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FLOOD PLAIN INFORMATION BRANDYWINE CREEK, NEW CASTLE COUNTY, DE--ETC(U)
JUL 73
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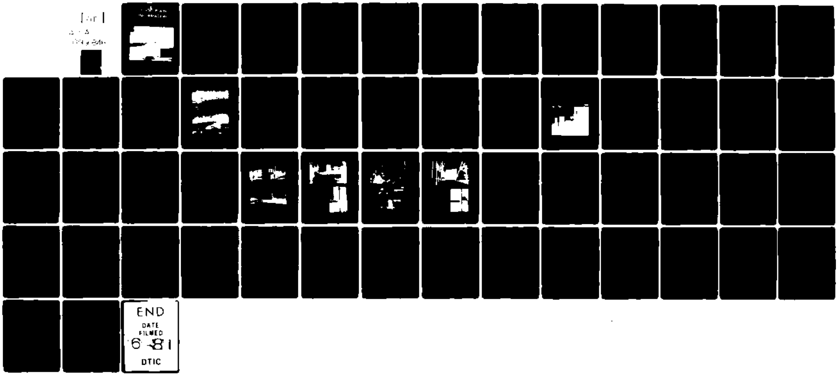

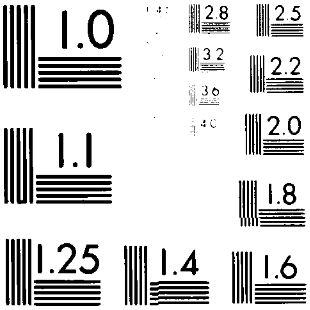

MICROCOPY RESOLUTION TEST CHART

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LEVEL II

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FLOOD PLAIN INFORMATION

BRANDYWINE CREEK
NEW CASTLE COUNTY, DELAWARE

PREPARED FOR THE NEW CASTLE COUNTY DEPARTMENT OF PLANNING
BY CORPS OF ENGINEERS, U.S. ARMY PHILADELPHIA DISTRICT
JULY 1973

REPT. NO: DAEN/NAP- 82040/FPI05 - 73/07

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New Castle County, Del.
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Flood plains
New Castle County Dept. of Planning

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The portion of Brandywine Creek covered by this report is the Main Stem from its confluence with the Christian River in Wilmington, Delaware to Smith's Bridge Road located 500 feet downstream from the Pennsylvania-Delaware border near Granoque, Delaware. This was a fourth of a series of four reports covering flooding along the Branywine Creek and its tributaries. The developed areas of this flood plain were (at the time of this report) primarily residential and industrial and have been damaged by floods in 1920, 1952, 1955 and 1972.

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This report included a history of flooding in the Brandywine area and identified those areas which may be subject to possible future floods. Special emphasis was given to these possible future flood forecasts thru maps, photographs and profiles. While this report doesn't provide solutions it can aid in the identification of flood damage reduction techniques.

Under authority of Section 206 of the 1960 Flood Control Act as amended the flood plain information was prepared by the U.S. Army Corps of Engineers Philadelphia District at the request of the New Castle County Dept. of Planning. The information should be considered for its historical nature. Since the publication of this FPI report other Flood Insurance studies have been undertaken and should also be consulted.

TO THE REQUESTOR:

This Flood Plain Information (FPI) Report was prepared by the Philadelphia District office of the U.S. Army Corps of Engineers, under the continuing authority of the 1960 Flood Control Act, as amended. The report contains valuable background information, discussion of flood characteristics and historical flood data for the study area. The report also presents through tables, profiles, maps and text, the results of engineering studies to determine the possible magnitude and extent of future floods, because knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning floodplain utilization. These projections of possible flood events and their frequency of occurrence were based on conditions in the study area at the time the report was prepared.

Since the publication of this FPI Report, other engineering studies or reports may have been published for the area. Among these are Flood Insurance Studies prepared by the Federal Insurance Administration of the Federal Emergency Management Agency, Flood Insurance Studies generally provide different types of flood hazard data (including information pertinent to setting flood insurance rates) and different types of floodplain mapping for regulatory purposes and in some cases provide updated technical data based on recent flood events or changes in the study area that may have occurred since the publication of this report.

It is strongly suggested that, where available, Flood Insurance Studies and other sources of flood hazard data be sought out for the additional, and, in some cases, updated flood plain information which they might provide. Should you have any questions concerning the preparation of, or data contained in this FPI Report, please contact:

U.S. Army Corps of Engineers
Philadelphia District
Custom House, 2nd and Chestnut Streets
Philadelphia, PA 19106

ATTN: Flood Plain Mgt. Services Branch, NAPEN-M

Telephone number: (215) 597-4807

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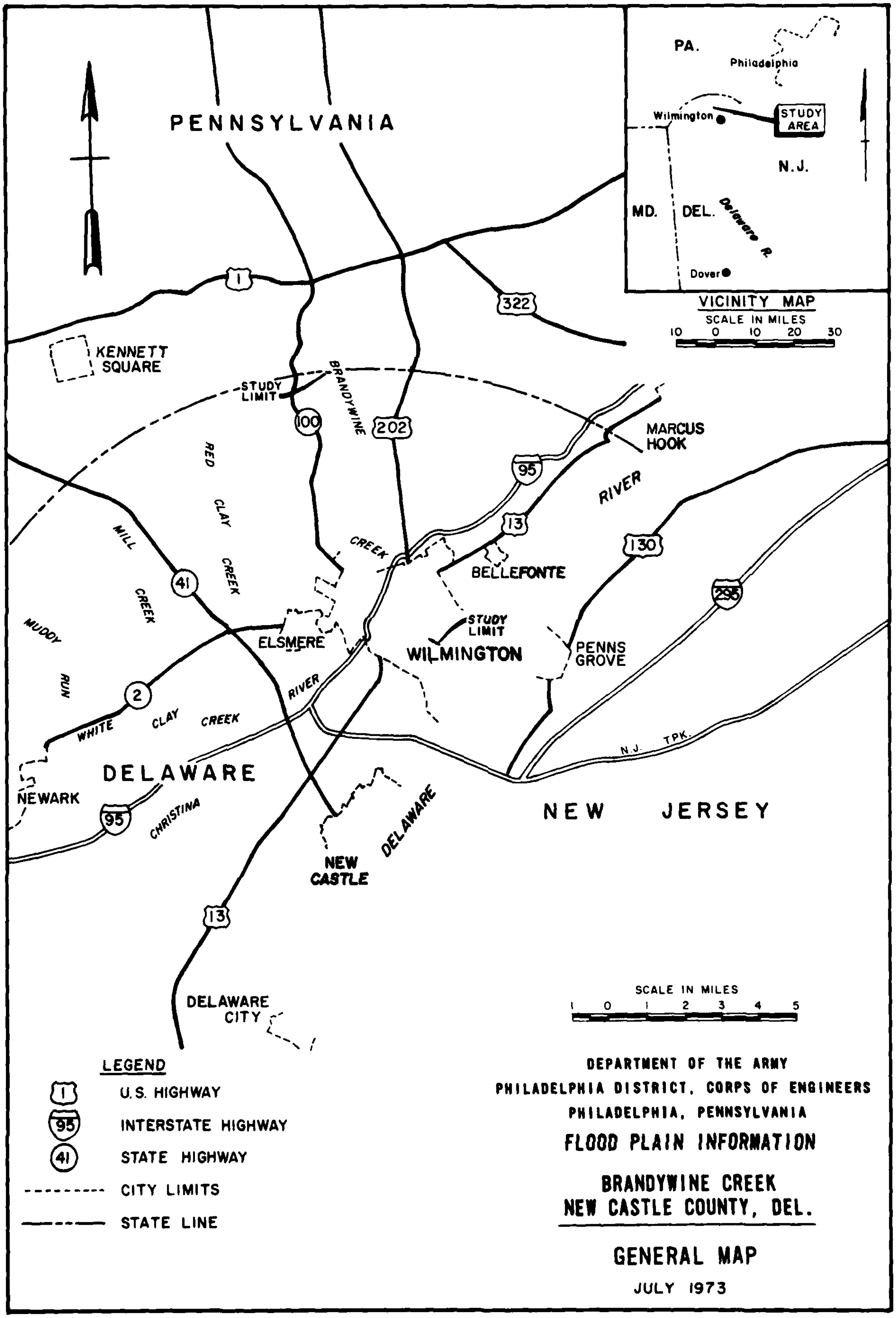


DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION

BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

GENERAL MAP

JULY 1973

PLATE I

PREFACE

The portion of Brandywine Creek covered by this report is the Main Stem from its confluence with the Christian River in Wilmington, Delaware, to Smith's Bridge Road located 500 feet downstream from the Pennsylvania-Delaware border near Granoque, Delaware. This is the fourth of four reports covering flooding along Brandywine Creek and its tributaries. The developed areas of the flood plain along this reach of Brandywine Creek are primarily residential and industrial and have been damaged by floods in 1920, 1952, 1955, and 1972. Many areas in the flood plain may become more populated and developed in the future. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report presents flood hazard information which is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding along Brandywine Creek and identifies those areas that are subject to possible future floods. Special emphasis is given to these possible future floods through maps, photographs, profiles and cross sections. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of areas where other flood damage reduction techniques such as works to modify flooding and adjustments including flood proofing might be embodied in an overall flood plain management (FPM) program. Other FPM program studies—those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings—would also profit from this information.

At the request of the New Castle County department of Planning and indorsement of the Delaware State Department of Highways and Transportation, this report was prepared by the Philadelphia District Office of the U.S. Army Corps of Engineers under the continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of the U.S. Geological Survey (U.S.G.S.), Soil Conservation Service, the Delaware State Department of Highways and Transportation, the New Castle County Department of Planning, and private citizens in supplying useful data and photographs for the preparation of this report are appreciated.

Additional copies of this report can be obtained from the New Castle County Department of Planning. The Philadelphia District Office, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented as well as planning guidance and further assistance, including the development of additional technical information.

BACKGROUND INFORMATION

Settlement

The banks of the Brandywine were first inhabited by the Lenni-Lenape Indians. Fertile lands along the banks were ideal for farming, and an abundance of fish in the Brandywine Creek supplied the Indians with a major source of food. Swedish settlers located in the Brandywine-Christina area in 1638. Their hamlet was captured by the Dutch in 1654. The Dutch took advantage of the creek's natural protection by using it as a winter harbor for their ships. It was one of these Dutch ships that had its cargo of brandy and wine spilled into the creek when ice cut through her rotted planks. Hence came the name Brandywine which eventually replaced local names for the creek. The reign of the Dutch did not endure though, as the British added all the Dutch settlements on the Delaware to their empire in 1664.

The Brandywine geology made possible one of the greatest developments of water power in all of the American colonies. The processing of flour and gunpowder became early predominant industries and, later, paper in rolls was first manufactured on the banks of the Brandywine. Fulfillment of these industries' needs for water supply, power, and transportation was accomplished by building near the stream. Residential and commercial development naturally located near the factories.

No formal attempts were made to establish a town until 1731 when a tract of 10 acres was laid out into lots and sold to interested villagers. Named after its developer, the town of Willingtown had 20 newly-built houses within its limits by 1735. New immigrants, mostly Quakers, started arriving in Willingtown to take advantage of the availability of raw materials and agricultural products. In 1739, Willingtown was granted a borough charter by the King of England and its name was changed to Wilmington. The Borough of Wilmington officially became a City in 1832 when a new charter was granted by the Delaware State Legislature.

The Civil War and World Wars I and II had profound effects on the economy of the City of Wilmington by stimulating the expansion and growth of the city's industrial plants. There is at the present time an increase in industrial and commercial activity in the area with older established industries expanding and new industries being attracted to the area. As this growth increases, the accompanying increase in population will result in additional settlement of the Brandywine watershed area.

The Stream and Its Valley

The Brandywine Creek, with a total drainage area of 323.8 square miles, is a major tributary of Christina River. The main branch of the Brandywine drains portions of Chester and Delaware Counties in southeastern Pennsylvania and portions of New Castle County, Delaware. The East and West Branches, the two main tributaries of Brandywine Creek, unite to form the main stream near Lenape, Pennsylvania. The Brandywine then flows 20.3 miles south to its confluence with Christina River at Wilmington, Delaware. The 10.5 mile portion of Brandywine Creek included in this study is shown on the general map.

The Brandywine's course through Delaware is fairly straight and cuts through a valley of rugged terrain. The adjacent land slopes that comprise its flood plain are very steep and usually wooded. Portions of the Brandywine Valley through Wilmington have been set aside in their almost natural state as municipal parks. Below Market Street in Wilmington, the flood plain broadens to its tidal confluence with the Christina River.

The stream's gradient varies sharply in 3 distinct reaches. The upper reach from the State Line to Rockland Road falls 15.5 feet at a slope of 4.9 feet per mile. The middle reach from Rockland Road to Market Street in Wilmington falls 125 feet and drops an average of 25 feet per mile. Below Market Street to its tidal confluence with the Christina River, the stream returns to a milder gradient of 2.5 feet per mile. Throughout its course above Market Street in Wilmington, the Brandywine flows rather swiftly, despite the many small former mill dams that block its way. The stream is generally characterized in literature for its rough tumbling rapids and swiftly flowing water. Drainage areas contributing to runoff at locations in the study area are shown in Table 1.

The climate is moderate with hot, humid summers and damp, but not cold, winters. Average annual precipitation is 45 inches, with the greatest amount of rainfall generally occurring in July and August and the least amounts, in autumn and early winter.

TABLE 1
DRAINAGE AREAS ALONG BRANDYWINE CREEK

Location	Mileage Above Mouth	Drainage Area	
		Tributary	Total
		sq. mi.	sq. mi.
Pennsylvania-Delaware State Line	10.55	---	299.9
Confluence with Beaver Creek	10.23	4.2	304.4
Confluence with Rocky Run	8.38	1.7	308.3
Confluence with Wilson Run	7.31	3.3	312.6
Confluence with Husbands Run	5.85	1.4	314.0
U.S.G.S. Gage at Wilmington	4.58	---	318.2(a)
Confluence with Alapocas Run	3.84	0.9	319.7
Mouth	0.0	---	323.8

(a) The U.S. Geological Survey publication "Magnitude and Frequency of Floods in the U.S., Part 1-B," lists the Wilmington gage drainage area as 314.0 square miles.

Developments in the Flood Plain

In the upper reaches of the Brandywine above Rockland Road, the Brandywine flood plain is sparsely occupied. As the stream approaches Wilmington, the incidence of flood plain occupancy by industrial and residential development increases. Industrial encroachments on the flood plain are related to the historical development of the early water mills on the Brandywine. New industrial expansion simply grew around the already-established mill sites. In comparatively recent years, residential growth has been attracted by the beauty of the valley. As Wilmington's suburbs expand, additional pressure for development of the flood plain will arise from this sector of growth.

In Wilmington, much of the flood plain above Market Street was incorporated into Brandywine Park. The City filtration plant located on the flood plain at Market Street is affected by floods on the Brandywine and the City is often forced to rely on water supply from Hoopes Reservoir in the Red Clay Creek watershed.

FLOOD SITUATION

Sources of Data and Records

The United States Geological Survey maintains gaging stations at Chadds Ford, Pennsylvania, and Wilmington, Delaware, on the main stem of Brandywine Creek below Rising Sun Road bridge. The Chadds Ford Gage has continuous records of daily flows from August 1911 through December 1953 and October 1962 to date. The Wilmington Gage records daily flows and has been in operation since October 1946. In the Upper Basin, a gage has been maintained on the East Branch near Downingtown, Pennsylvania, from October 1965 to date, while on the West Branch, one was maintained at Coatesville, Pennsylvania, for the period October 1943 to December 1951.

To supplement the records at the gaging stations, newspaper files, historical documents and records were searched for information concerning past floods. These records have developed a knowledge of floods which have occurred on Brandywine Creek.

Maps prepared for this report were based on U.S. Geological Survey quadrangle sheets entitled "Wilmington South, Delaware-New Jersey," 1967, and "Wilmington North, Pennsylvania-Delaware," 1954. Structural data on bridges and culverts were obtained by field surveys performed by personnel from the Philadelphia District.

Flood Season and Flood Characteristics

Major flooding in this reach of Brandywine Creek has occurred during the summer and fall seasons. The only major flood to occur outside of these seasons was that of March 1920. Some flooding has occurred within the study area during all months of the year and usually results from heavy rains within the watershed. Stages can rise from normal flow to extreme flood peaks in relatively short time periods with high velocities in the main stream channel. In addition to floods caused by runoff from general rainfall, the Brandywine is susceptible to hurricane activity and floods from snowmelt in combination with rainfall.

Factors Affecting Flooding and Its Impact

Obstructions to floodflows - Natural obstructions to floodflows include trees, brush and other vegetation growing along the stream banks in floodway areas. Man-made encroachments on or over the stream such as dams, bridges and culverts can also create more extensive flooding than would otherwise occur.

During floods, trees, brush and other vegetation growing in floodways impede floodflows, thus creating backwater and increased flood heights. Trees and other debris may be washed away and carried downstream to collect on bridges and other obstructions to flow. As floodflows increase, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge until the hydraulic load exceeds its structural capacity and the bridge is destroyed. The limited capacity of obstructive bridges or culverts, debris plugs at the culvert mouth or a combination of these factors retard floodflows and result in flooding upstream, erosion around the culvert entrance and bridge approach embankments and possible damage to the overlying roadbed. Figure 1 shows debris accumulation in a channel just downstream of a dam.

In general, obstructions restrict floodflows and result in overbank flows and unpredictable areas of flooding; destruction of or damage to bridges and culverts; and, an increased velocity of flow immediately downstream. It is impossible to predict the degree or location of the accumulation of debris; therefore, for the purposes of this report, it was assumed that there would be no accumulation of debris to clog any of the bridge or culvert openings in the development of the flood profiles.

The nine small dams located in this reach of the Brandywine have no flood control capacities but do act as obstructions to floodflows. Figure 2 shows one of the larger old mill dams which can obstruct floodflows. Also, within this study area, Brandywine Creek is spanned by nineteen bridges. Pertinent information on all bridges can be found in Table 6 on Page 17. Many of these bridges are obstructive to floodflows.

Flood damage reduction measures - New Castle County has recently passed an ordinance prohibiting the filling in of and construction on flood plain areas. Although this ordinance will not actually reduce flood damages, it will effectively eliminate increasing damages associated with continued flood plain encroachments. This Flood Plain Information Study has been requested so that it may be used as a basis for flood plain management regulatory measures in New Castle County.

Under the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended, the construction of ten dams has been proposed to control flooding on the Brandywine. The Work Plan for the Brandywine Creek Watersheds, which is a statement of problems and recommended solutions and a requirement for Federal participation, was completed by several agencies in April 1962. Four of the ten dams will be located within the West Branch watershed and six will be located within the East Branch watershed. Pertinent information on all of these dams can be found in the Flood Plain Information Reports prepared for the West Branch and East Branch sub-basins. Although there are no proposed dams across the main stem, flooding on the main stem will be affected as shown in Plates 9 and 10. At the present time, two of these dams are completed and one is scheduled for construction in the summer of 1973.

FIGURE 1 - Debris beginning to accumulate in channel just downstream of a dam on Hagley Museum Property.

FIGURE 2 - Hagley Museum Dam, one of the larger old mill dams across the Brandywine Creek, can obstruct floodflows.

Other factors and their impacts - The impact of flooding along Brandywine Creek can be affected by the ability of local residents to anticipate and effectively react to a flood emergency. Efficient flood warning and forecasting systems can give homeowners, business and industry valuable time to remove damageable materials from low-lying areas. Increased damages to downstream areas can also be reduced if floatable materials stored on the flood plain can be removed before being carried downstream to block bridge and culvert openings. Implementation of effective flood fighting and emergency evacuation plans can further reduce flood damages and the incidence of personal injury and death once the creek has reached flood stage.

Flood warning and forecasting - Inhabitants of the area depend entirely on the usual warnings issued through radio, television, and the local press media. The National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions in the study area with stations at the Philadelphia and Wilmington Airports. Flood warnings and predicted flood peaks are issued by the NOAA Flood Forecasting Centers located at Harrisburg, Pennsylvania, and Trenton, New Jersey.

Flood fighting and emergency evacuation plans - Although there are no formal flood fighting or emergency evacuation plans for the Brandywine Basin, provisions for alerting area residents through local communications media and coordinating operations for New Castle County are accomplished by the County Civil Defense Office. This office maintains communications with the State Civil Defense Headquarters and the National Weather Service and establishes a "flood watch" during the earliest stages of a flood threat. Flood fighting, evacuation, and rescue activities are coordinated on a countywide basis with local public agencies.

Material storage on the flood plain - Very little material is stored on the relatively undeveloped portion of the Brandywine above Rockland Road to the Pennsylvania-Delaware State Line. Further downstream as industrial encroachment increases, the quantity of material stored on the flood plain also increases. Much of the material is floatable such as lumber, crates, and large volume lightweight containers. In addition, there are storage tanks and containers which may be unrestrained and buoyant. During time of floods, these floatable materials may be carried away by floodflows causing serious damage to structures downstream and clogging bridge openings creating more hazardous flooding problems.

PAST FLOODS

Summary of Historical Floods

Events of flooding on the Brandywine Creek are frequent. Floods causing significant damage are reported to have occurred in 1920, 1952, 1955, 1960, 1971, and 1972. Of these, the June 23, 1972, flood was the highest flood of record at Chadds Ford, Pennsylvania, and Wilmington, Delaware.

Flood Records

Information on historical floods in Brandywine Creek was obtained from stream gaging stations maintained by the U.S. Geological Survey at Chadds Ford, Pennsylvania, and Wilmington, Delaware. The Chadds Ford Gage has been in operation from 1911 to 1953 and again from 1962 to the present. The period of record for the Wilmington Gage is 1946 to the present. High water marks of past floods were obtained, residents were interviewed, and newspaper files and historical documents were searched for information concerning past floods.

Crest stages and discharges for known floods at the gaging stations on the main stem of Brandywine Creek at Chadds Ford, Pennsylvania, and Wilmington, Delaware, are shown in Tables 2 and 3.

TABLE 2
FLOOD CREST ELEVATIONS
Brandywine Creek at Chadds Ford, Pennsylvania

Date of Crest	Estimated Peak Discharge cfs	Stage(a)	Elevation(b)
June 23, 1972	18,100	16.6	167.0
March 5, 1920	17,200	15.0	165.5
August 9, 1942	16,800	14.8	165.3
August 4, 1915	16,500	14.7	165.2
August 19, 1955	16,400(c)	14.6(c)	165.1(c)
September 13, 1971	14,300	14.4	164.9
August 24, 1933	14,800	14.0	164.5

(a) Overbank flooding begins at a stage of 7.0 feet, as per U.S.G.S.
(b) Feet, mean sea level datum · Gage datum is 150.45 feet, mean sea level datum.
(c) Estimated value from gaging station data at Wilmington, Delaware.

TABLE 3
FLOOD CREST ELEVATIONS
Brandywine Creek at Wilmington, Delaware

Date of Crest	Estimated Peak Discharge cfs	Stage[a]	Elevation[b]
June 23, 1972	29,000	15.5	83.7
August 19, 1955	17,800	13.9	82.1
September 13, 1971	21,300	13.8	82.0
August 13, 1955	12,600	11.8	80.0
September 13, 1960	15,600	11.4	79.6
November 25, 1950	11,500	11.3	79.5

(a) Overbank flooding begins at a stage of 8.5 feet, as per U.S.G.S.
(b) Feet, mean sea level datum - Gage datum is 68.23 feet, mean sea level datum.

Flood Descriptions

The following are descriptions of known large floods that have occurred on Brandywine Creek in the vicinity of Wilmington, Delaware, and neighboring communities.

March 5, 1920 - This flood was the maximum flood of record for the gage at Chadds Ford until June 23, 1972, when Hurricane Agnes produced the maximum flood of record. Since the gaging station at Wilmington was not established until 1946, no estimate of discharge is given at Wilmington. The 1920 flood was the result of a gentle rainfall period followed by driving sleet and snow accompanied by 40 mile per hour winds.

EXCERPTS FROM THE WILMINGTON EVERY EVENING,[a]
MARCH 6, 1920, RELATIVE TO THE FLOOD OF MARCH 5, 1920

Forty City Blocks Under Water by Brandywine Flood

Hundreds of families driven from their homes others forced to seek refuge from the waters flooding the first floors of their domiciles; the police department, fire department and every other agency that could be brought into action, busy during the night in the work of rescue, marked the climax of the floods that swept down the Brandywine during the worst of the blizzard.

It became evident early in the evening the way the waters were rushing down the Brandywine and its tributaries, that the flood was going to reach if not surpass record heights, and many families in the low-lying sections on the other side of the Eleventh Street bridge got out without waiting to be driven out by the waters.

Across the Brandywine everything was flooded from Brandywine River to Dure Street, and a little beyond to Marsh Road, and from Twelfth Street as far as Heald to Vandever Avenue and beyond. The flooded territory embraces about forty city blocks.

July 9, 1952 - Heavy rainfall caused a substantial amount of flooding throughout New Castle County; 6.53 inches of rain fell between 7:30 A.M. and 2:30 P.M. causing the Brandywine to rise very quickly. In addition to the obvious problems associated with floods, increased sediment loads during high flows interfere with the City of Wilmington's water supply by contamination and the plugging of supply intakes.

(a) Simulated from newspaper clippings

EXCERPTS FROM THE WILMINGTON EVERY EVENING JOURNAL,[a]
JULY 9, 1952

Red Cross Helps 120 Flee Homes in Suburbs
Many Roads Blocked as Torrents End Drought
End is Not in Sight

The interrupted but heavy rainfall of the morning accounted for a rapid rise of five feet in the Brandywine River and for alternating high and low tides in the Brack-Ex neighborhood.

Doeskin Products, Inc., at Rockland along the Brandywine estimates more than $25,000 damage to equipment and stored goods in its basement.

Spaniels of the S. Hellock DuPont estate at "Squirrel Run" near the Brandywine River had to be moved when water threatened their safety.

A large amount of road fill for the New Brandywine River bridge between the Old DuPont powder mills and the DuPont Experimental Station was washed away.

19 August 1955 - By 15 August 1955, the Brandywine valley received approximately 7 inches of rainfall within a four-day period due to Hurricane Connie. Streams in the area overflowed their banks causing considerable damage to homes, businesses and roads throughout the area. While the ground was still saturated due to the heavy rainfall induced by Hurricane Connie, the area was again hit on 19 August by heavy rains caused by Hurricane Diane. Many areas had not recovered from the effects of Hurricane Connie and, as a result, were vulnerable to considerably more damage and devastation when hit by floodflows caused by Hurricane Diane.

EXCERPTS FROM THE WILMINGTON MORNING NEWS,[a]
20 AUGUST 1955

Brandywine River Recedes, Leaves Damage in Wake

The Brandywine River, still a churning torrent from two hurricane-inspired downpours within less than a week, began receding rapidly yesterday, leaving unestimated damage to plants, homes and land along its banks . . . Reaching a peak flow of about 13 billion gallons between 6 and 7 a.m. yesterday, the creek started to recede shortly thereafter and by 4 p.m. it had gone down three feet and was continuing to fall at a rapid pace . . . Yesterday's peak flow, computed at the rate of from 18,000 to 20,000 cubic feet per second, was nearly twice the 7.4 billion gallon crest reached during Connie's onslaught . . . Although there are no figures to substantiate the theory, it is believed that the Connie and Diane floods of the current month were exceeded by the Brandywine's other famous double rampage of Aug. 9 and 13, 1942, causing hundreds of thousands of dollars worth of damage, including the loss of livestock by drowning. It also resulted in the death of at least five persons by drowning and lightning.

June 23, 1972 - Hurricane Agnes struck the Middle Atlantic Coastal States with destructive results. Although the press was filled with accounts of flooding in devastated central Pennsylvania, Delaware experienced its highest flood of record on the Brandywine.

(a) Simulated from newspaper clippings.

EXCERPTS FROM THE WILMINGTON EVERY EVENING JOURNAL,(a) JUNE 23, 1972

Brandywine Hits Record Flood Level

100 Flee Northeast Wilmington

Rising floodwaters last night forced more than 100 Wilmington residents from their homes and left thousands of basements under water.

Streets in northeast Wilmington were impassable, water on some as deep as five feet.

The Brandywine River rose to record flood levels.

The storm, the remnants of Hurricane Agnes, was considered one of the worst in Delaware in recent years.

The Brandywine River was so high in the city, it was lapping against the motor vehicle division garage of the Public Works Department at 12th and Thatcher Streets. That building is normally 15 feet above the water level.

Officials said that the Brandywine crested at 16.5 ft. at 3:00 this morning.

NOTE: Flooded area in Wilmington bounded roughly by Governor Printz Boulevard, Claymont Street, Vandever Avenue and the Brandywine River.

(a) Simulated from newspaper clippings.

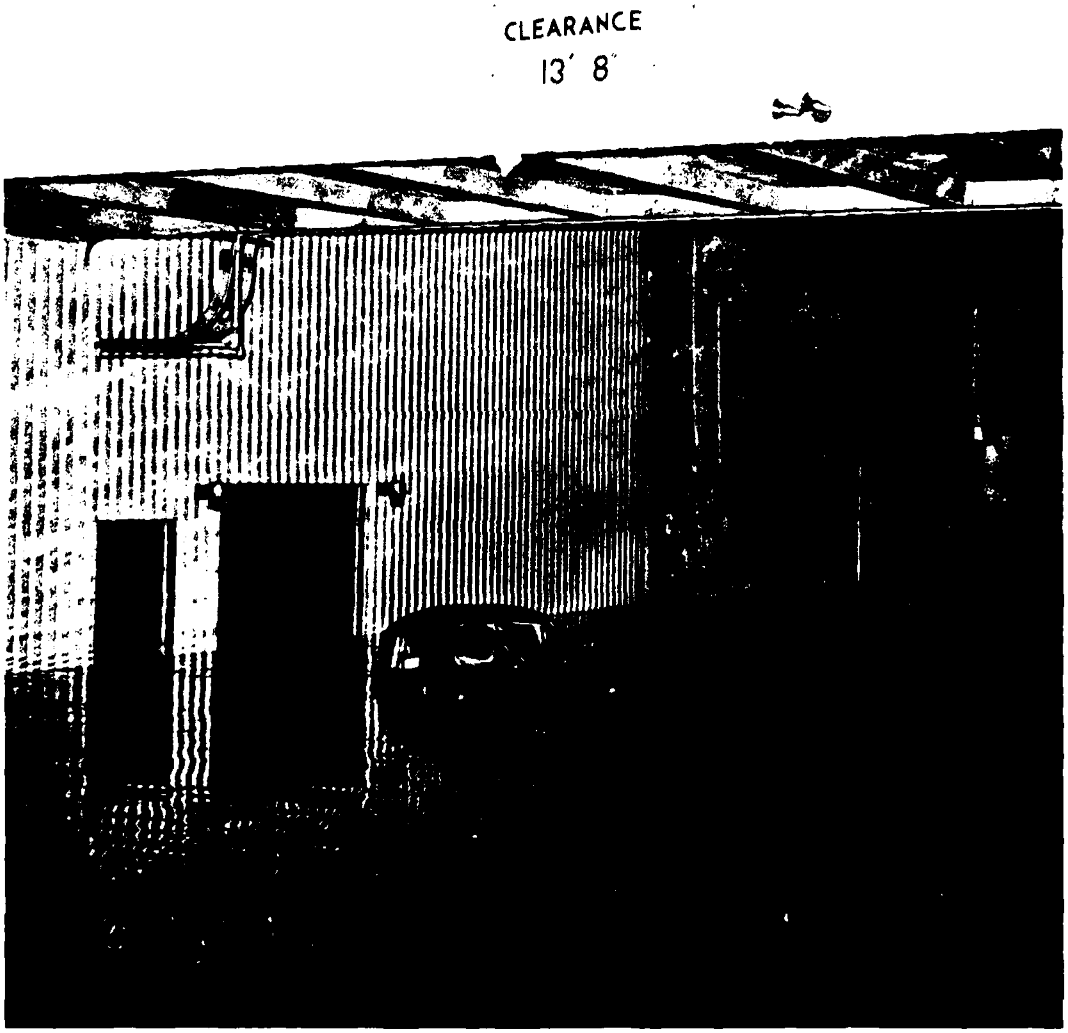


FIGURE 3 - Brandywine floodwaters resulting from Tropical Storm Agnes on June 23, 1972, inundated part of the Concel Plant near Rockland.

(Photograph by John Jankowski)

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occurred in the past could occur in the future. Larger floods have been experienced in the past on streams with similar geographical and physiographical characteristics as those found in the study area. Similar combinations of rainfall and runoff which caused these floods could occur in the study area. Therefore, to determine the flooding potential of the study area, it was necessary to consider storms and floods that have occurred in regions of like topography, watershed cover, and physical characteristics. Discussion of the future floods in this report is limited to those that have been designated as the Intermediate Regional Flood and the Standard Project Flood. The estimates of the Intermediate Regional Flood and the Standard Project Flood as presented in this report are based on the existing development of the watershed since future changes within the basin cannot be accurately predicted. The Standard Project Flood represents a reasonable upper limit of expected flooding in the study area. The Intermediate.Regional Flood may reasonably be expected to occur more frequently although it will not be as severe as the infrequent Standard Project Flood.

Intermediate Regional Flood

The Intermediate Regional Flood is defined as one that occurs once in 100 years on the average, although it could occur in any year. The peak flow of this flood was developed from statistical analyses of streamflow records at Chadds Ford, Pennsylvania, and Wilmington, Delaware, in conjunction with regional synthetic analyses at selected locations along the main stream. Peak flows thus developed for the Intermediate Regional Flood at selected locations in the study area are shown in Table 4. Also presented in Table 4 are discharges for the same flood with all proposed Soil Conservation Service Dams in operation.

Standard Project Flood

The Standard Project Flood is defined as a major flood that can be expected to occur from a severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the study area is located, excluding extremely rare combinations. The Corps of Engineers, in cooperation with the NOAA Weather Service, has made comprehensive studies and investigations based on the past records of experienced storms and floods and has developed generalized procedures for estimating the flood potential of streams. Peak discharges for the Standard Project Flood at selected locations in the study area are shown in Table 4 along with discharges as modified by proposed Soil Conservation Service Dams. A discharge hydrograph for the Standard

Project Flood at Wilmington, Delaware, is shown on Plate 12. The relative water surface elevations for the Intermediate Regional Flood and the Standard Project Flood are shown on Plates 7 and 8. Plates 9 and 10 represent water surface elevations for both floods as modified by all proposed Soil Conservation Service Dams in operation.

TABLE 4
PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS ALONG BRANDYWINE CREEK

Location	River Mile	Drainage Area sq. mi.	Intermediate Regional Flood Natural cfs	Intermediate Regional Flood With Soil Conserv. Service Dams cfs	Standard Project Flood Natural cfs	Standard Project Flood With Soil Conserv. Service Dams cfs
Mouth – Confluence with Christina River	0.0	323.8	26,100	20,400	73,100	57,000
Wilmington Gage	4.5	318.2	25,000	19,500	72,400	56,500
Upstream of the Pennsylvania-Delaware State Boundary	10.6	299.9	24,600	19,200	68,400	53,300
Chadds Ford Gage	14.8	287.0	24,000	18,700	63,100	49,200

Table 5 shows comparisons of flood elevations for the Intermediate Regional Flood and the Standard Project Flood with the highest recorded floods at Wilmington, Delaware.

TABLE 5
COMPARISON OF FLOOD ELEVATIONS
U.S.G.S. Gage on Brandywine Creek at Wilmington, Delaware

Flood	Elevation(a)	
	Natural	With Soil Conservation Service Dams
Standard Project	96.5	92.5
Intermediate Regional	84.4	82.5
June 23, 1972	83.7	–
September 13, 1971	82.0	–
August 19, 1955	82.1	–
August 13, 1955	80.0	–

(a) Feet, mean sea level datum.

Frequency

A frequency curve of peak flows was developed from available recorded annual peaks. The curve presents the frequency of floodflows up to the magnitude of once in 100 years (Intermediate Regional Flood). Frequencies of floods equivalent to the Standard Project Flood and larger can be obtained through extrapolation of the curve, but it is not practical to assign a frequency to such large but possible flows as their occurrence is so extremely rare. The curve, which is available upon request, reflects the judgment of engineers who have studied the area and are familiar with the region; however, it must be regarded as approximate and should be used with caution in connection with any planning of flood plain use.

Hazards of Large Floods

The extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An Intermediate Regional or Standard Project Flood on Brandywine Creek would result in the inundation of residential, commercial, and industrial properties in the study area. Deep floodwater flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that may be destroyed, or in vehicles that are ultimately submerged or floated. Waterlines can be ruptured by deposits of debris and the force of floodwaters, thus creating the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters creating health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded areas and flood damages - The areas along the study reach of Brandywine Creek that would be flooded by the Standard Project Flood are shown on Plate 2, which is also an index map to Plates 3 through 6. Areas that would be flooded by the Intermediate Regional Flood and the Standard Project Flood are shown in detail on Plates 3 through 6. The actual limits of these overflow areas may vary somewhat from those shown on the maps because the 10-foot contour interval and scale of the maps do not permit precise plotting of the flooded area boundaries. As may be seen from these plates, floodflows from the main stem of Brandywine Creek inundate Wilmington and other small communities adjacent to the stream. The areas that would be flooded by the Intermediate Regional and Standard Project Floods include commercial and residential properties, along with associated streets and roads. Considerable damage to the facilities would occur during an Intermediate Regional Flood. However, due to the wider extent, greater depths of flooding, higher velocity flow and longer duration of flooding during a Standard Project Flood, damage would be more severe than during an Intermediate Regional Flood. Plates 7 and 8 show the water surface profile for the Intermediate Regional and Standard Project Floods. Plates 9 and 10 show the water surface profile for the same floods as modified by the proposed Soil Conservation Service Dams. Depth of flow in the channel can be estimated from these illustrations. Cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the Intermediate Regional and the Standard Project Floods are shown on Plate 11.

Obstructions - During floods, debris collecting on bridges and culverts could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the Intermediate Regional and Standard Project Floods. Similarly, the maps of flooded areas show the backwater effect of obstructive bridges and culverts, but do not reflect increased water surface elevation that could be caused by debris collecting against the structures, or by deposition of silt in the stream channel under structures. As previously indicated, there are 9 dams within the study area which have no flood control capacities but do act as obstructions to floodflows. Of the 19 bridges crossing the stream in the study area, many of them are obstructive to the Intermediate Regional Flood and all but 7 are obstructive to the Standard Project Flood. Table 6 shows water surface elevations at these bridges.

TABLE 6
BRIDGES ACROSS BRANDYWINE CREEK

			Water Surface Elevation(a)			
			Intermediate Regional Flood		Standard Project Flood	
Identification	Mileage Above Mouth	Under-clearance Elev. (a)	Natural	With Soil Conserv. Service Dams	Natural	With Soil Conserv. Service Dams
Abandoned Bridge	0.15	8.5	9.2(c)	9.2(c)	13.8(c)	13.8(c)
Penn Central R.R.	1.21	23.2	13.0	11.7	18.5	16.9
Gov. Printz Blvd.	1.49	14.0(b)	14.2	13.0	21.1	19.6
Jessup St.	1.87	15.7	14.9	13.6	24.6	22.3
Market St.	2.15	21.9	15.3	13.9	30.0	25.3
Baynard Blvd.	2.42	High Level Bridge	24.0	23.0	36.0	31.5
Van Buren St.	2.74	34.4(b)	26.9	25.1	40.2	34.5
Interstate Rte. 95	2.82	High Level Bridge	28.5	26.5	41.0	36.0
Foot Bridge-Brandywine Park	3.16	38.7	38.0	36.0	49.4	46.3
Baltimore & Ohio R.R.	3.17	High Level Bridge	38.2	36.0	49.5	46.5
Union St.	3.19	High Level Bridge	38.3	36.2	49.5	46.5
Private Bridge-Textile Mill	3.93	64.0	61.4	59.6	72.0	68.6
Rising Sun Rd.	4.78	110.2	92.1	90.6	103.6	99.8
New Bridge Rd.	5.11	High Level Bridge	104.0	101.0	115.0	112.2
Iron Bridge	6.19	133.4	126.5	124.6	136.7	135.4
Reading R.R.	7.21	138.8	137.1	135.0	150.4	148.3
Rockland Rd.	7.30	135.3	139.5	137.5	153.2	151.2
Thompson Bridge Rd.	8.82	145.7	148.8	145.3	161.2	158.0
Smith Bridge Rd.	10.47	150.6	154.0	148.8	164.3	161.4

(a) Feet, mean sea level datum, on upstream side of bridge.

(b) Indicates average elevation.

(c) Tidal.

Velocities of flow - Water velocities during floods depend largely on the size and shape of the cross sections, conditions of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream. During an Intermediate Regional Flood, velocities of main channel flow in the study area would be 4 to 15 feet per second. Water flowing at this rate is capable of causing severe erosion to streambanks and fill around bridge abutments and transporting large objects. It is expected that velocity of main channel flow during a Standard Project Flood would be slightly higher than during an

Intermediate Regional Flood. Overbank flow in the study area during these floods would average 2 to 6 feet per second. Water flowing at 2 feet per second or less would deposit debris and silt. Table 7 lists the maximum velocities that would occur in the main channel and overbank areas of Brandywine Creek in the study area during the Intermediate Regional and the Standard Project Floods.

Rates of rise and duration of flooding - Intense rainfalls that accompany severe storm fronts usually produce the floods occurring in the Brandywine Basin. There is a time lag of several hours before overbank flooding occurs along the main stream. Floods generally rise slowly and stay out of banks for long periods of time. Table 8 gives the maximum rate of rise, height of rise (from critical stage level to maximum floodflow level), time of rise (time period corresponding to height of rise), and duration of critical stage (period of time flooding is above critical stage level) for the Standard Project Flood and various past floods.

TABLE 7
MAXIMUM VELOCITIES
Brandywine Creek in Study Area

Location	Mileage Above Mouth	Intermediate Regional Flood				Standard Project Flood			
		Natural		With Soil Conservation Service Dams		Natural		With Soil Conservation Service Dams	
		Channel ft/sec	Overbank ft/sec	Channel ft/sec	Overbank ft/sec	Channel ft/sec	Overbank ft/sec	Channel ft/sec	Overbank ft/sec
Cross Section:									
2	2.95	6.4	2.1	5.8	1.8	9.2	3.4	8.5	3.1
7	5.59	10.9	4.1	9.8	3.8	15.1	5.6	14.1	5.2
10	9.67	4.7	1.7	4.7	1.7	6.4	2.7	5.9	2.4

TABLE 8
RATES OF RISE AND DURATION
U.S.G.S. Gage on Brandywine Creek at Wilmington, Delaware

Flood	Maximum Rate of Rise ft./hr.	Height of Rise ft.	Time of Rise hrs.	Duration of Critical Stage hrs.
Standard Project	2.5	21.0	15	42
August 19, 1955	1.3	6.6	12	28
September 13, 1960	1.0	4.1	18	31
November 25, 1950	0.8	4.0	13	27

NOTE: Critical stage is 7.3 feet at the gage and is 1.2 feet below overbank. This data from actual floods shows the effects on flood characteristics from various rainfall distributions and intensities.

Photographs, future flood heights - The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations along Brandywine Creek are indicated on the following photographs.

FIGURE 4 - Future flood height at the intersection of Bennett and 11th Streets.

FIGURE 5 - Future flood height at Jessup Street bridge.

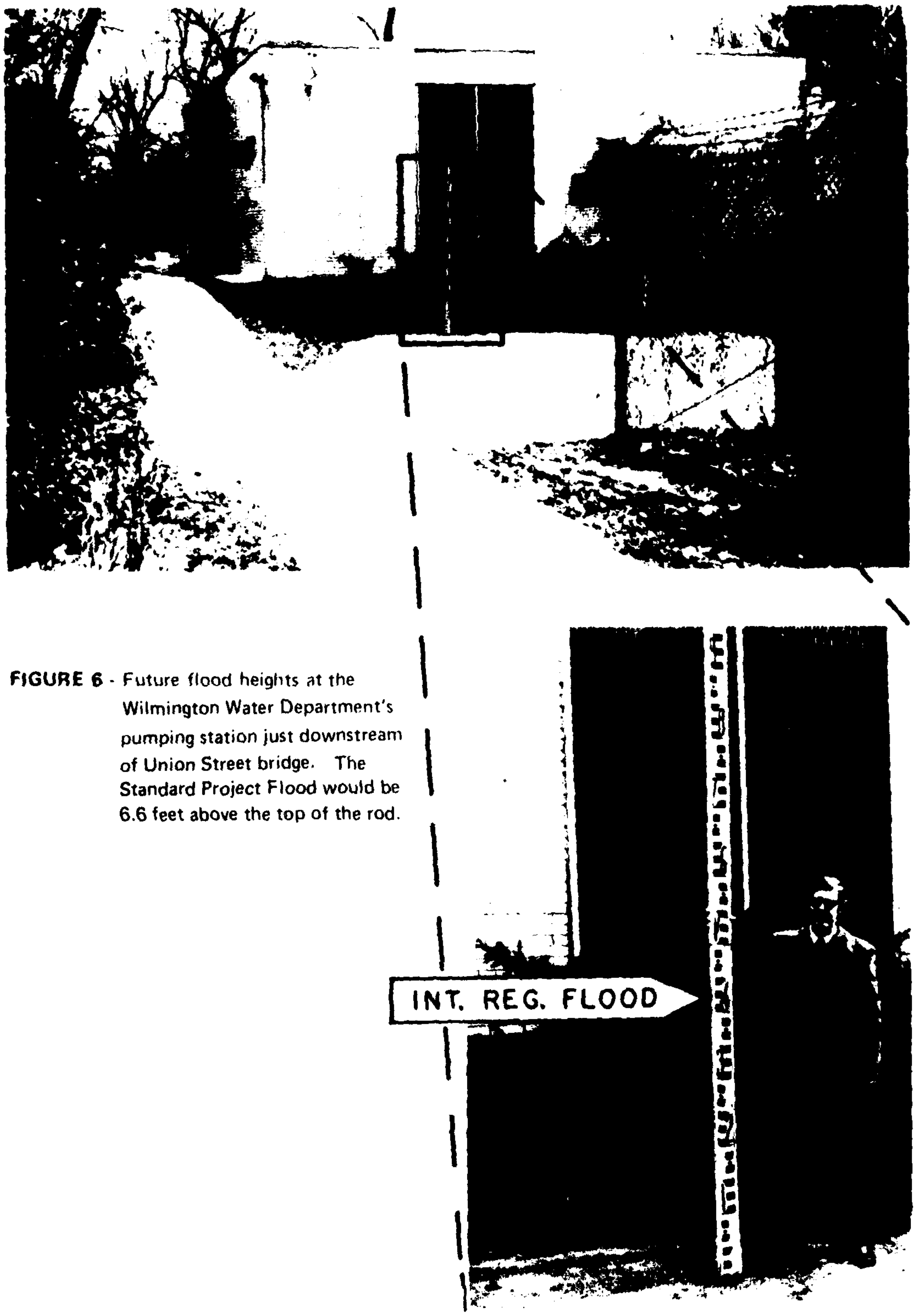


FIGURE 6 - Future flood heights at the Wilmington Water Department's pumping station just downstream of Union Street bridge. The Standard Project Flood would be 6.6 feet above the top of the rod.

FIGURE 7 - Future flood heights at Hagley Museum. The Standard Project Flood would be 5.8 feet above the top of the rod.

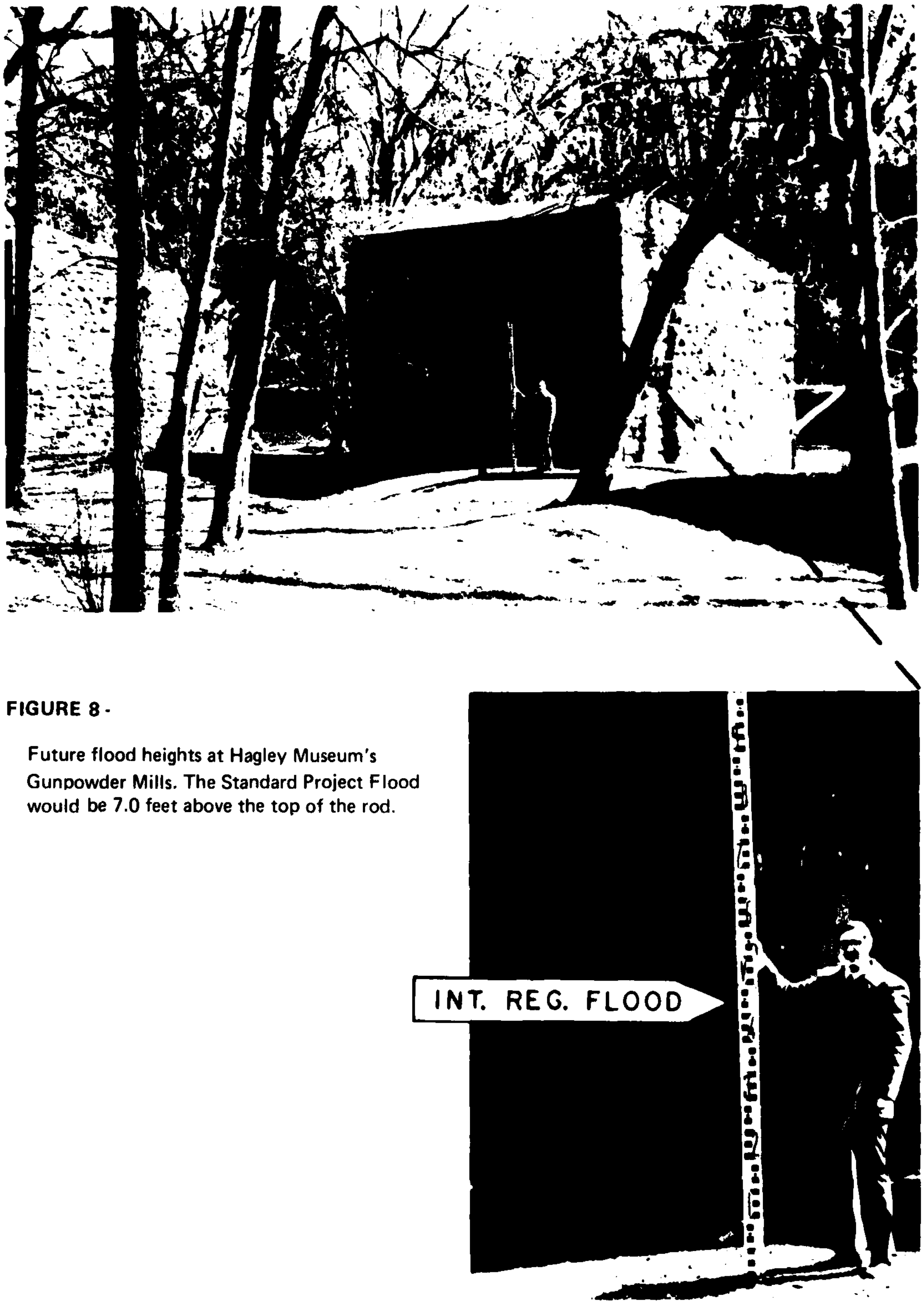


FIGURE 8 -

Future flood heights at Hagley Museum's Gunpowder Mills. The Standard Project Flood would be 7.0 feet above the top of the rod.

GLOSSARY

Backwater. The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Plain. The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Hurricane. An intense cyclonic windstorm of tropical origin in which winds tend to spiral inward in a counterclockwise direction toward a core of low pressure, with maximum surface wind velocities that equal or exceed 75 miles per hour (65 knots) for several minutes or longer at some points. Tropical storm is the term applied if maximum winds are less than 75 miles per hour.

Hydrograph. *A graph showing flow values against time at a given point, usually* measured in cubic feet per second. The area under the curve indicates total volume of flow.

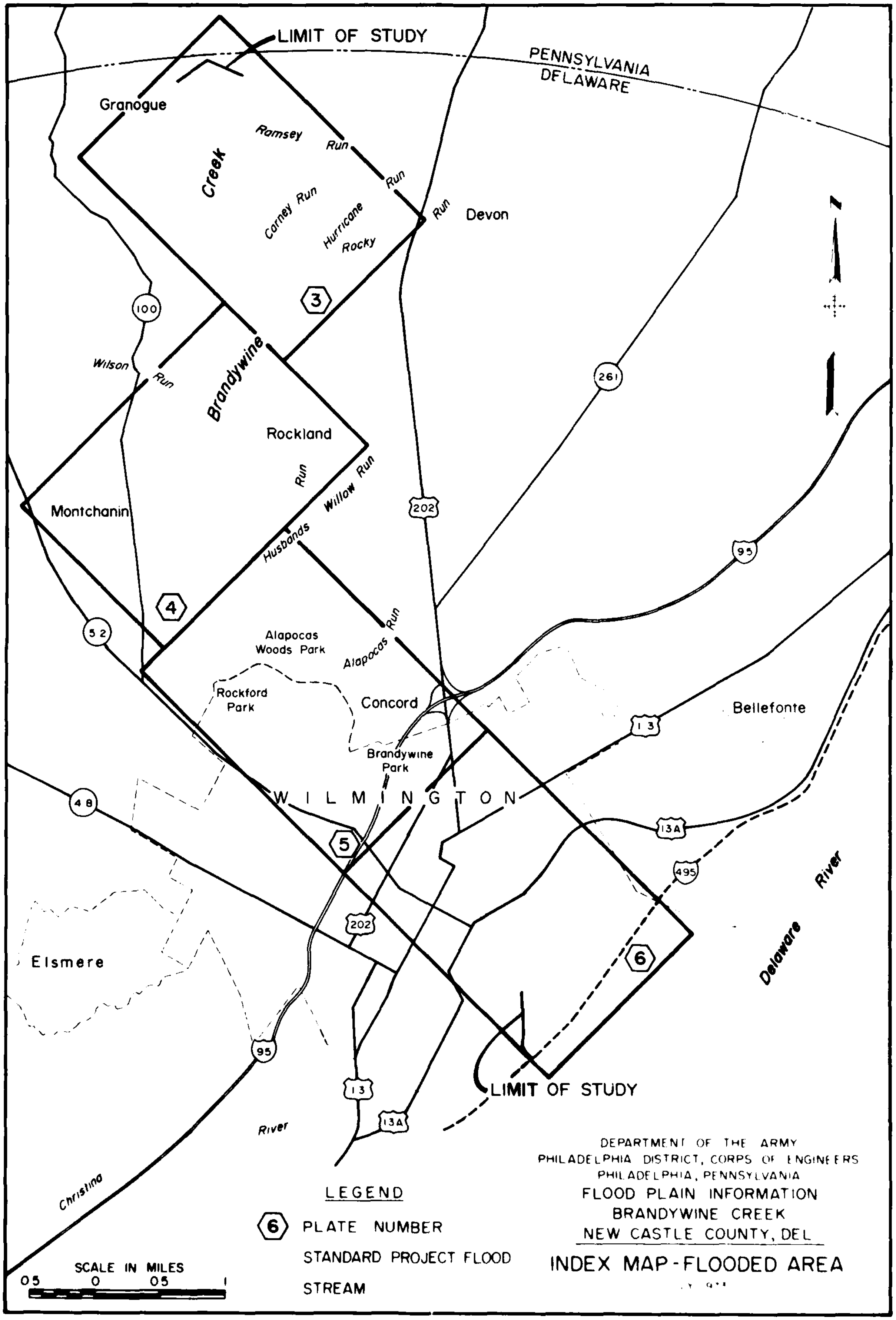
Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40-60 percent of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance Elevation. The elevation at the top of the opening of a culvert, or other structure through which water may flow along a watercourse.



LEGEND

⑥ PLATE NUMBER

STANDARD PROJECT FLOOD

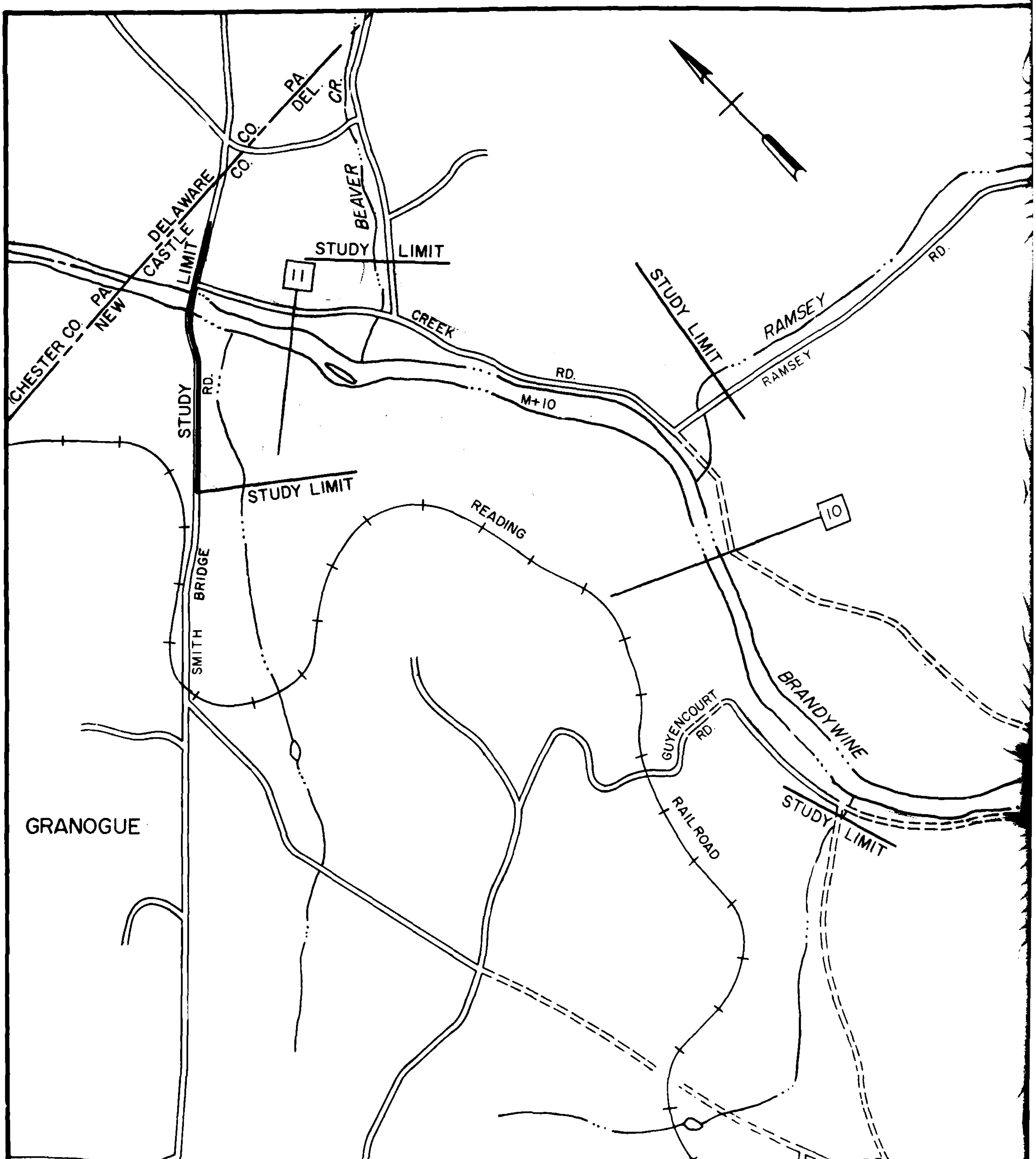
STREAM

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

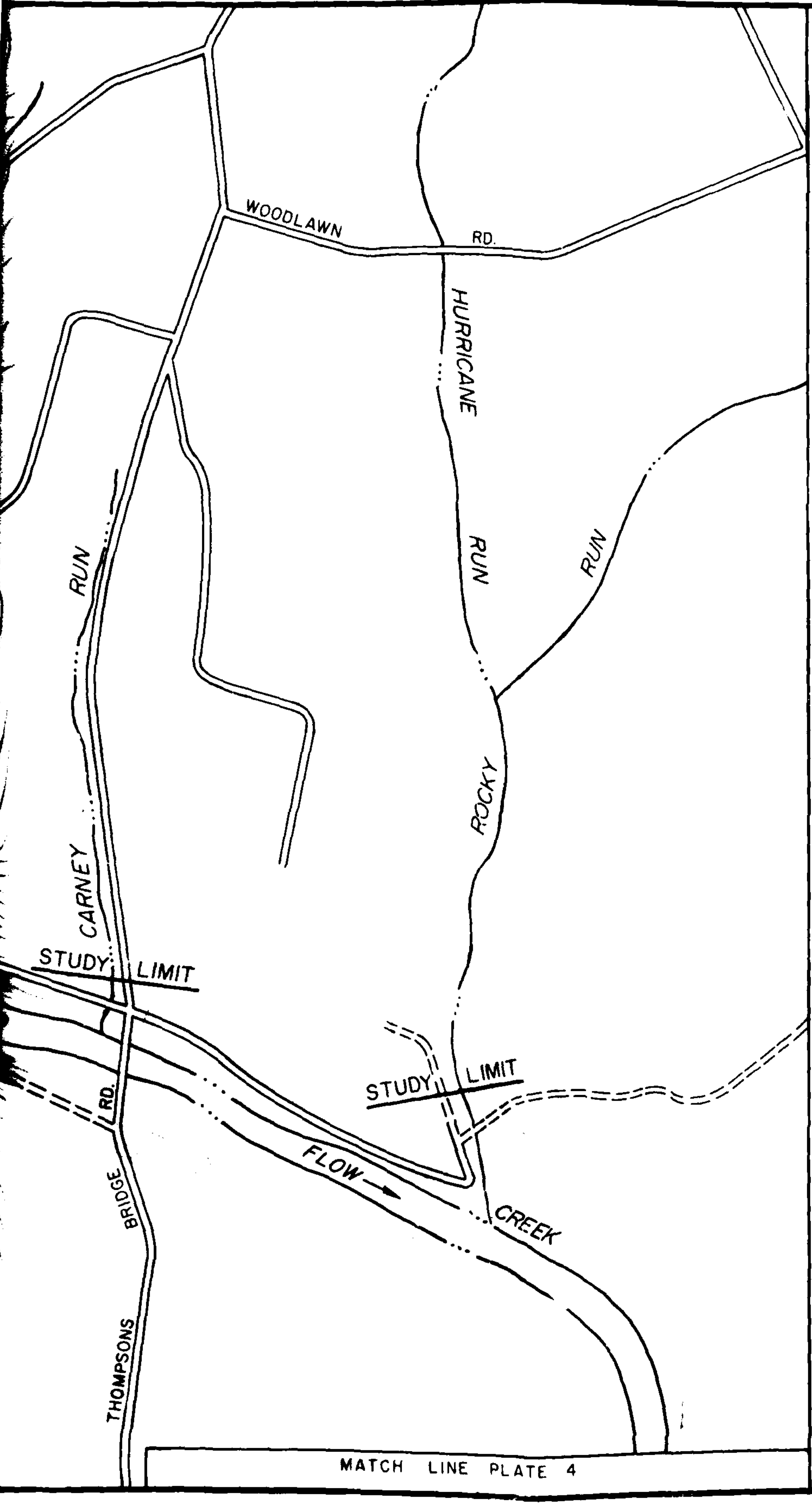
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL

INDEX MAP-FLOODED AREA

PLATE 2



CHESTER CO. PA.
NEW CASTLE CO.
DELAWARE
DEL. CO. PA.
CR.
BEAVER
STUDY LIMIT
11
CREEK
RD.
M+10
STUDY RD. LIMIT
STUDY LIMIT
RAMSEY RD.
RAMSEY
STUDY LIMIT
10
READING RAILROAD
SMITH BRIDGE RD.
BRANDYWINE
GUYENCOURT RD.
STUDY LIMIT
GRANOGUE



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD
M+10	MILES ABOVE MOUTH
10	CROSS SECTION
	GROUND ELEVATION IN FEET (U.S.C.& G.S. 1929 ADJ.) SEA LEVEL DATUM
	CHANNEL
	STATE LINE

NOTES:

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEETS WILMINGTON-NORTH 1967 & WILMINGTON-SOUTH 1967. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

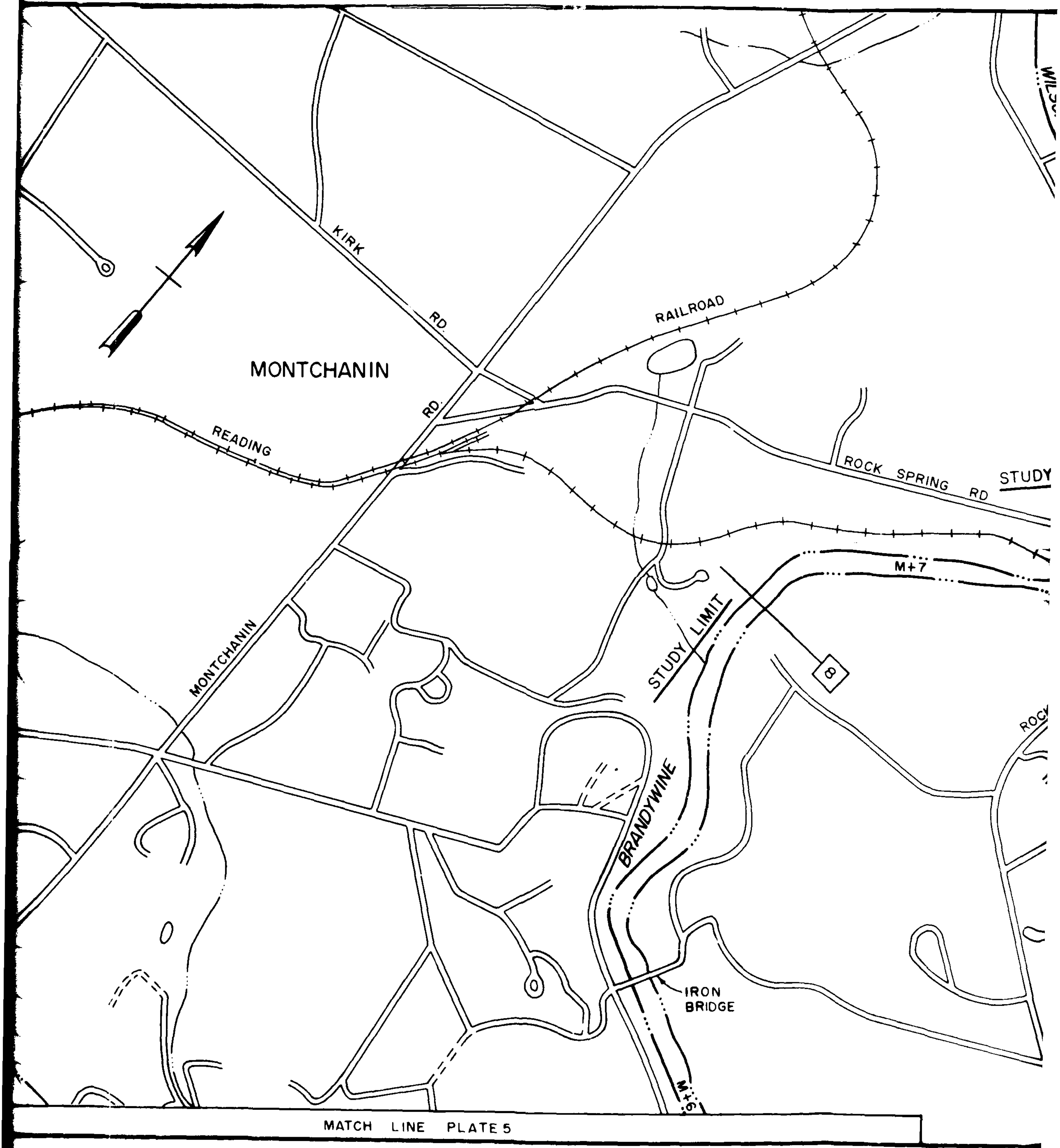
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

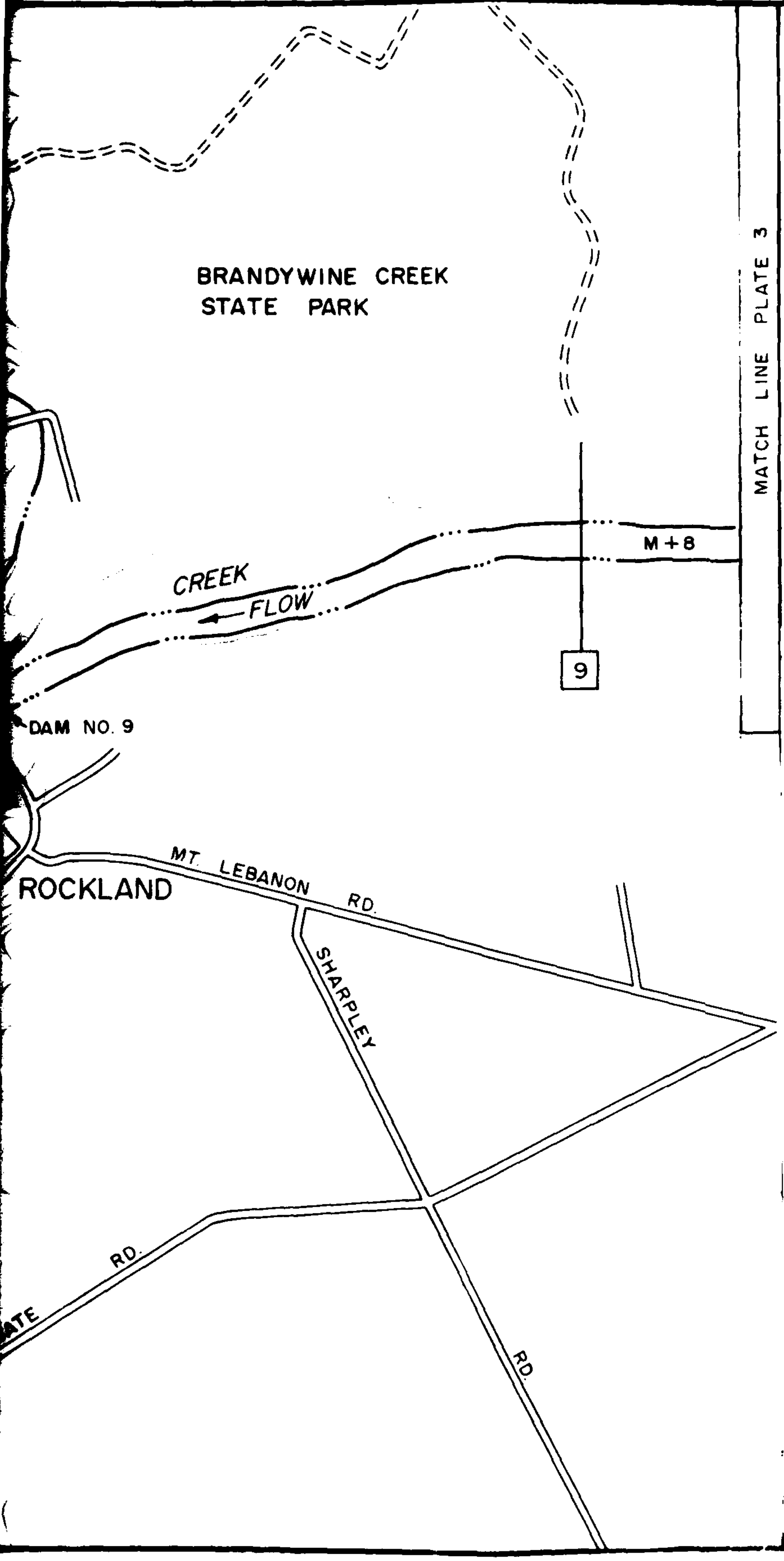
FLOOD PLAIN INFORMATION

BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

FLOODED AREAS

JULY 1973


KIRK RD.
RAILROAD
MONTCHANIN
RD.
READING
ROCK SPRING RD
STUDY
WILS
M+7
STUDY LIMIT
8
MONTCHANIN
ROCK
BRANDYWINE
IRON BRIDGE
M+6
MATCH LINE PLATE 5



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD
M+6	MILES ABOVE MOUTH
8	CROSS SECTION
	GROUND ELEVATION IN FEET (U.S.C.& G.S. 1929 ADJ.) SEA LEVEL DATUM
	CHANNEL

NOTES:

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEETS WILMINGTON-NORTH 1967 & WILMINGTON-SOUTH 1967. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
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4. MINIMUM CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

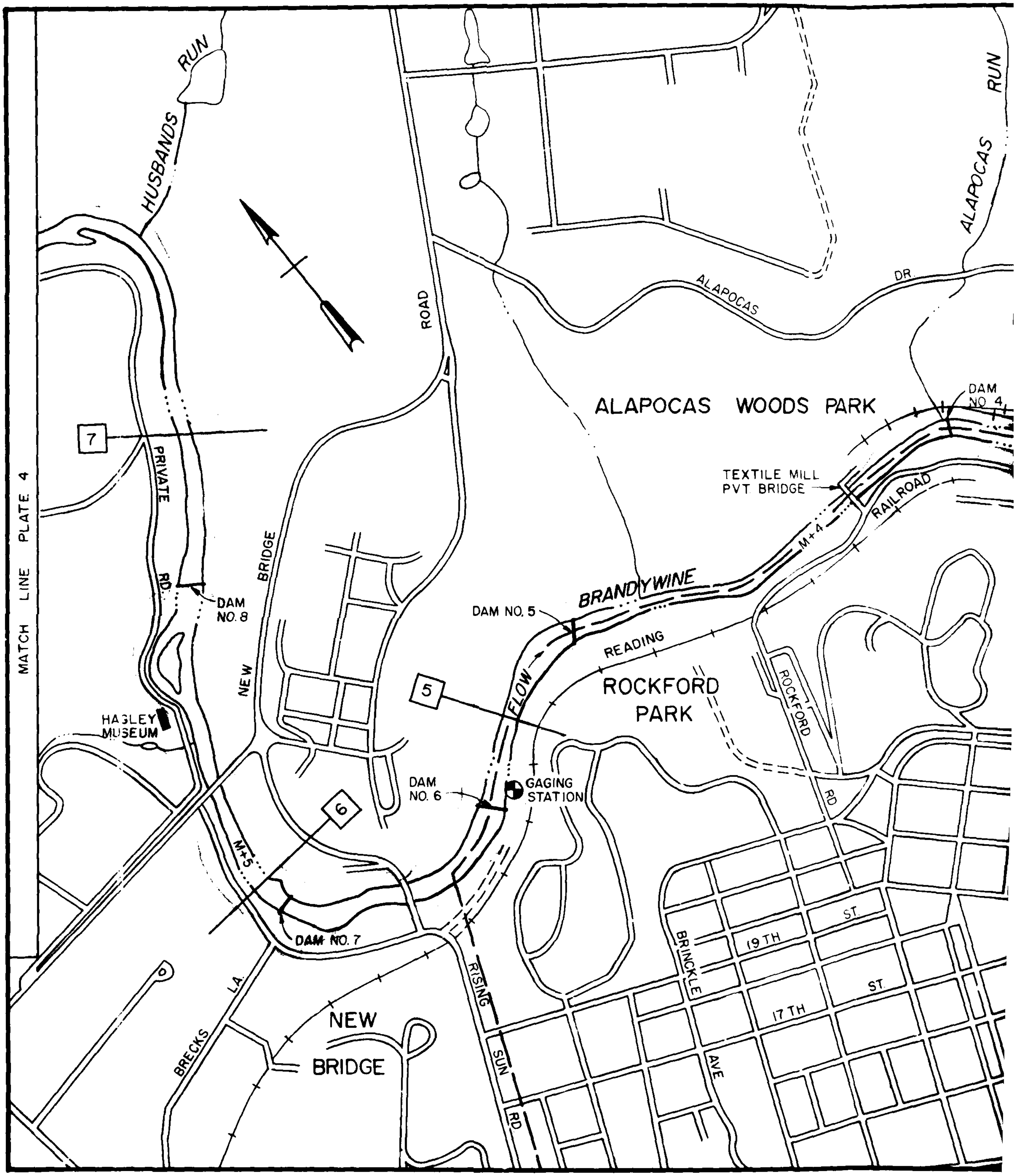
FLOOD PLAIN INFORMATION

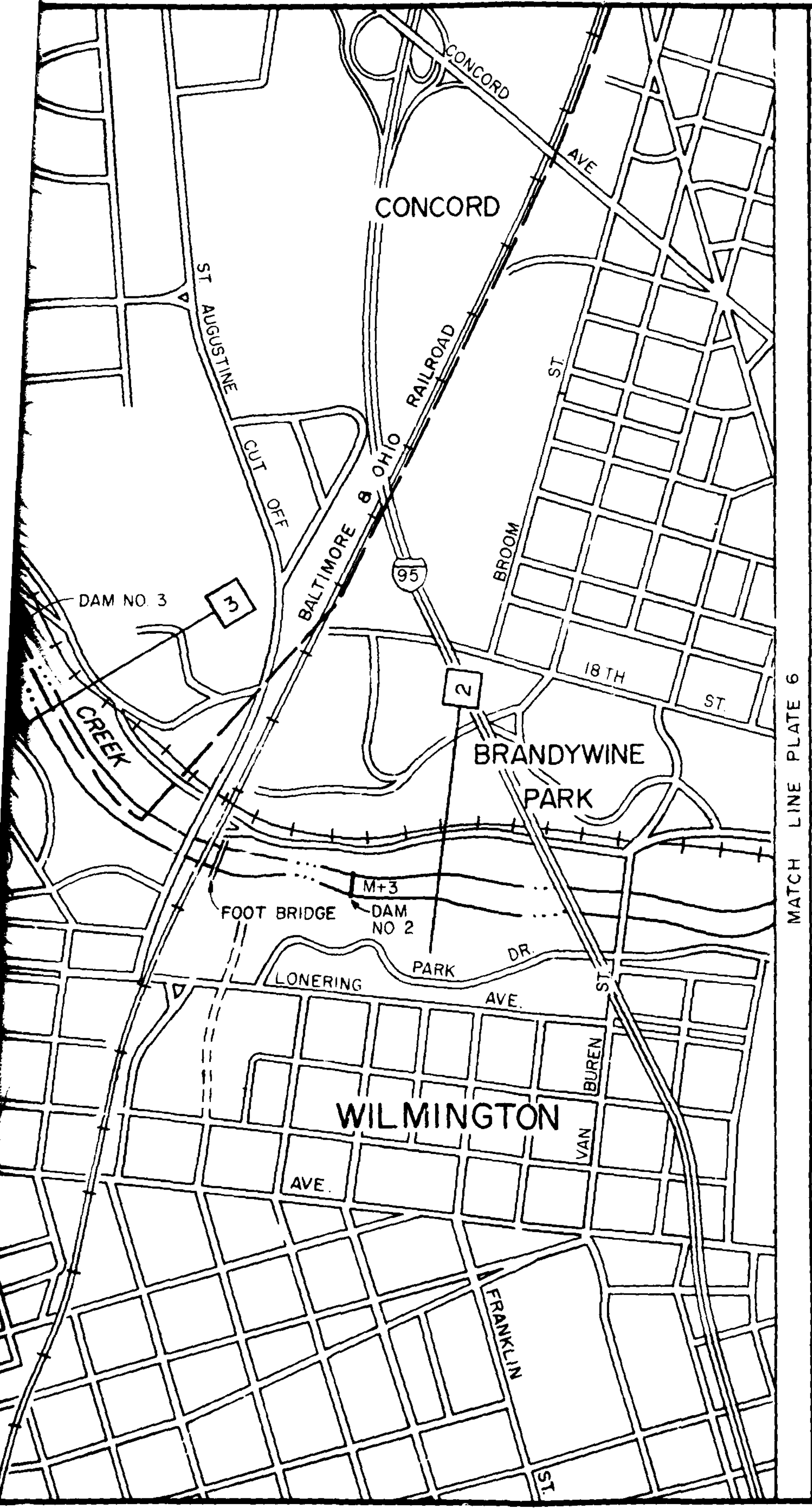
BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

FLOODED AREAS

JULY 1973

PLATE 4


MATCH LINE PLATE 4
HUSBANDS RUN
ALAPOCAS RUN
ROAD
ALAPOCAS DR.
ALAPOCAS WOODS PARK
DAM NO. 4
TEXTILE MILL PVT. BRIDGE
RAILROAD
M+4
BRANDYWINE
FLOW
DAM NO. 5
READING
ROCKFORD PARK
ROCKFORD RD
5
GAGING STATION
DAM NO. 6
6
7
PRIVATE RD.
DAM NO. 8
NEW BRIDGE
HAGLEY MUSEUM
M+5
DAM NO. 7
RISING SUN RD
BRINCKLE AVE
19 TH ST.
17 TH ST.
BRECKS LA.
NEW BRIDGE



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+3 MILES ABOVE MOUTH

4 CROSS SECTION

GROUND ELEVATION IN FEET (U.S.C.& G.S. 1929 ADJ.) SEA LEVEL DATUM

CHANNEL

95 INTERSTATE HIGHWAY

CITY LIMITS

NOTES:

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEETS WILMINGTON-NORTH 1967 & WILMINGTON -SOUTH 1967. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

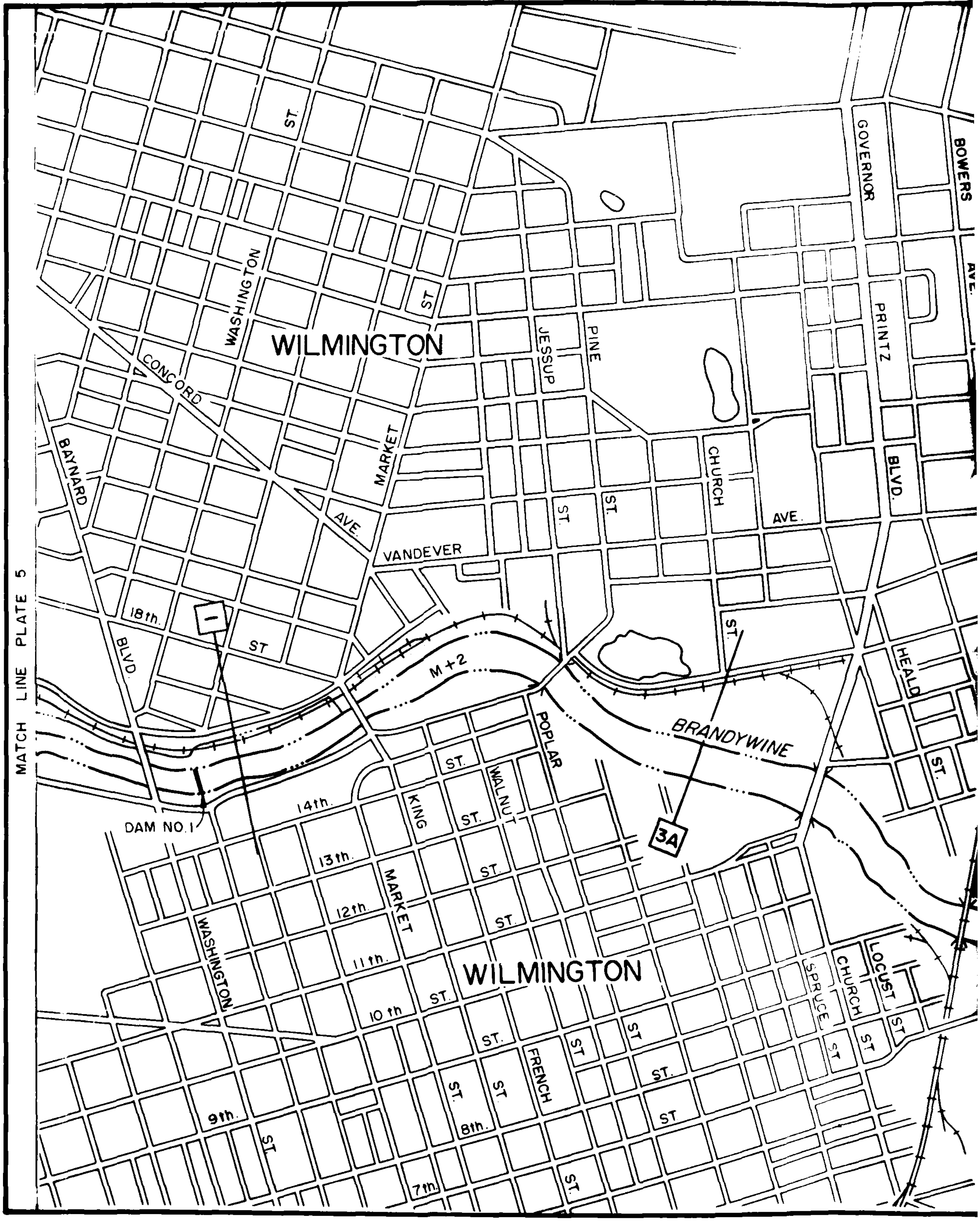
FLOOD PLAIN INFORMATION

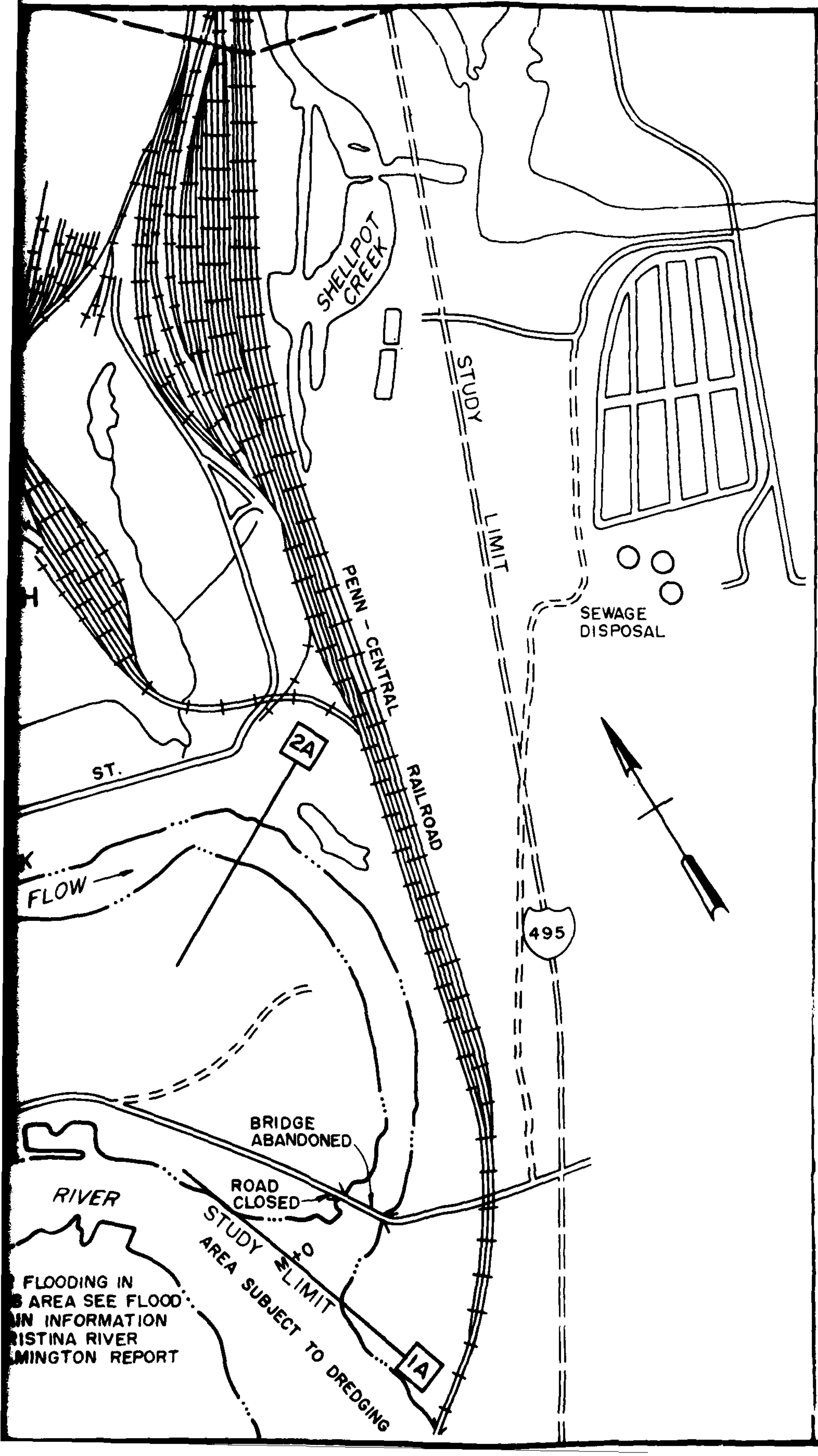
BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

FLOODED AREAS

JULY 1973

PLATE 5


MATCH LINE PLATE 5
WILMINGTON
WILMINGTON
WASHINGTON
WASHINGTON
ST.
ST.
CONCORD
AVE.
MARKET
MARKET
BAYNARD
BLVD.
18th.
ST
VANDEVER
JESSUP
ST.
PINE
ST.
CHURCH
AVE.
GOVERNOR
PRINTZ
BLVD.
BOWERS
AVE.
HEALD
ST.
M+2
BRANDYWINE
POPLAR
ST.
KING
WALNUT
ST.
ST.
ST.
DAM NO.1
14th.
13th.
12th.
11th.
10 th
ST.
ST.
FRENCH
ST
ST
ST.
ST
ST.
ST.
9th.
ST.
8th.
7th.
ST.
SPRUCE
ST
CHURCH
ST
LOCUST
ST
1
3A



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M+2	MILES ABOVE MOUTH
1	CROSS SECTION
	GROUND ELEVATION IN FEET (U.S.C.& G.S. 1929 ADJ.) SEA LEVEL DATUM
	CHANNEL
495	INTERSTATE HIGHWAY
	CITY LIMITS

NOTES:

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEETS WILMINGTON-NORTH 1967 & WILMINGTON -SOUTH 1967. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

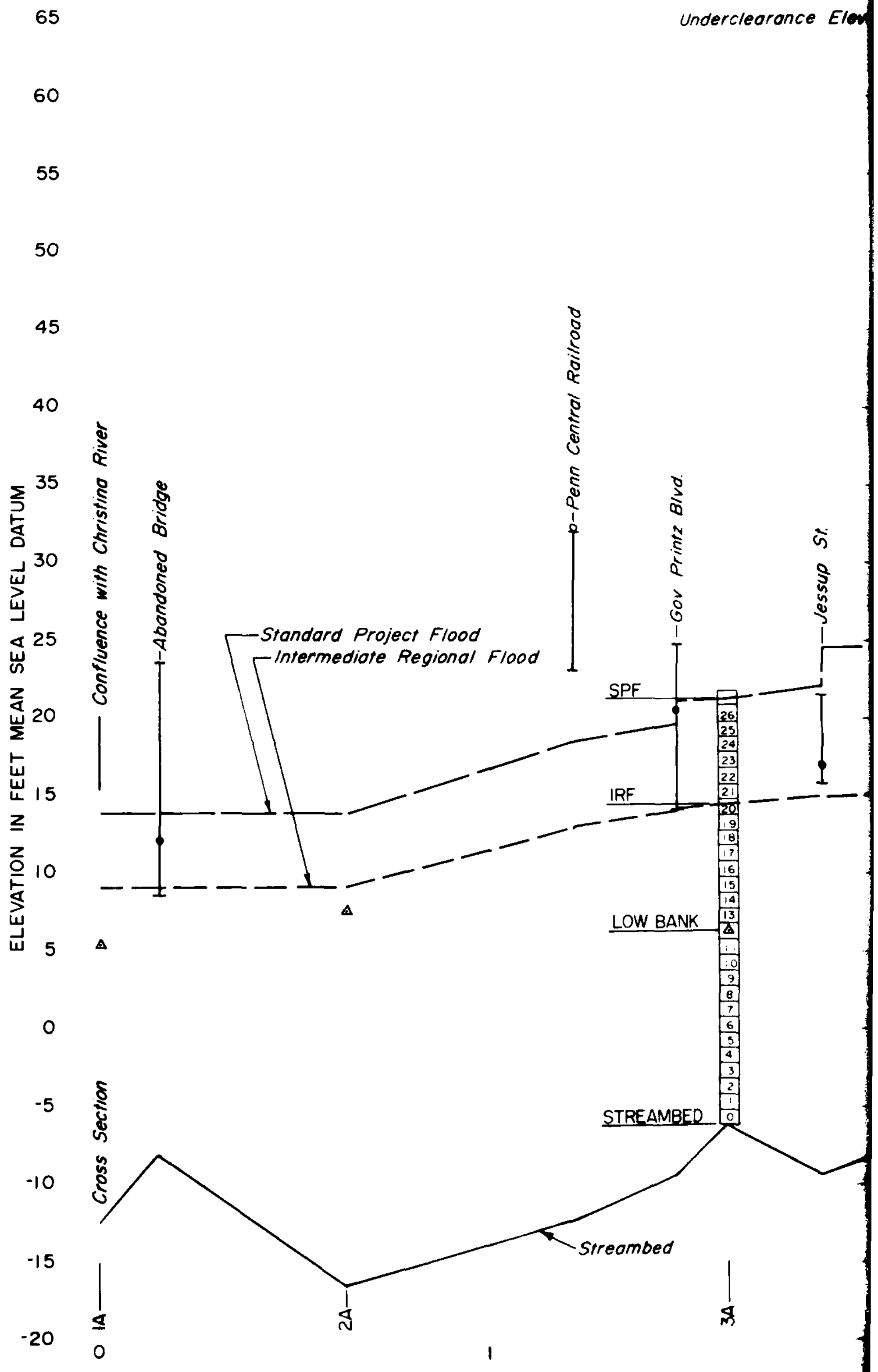
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION

BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

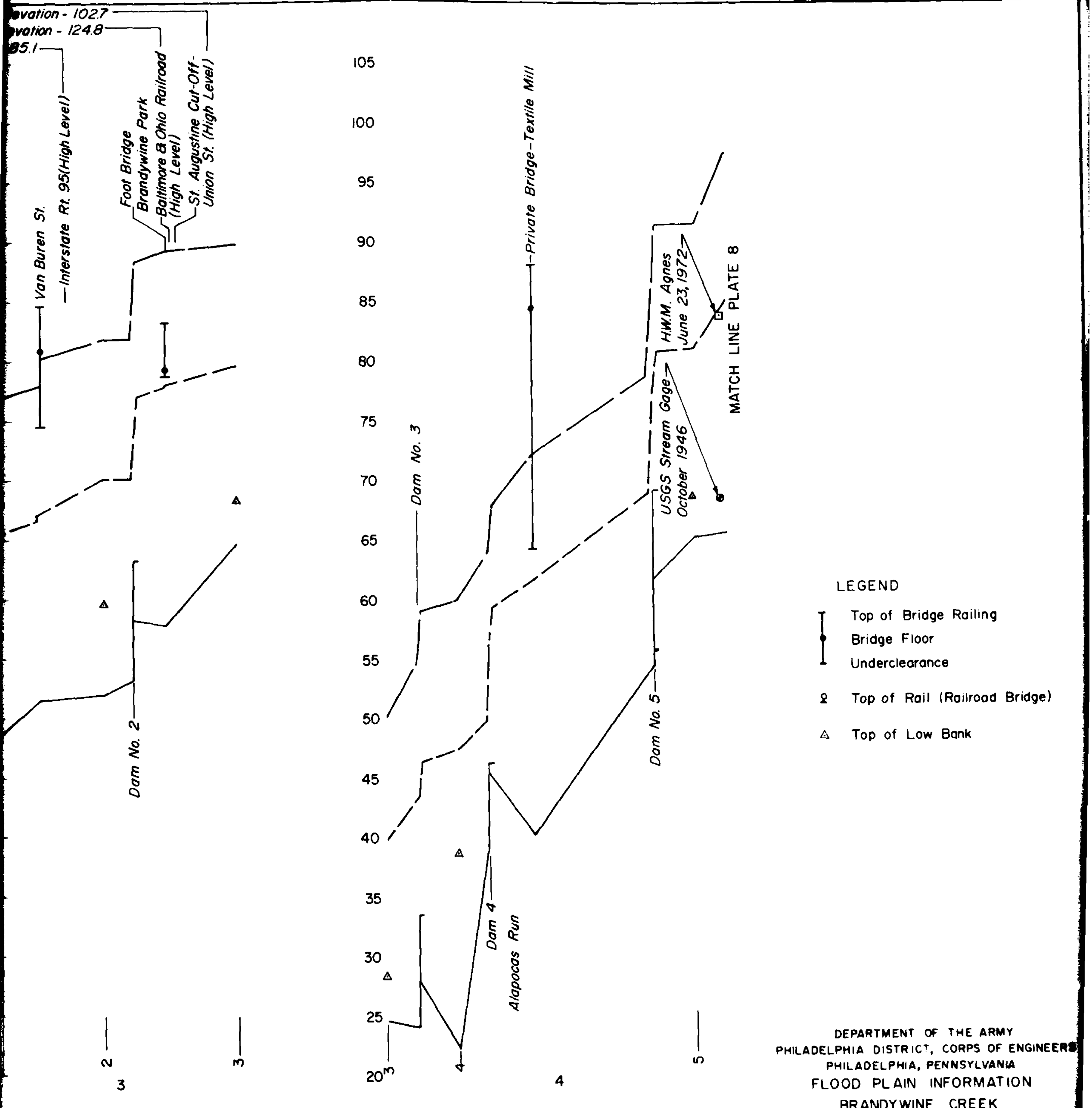
FLOODED AREAS

JULY 1973



<u>Note</u>

Stationing of natural streambed for Brandywine Creek begins along the projection of the left bank of Christina River at the confluence with Brandywine Creek



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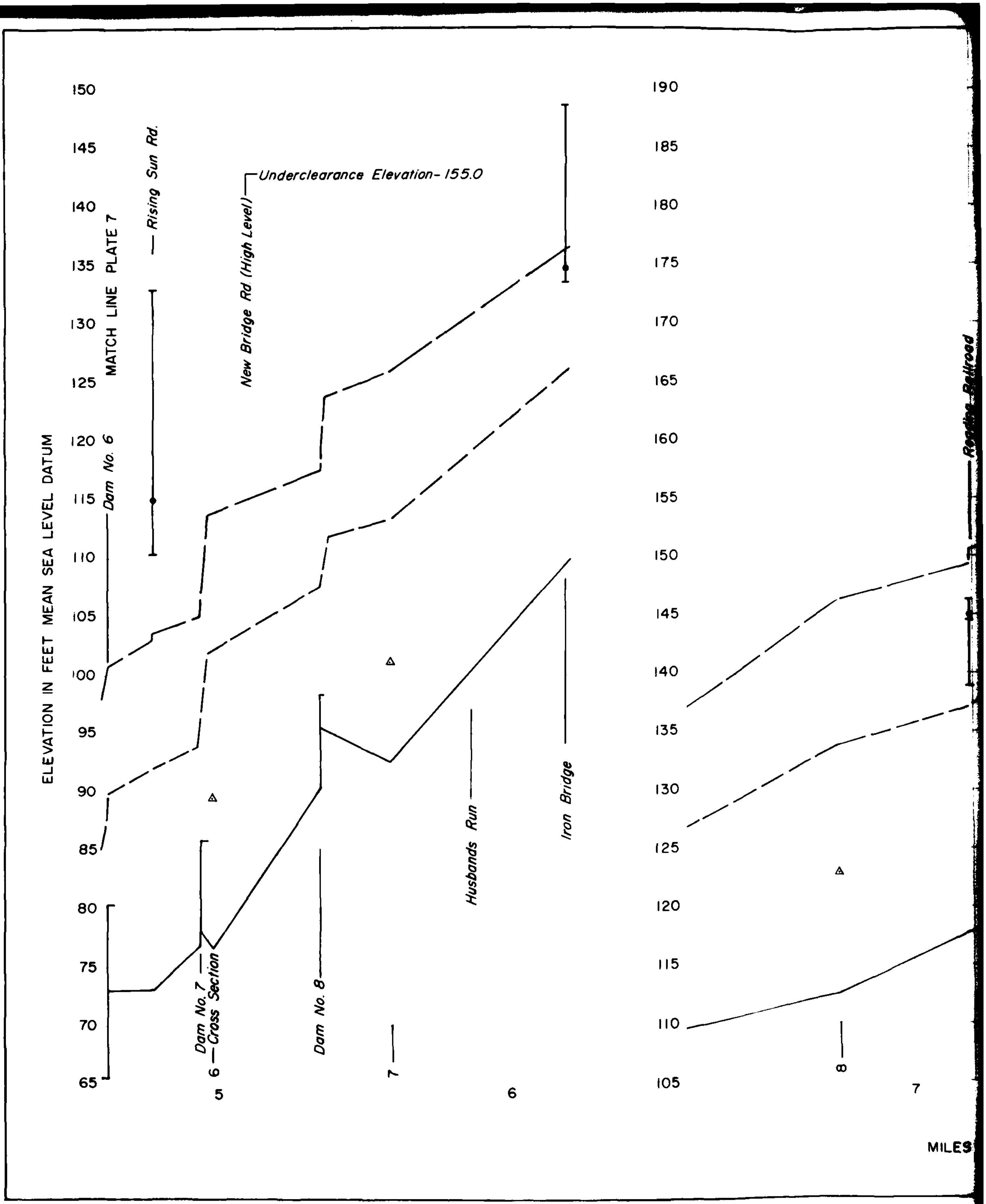
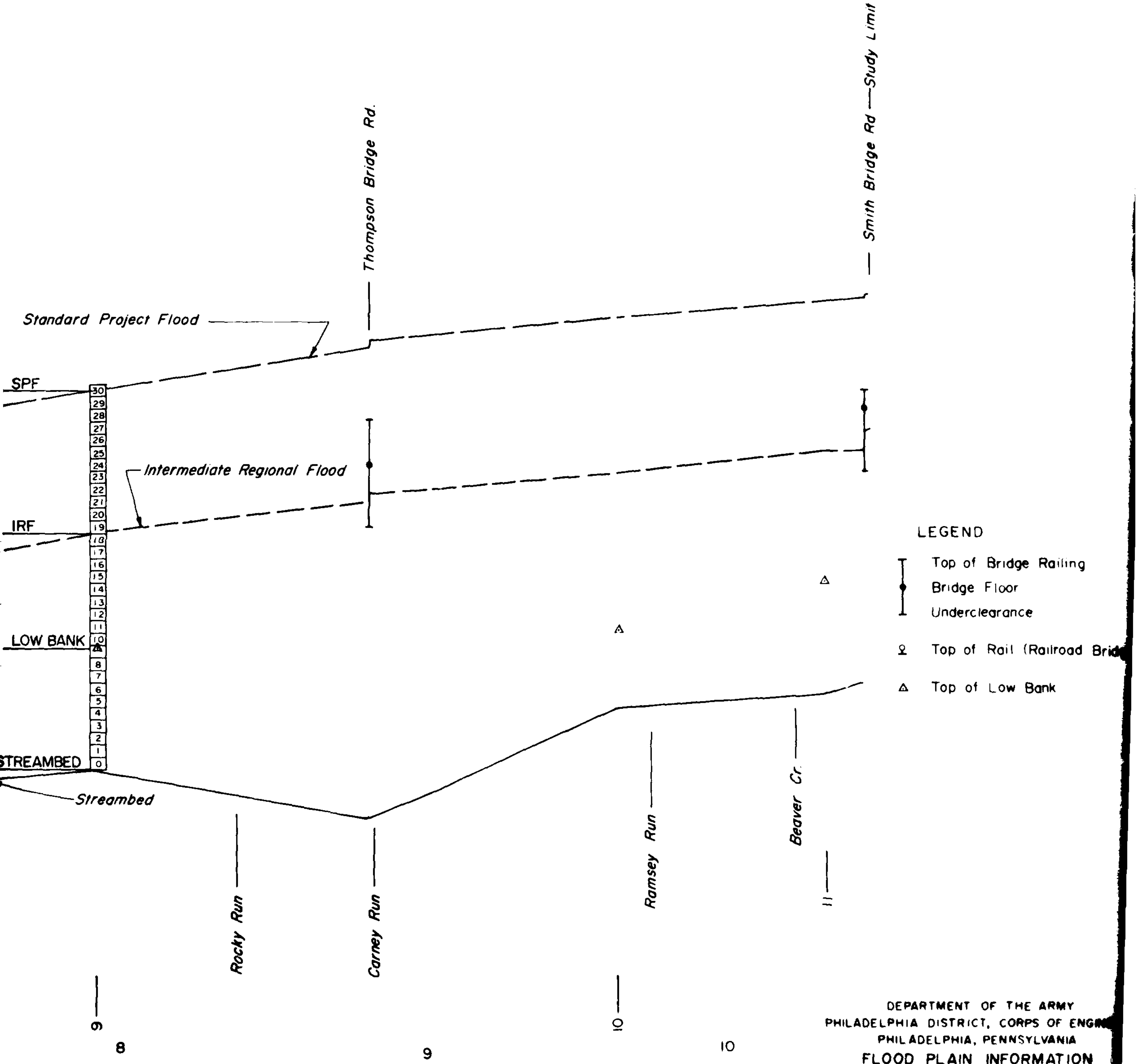
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY
DELAWARE
HIGH WATER PROFILES
JULY 1973

PLATE


ELEVATION IN FEET MEAN SEA LEVEL DATUM
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
MATCH LINE PLATE 7
Rising Sun Rd.
Underclearance Elevation- 155.0
New Bridge Rd (High Level)
Dam No. 6
Dam No.7
Cross Section
Dam No. 8
Husbands Run
Iron Bridge
Reading Railroad
6
7
8
5
6
7
MILES



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PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION

BRANDYWINE CREEK

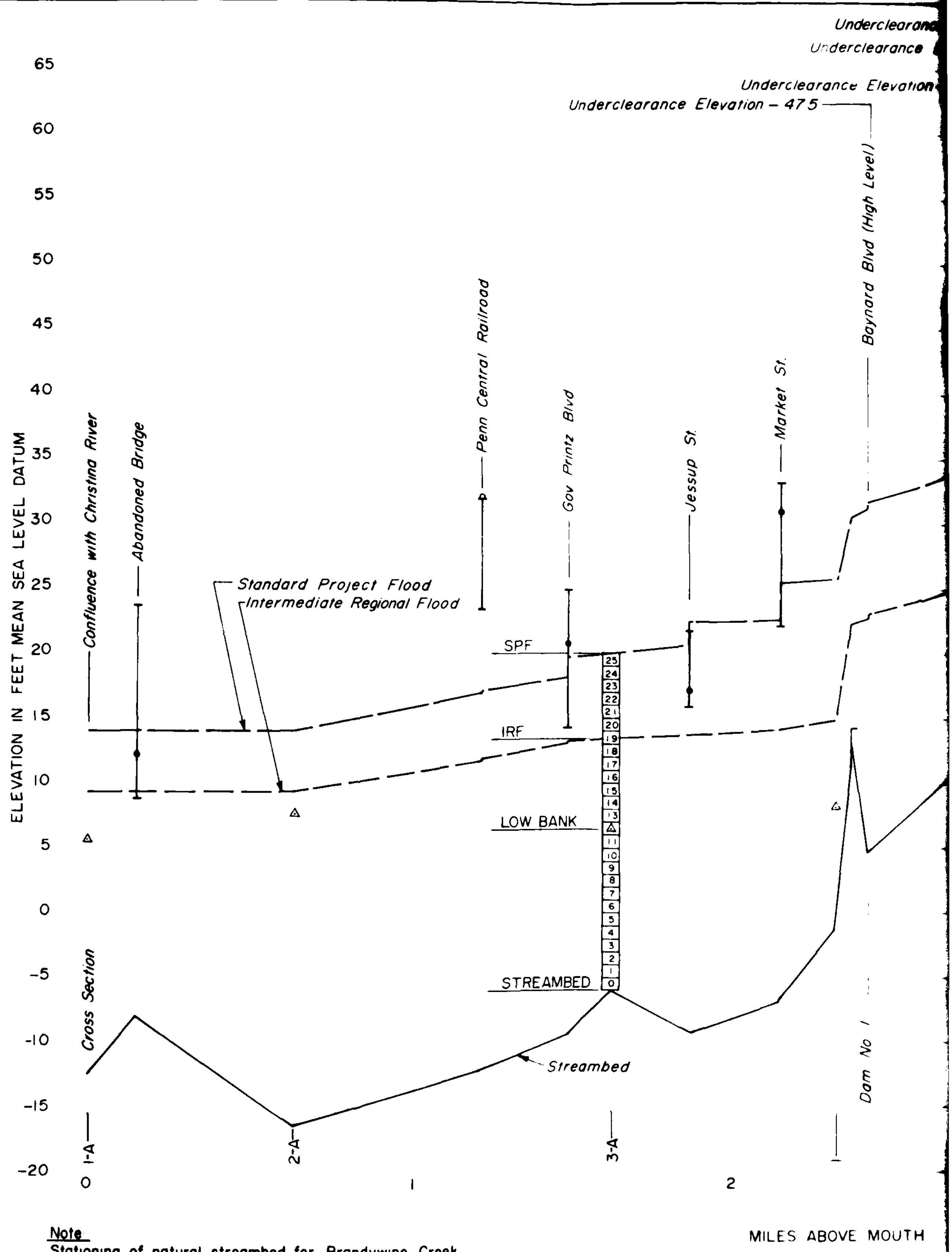
NEW CASTLE COUNTY

DELAWARE

HIGH WATER PROFILES

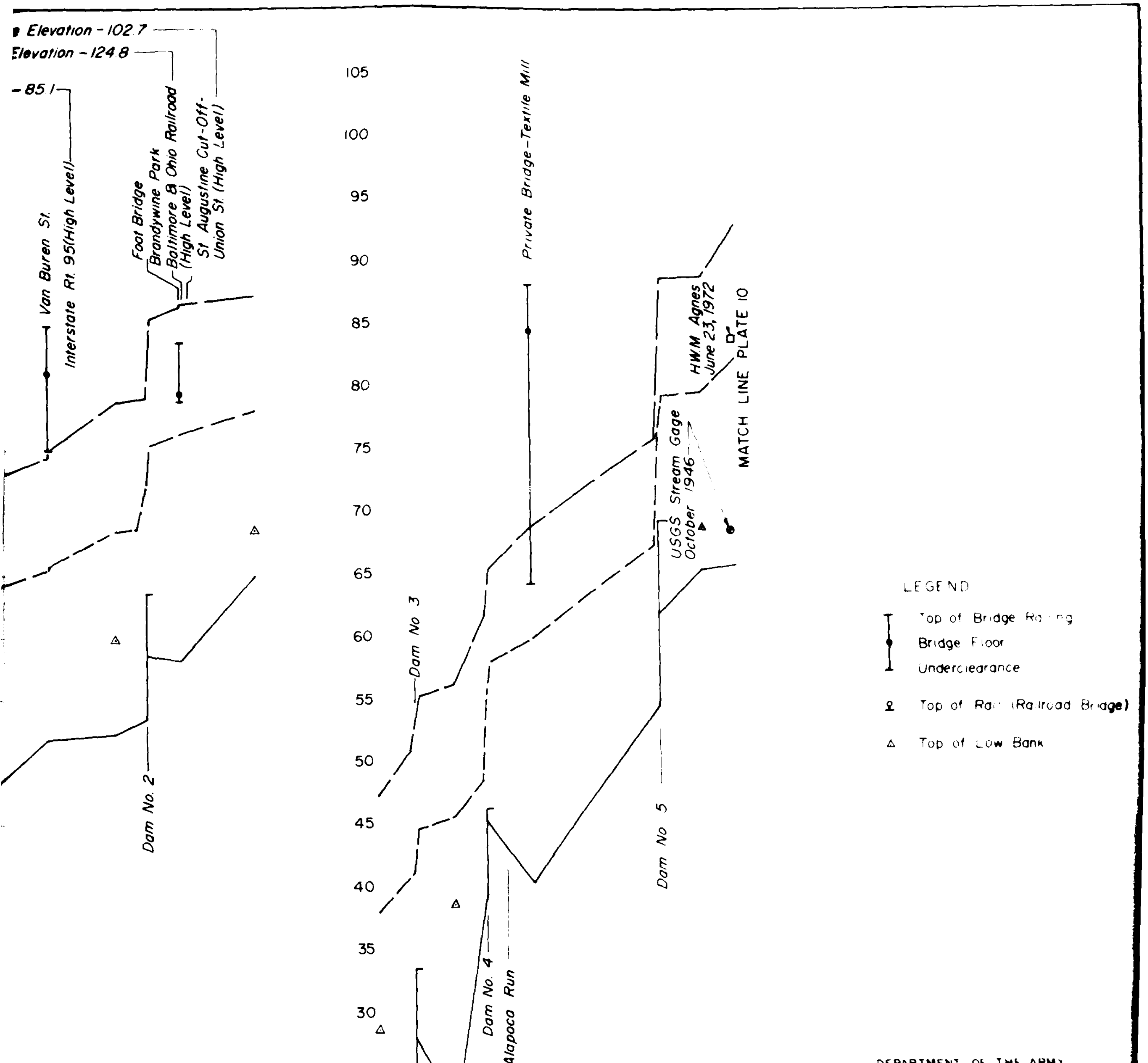
JULY 1973

PLA



Note

Stationing of natural streambed for Brandywine Creek begins along the projection of the left bank of Christina River at the confluence with Brandywine Creek.



DEPARTMENT OF THE ARMY
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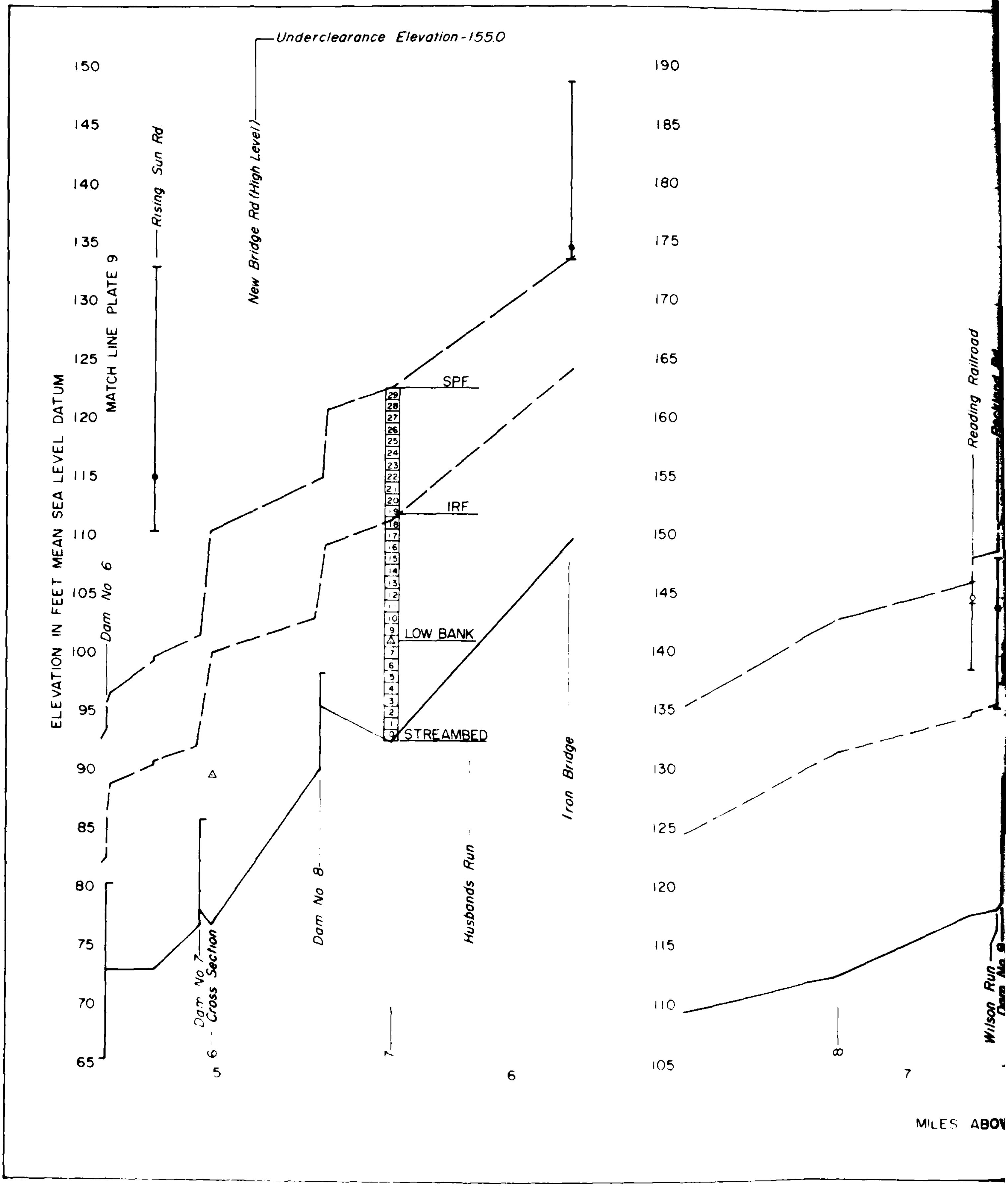
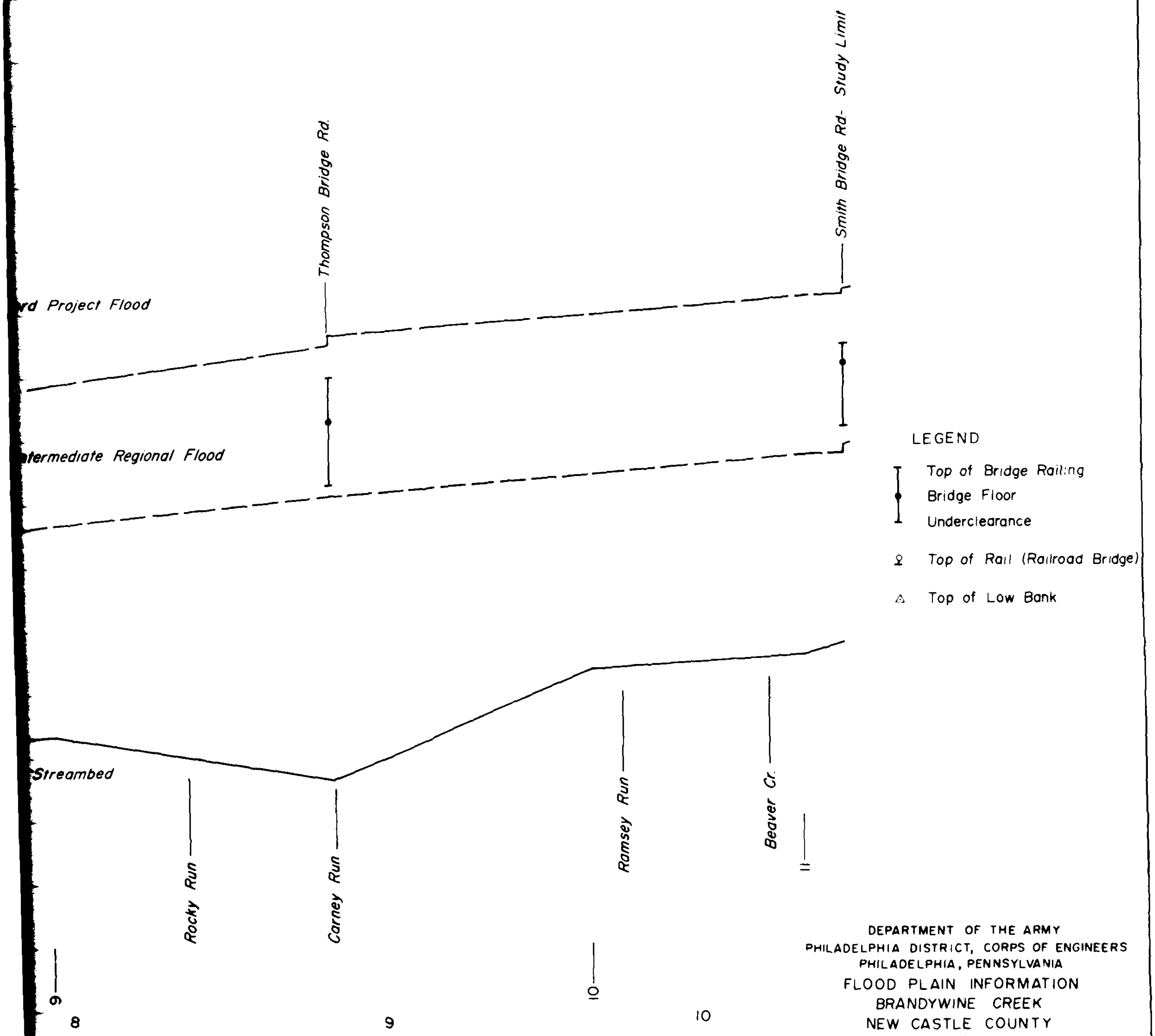
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY
<u>DELAWARE</u>
HIGH WATER PROFILES
WITH SOIL CONSERVATION
SERVICE DAMS

PLAT



Underclearance Elevation - 155.0
New Bridge Rd (High Level)
Rising Sun Rd
MATCH LINE PLATE 9
ELEVATION IN FEET MEAN SEA LEVEL DATUM
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
SPF
IRF
LOW BANK
STREAMBED
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Dam No 6
Dam No 7
Cross Section
6
Dam No 8
7
Husbands Run
Iron Bridge
8
Reading Railroad
Rockland Rd
Wilson Run
Dam No 9
5
6
7
MILES ABOV



DEPARTMENT OF THE ARMY
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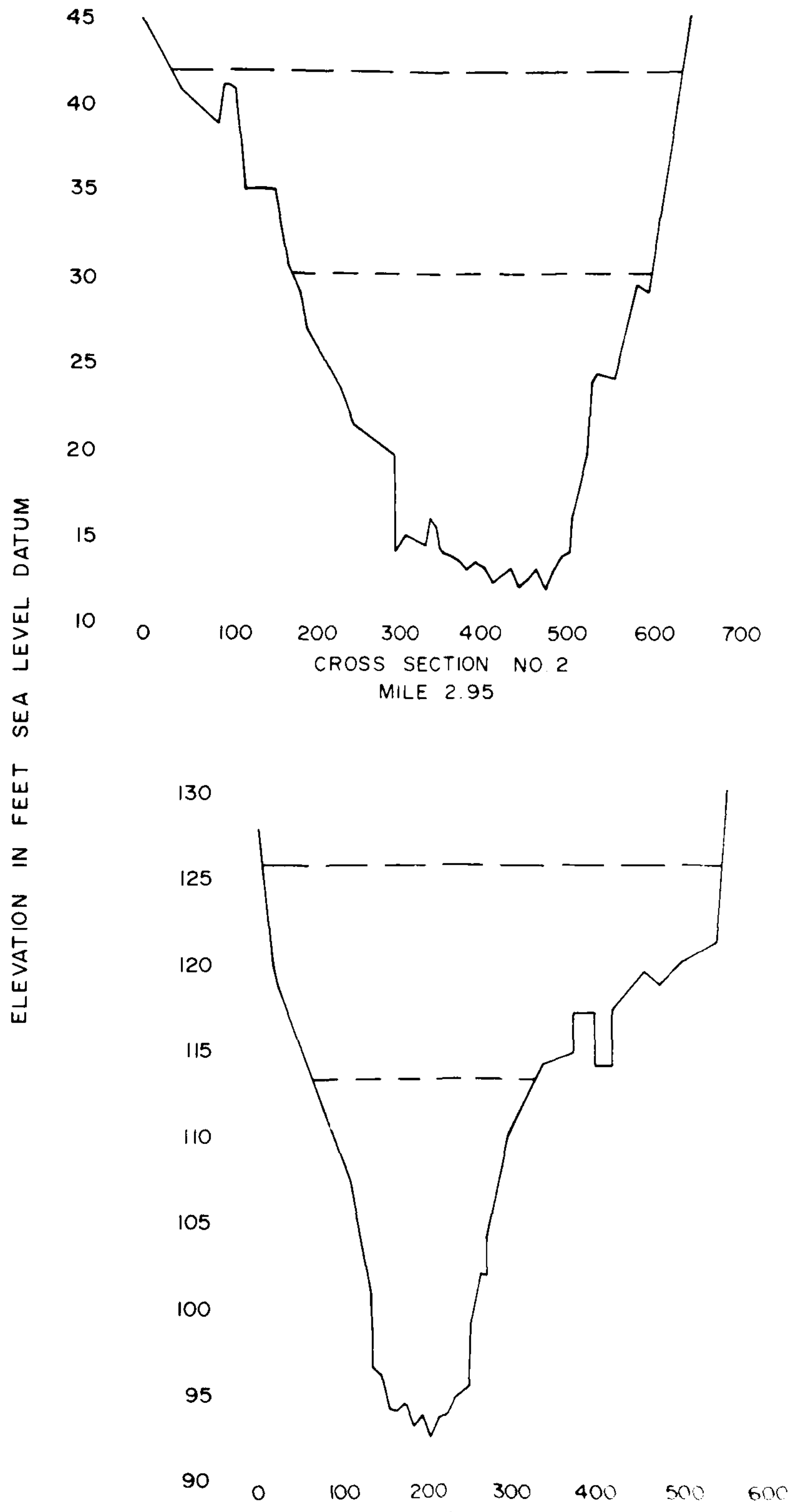
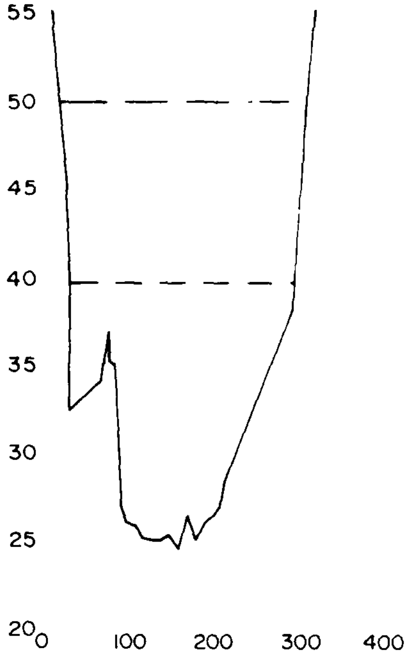
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY
DELAWARE
HIGH WATER PROFILES
WITH SOIL CONSERVATION
SERVICE DAMS
JULY 1973

PLATE 10

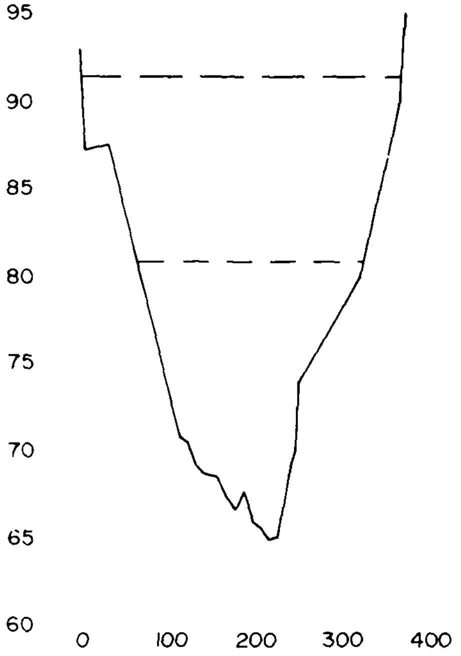


CROSS SECTION NO. 2
MILE 2.95

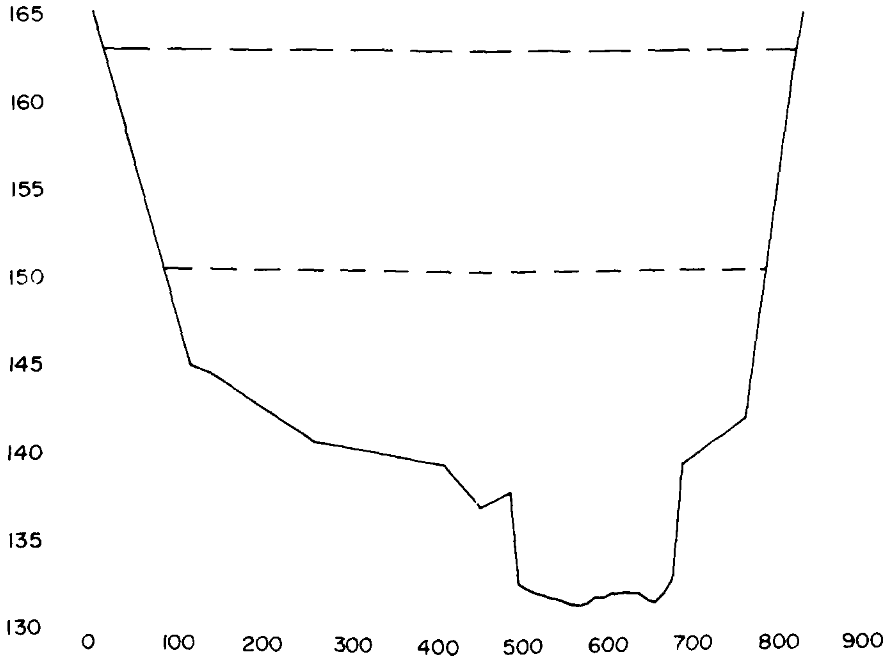
CROSS SECTION NO 7
MILE 5 59



CROSS SECTION NO. 3
MILE 3.40



CROSS SECTION NO. 5
MILE 4.49



CROSS SECTION NO. 10
MILE 9.67

LEGEND

— — STANDARD PROJECT FLOOD
— — — INTERMEDIATE REGIONAL FLOOD
——— GROUND LINE

NOTES:

THE 9 CROSS SECTIONS ON BRANDYWINE CREEK NOT SHOWN IN THIS REPORT ARE ON FILE AT PHILADELPHIA DISTRICT, CORPS OF ENGINEERS AND ARE AVAILABLE FOR INSPECTION UPON REQUEST.

CROSS SECTIONS TAKEN LOOKING DOWNSTREAM.

DEPARTMENT OF THE ARMY
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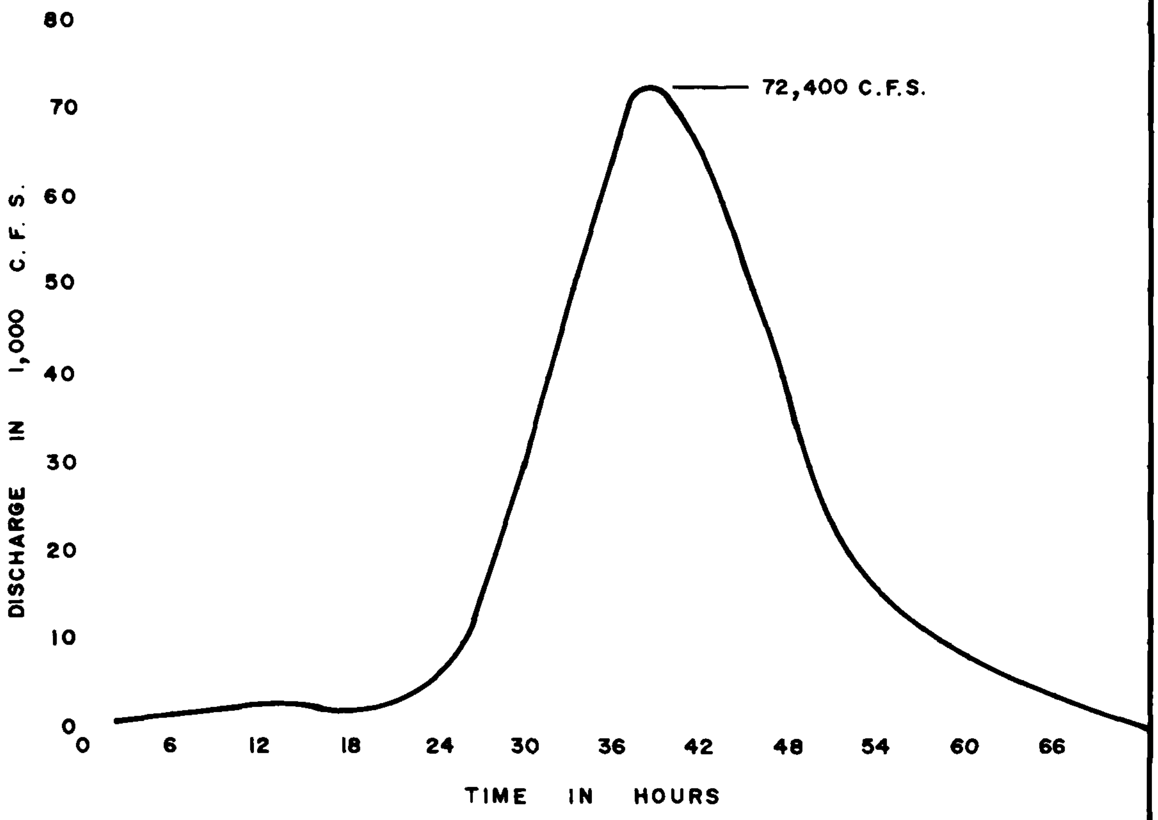
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

SELECTED CROSS SECTIONS

JULY 1973



NOTES:

1. U.S.G.S. STREAM GAGING STATION AT WILMINGTON, DELAWARE.
2. TOTAL DRAINAGE AREA = 318.2 SQ. MI.

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
NEW CASTLE COUNTY, DEL.

STANDARD PROJECT FLOOD
HYDROGRAPHS
JULY 1973

DATE
ILMED
-8