8	52.8	53.7	0.9
J	28,245[2]	290	3,280	4.2	53.9	53.9	54.8	0.9
K	33,500[2]	280	3,160	4.4	62.3	62.3	63.3	1.0
L	34,550[2]	260	2,750	5.0	63.7	63.7	64.7	1.0
M	37,450[2]	250	2,860	4.8	67.1	67.1	67.8	0.7
N	40,550[2]	250	3,290	4.2	73.1	73.1	73.8	0.7
O	46,925[2]	310	2,450	5.3	83.9	83.9	84.9	1.0
P	51,075[2]	220	2,230	5.8	93.5	93.5	94.3	0.8
Q	53,450[2]	470	3,540	3.4	96.5	96.5	97.2	0.7

[1] Feet above confluence with Cobbs Creek

[2] Feet above confluence with Delaware River

[3] Elevation computed without consideration of backwater effects from Delaware River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

INDIAN CREEK AND PENNYPACK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH [2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Poquessing								
A	180	215/75	907	11.7	10.5	3.0[3]	3.0	0.0
B	1,270	100/50	720	14.7	10.5	5.7[3]	5.7	0.0
C	1,660	153/73	1,428	7.4	14.8	14.8	15.7	0.9
D	2,750	240/70	2,019	5.2	18.3	18.3	18.9	0.6
E	4,240	320/190	2,291	4.6	21.7	21.7	22.7	1.0
F	6,450	300/110	2,042	5.2	27.1	27.1	27.4	0.3
G	6,890	200/100	2,055	2.4	31.6	31.6	31.8	0.2
H	7,500	250/100	2,953	1.7	31.8	31.8	32.1	0.3
I	8,500	225/105	2,131	2.3	32.0	32.0	32.4	0.4
J	12,615	260/90	1,201	4.1	35.2	35.2	36.1	0.9
K	14,580	305/85	1,623	3.0	40.5	40.5	41.0	0.5
L	16,580	120/80	814	6.1	44.0	44.0	44.3	0.3
M	18,080	160/25	793	6.2	48.5	48.5	48.7	0.2
N	21,850	158/28	938	4.4	56.5	56.5	57.3	0.8
O	22,460	230/200	1,241	3.3	58.4	58.4	58.8	0.4
P	23,200	230/210	1,127	3.6	59.6	59.6	60.3	0.7
Q	23,700	185/165	848	4.8	61.0	61.0	61.2	0.2
R	25,800	76/36	536	7.7	67.2	67.2	68.0	0.8
S	26,150	250/90	1,806	2.3	70.1	70.1	71.1	1.0
T	29,600	118/48	555	5.9	77.4	77.4	78.1	0.7
U	32,050	180/20	969	3.4	89.4	89.4	89.7	0.3
V	37,050	149/100	950	3.5	110.4	110.4	111.1	0.7
W	37,650	220/20	1,223	2.7	111.6	111.6	112.0	0.4
X	38,550	165/95	707	4.7	112.6	112.6	113.4	0.8
Y	41,100	170/90	1,322	2.5	121.8	121.8	122.7	0.9
Z	44,780	120/40	642	3.7	134.6	134.6	135.3	0.7

[1] Feet above confluence with Delaware River

[2] Width \ width within Philadelphia County

[3] Elevation computed without consideration of backwater effects from Delaware River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

POQUESSING CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Schuylkill River								
A	3,200	625	20,861	6.1	10.0	5.2[3]	5.2	0.0
B	10,250	601	18,838	6.8	10.0	5.9[3]	6.0	0.1
C	16,888	481	16,113	7.9	10.0	6.7[3]	6.8	0.1
D	20,607	600	14,218	9.0	10.0	8.4[3]	8.5	0.1
E	24,965	539	13,536	9.5	10.7	10.7	10.7	0.0
F	28,121	480	14,299	9.0	12.2	12.2	12.2	0.0
G	33,542	430	14,176	9.0	17.2	17.2	17.3	0.1
H	37,560	390	14,491	8.8	18.6	18.6	19.1	0.5
I	42,229	365	12,824	10.0	20.6	20.6	21.2	0.6
J	45,618	570	13,178	9.7	23.9	23.9	24.3	0.4
K	50,144	730	24,532	5.2	28.7	28.7	29.0	0.3
L	54,073	850	18,083	7.1	29.8	29.8	30.2	0.4
M	56,319	670	16,180	7.9	30.2	30.2	30.6	0.4
N	58,113	830	19,182	6.7	30.9	30.9	31.4	0.5
O	60,406	520	12,576	10.2	31.0	31.0	31.5	0.5
P	62,091	449	11,875	10.8	33.8	33.8	34.4	0.6
Q	63,667	520	15,452	8.3	35.7	35.7	36.4	0.7
R	66,301	3762	11,775	10.9	37.2	37.2	37.9	0.7
S	69,030	370[2]	10,917	10.0	40.6	40.6	41.6	1.0
T	71,537	400[2]	10,305	10.6	42.1	42.1	43.0	0.9
U	73,395	589[2]	14,927	7.3	43.6	43.6	44.6	1.0
V	76,046	789[2]	15,778	6.9	45.0	45.0	46.0	1.0
W	78,239	1,094[2]	14,523	7.5	45.8	45.8	46.7	0.9
X	79,960	608[2]	11,148	9.8	46.4	46.4	47.2	0.8
Y	81,813	580[2]	11,846	9.2	51.6	51.6	52.0	0.4

[1] Feet above confluence with Delaware River

[2] Width extends beyond county boundary

[3] Elevation computed without consideration of backwater effects from Delaware River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

SCHUYLKILL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Schuylkill River (continued)								
Z	84,453	500[2]	12,099	9.0	52.8	52.8	53.0	0.2
AA	86,507	580[2]	13,962	7.8	53.6	53.6	54.0	0.4
AB	88,127	500[2]	12,062	9.0	53.7	53.7	54.2	0.5

[1] Feet above confluence with Delaware River

[2] Width extends beyond county boundary

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

SCHUYLKILL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Tacony Frankford Creek								
A	3,845[1]	160	2,040	8.6	11.1	11.1	11.7	0.6
B	9,285[1]	490	5,160	3.4	20.1	20.1	20.9	0.8
C	10,795[1]	230	2,040	8.6	21.8	21.8	22.6	0.8
D	13,230[1]	120	1,400	11.9	27.4	27.4	28.1	0.7
E	16,800[1]	360	2,930	5.3	43.6	43.6	43.6	0.0
F	21,535[1]	230	3,230	4.3	54.6	54.6	55.5	0.9
G	24,100[1]	260	3,090	4.2	60.0	60.0	61.0	1.0
H	26,330[1]	340	4,410	2.8	64.6	64.6	65.5	0.9
I	29,740[1]	160	2,160	5.1	73.1	73.1	74.1	1.0
J	31,605[1]	280	3,370	3.1	77.9	77.9	78.7	0.8
K	33,000[1]	340	3,350	3.0	79.0	79.0	79.8	0.8
Walton Run								
A	300[2]	200	1,530	1.1	66.5	66.5	67.5	1.0
B	2,750[2]	150	540	3.2	70.2	70.2	71.2	1.0
C	6,350[2]	70	280	6.0	85.0	85.0	85.7	0.7

[1] Feet above confluence with Delaware River

[2] Feet above confluence with Byberry Creek

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

TACONY FRANKFORD CREEK AND WALTON RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Wissahickon Creek								
A	550[1]	150	1,820	8.2	37.8	29.0[2]	30.0	1.0
B	4,830[1]	200	2,310	6.5	49.0	49.0	49.0	0.0
C	9,290[1]	150	1,550	9.7	61.5	61.5	61.5	0.0
D	14,915[1]	150	1,750	8.6	74.0	74.0	74.8	0.8
E	29,075[1]	140	1,840	8.0	113.9	113.9	114.7	0.8
F	35,235[1]	270	2,330	6.1	126.8	126.8	127.8	1.0
G	36,210[1]	220	1,690	8.4	132.9	132.9	133.7	0.8
Wooden Bridge Run								
A	280[3]	220	2,980	0.9	32.4	32.4[4]	33.4	1.0
B	1,710[3]	180	1,220	2.3	45.4	45.4	45.5	0.1
C	3,940[3]	120	650	4.1	50.9	50.9	51.7	0.8
D	8,115[3]	90	440	5.7	65.9	65.9	66.3	0.4

[1] Feet above confluence with Delaware River

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

[3] Feet above confluence with Pennypack Creek

[4] Elevation computed without consideration of backwater effects from Pennypack Creek

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

WISSAHICKON CREEK AND WOODEN BRIDGE RUN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Tributary to Poquessing Creek								
A	138	50	230	6.6	144.81	144.81	145.31	0.5
B	417	30	190	8.3	146.11	146.11	146.21	0.1
C	718	40	220	7.1	146.71	146.71	147.71	1
D	986	30	180	8.8	147.81	147.81	148.81	1
E	1,236	60	300	4.9	149.61	149.61	150.31	0.7
F	1,332	40	180	8.1	150.01	150.01	150.41	0.4
G	1,448	40	220	6.8	150.71	150.71	151.41	0.7
H	1,565	40	180	8.3	150.71	150.71	151.71	1
I	1,624	130	460	3	153.51	153.51	153.51	0
J	1,782	40	220	6.3	153.41	153.41	153.51	0.1
K	1,968	60	280	4.9	154.11	154.11	154.11	0
L	2,053	80	560	2.4	156.71	156.71	156.71	0
M	2,222	80	540	2.5	156.81	156.81	156.81	0
N	2,458	50	310	4.1	156.81	156.81	156.91	0.1
O	2,694	40	230	5.5	156.91	156.91	157.11	0.2
P	2,817	30	140	9.2	156.81	156.81	157.11	0.3
Q	2,881	30	160	7.9	157.71	157.71	157.91	0.2
R	3,034	40	160	7.9	158.61	158.61	158.71	0.1
S	3,230	70	280	4.5	159.71	159.71	159.71	0
T	3,481	40	170	7.6	160.31	160.31	160.41	0.1
U	3,759	110	760	1.7	165.31	165.31	165.31	0
V	4,035	50	250	5	165.41	165.41	165.41	0
W	4,421	40	230	5.4	165.91	165.91	166.41	0.5
X	4,656	30	170	6.8	166.41	166.41	167.01	0.6
Y	4,915	70	370	3.2	167.11	167.11	168.11	1

[1] Feet above confluence with Delaware River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

TRIBUTARTY TO POQUESSING CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SCTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FT.)
Tributary to Poquessing Creek (continued)								
Z	5,184	40	200	6	167.51	145.82	168.41	0.9
AA	5,305	160	700	1.7	172.31	147.12	172.31	0
AB	5,453	80	340	2.2	172.41	147.72	172.41	0
AC	5,507	90	430	1.8	172.71	148.82	172.71	0
AD	5,616	100	570	1.3	172.81	150.62	172.81	0
AE	5,900	110	530	1.4	172.81	151.02	172.81	0
AF	6,056	40	180	4.3	172.81	151.72	172.81	0
AG	6,214	30	140	5.5	173.01	151.72	173.21	0.2
AH	6,375	40	180	4.2	175.51	154.52	175.51	0
AI	6,583	70	210	3.6	175.81	154.42	176.01	0.2
AJ	6,817	40	160	4.8	176.11	155.12	176.31	0.2
AK	7,030	30	100	7.3	176.31	157.72	176.91	0.6
AL	7,385	60	170	4.4	177.91	157.82	178.91	1
AM	7,554	170	530	1.4	178.71	157.82	179.51	0.8

[1] Feet above confluence with Delaware River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

PHILADELPHIA COUNTY

FLOODWAY DATA

TRIBUTARTY TO POQUESSING CREEK

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.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable. The FIRM includes flood hazard information that was presented separately on the Flood Boundary and Floodway Map in the previously printed FIS for the City of Philadelphia. Historical data relating to the maps prepared for the City of Philadelphia are presented in Table 6, "Community Map History".

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATES	FIRM EFFECTIVE DATES	FIRM REVISIONS DATES
Philadelphia, City of	December 6, 1974	February 27, 1976	June 15, 1979	May 29, 1981 March 19, 1982 February 19, 1992 August 2, 1996

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

FISs have been prepared for the following communities and counties adjacent to the City of Philadelphia: the Borough of Rockledge, and the Townships of Abington, Bensalem, Cheltenham, Lower Merion, Lower Moreland, Lower Southampton, Springfield, and Whitemarsh, and Delaware County, Pennsylvania (All Jurisdictions); and the Boroughs of Palmyra and Riverton, and the Townships of Cinnaminson, Delanco, Delran, and Pennsauken, New Jersey (References 11, 12, 36 through 49).

Because it is based on more up-to-date analyses, this study supersedes the previously printed FIS for the City of Philadelphia (Reference 28).

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, 6th Floor, 615 Chestnut Street, Philadelphia, Pennsylvania 19106-4404.

9.0 BIBLIOGRAPHY AND REFERENCES

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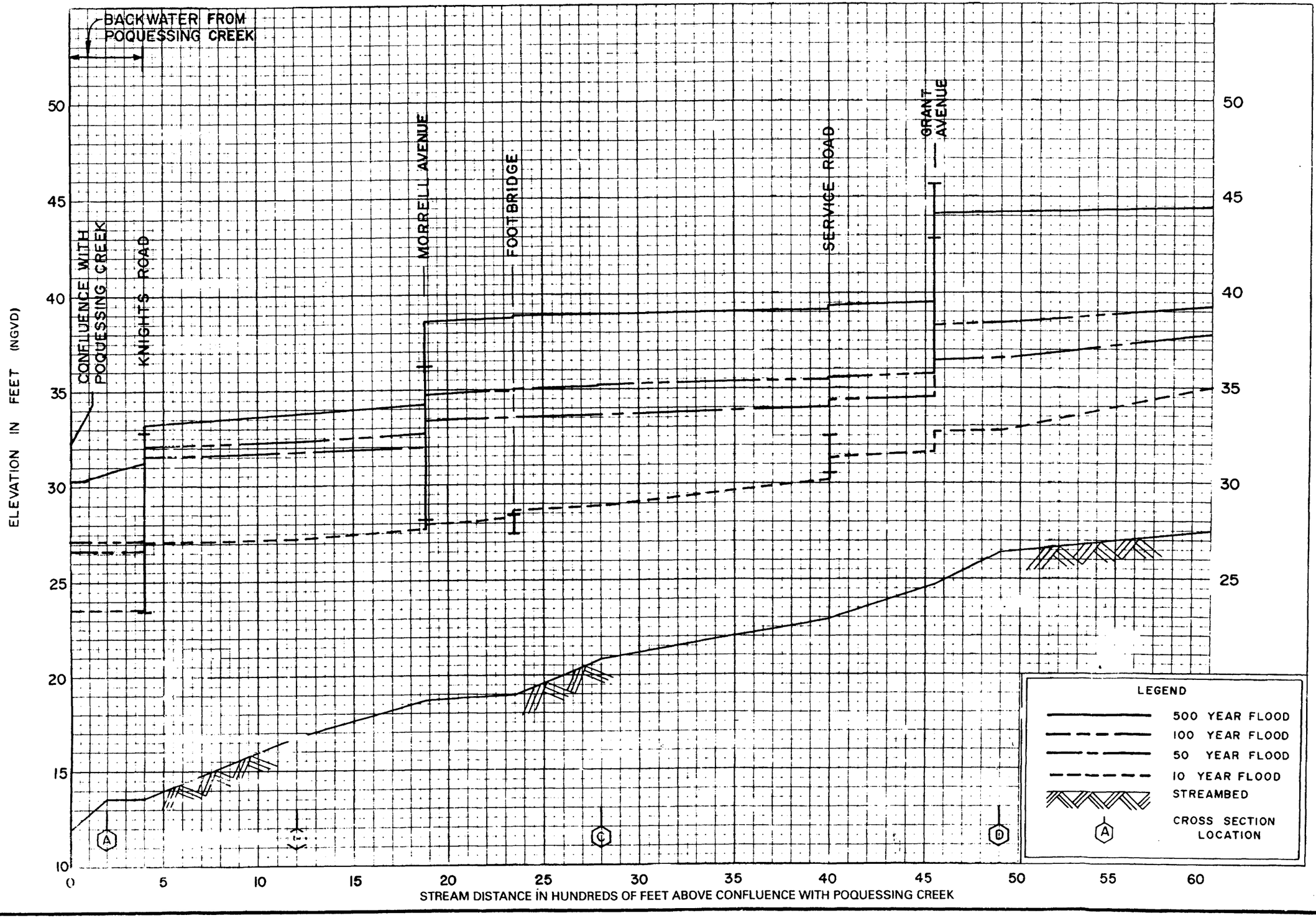


FLOOD PROFILES

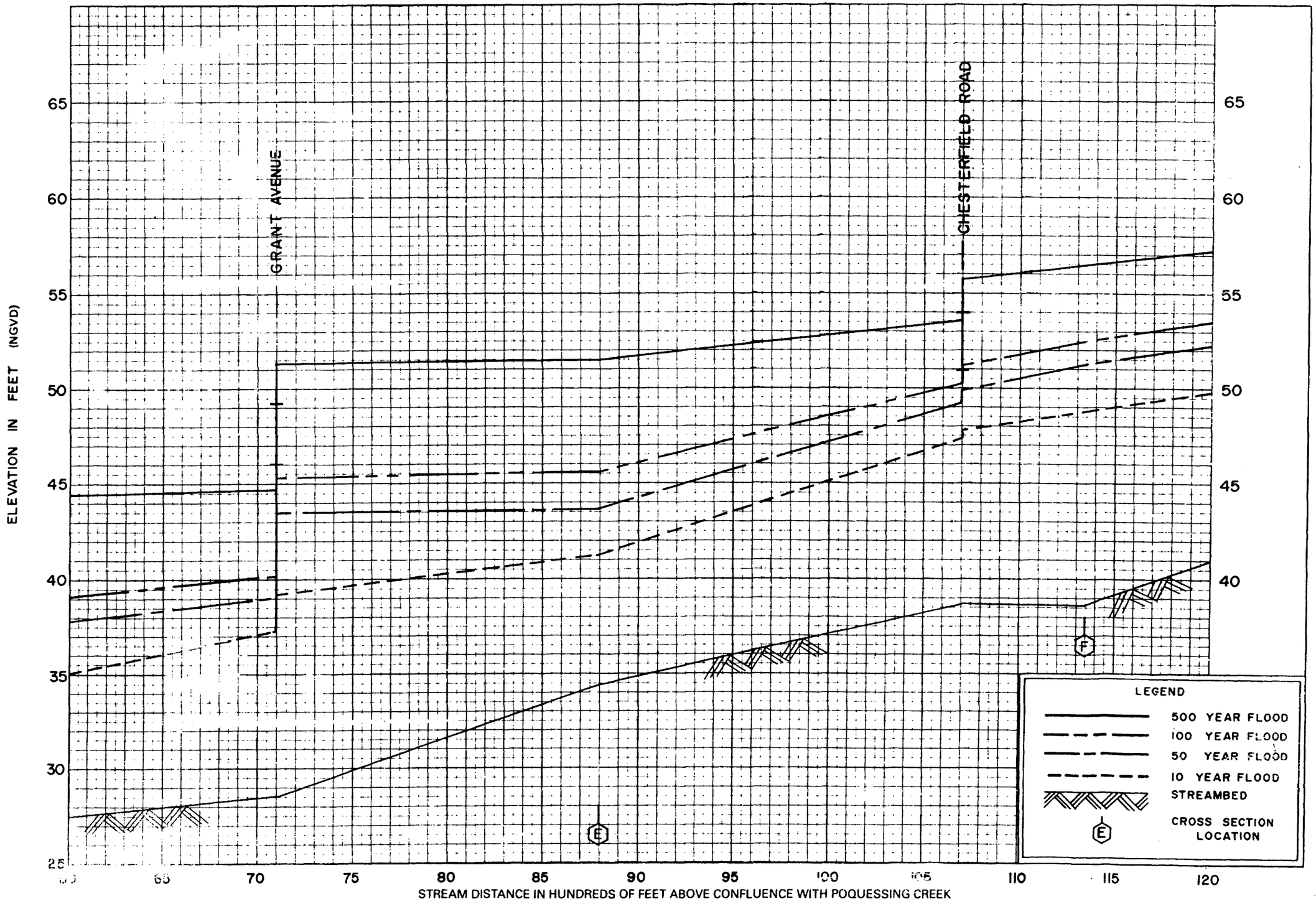
BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

01P



FLOOD PROFILES

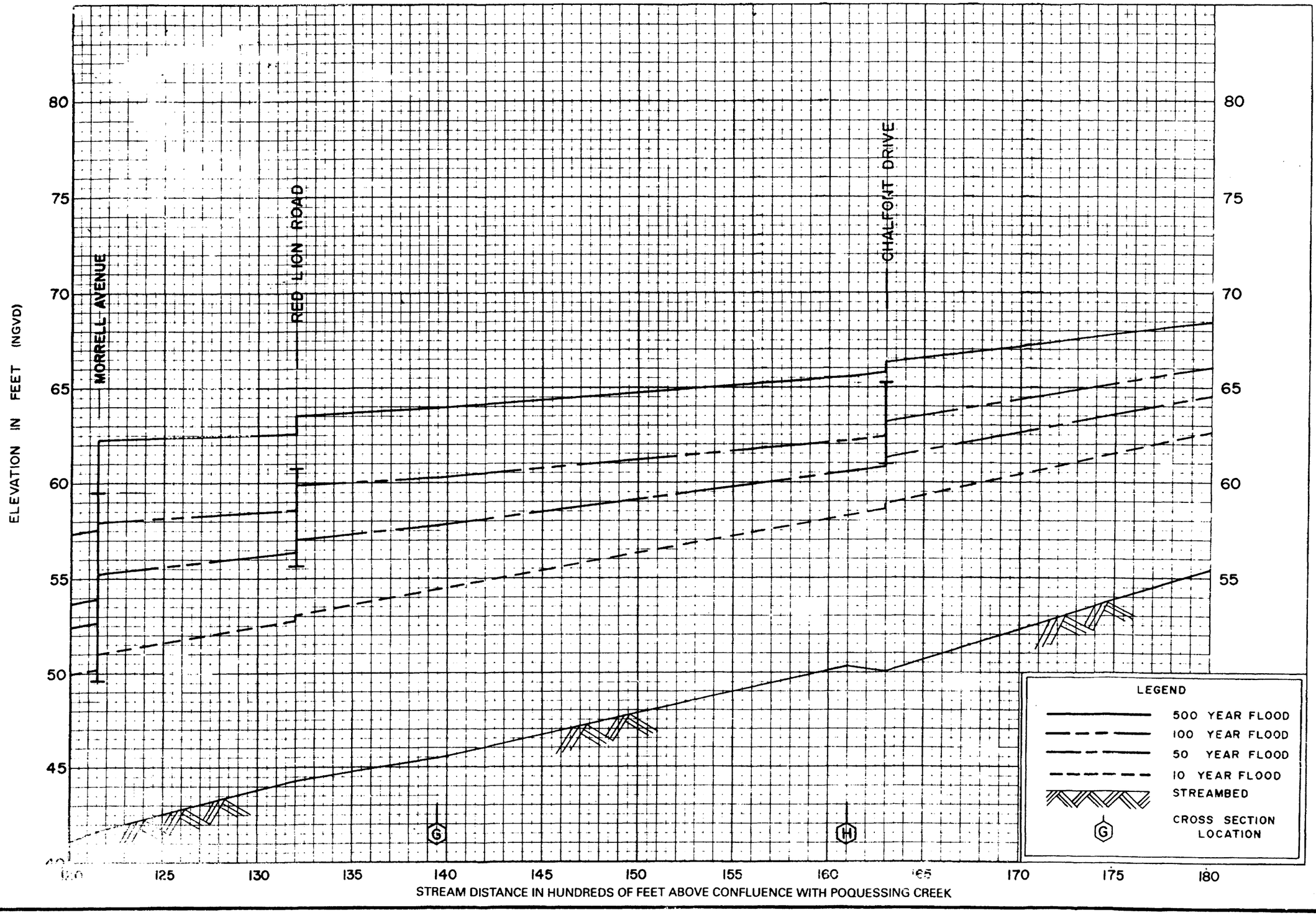
BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

02P



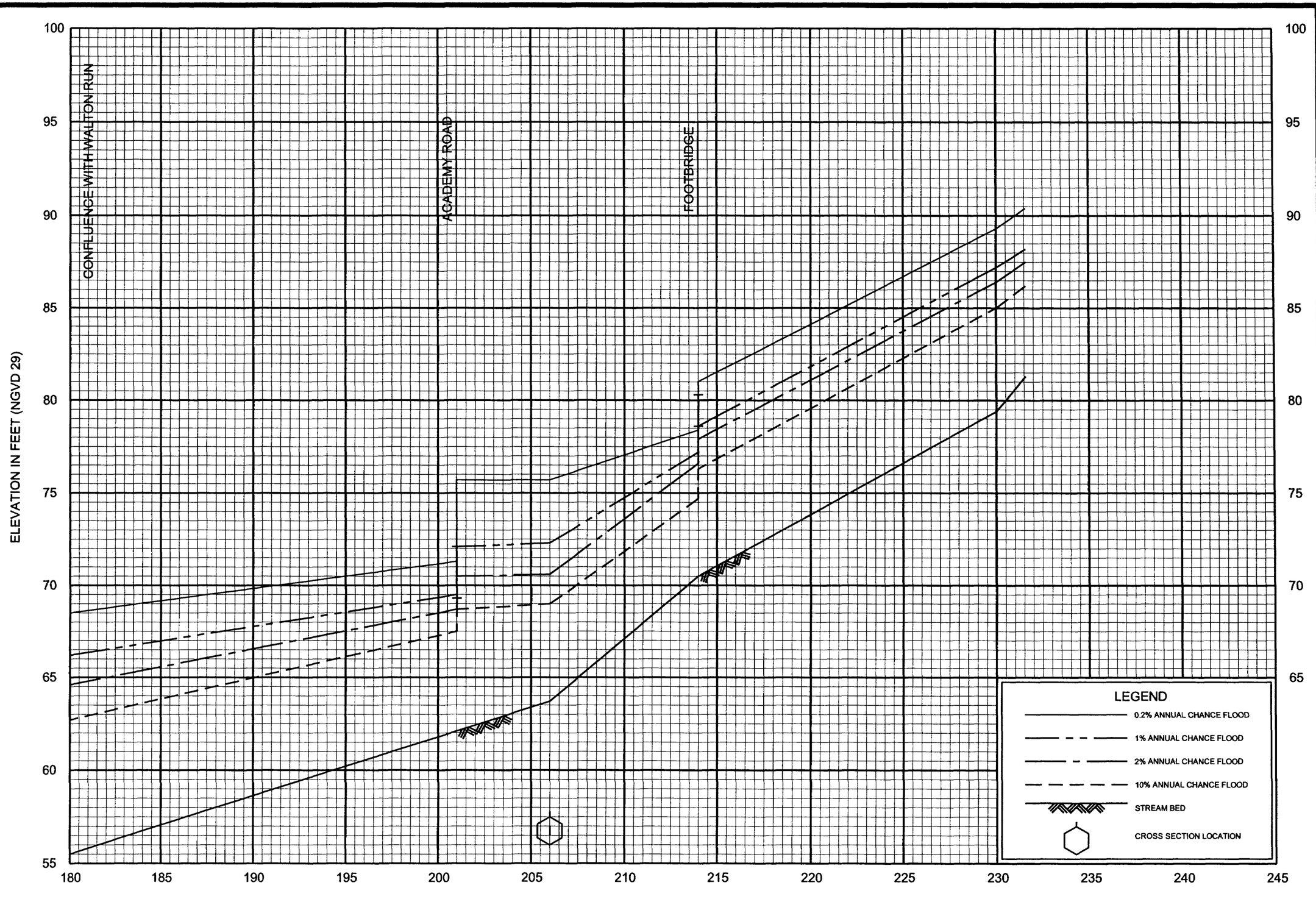
FLOOD PROFILES

BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

03P



FLOOD PROFILES

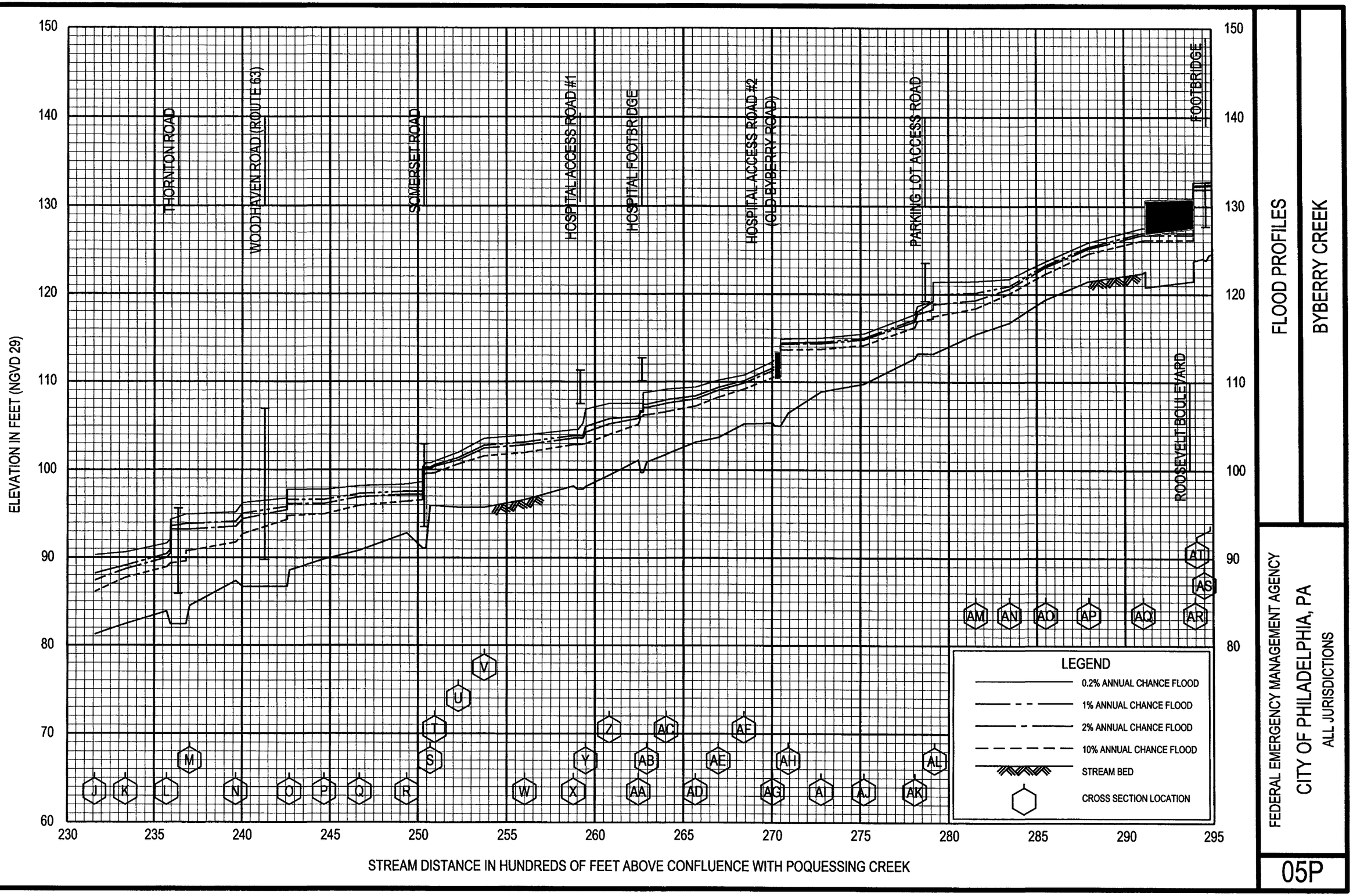
BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

ALL JURISDICTIONS

04P



FLOOD PROFILES

BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

ALL JURISDICTIONS

05P

ELEVATION IN FEET (NGVD 29)

190
180
170
160
150
140
130
120
110
100

295 300 305 310 315 320 325 330 335 340 345 350 355 360

STREAM DISTANCE IN HUNDEREDS OF FEET ABOVE CONFLUENCE WITH POQUESSING CREEK

AU AV AW AX

LEGEND

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

FLOOD PROFILES

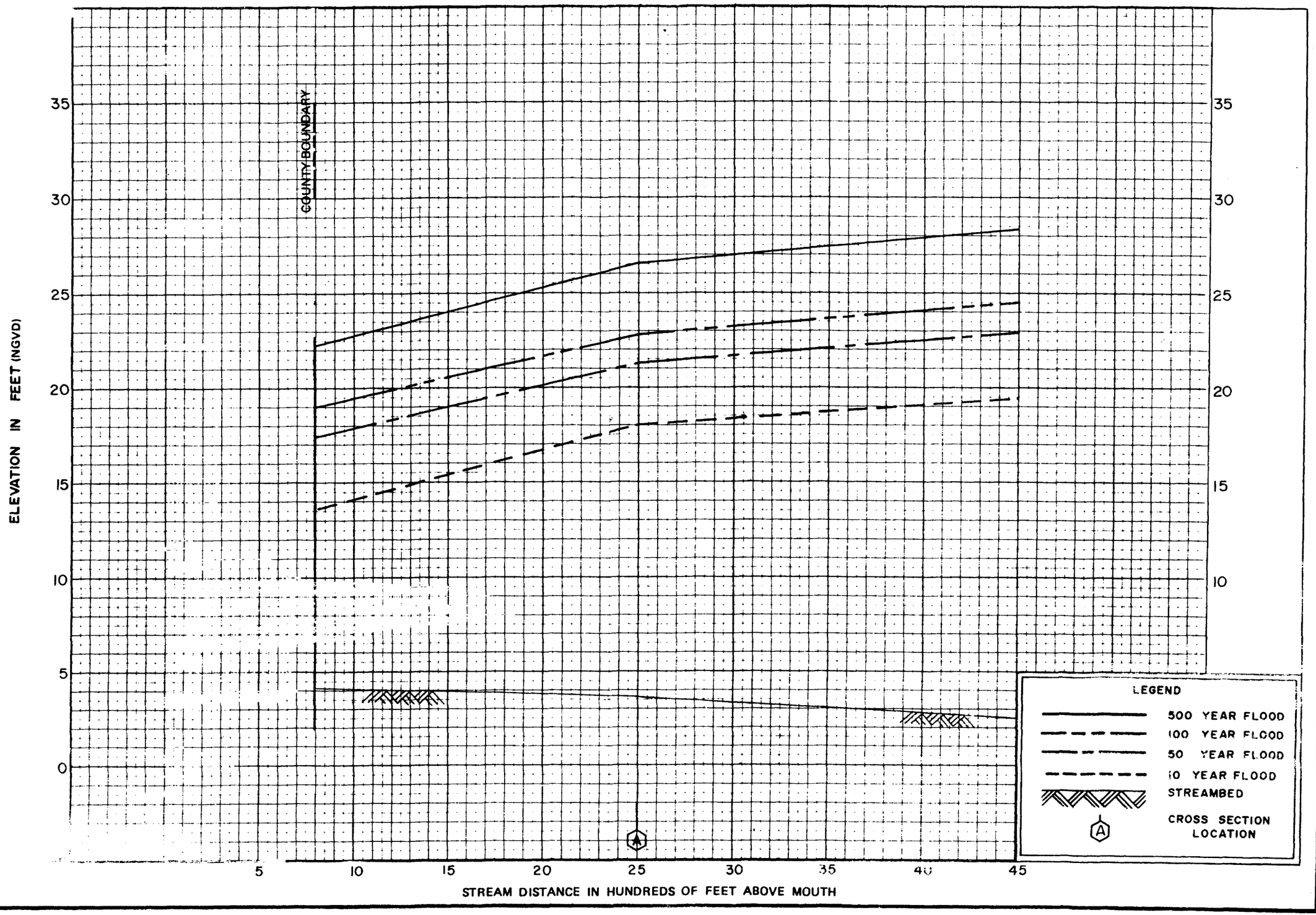
BYBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

ALL JURISDICTIONS

05P(a)



FLOOD PROFILES

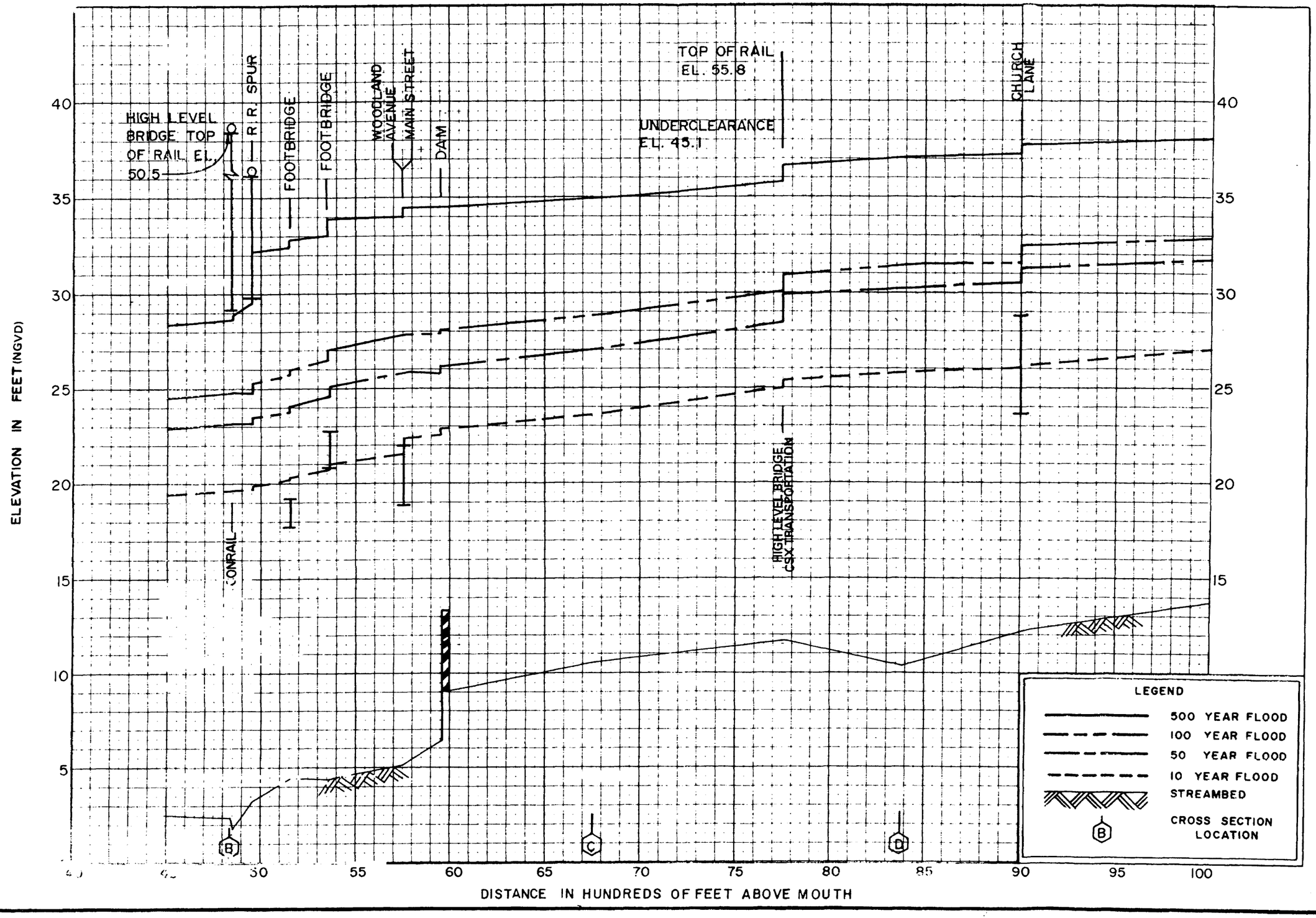
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

06P



FLOOD PROFILES

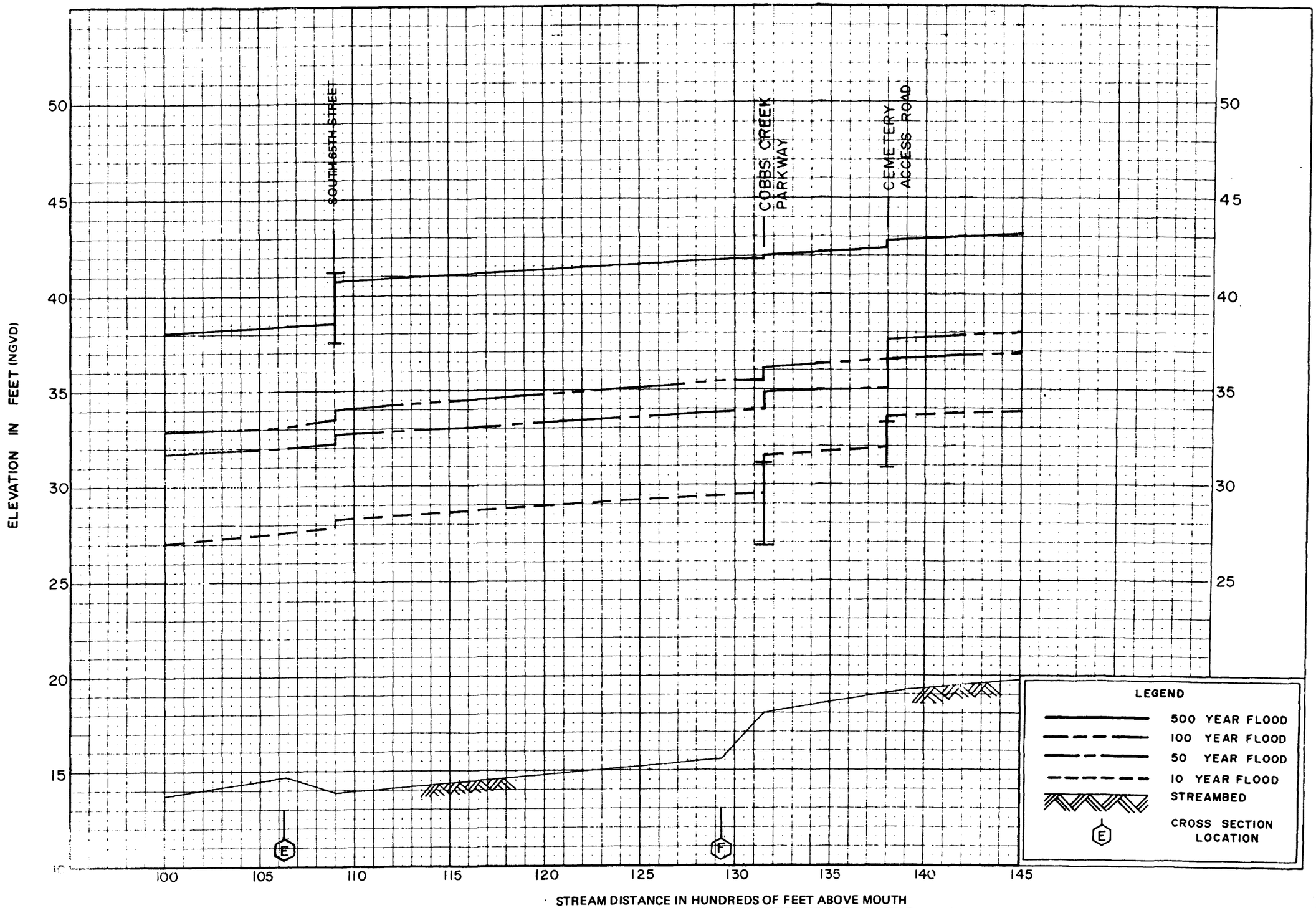
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

07P



FLOOD PROFILES

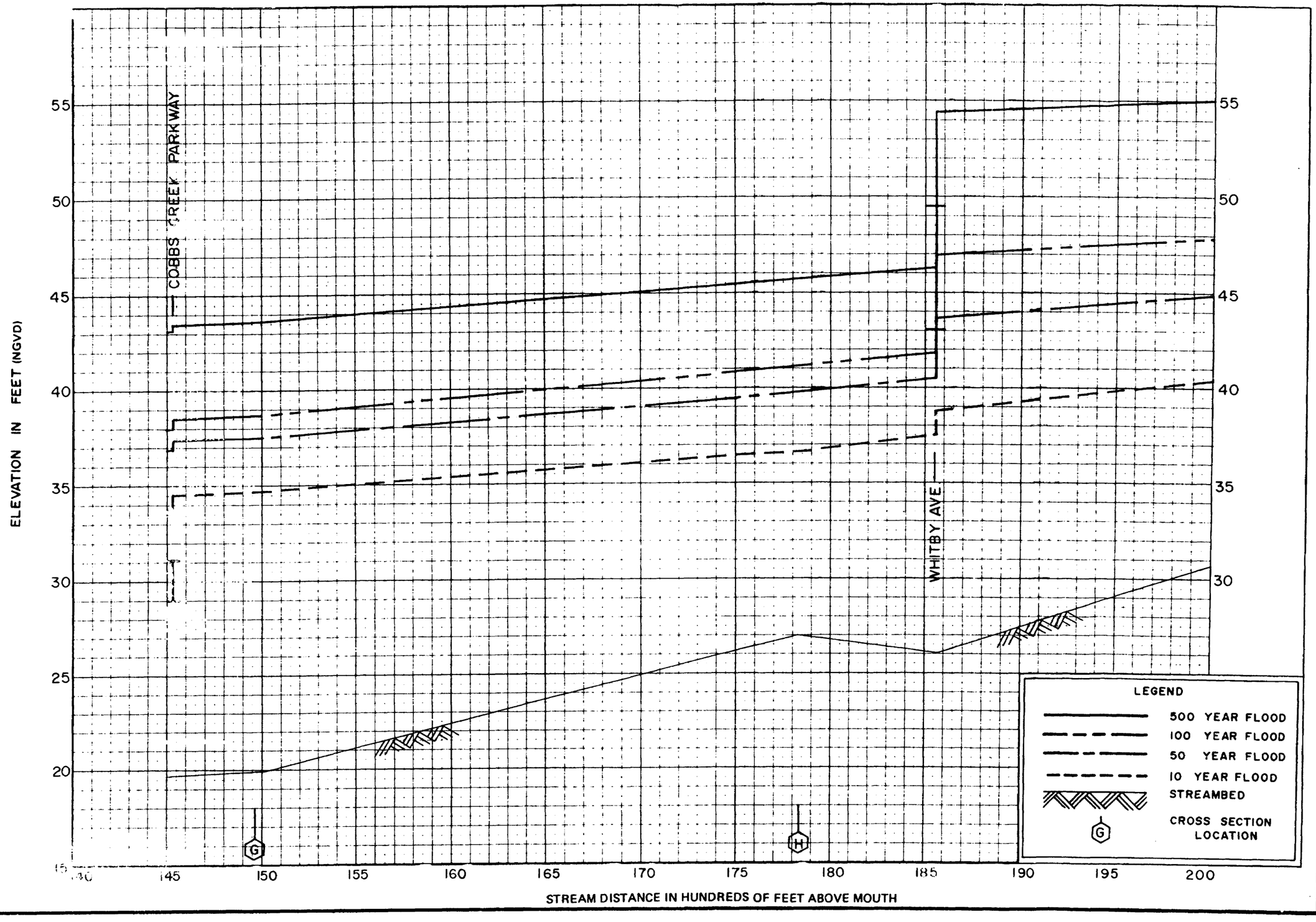
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

08P



FLOOD PROFILES

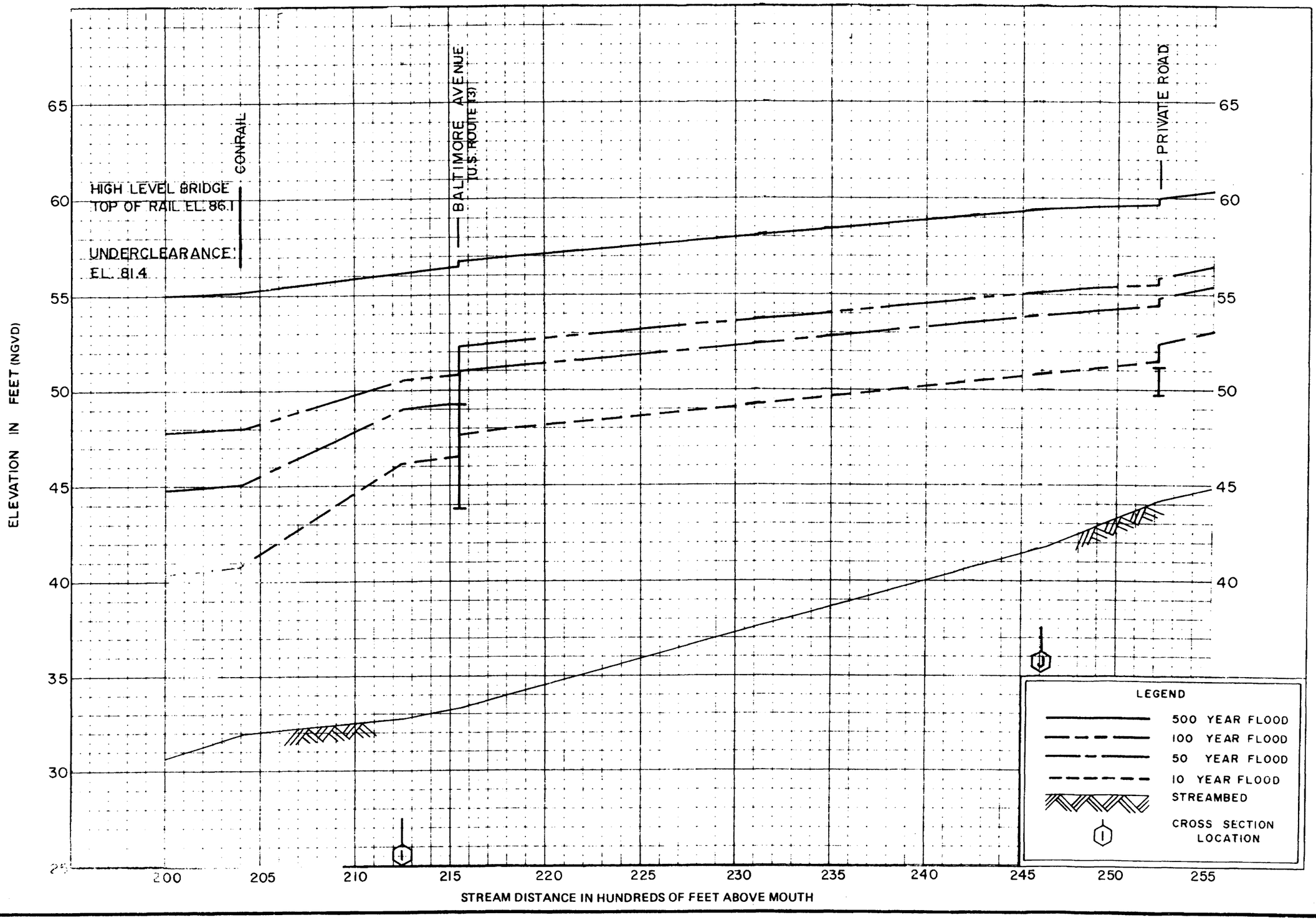
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

09P



FLOOD PROFILES

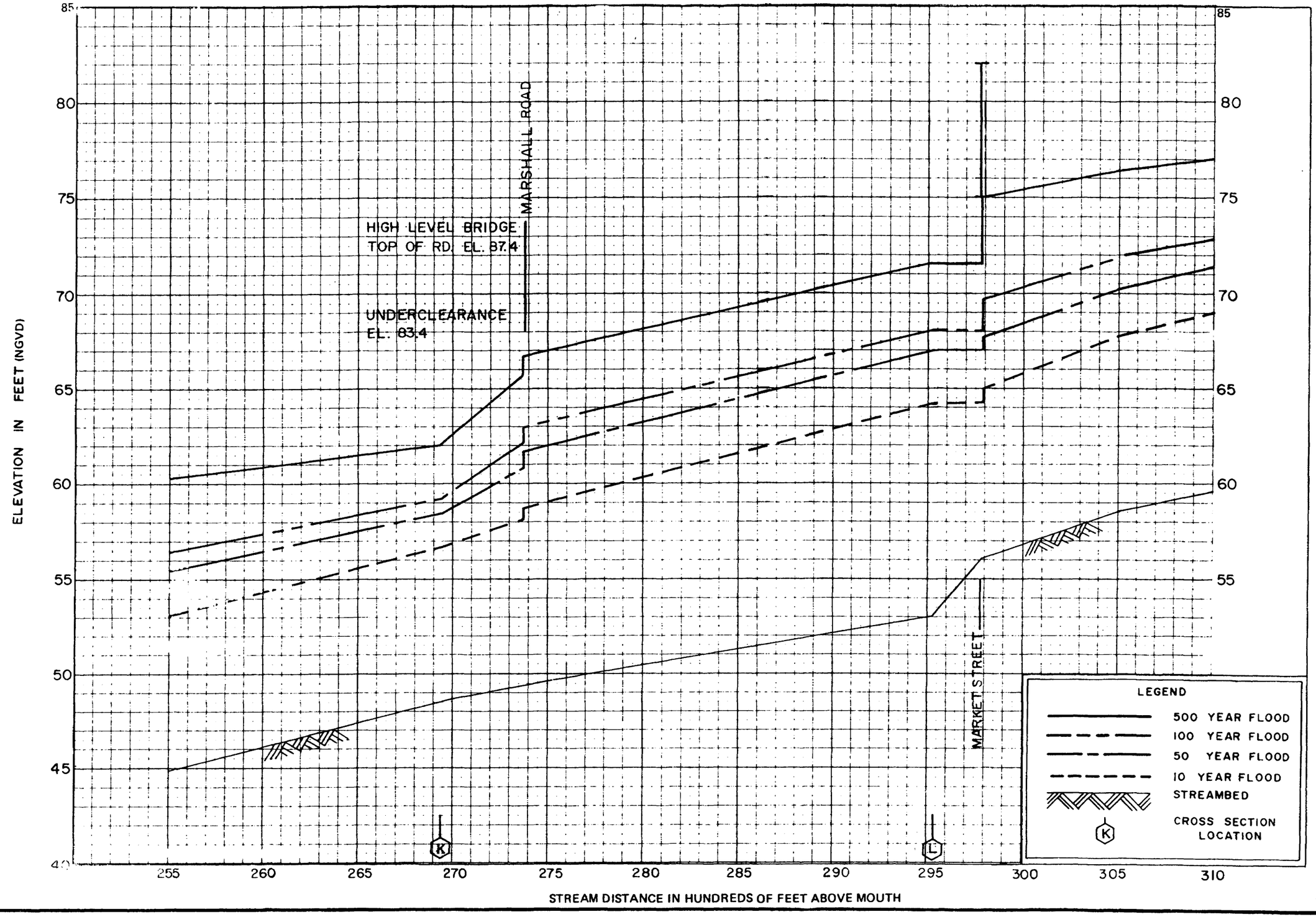
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

10P



FLOOD PROFILES

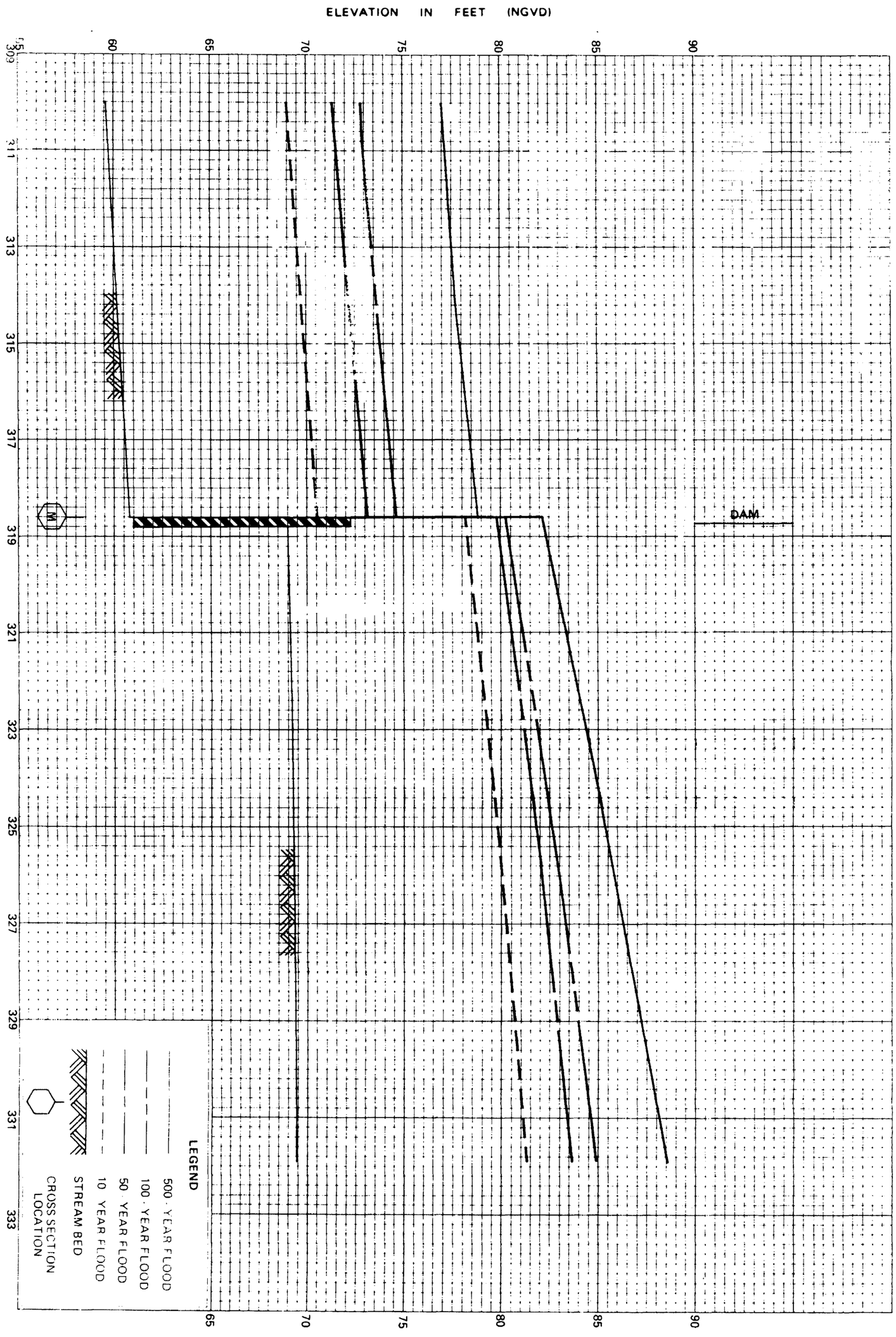
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

11P



12P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

FLOOD PROFILES

COBBS CREEK

ELEVATION IN FEET (NGVD)

95
90
85
80
75
70
65

CONFLUENCE OF INDIAN CREEK

N

M

330 335 340 345 350 355

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE MOUTH

LEGEND

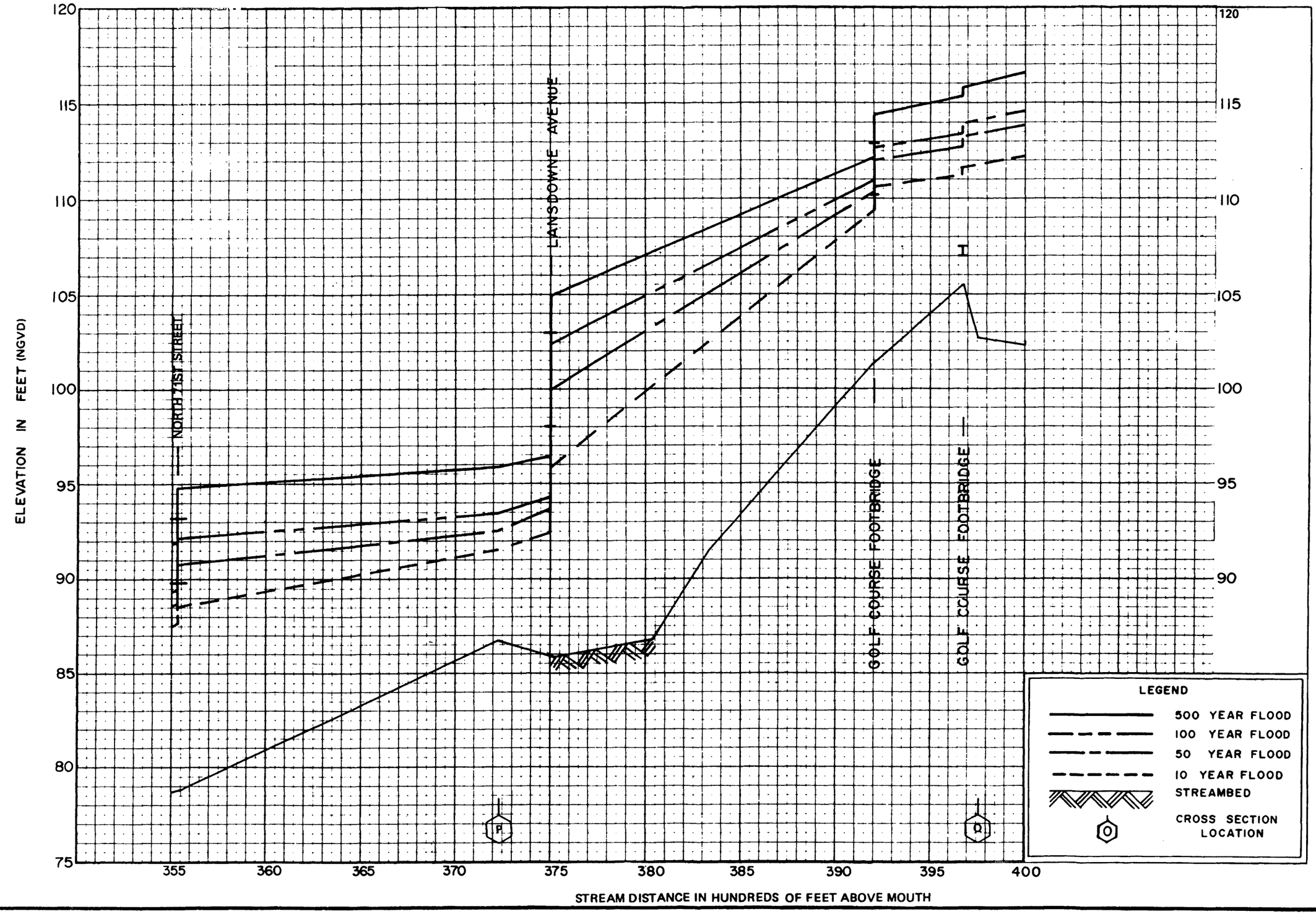
- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAMBED
- CROSS SECTION LOCATION

FLOOD PROFILES

COBBS CREEK

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

13P



FLOOD PROFILES

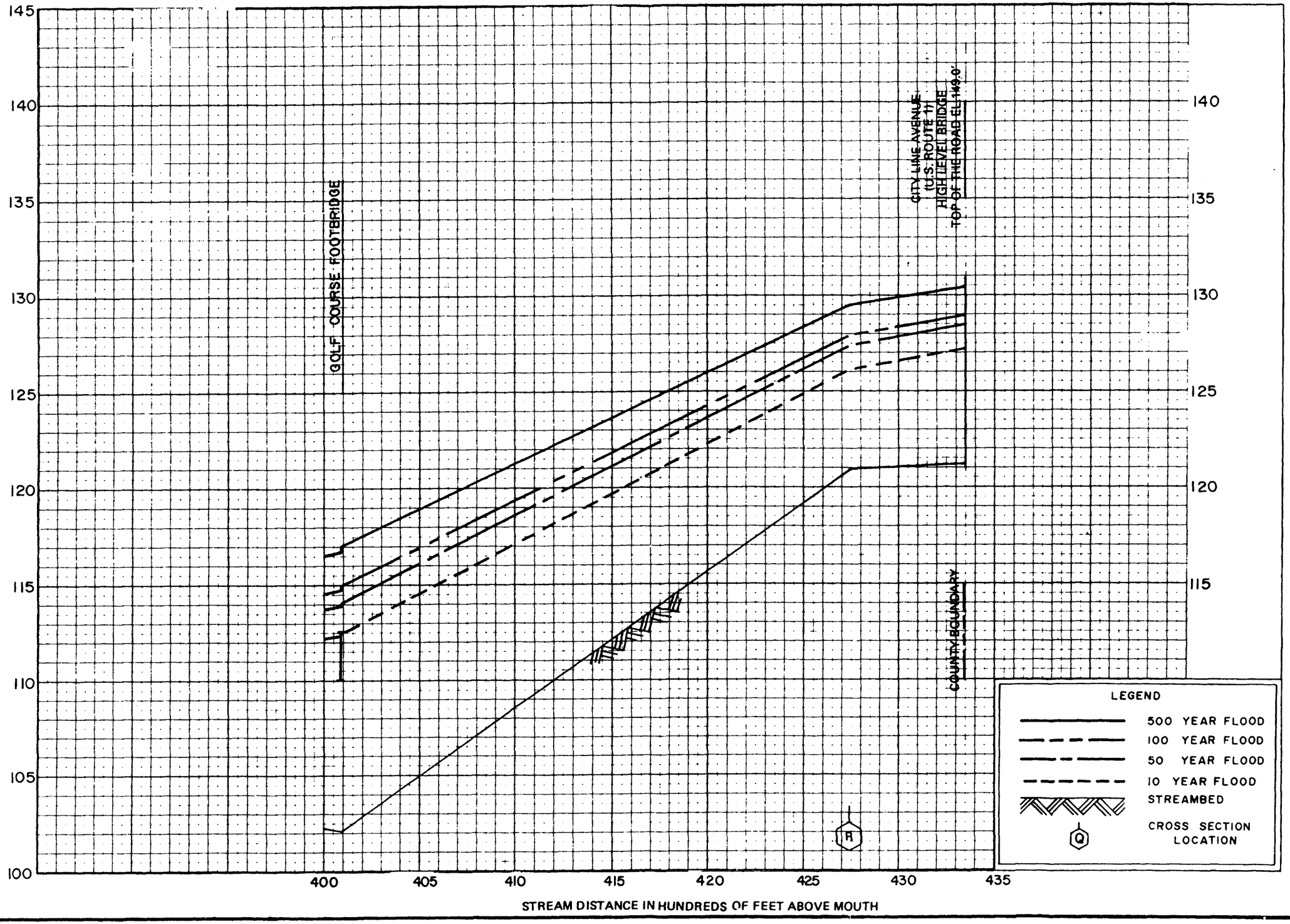
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

14P



FLOOD PROFILES

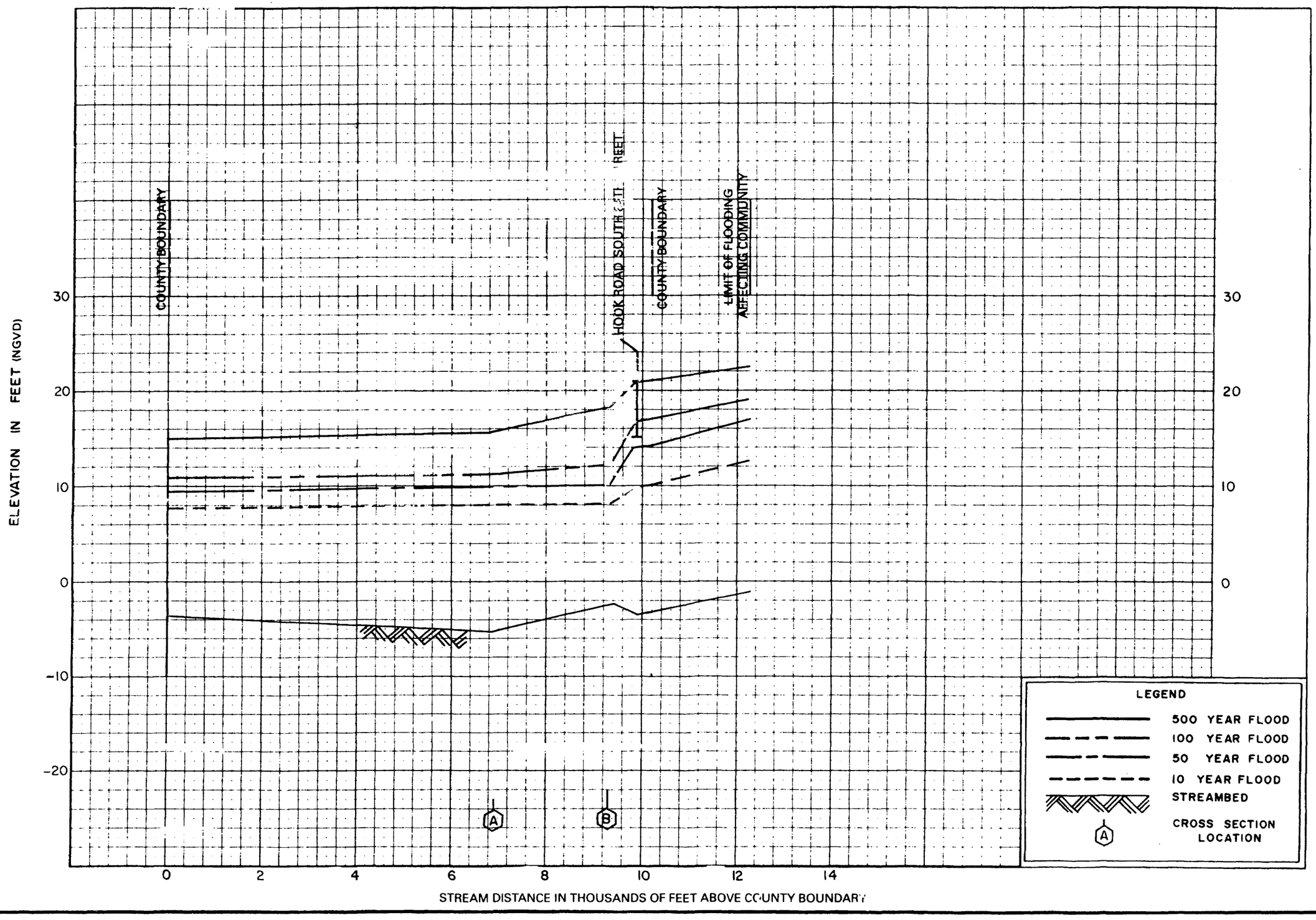
COBBS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

15P



FLOOD PROFILES

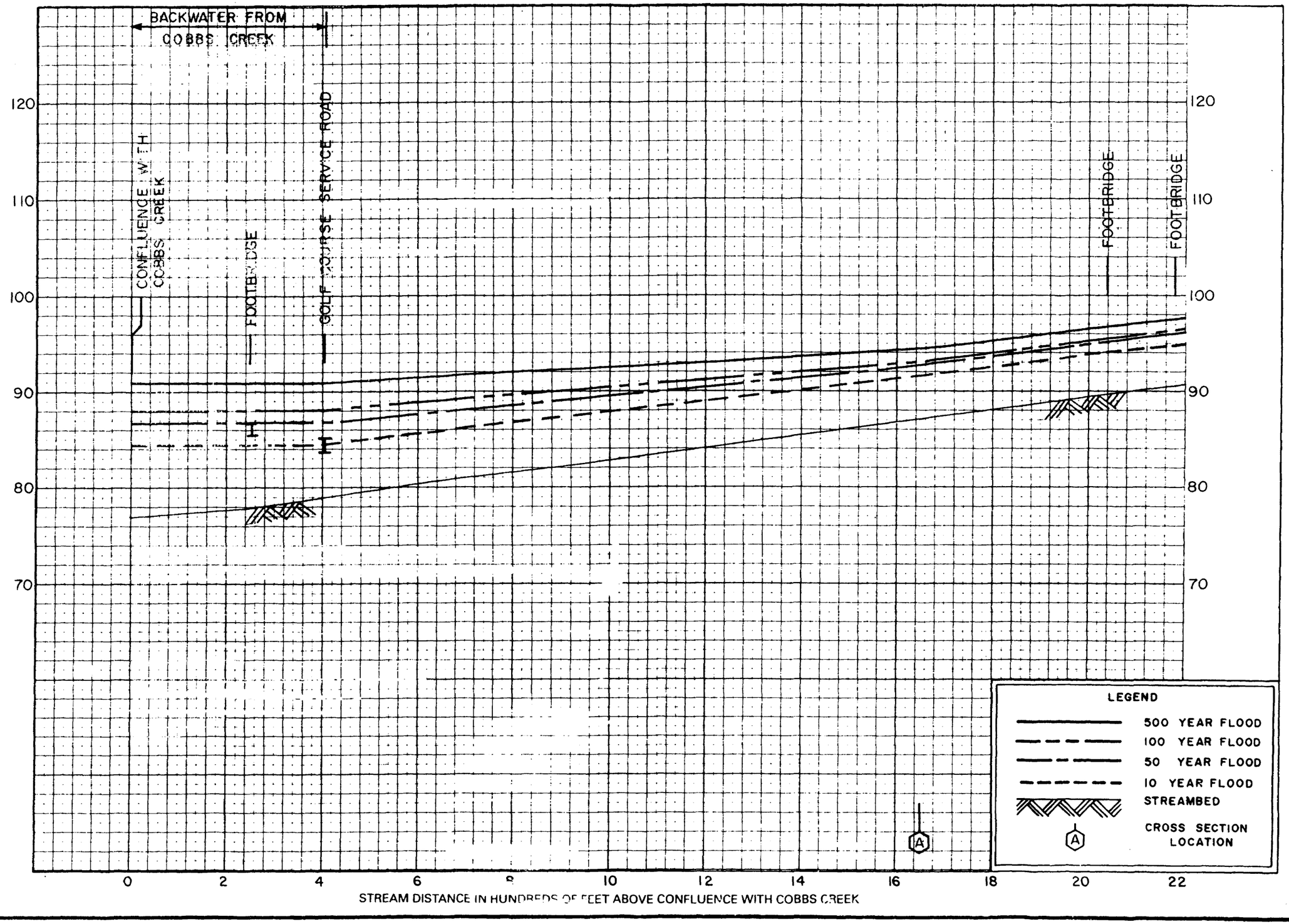
DARBY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

16P



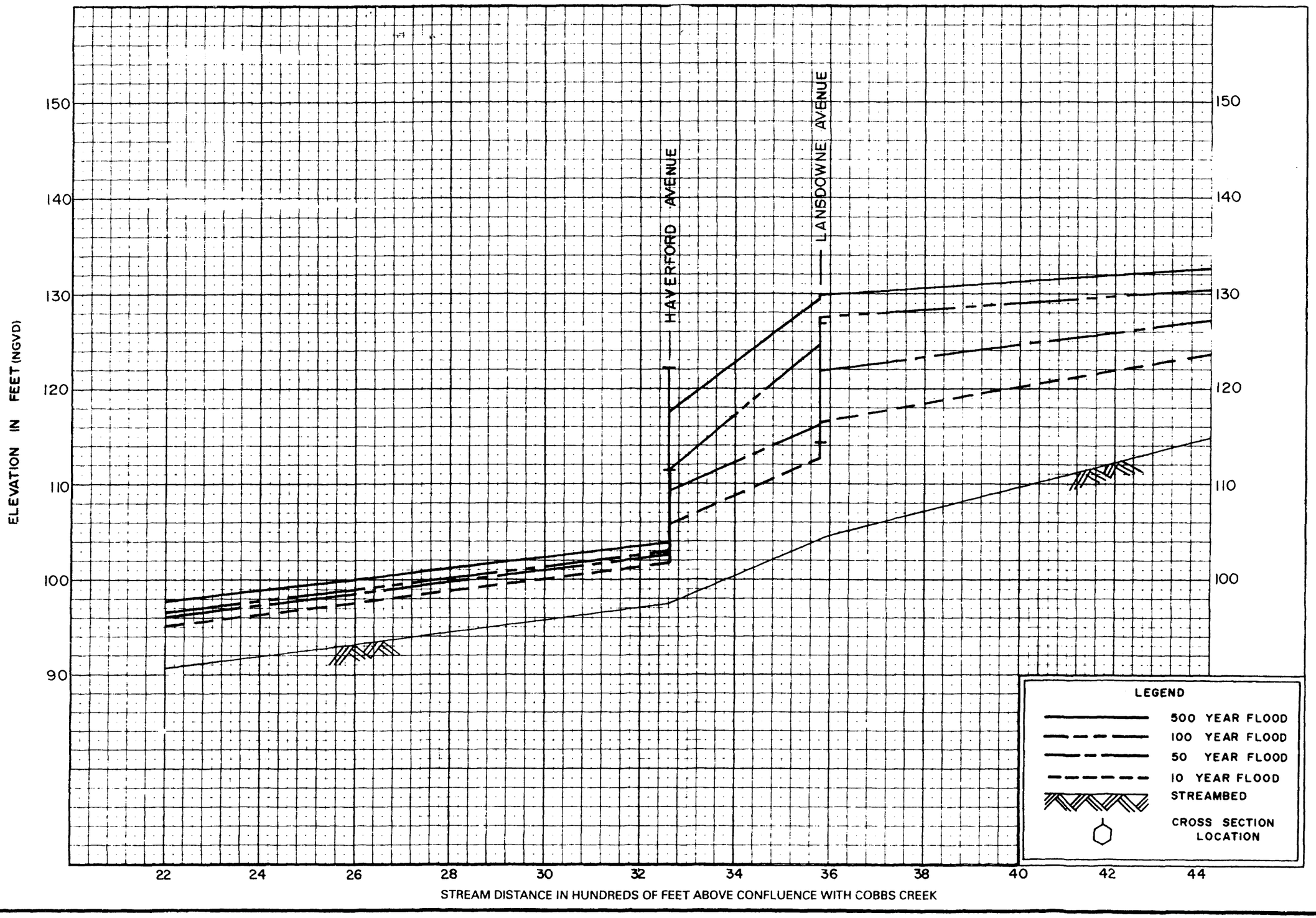
FLOOD PROFILES

INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

17P



FLOOD PROFILES

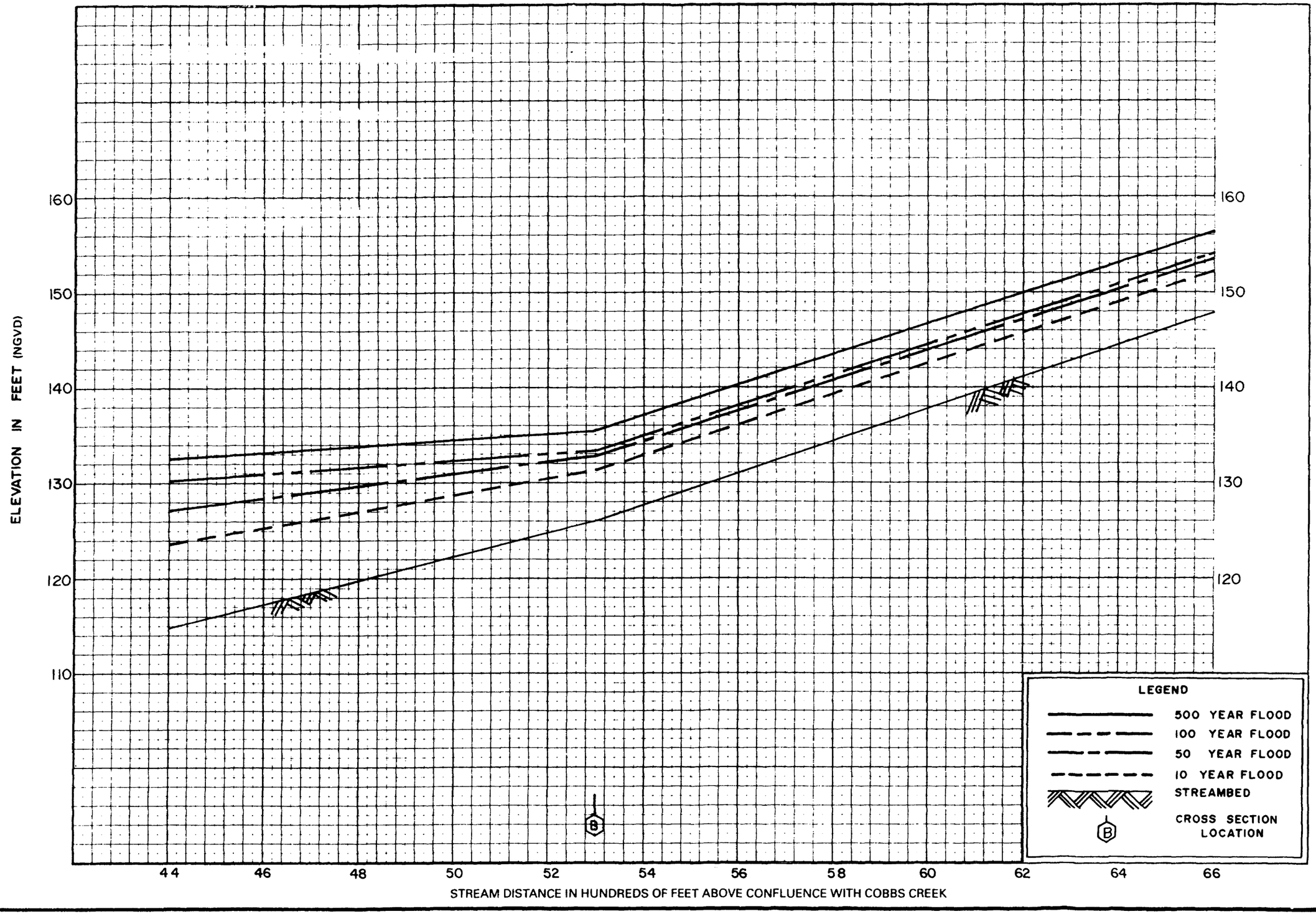
INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

18P



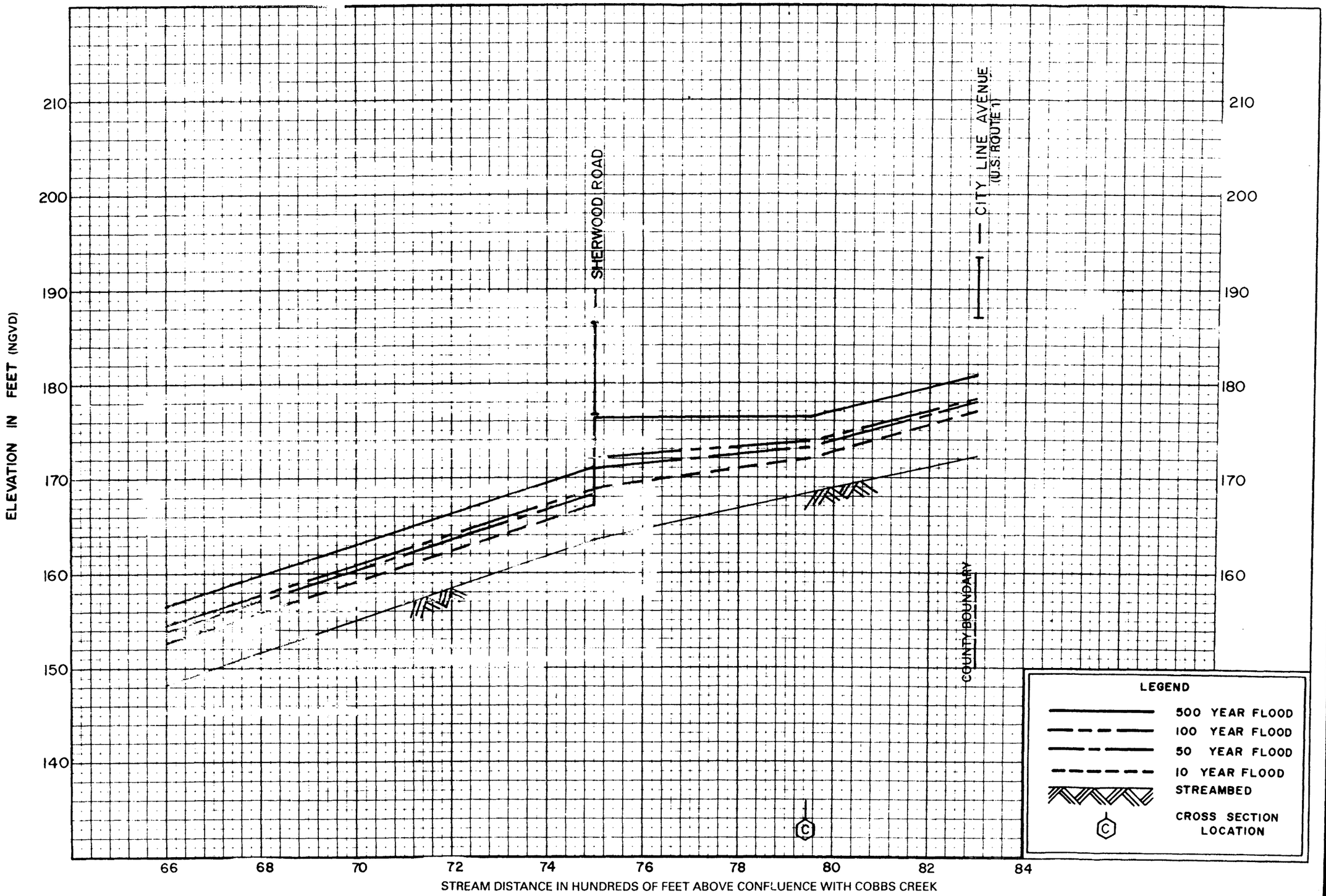
FLOOD PROFILES

INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)



FLOOD PROFILES

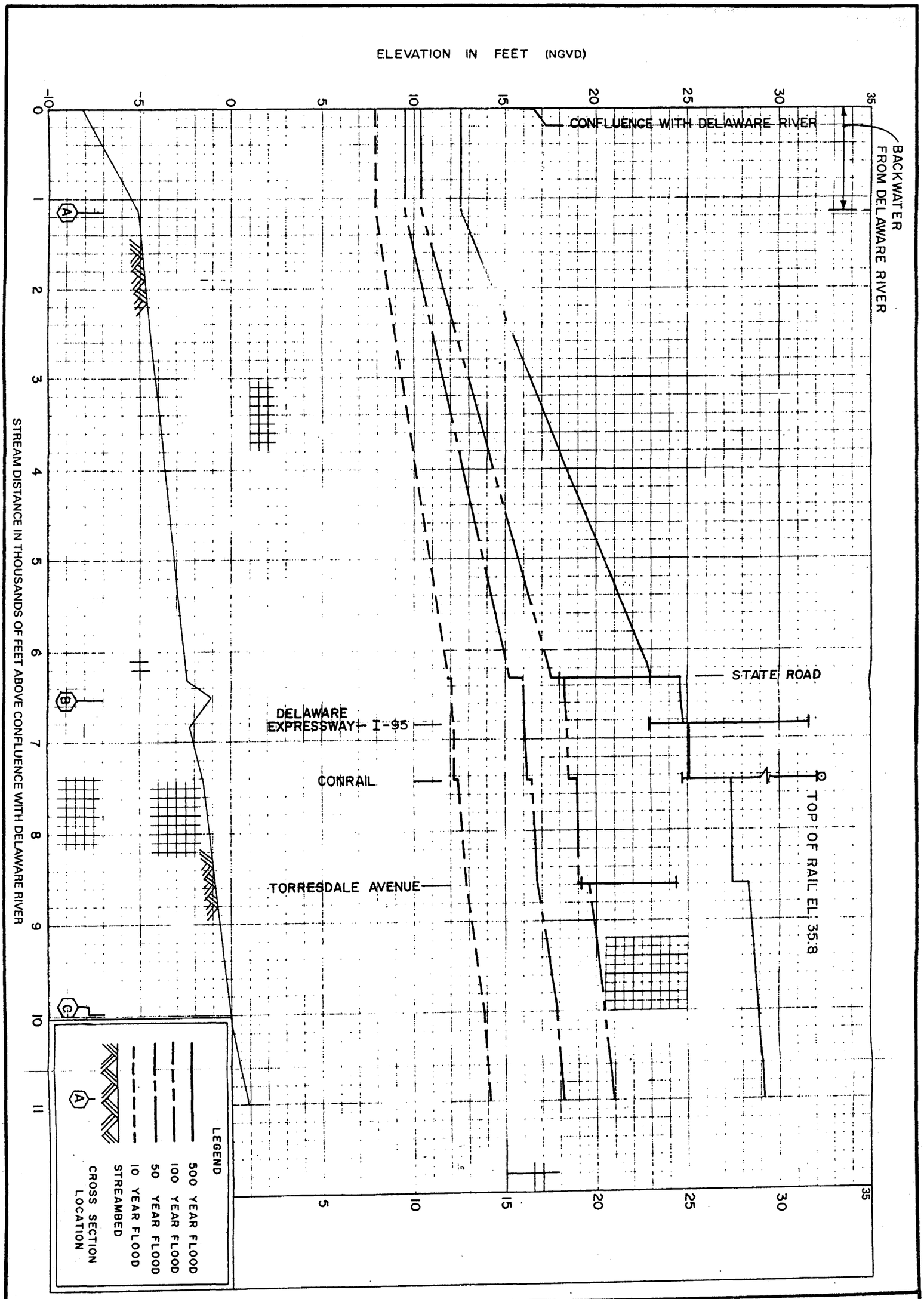
INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

20P



21P

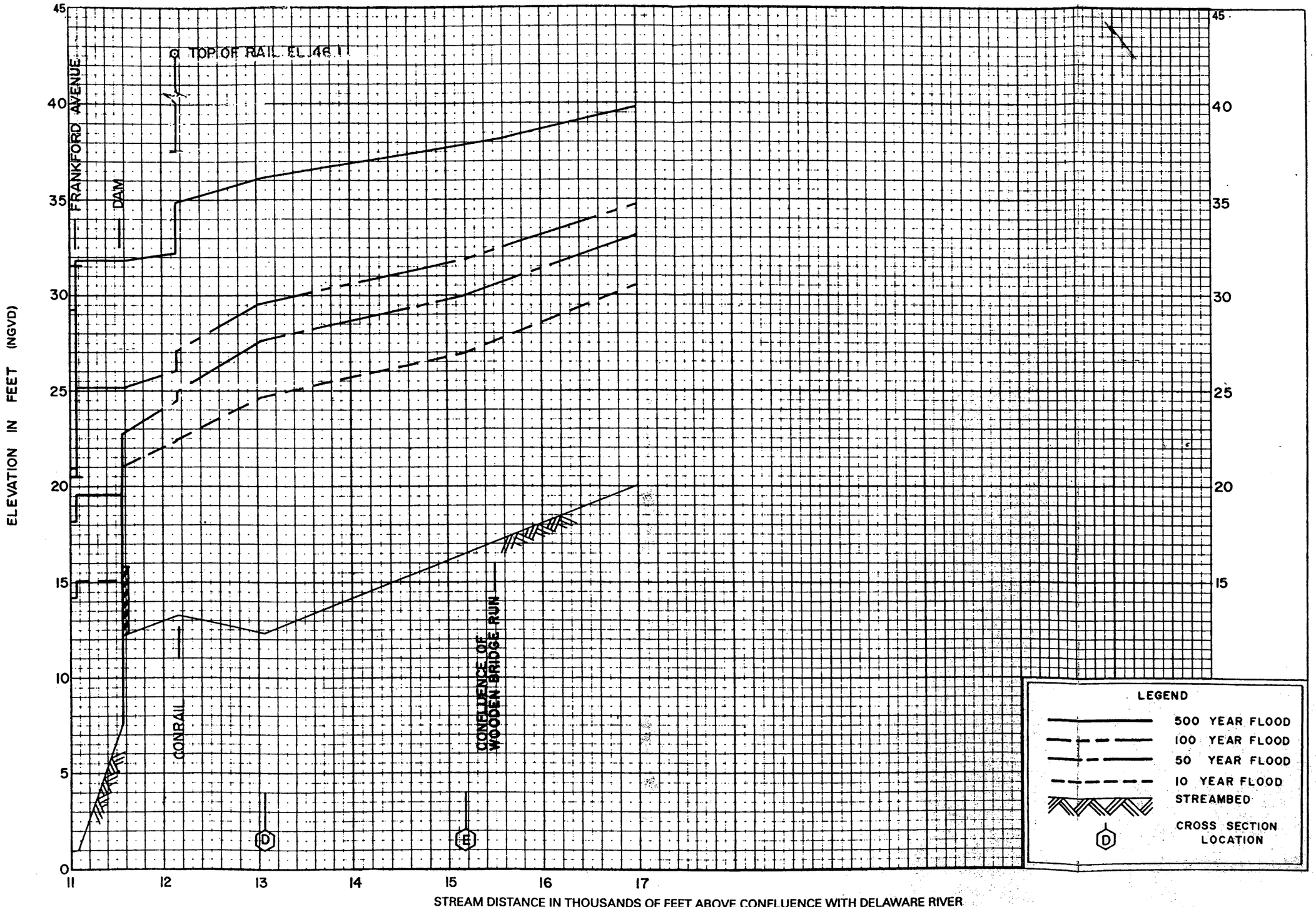
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

PENNYPACK CREEK



FLOOD PROFILES

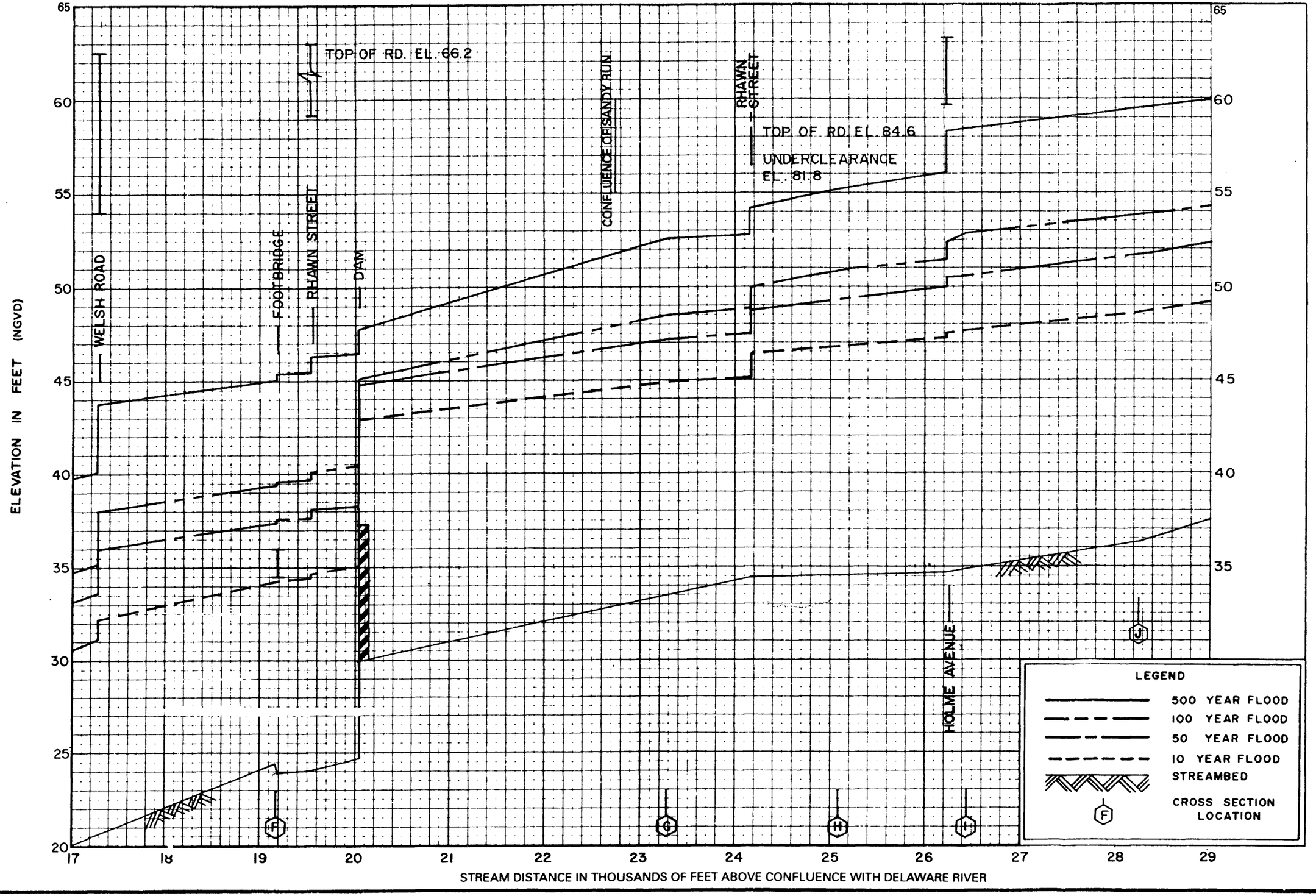
PENNYPACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

22P



FLOOD PROFILES

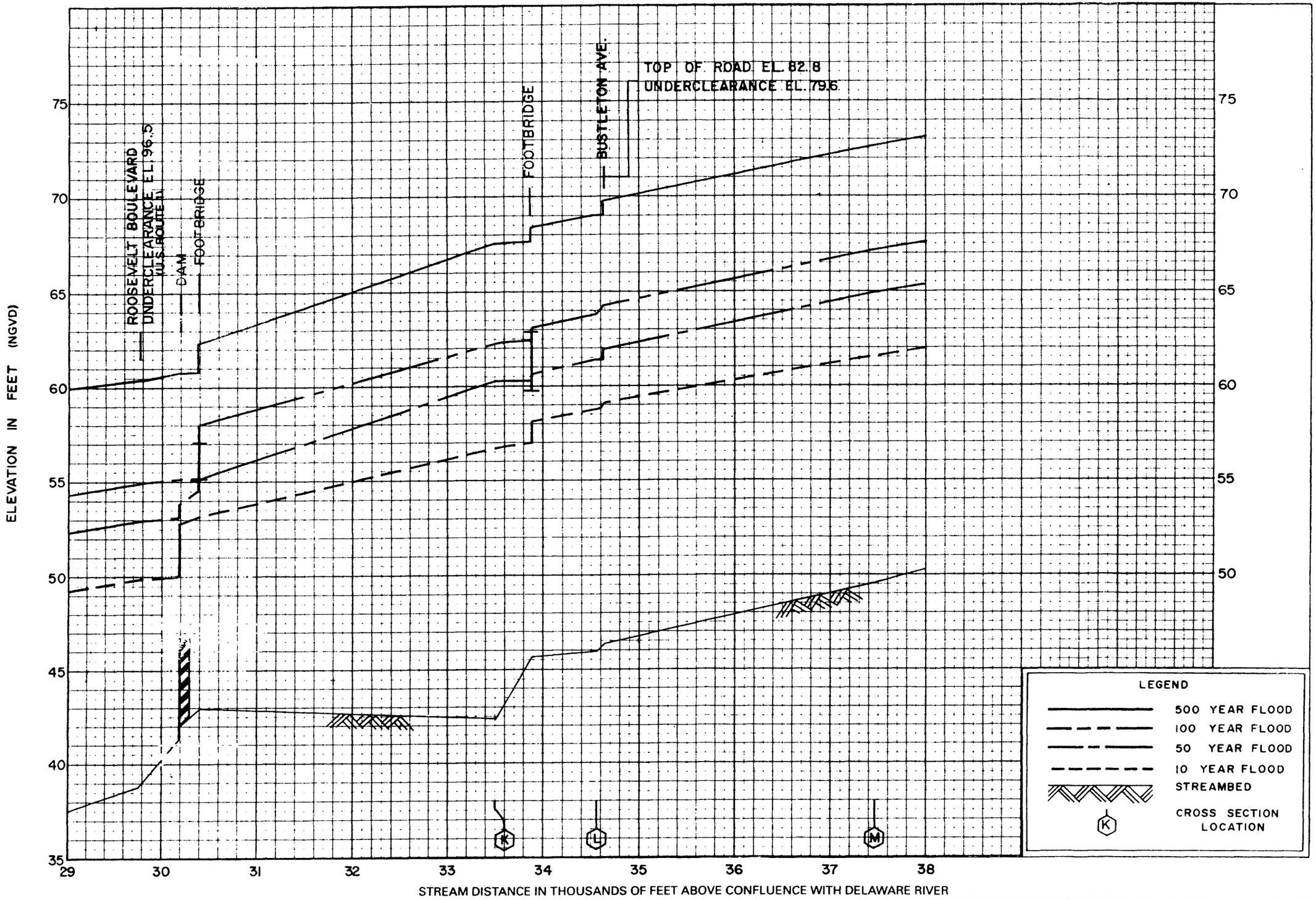
PENNYPACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

23P



FLOOD PROFILES

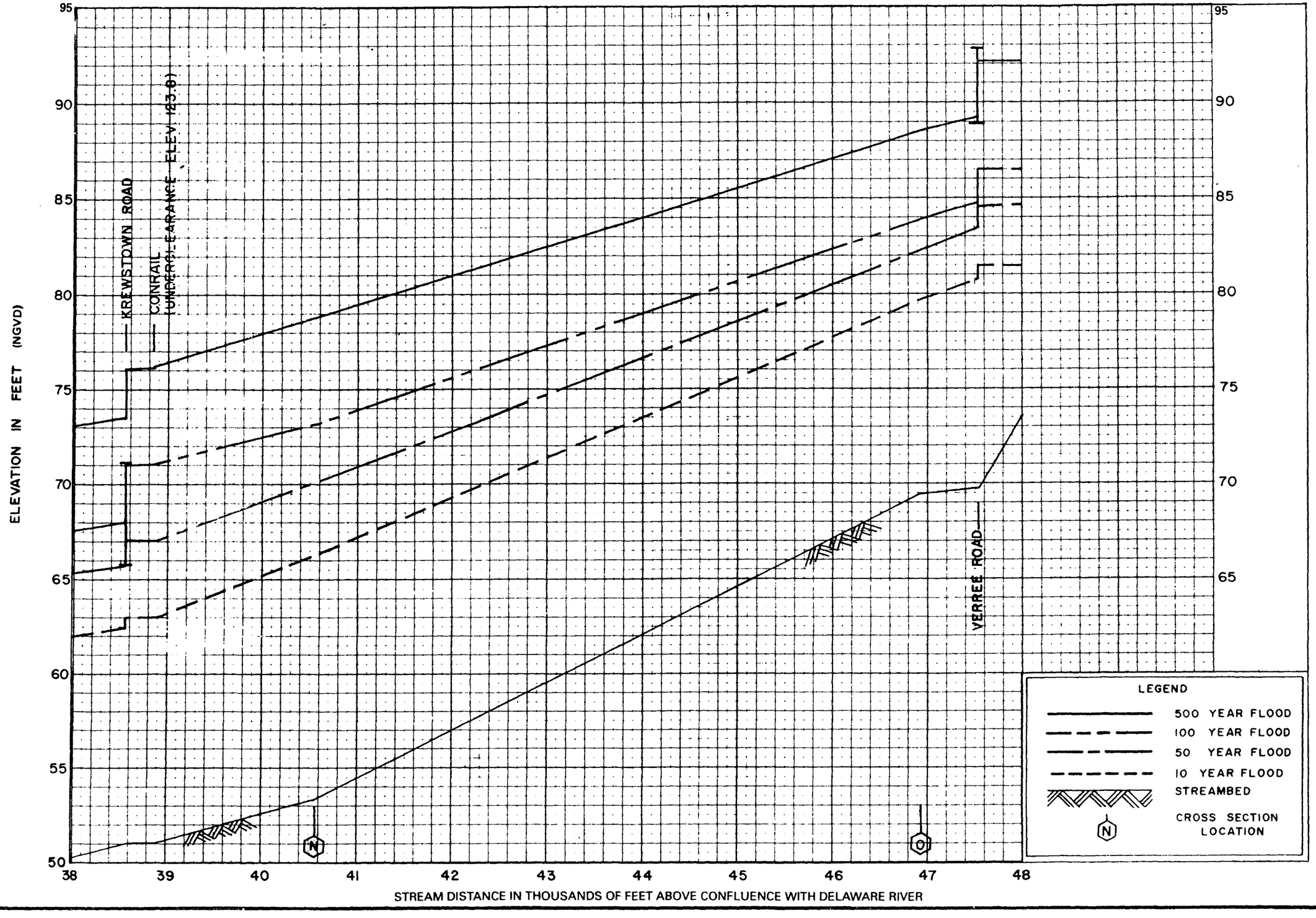
PENNYPACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

24P



FLOOD PROFILES

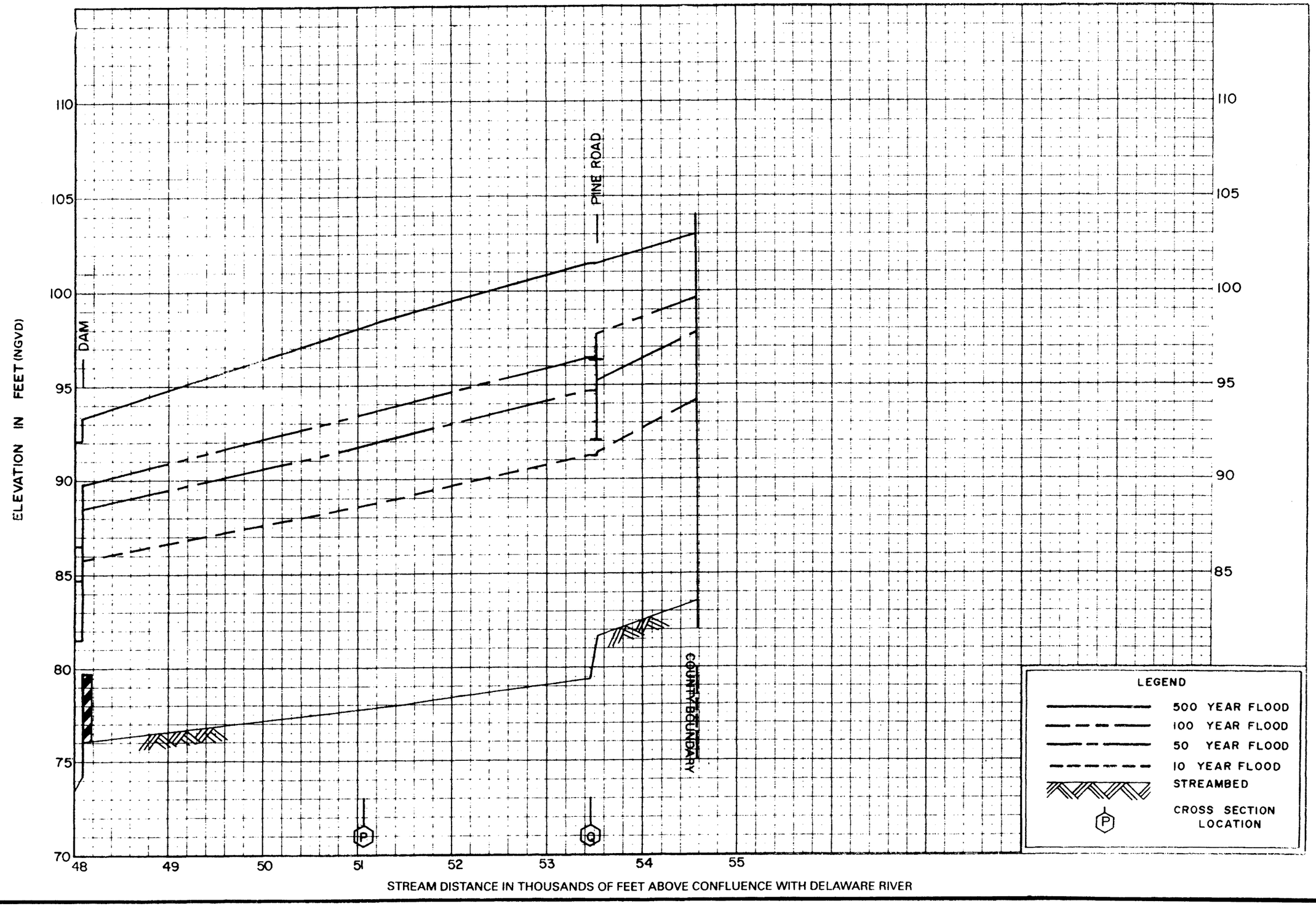
PENNYPACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

25P



FLOOD PROFILES

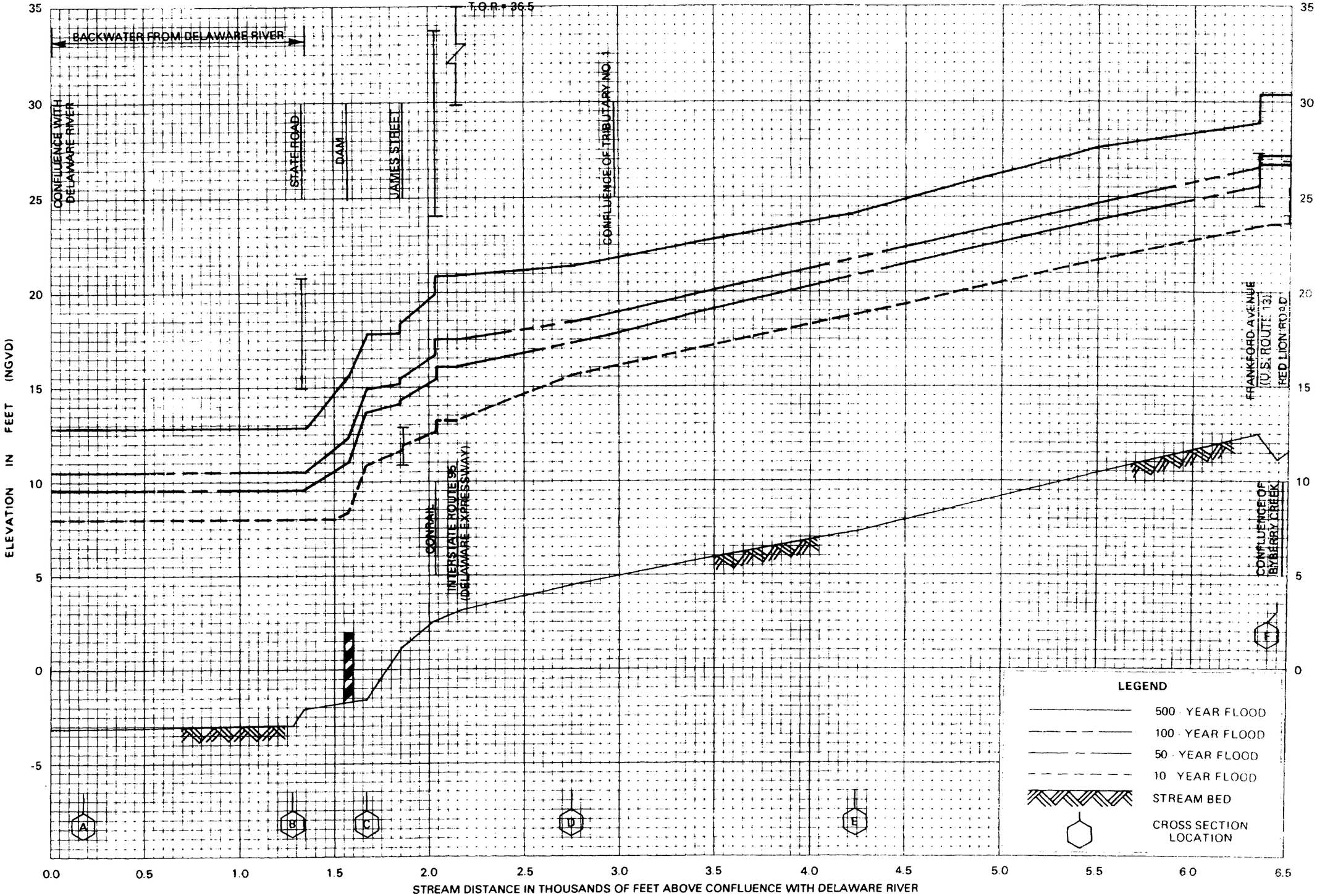
PENNYPACK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

26P



FLOOD PROFILES

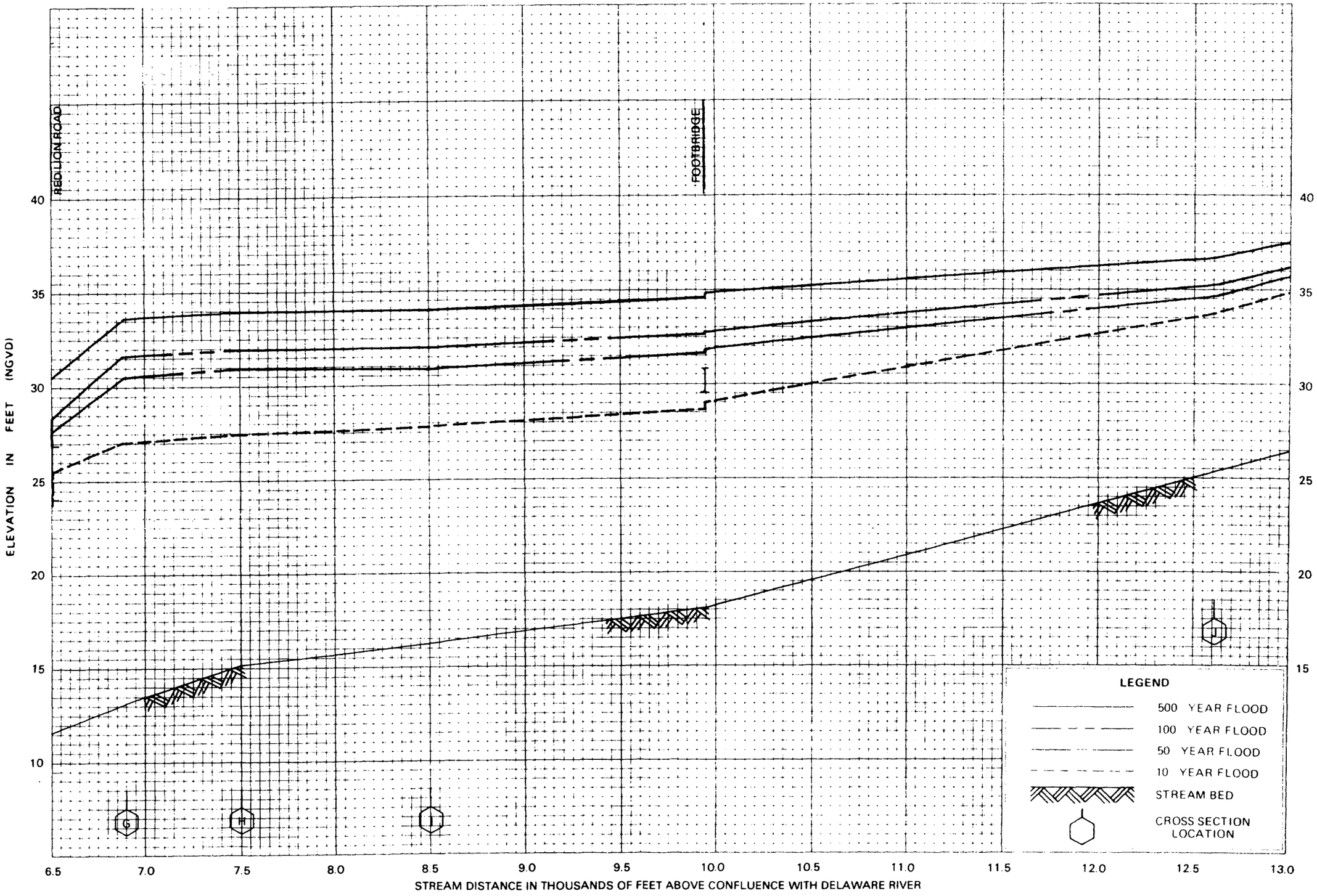
POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

27P



FLOOD PROFILES

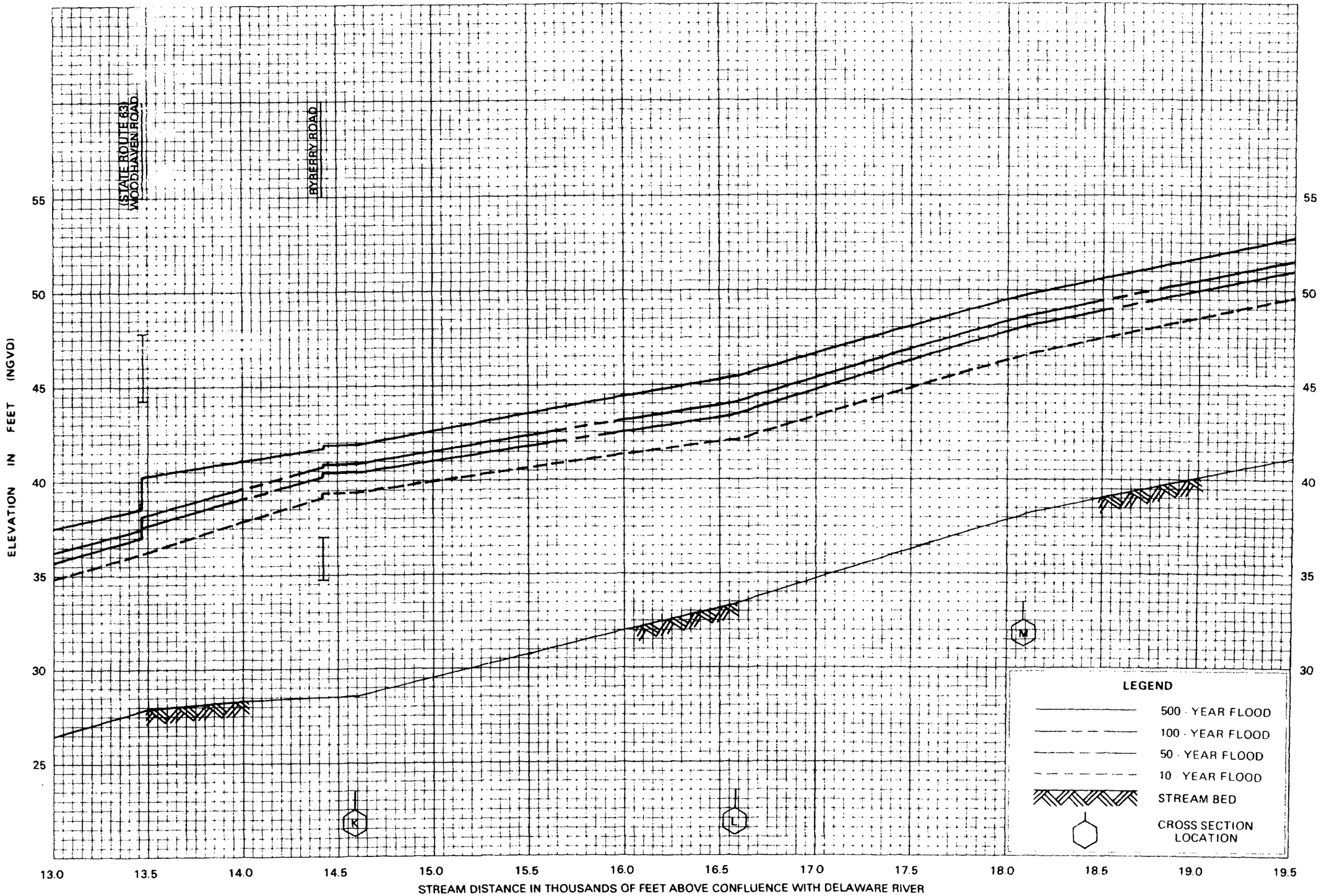
POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

28P



FLOOD PROFILES

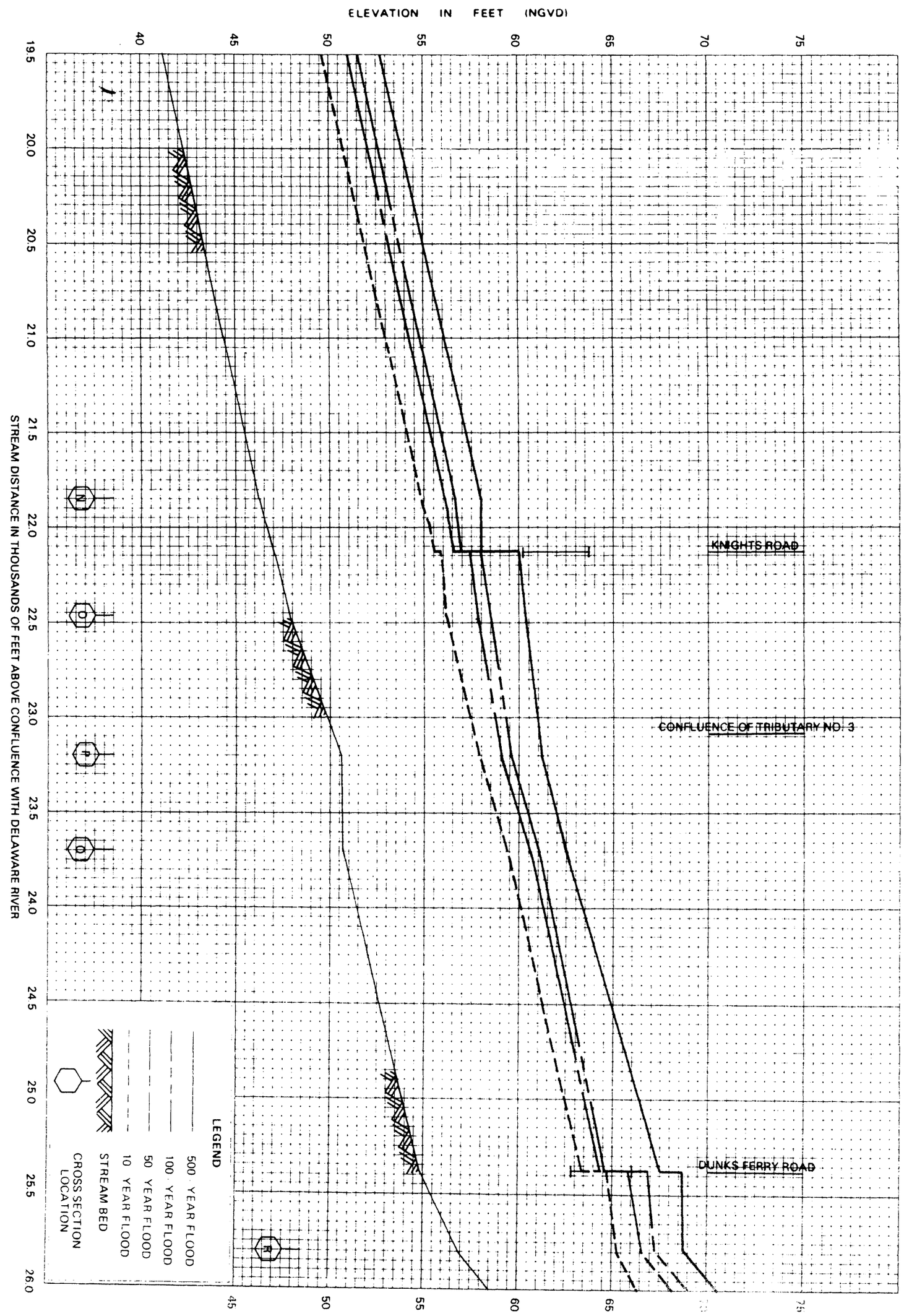
POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

29P



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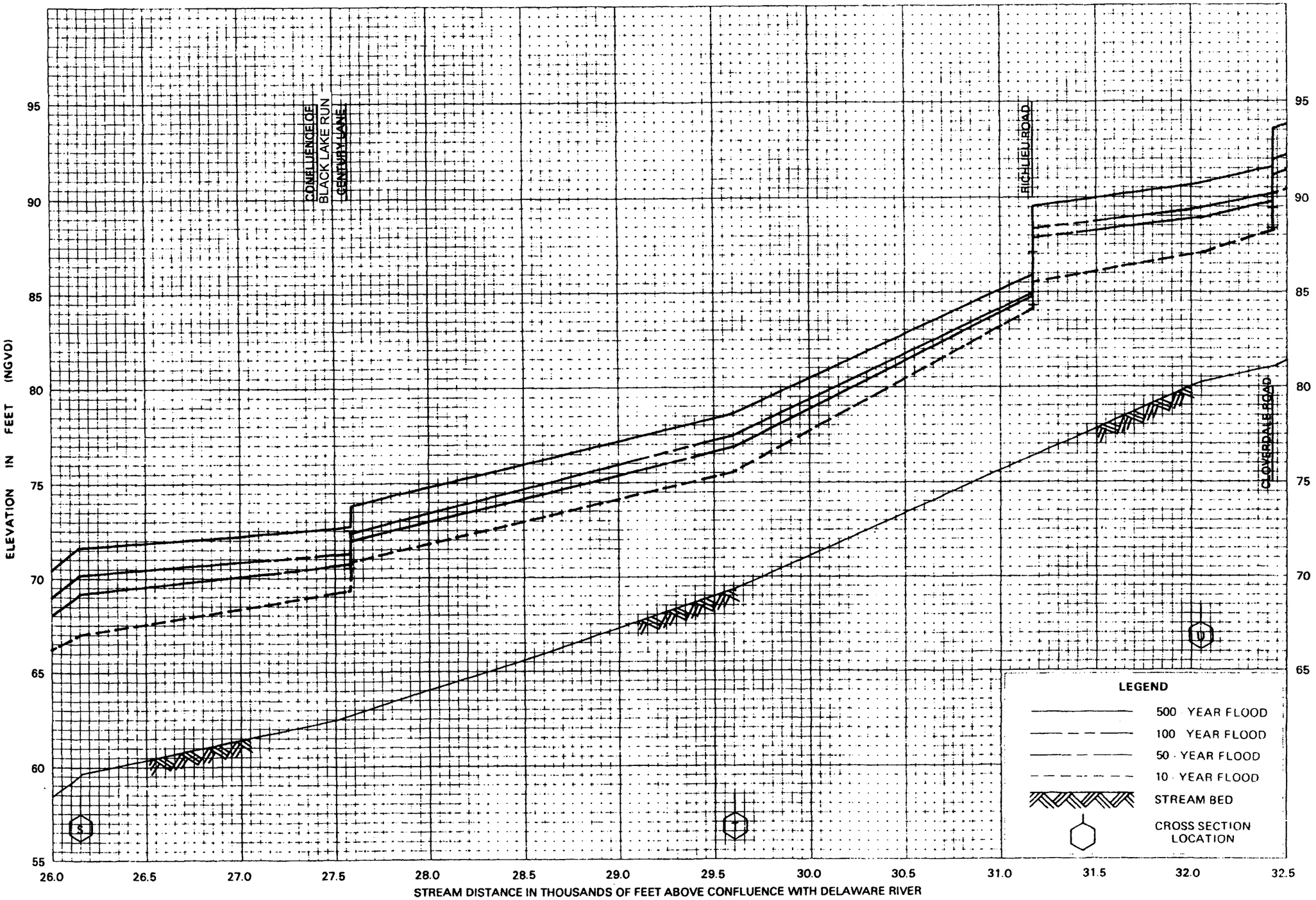
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

POQUESSING CREEK



FLOOD PROFILES

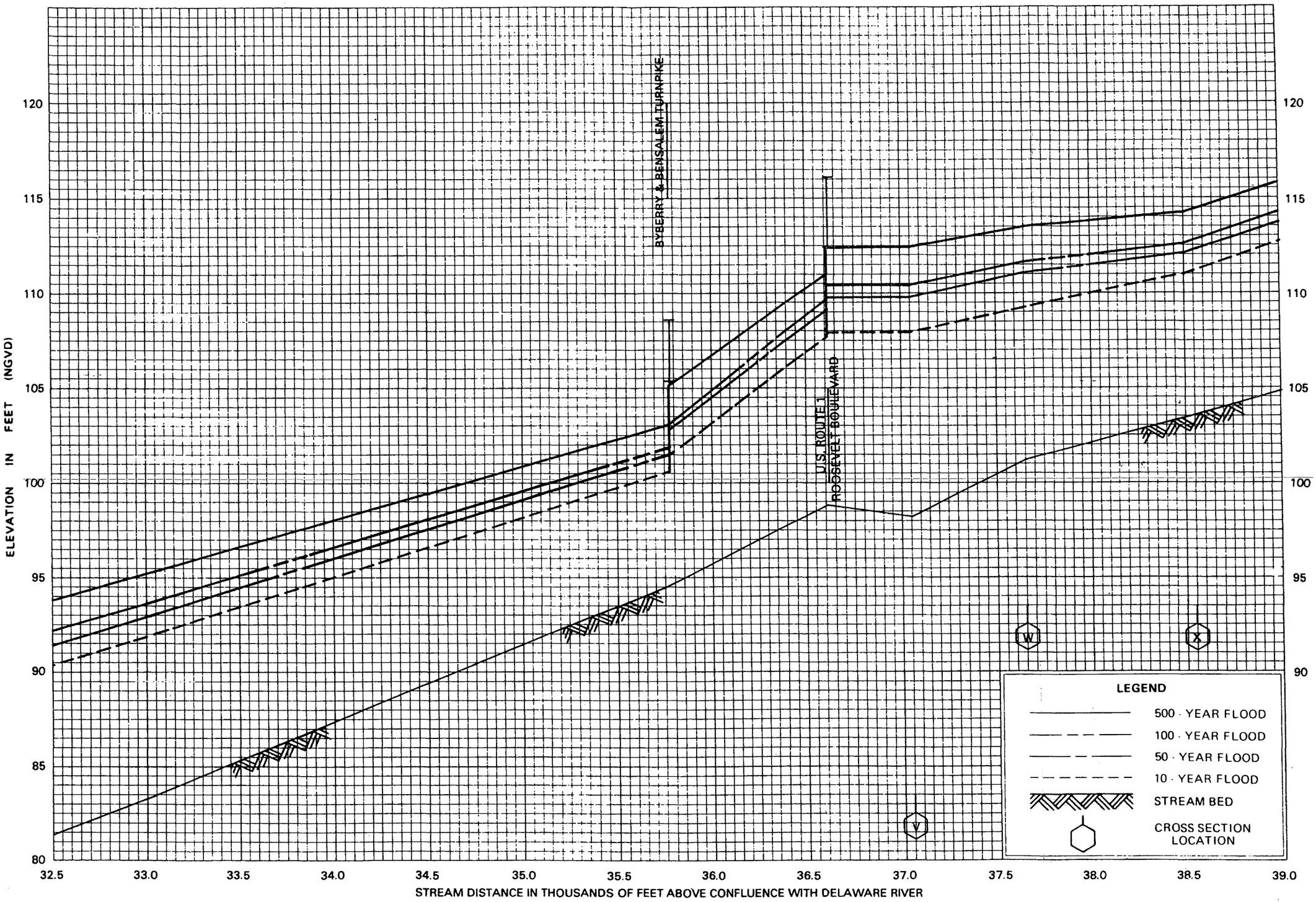
POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

31P



FLOOD PROFILES

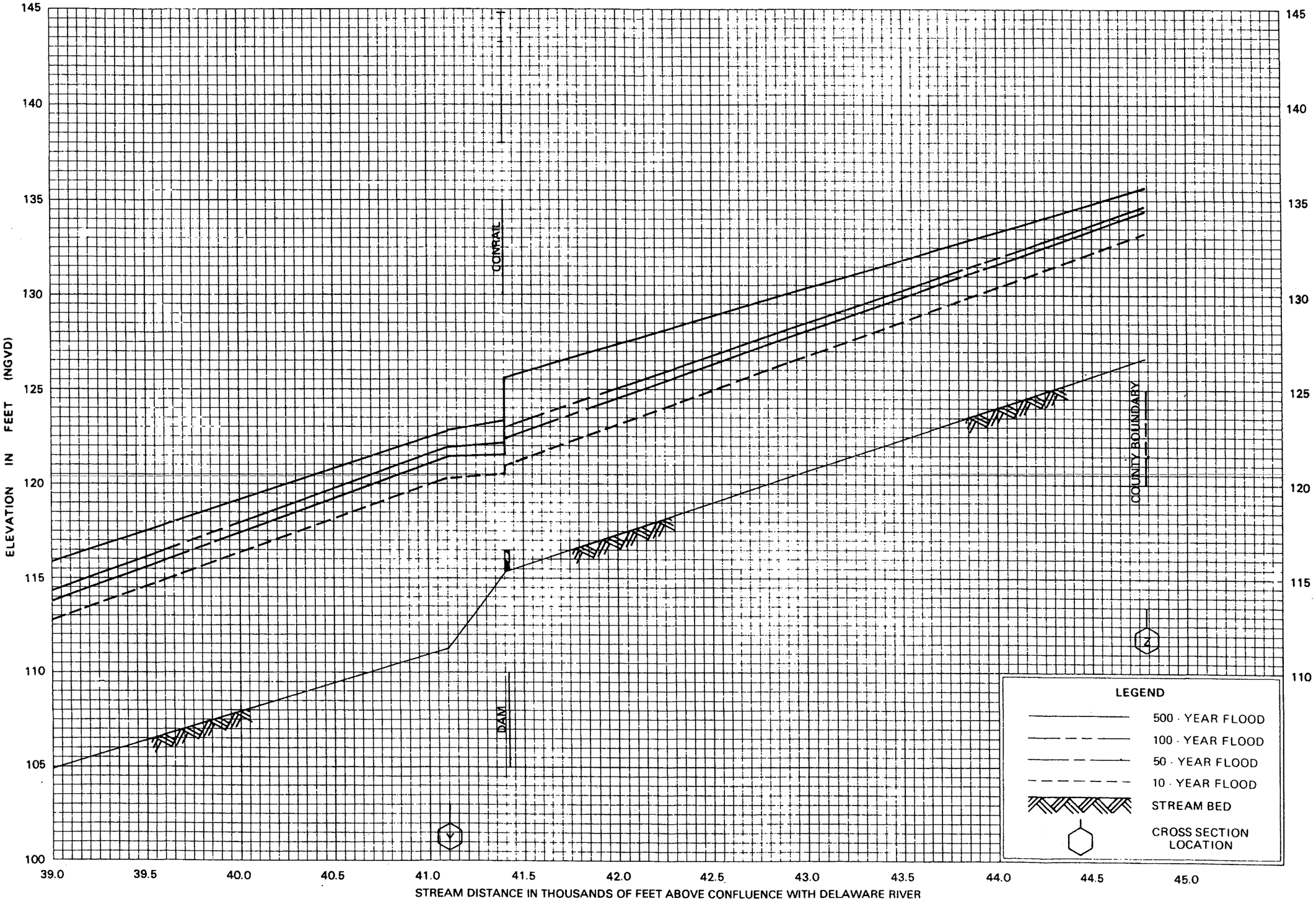
POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

32P



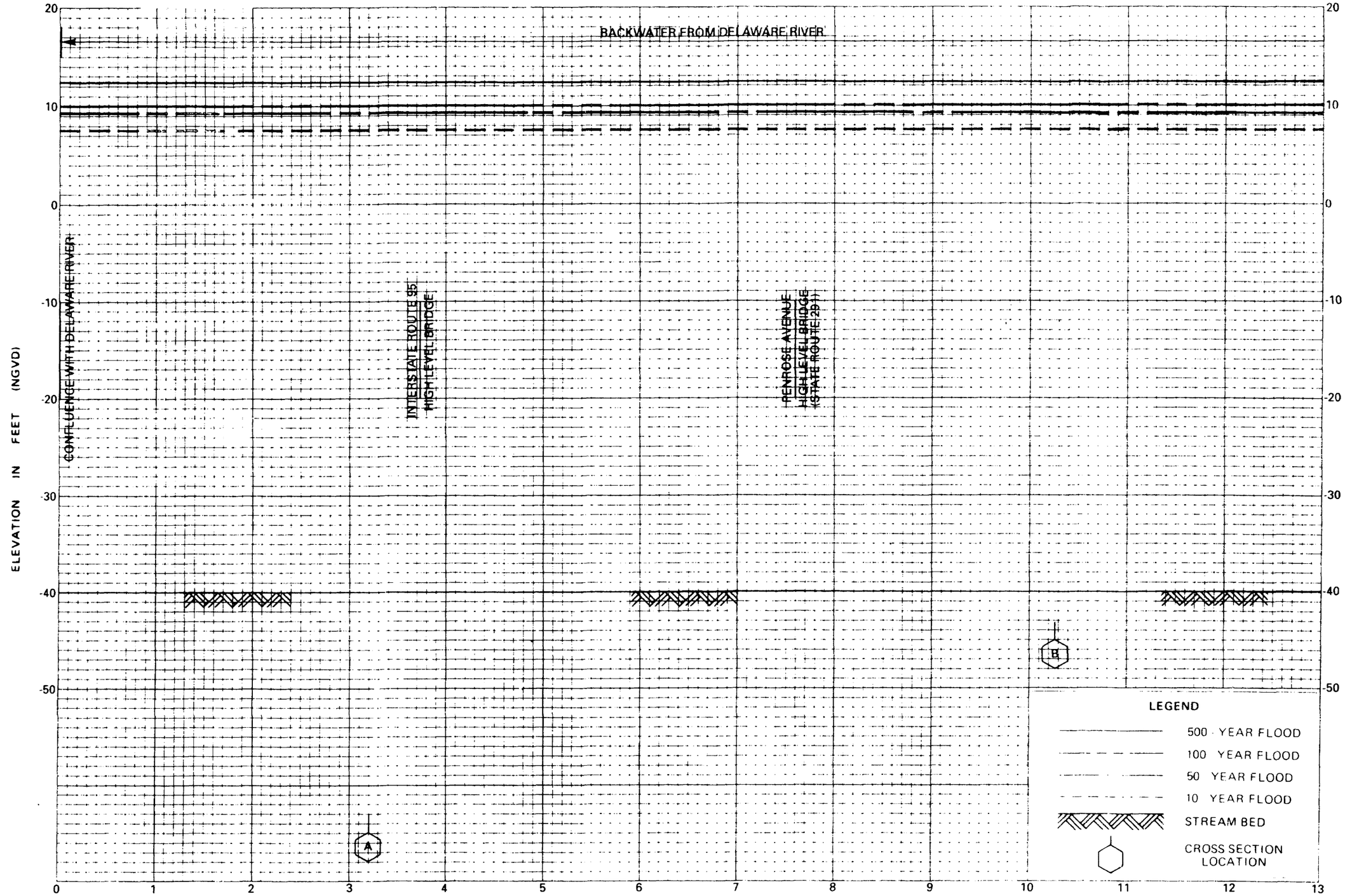
FLOOD PROFILES

POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)



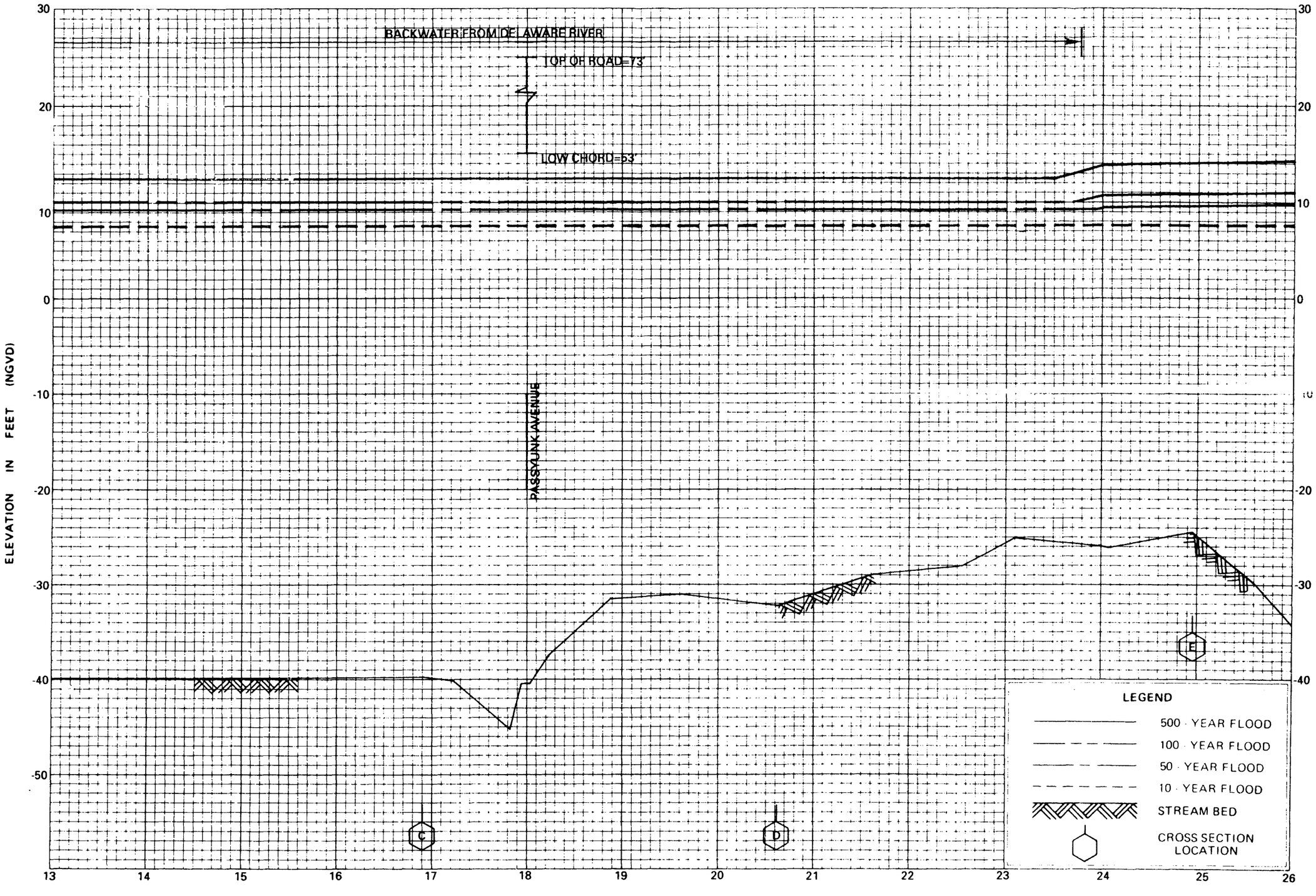
FLOOD PROFILES

SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

34P



FLOOD PROFILES

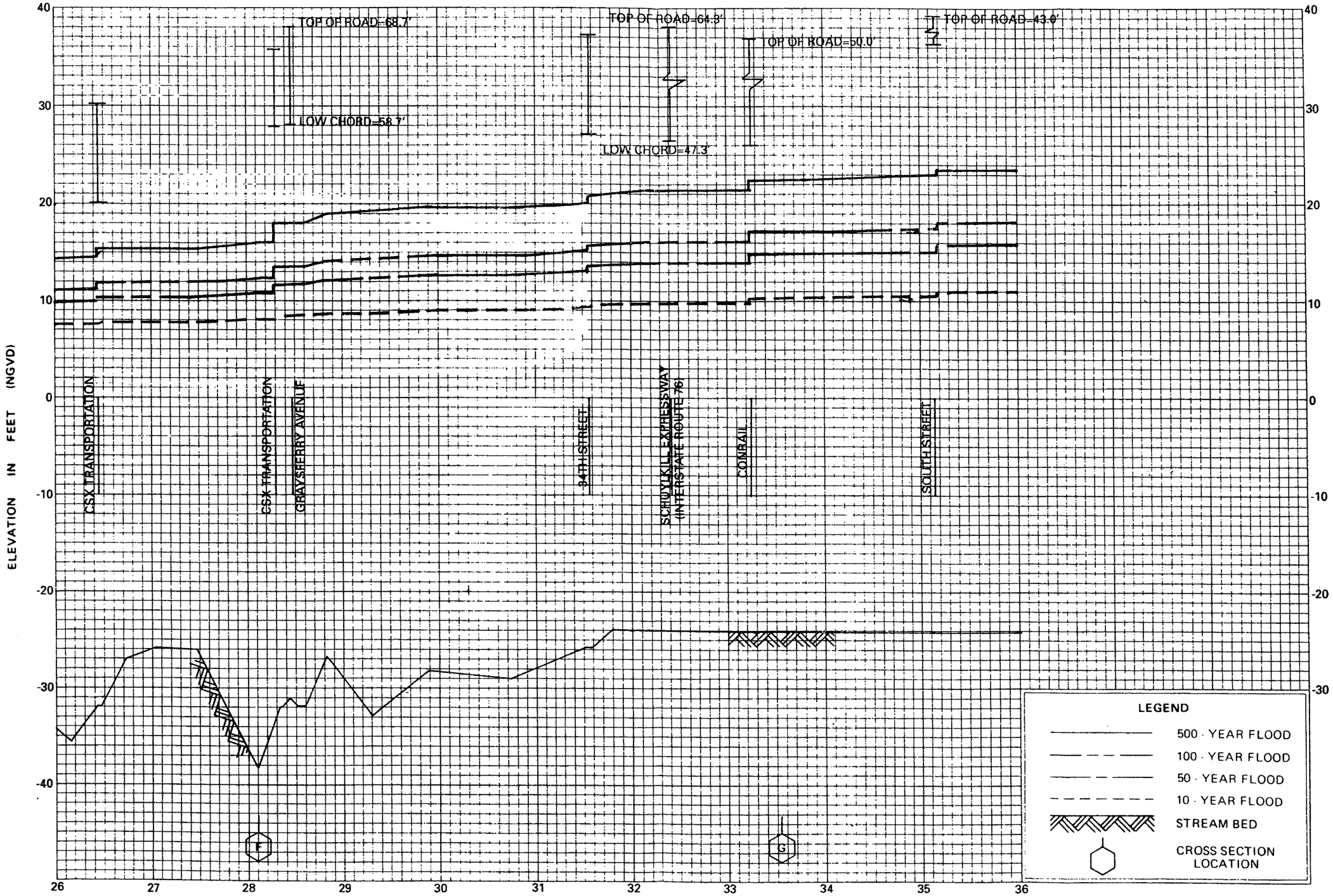
SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

35P



STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH DELAWARE RIVER

FLOOD PROFILES

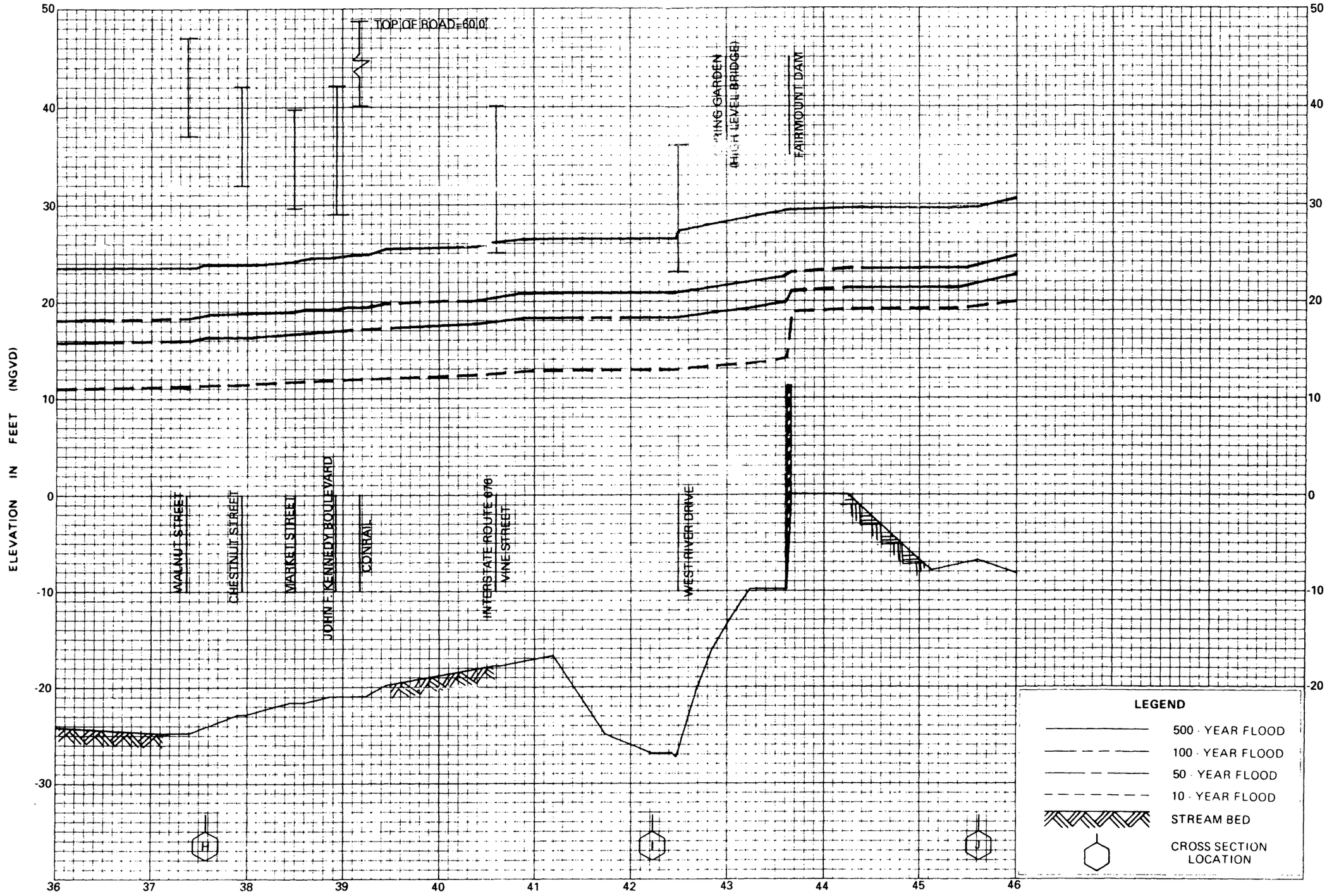
SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

36P



FLOOD PROFILES

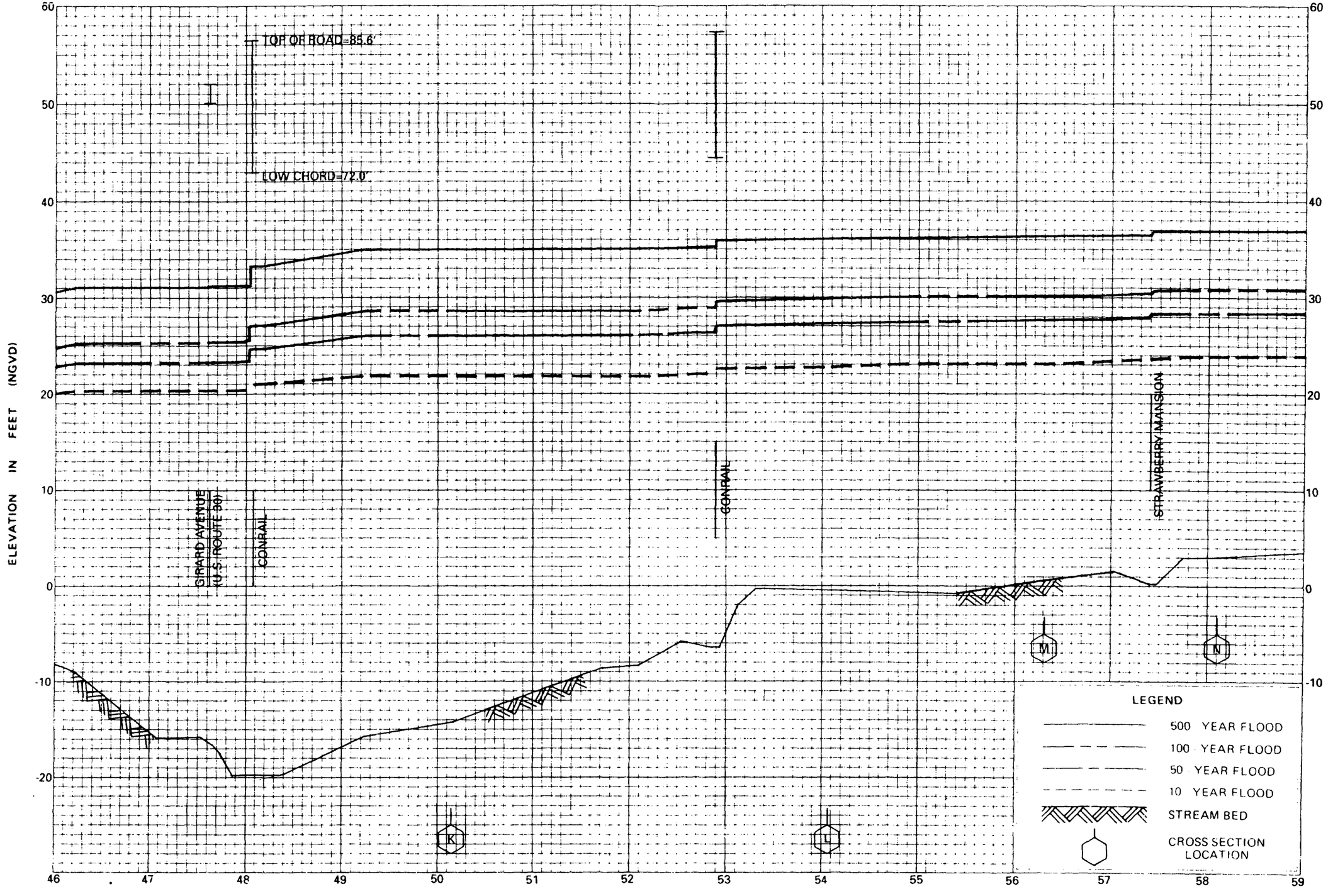
SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

37P



FLOOD PROFILES

SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

38P

ELEVATION IN FEET (NGVD)

60
50
40
30
20
10
0
-10

ROOSEVELT BOULEVARD EXTENSION (HIGH LEVEL BRIDGE, TWIN SPAN)

CONRAIL

FALLS BRIDGE

CITY LINE AVENUE (HIGH LEVEL BRIDGE, TWIN SPAN)

CONFLUENCE OF WISSAHICKON CREEK

CONNELLY CONTAINER RAILROAD BRIDGE

CONRAIL

CONRAIL

Q P Q R S T

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

59 60 61 62 63 64 65 66 67 68 69 70 71 72

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH DELAWARE RIVER

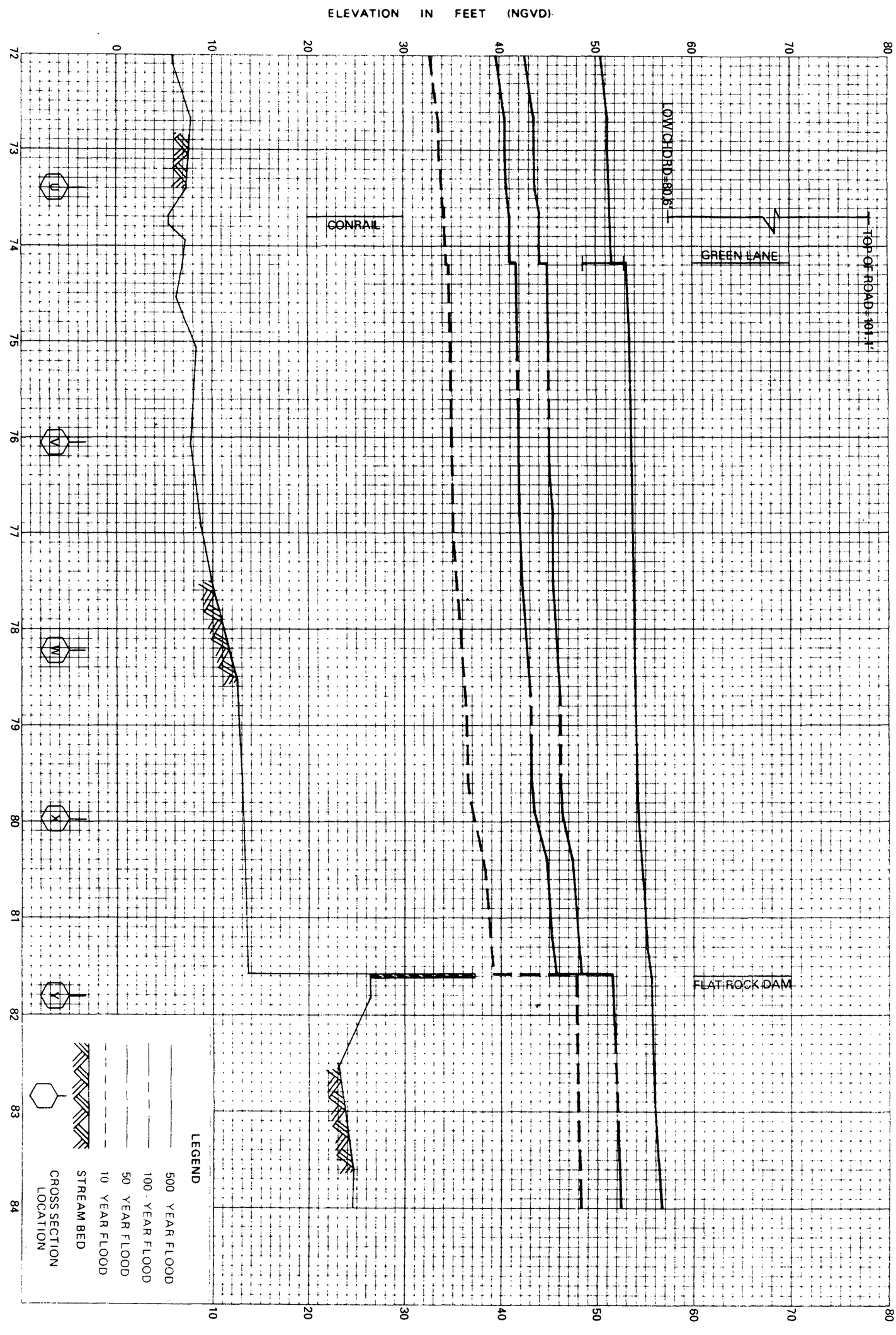
FLOOD PROFILES

SCHUYLKILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

39P



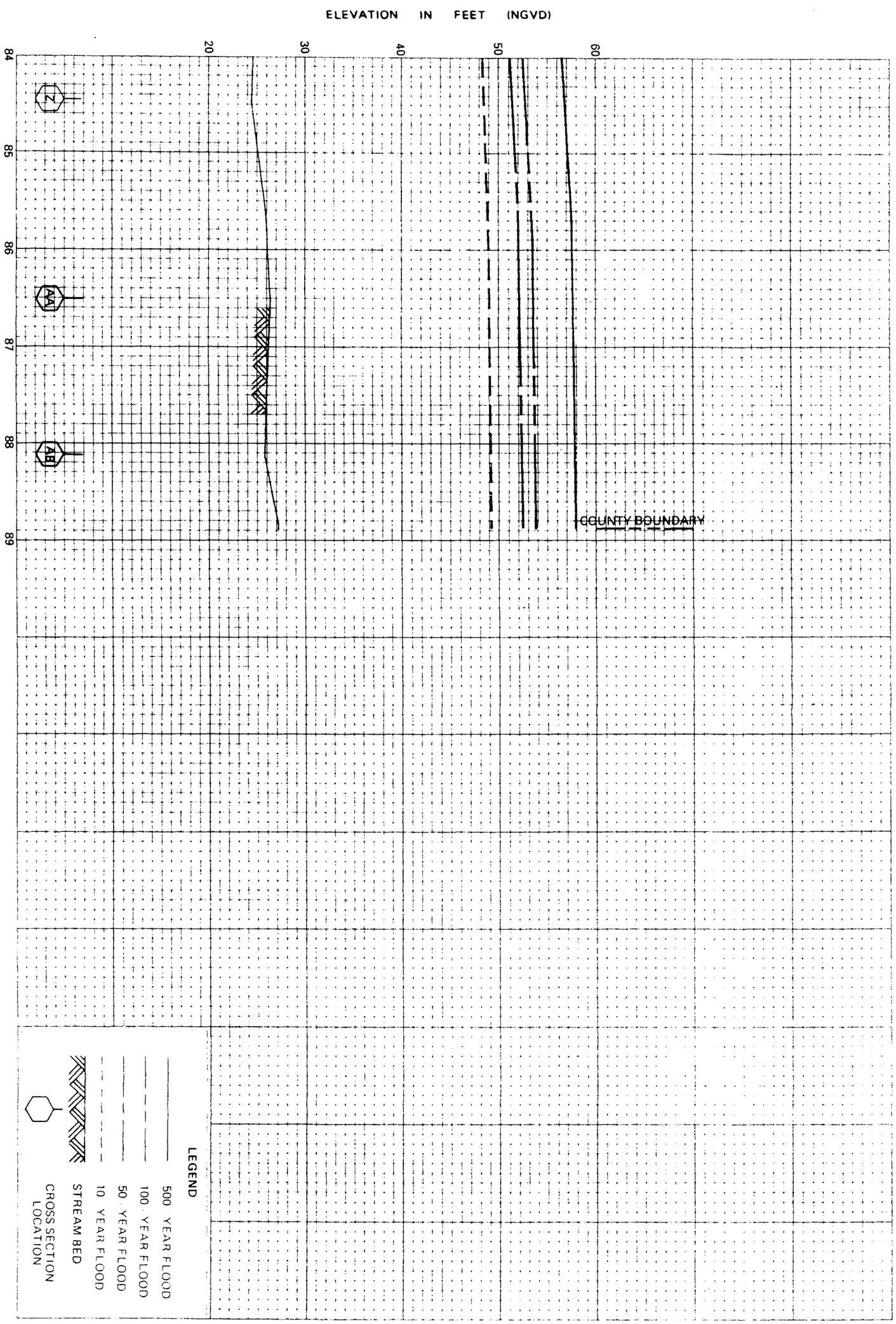
40P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

FLOOD PROFILES

SCHUYLKILL RIVER

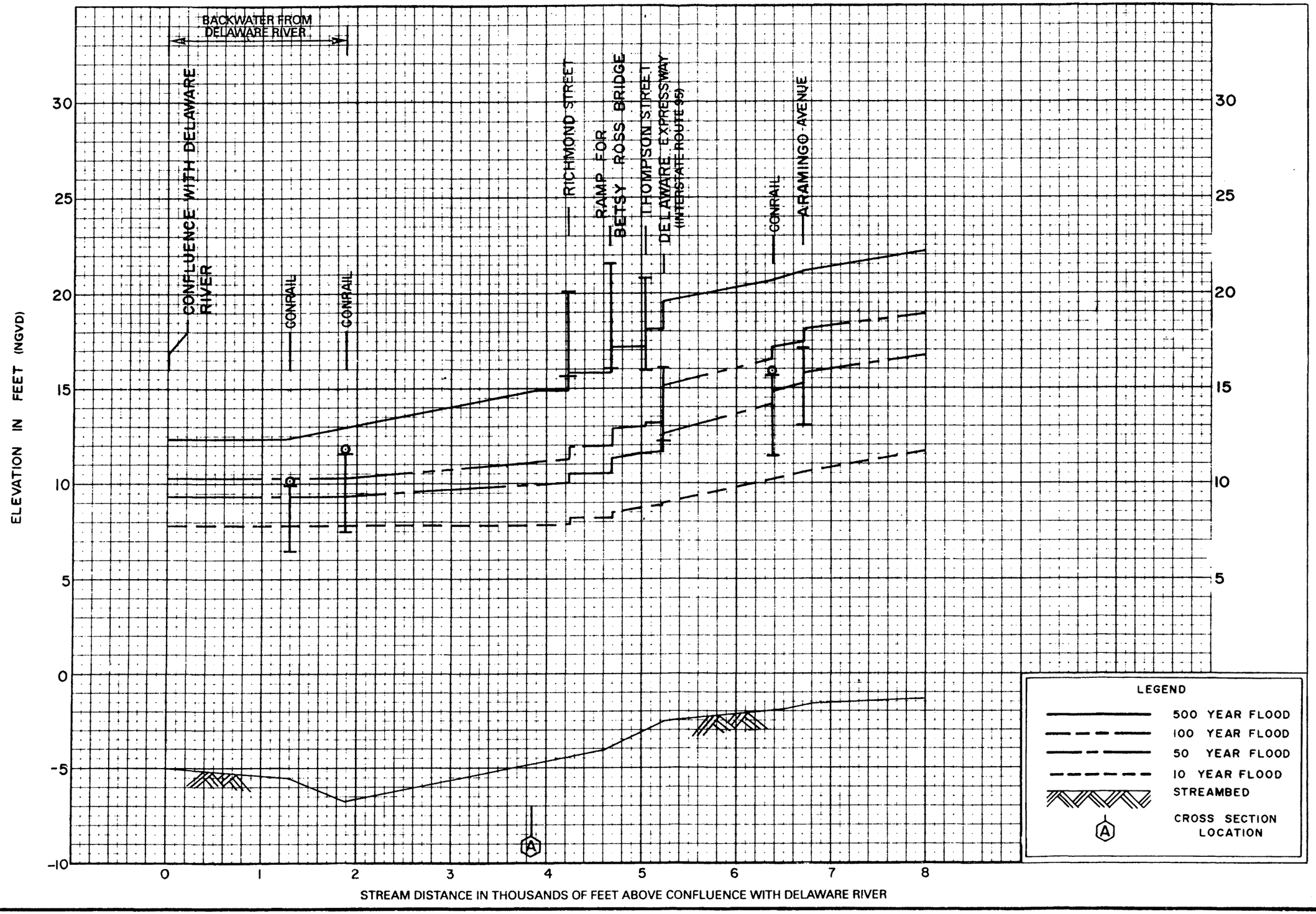


FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

FLOOD PROFILES

SCHUYLKILL RIVER



FLOOD PROFILES

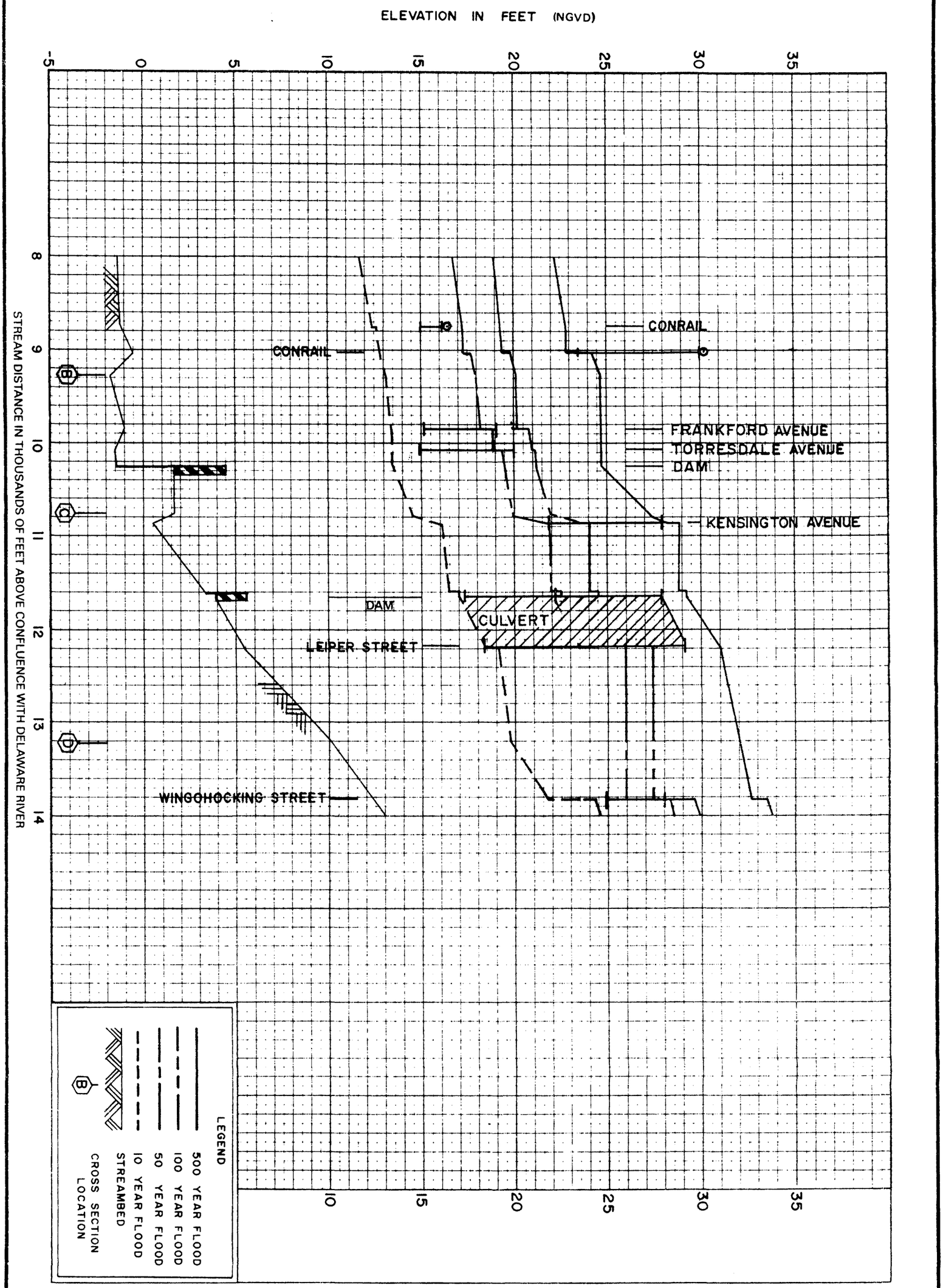
TACONY FRANKFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

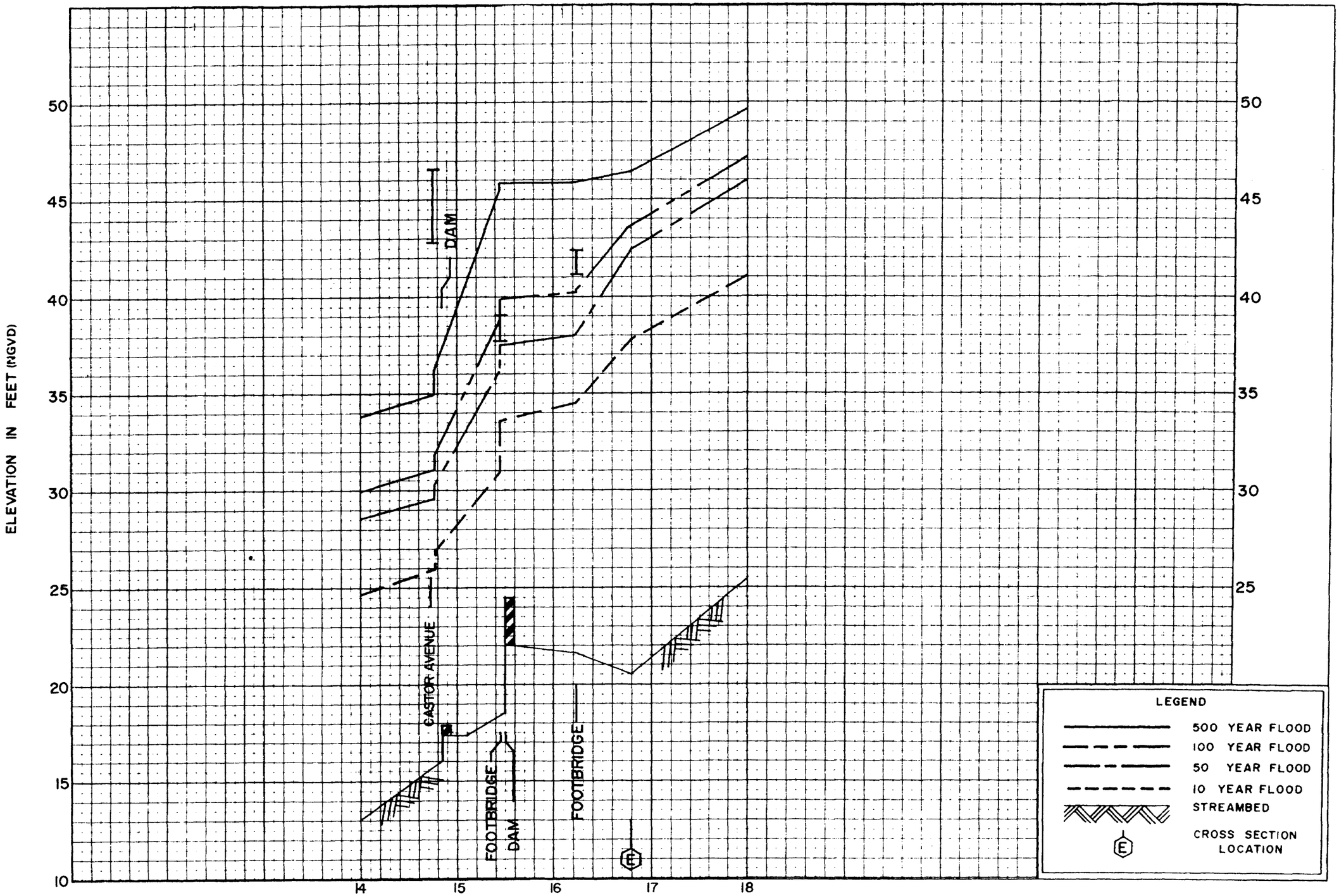
CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

42P



43P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF PHILADELPHIA, PA (PHILADELPHIA CO.)	FLOOD PROFILES TACONY FRANKFORD CREEK

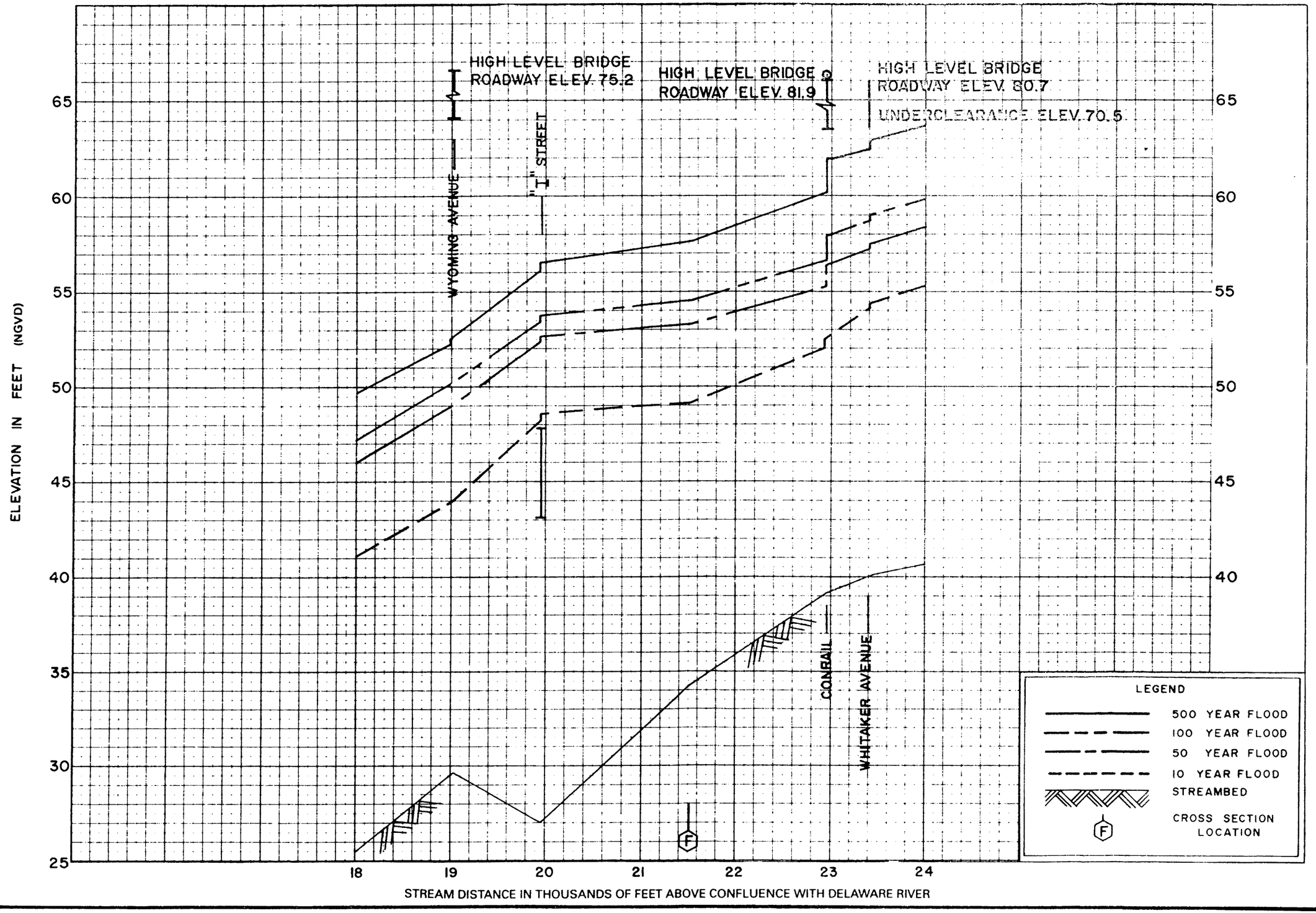


FLOOD PROFILES

TACONY FRANKFORD CREEK

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

44P



FLOOD PROFILES

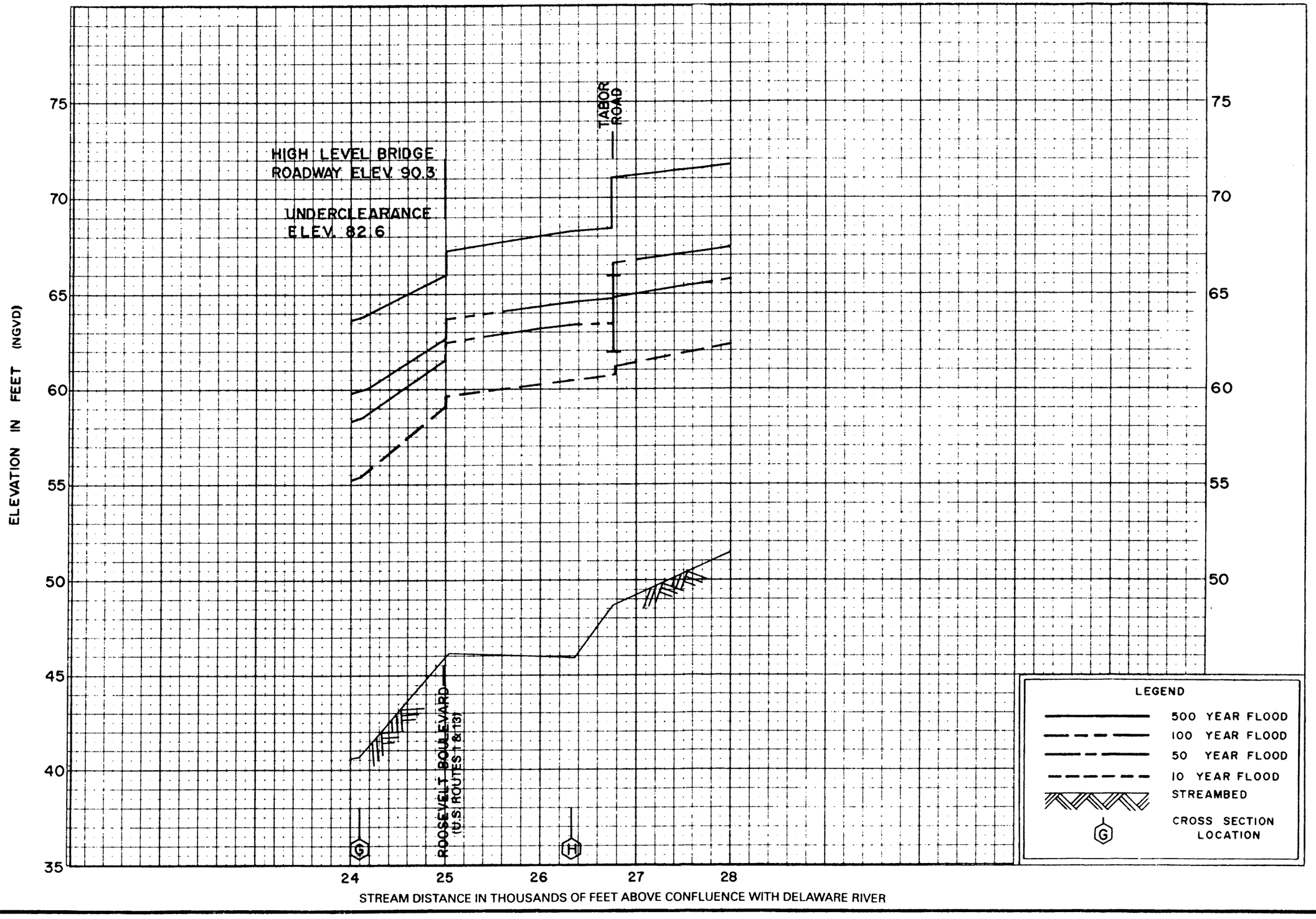
TACONY FRANKFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

45P



FLOOD PROFILES

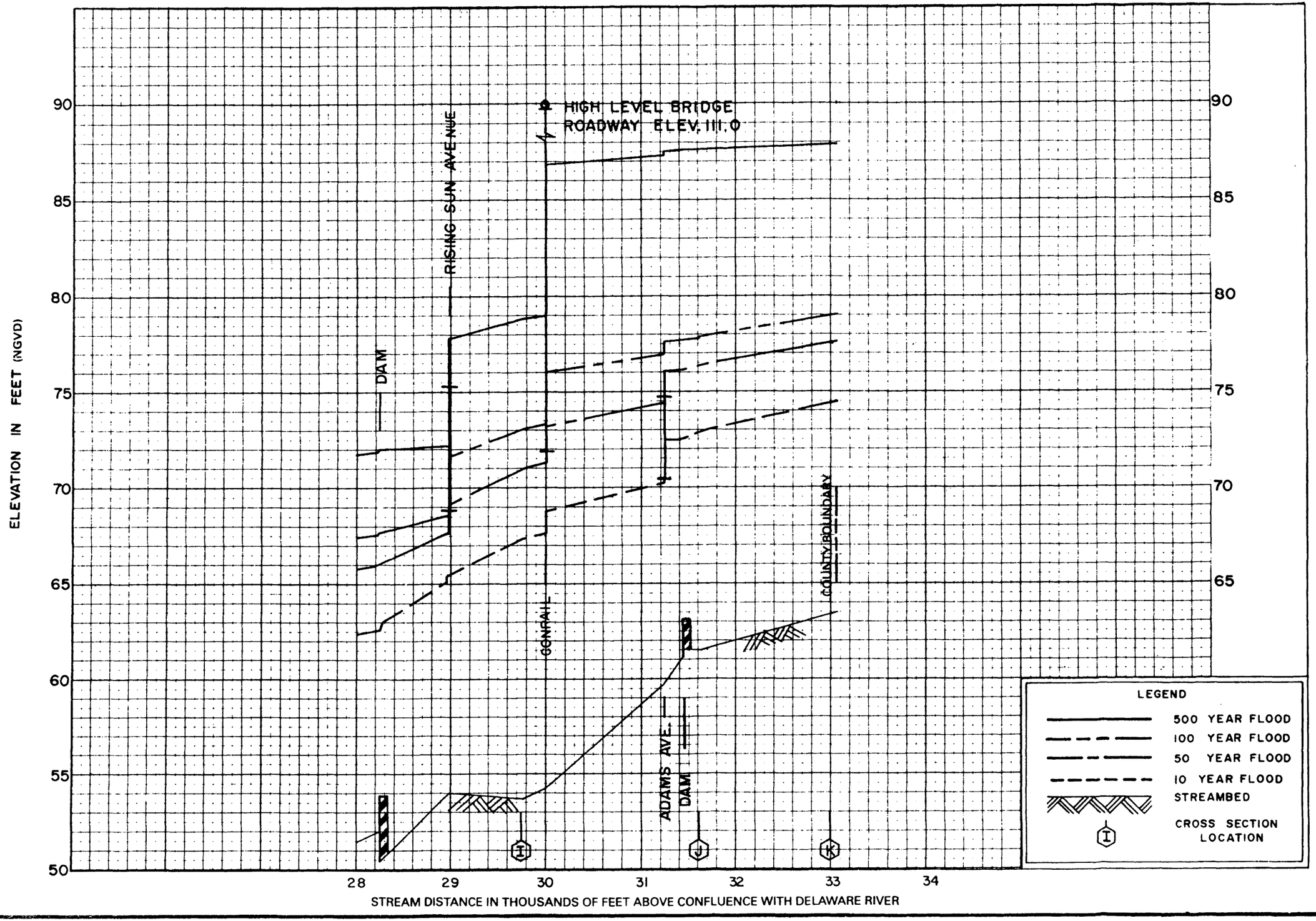
TACONY FRANKFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

46P



FLOOD PROFILES

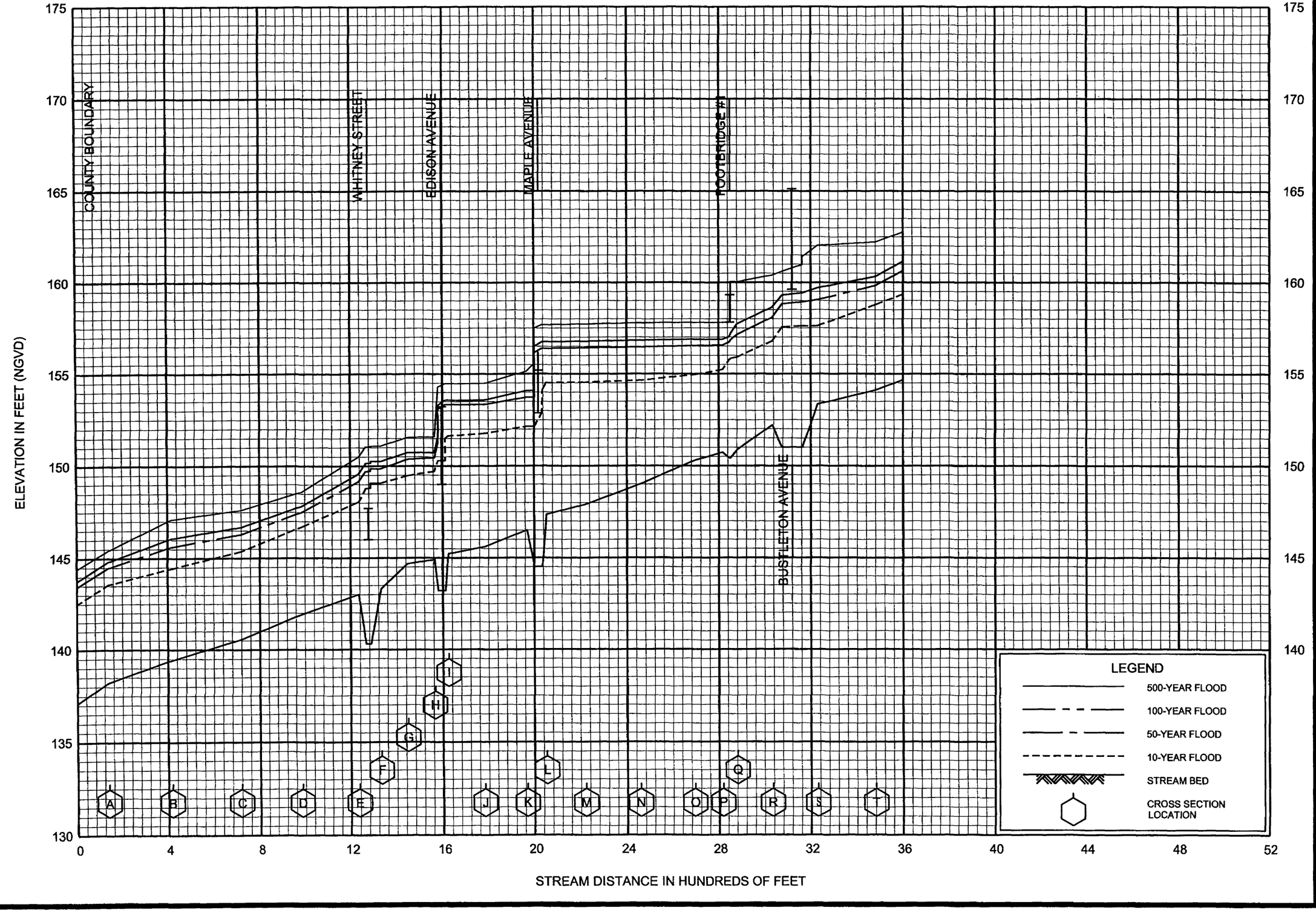
TACONY FRANKFORD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

47P



FLOOD PROFILES

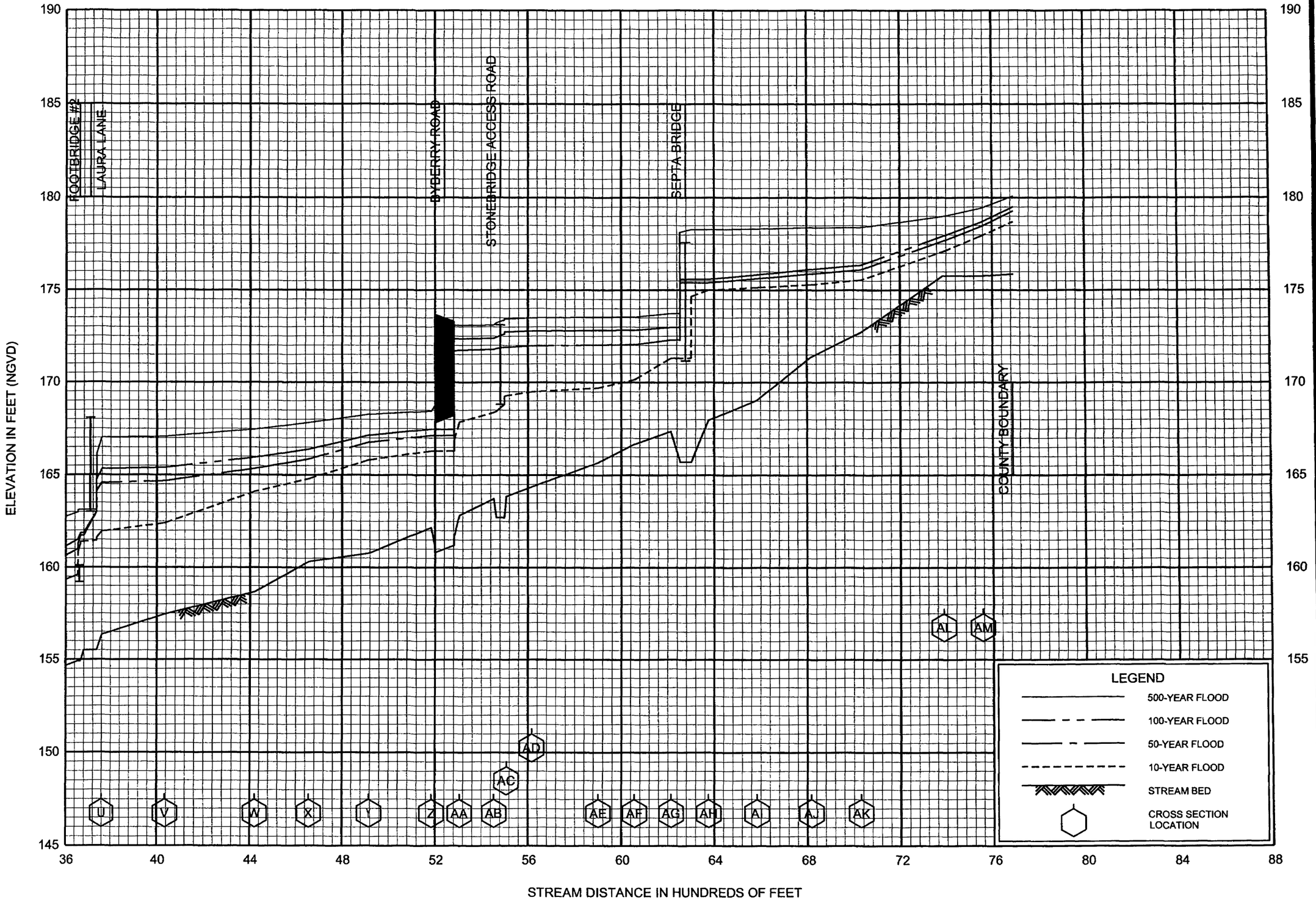
TRIBUTARY TO POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PHILADELPHIA, PA

PHILADELPHIA

47P(a)



FLOOD PROFILES

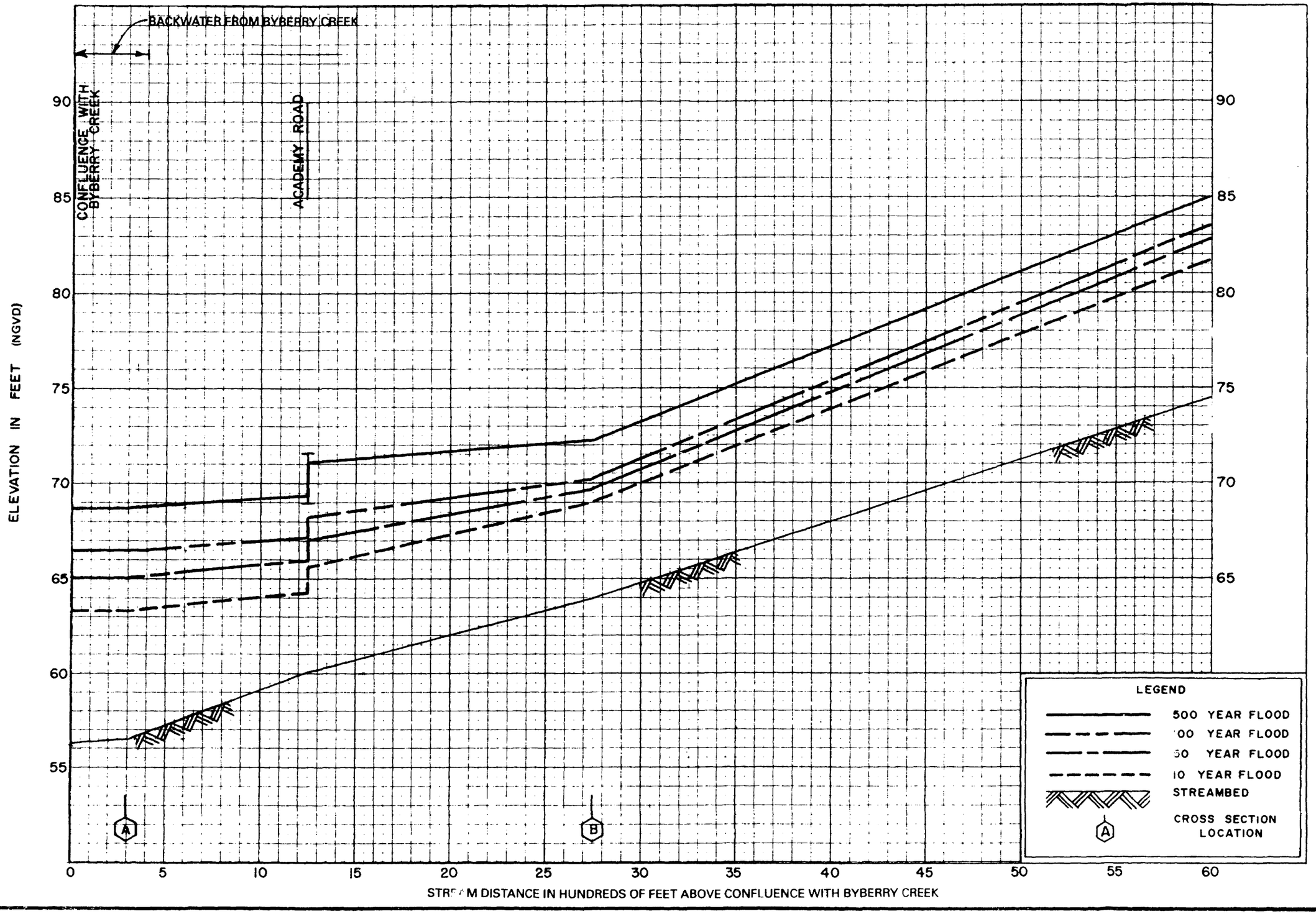
TRIBUTARY TO POQUESSING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PHILADELPHIA, PA

PHILADELPHIA

47P(b)



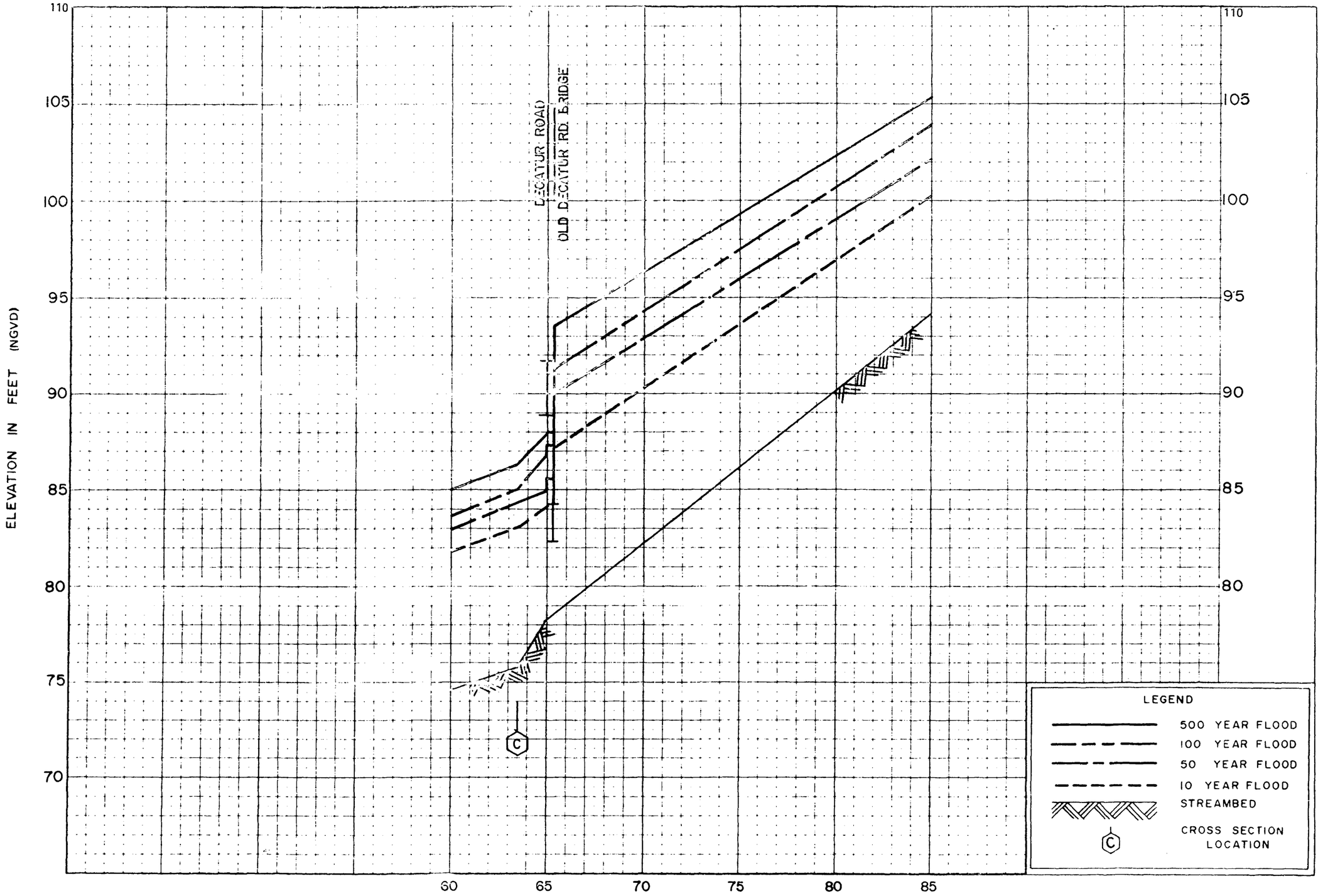
FLOOD PROFILES

WALTON RUN
(Byberry Tributary)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

48P



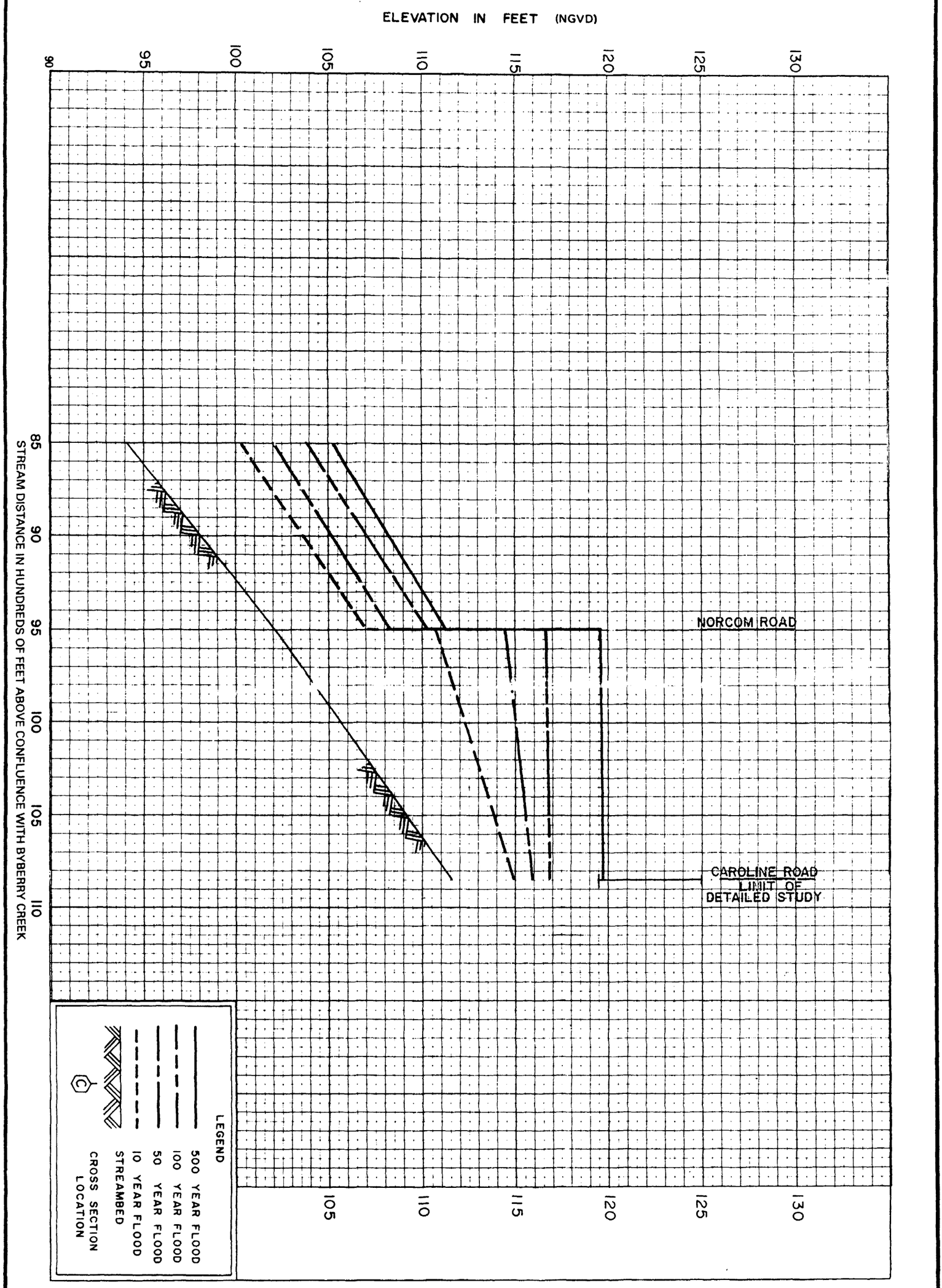
FLOOD PROFILES

WALTON RUN
(Byberry Tributary)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA
(PHILADELPHIA CO.)

49P



50P

FEDERAL EMERGENCY MANAGEMENT AGENCY

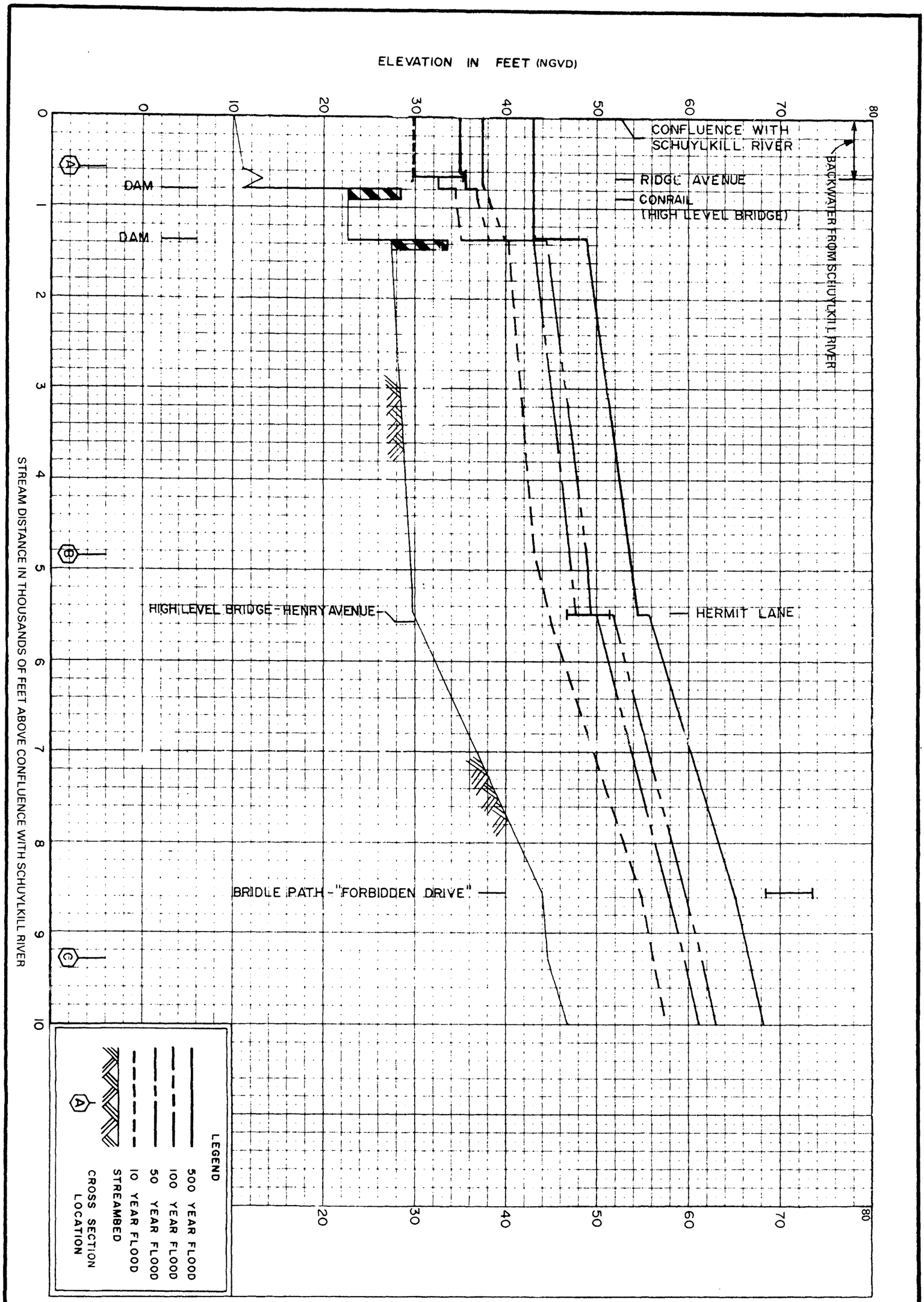
CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

WALTON RUN

(Byberry Tributary)



51P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

WISSAHICKON CREEK

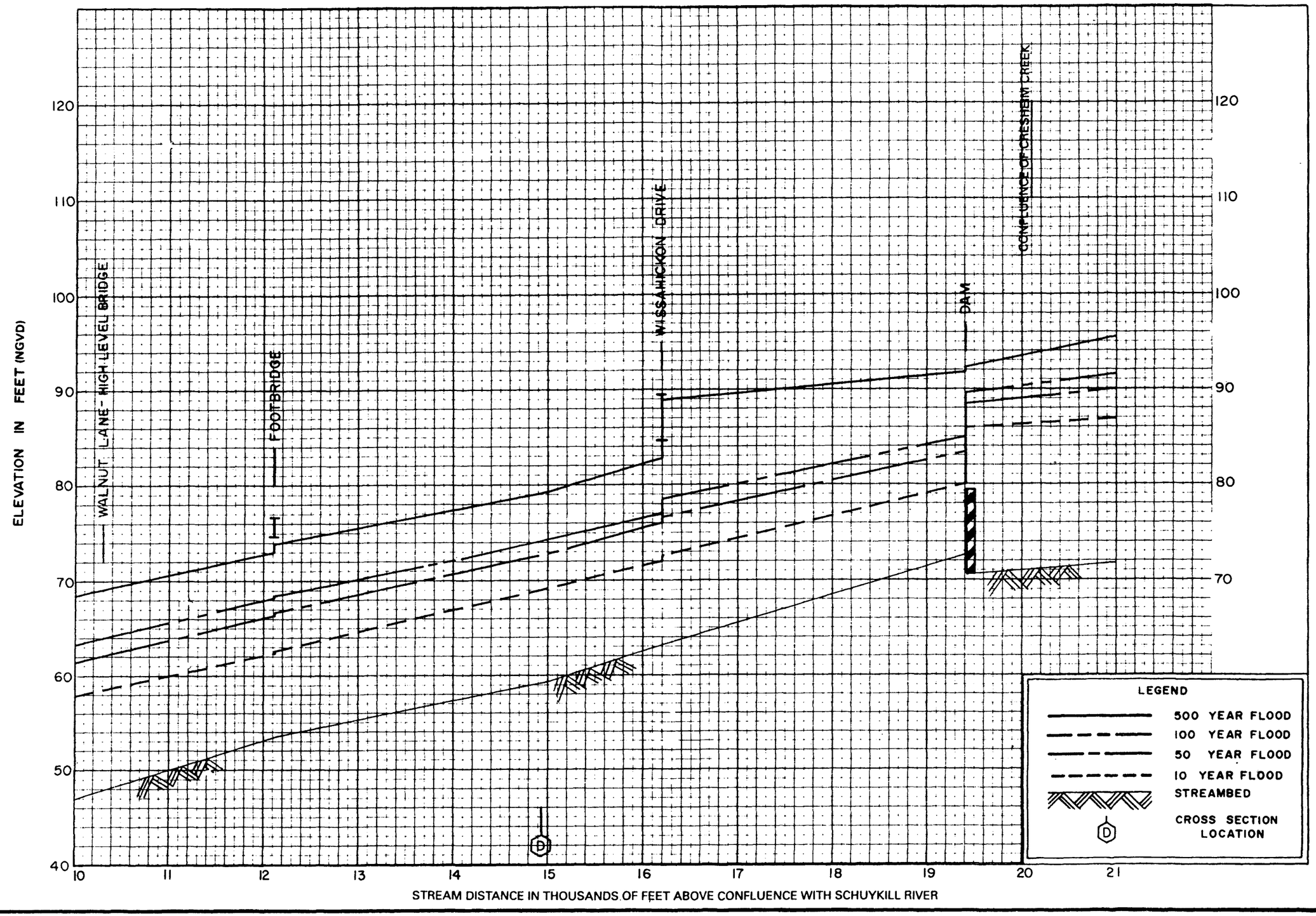
WISSAHICKON CREEK

FLOOD PROFILES

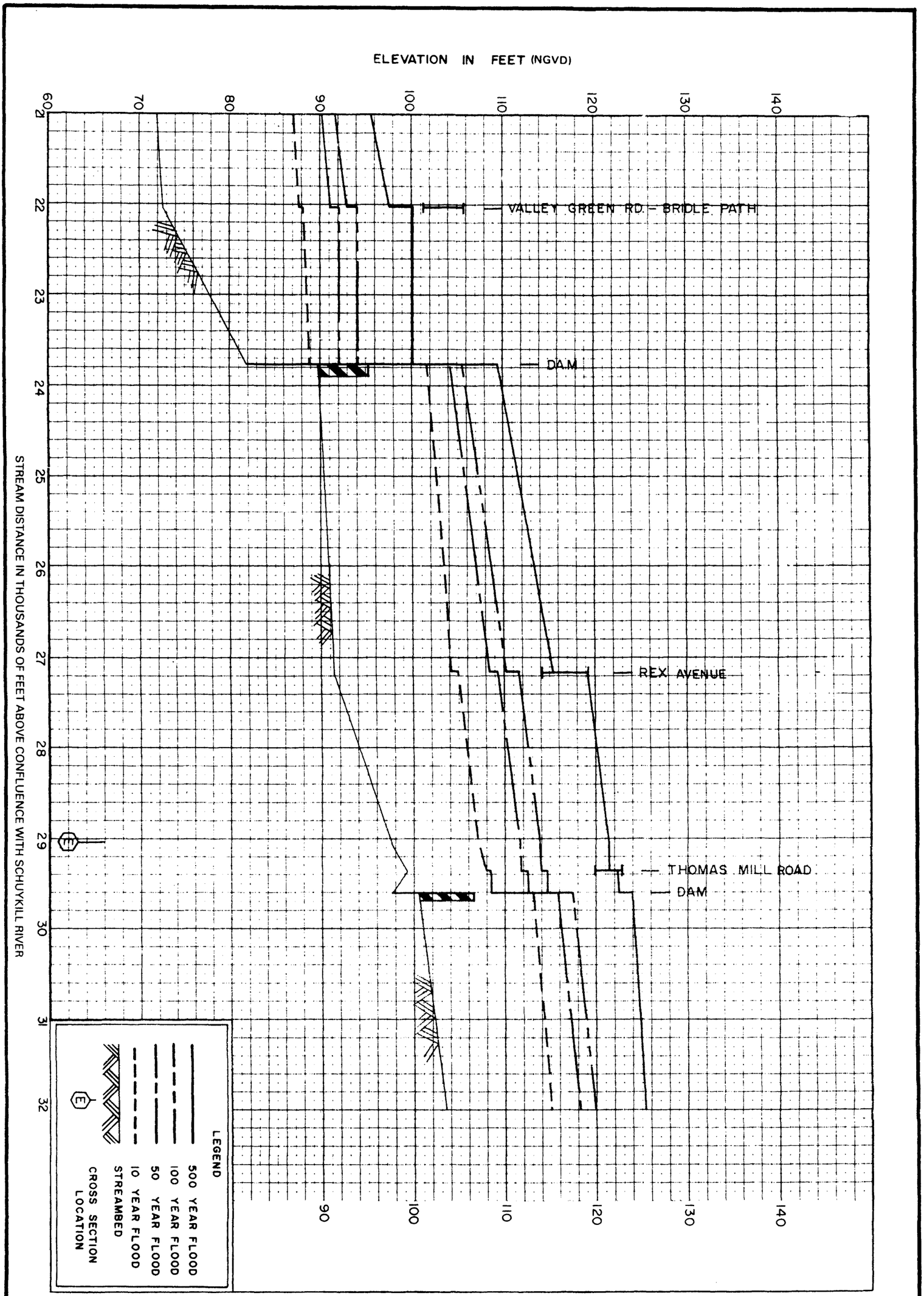
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)



52P



53P

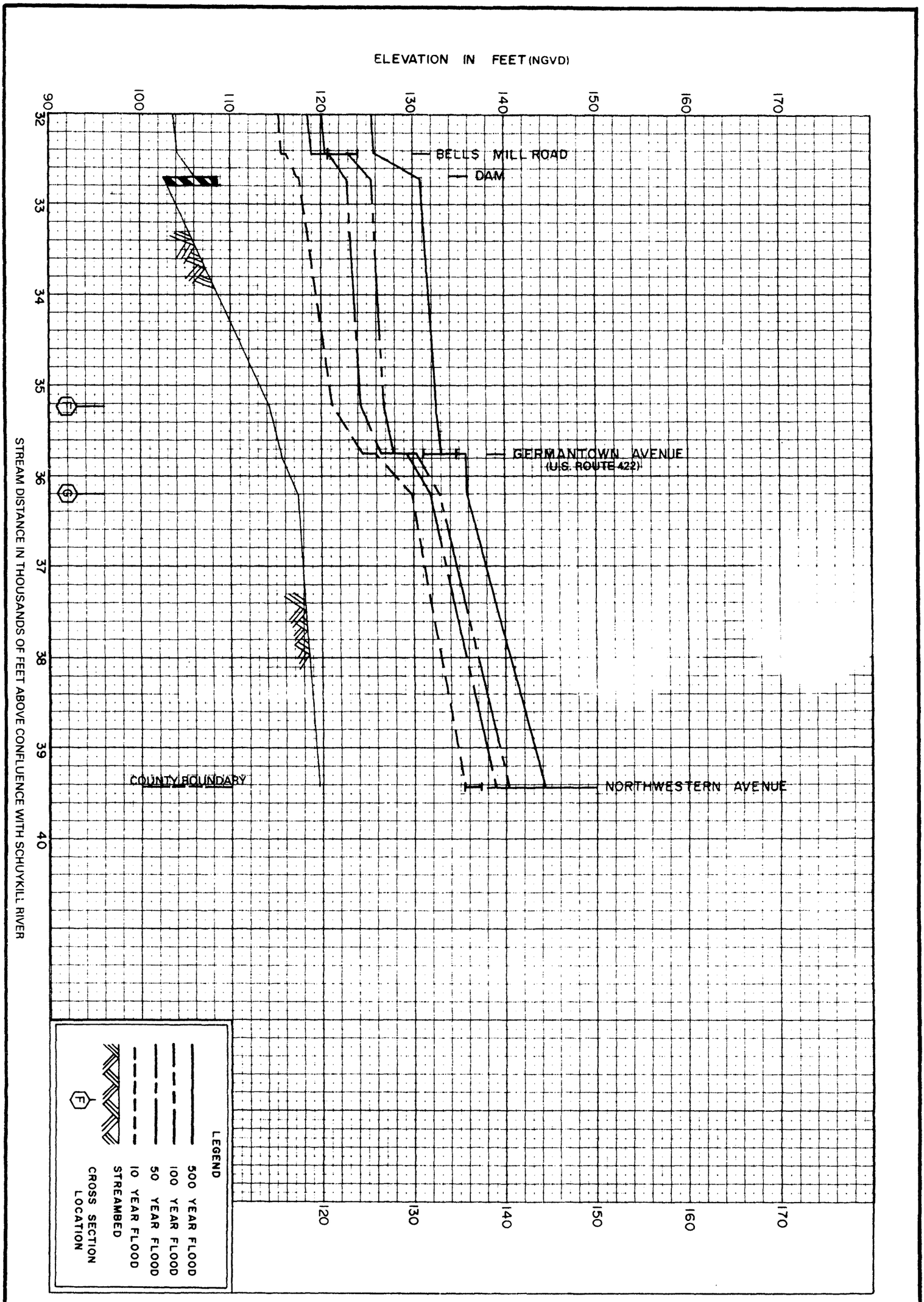
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

WISSAHICKON CREEK



54P

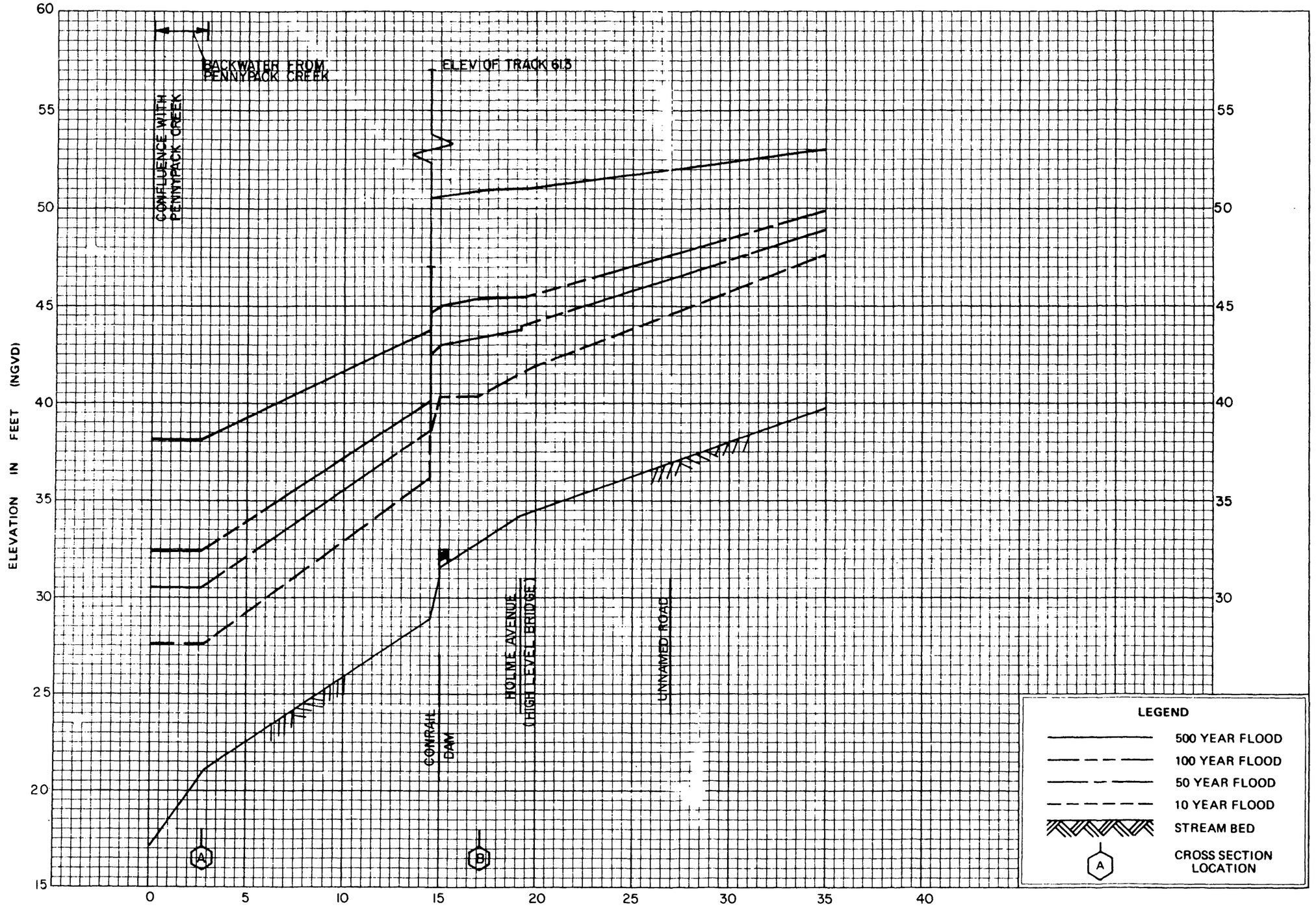
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

FLOOD PROFILES

WISSAHICKON CREEK



FLOOD PROFILES

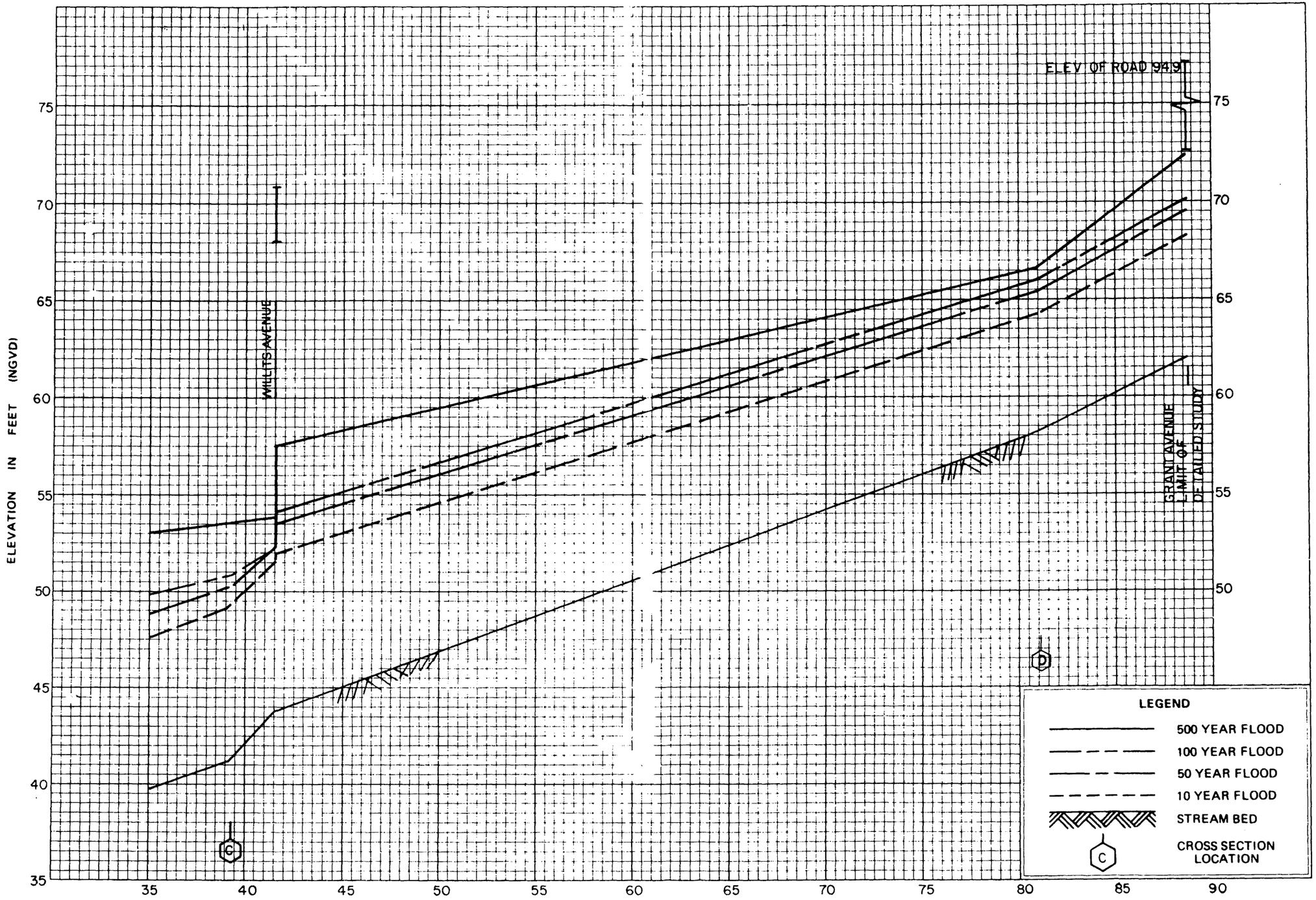
WOODEN BRIDGE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

55P



FLOOD PROFILES

WOODEN BRIDGE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHILADELPHIA, PA

(PHILADELPHIA CO.)

56P