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FLOOD PLAIN INFORMATION, MILL, WATSON, AND LAHASKA CREEKS, BUCK--ETC(U)
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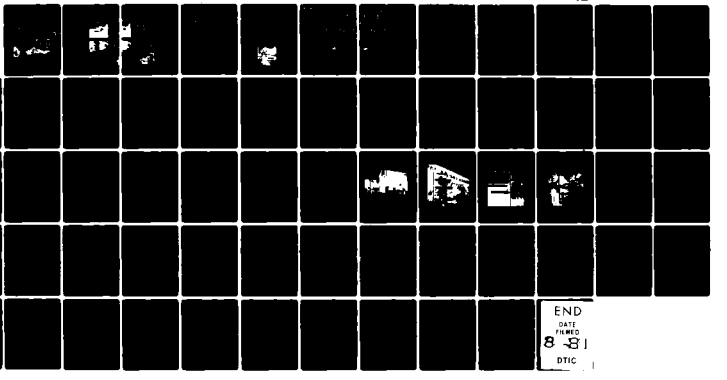

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FLOOD PLAIN INFORMATION

LEVEL II

MILL, WATSON, AND LAHASKA CREEKS

BUCKS COUNTY, PENNSYLVANIA

"Original contains color plates: All DTIC reproductions will be in black and white"

PREPARED FOR THE BUCKS COUNTY PLANNING COMMISSION
BY CORPS OF ENGINEERS, U.S. ARMY PHILADELPHIA DISTRICT

REPT. NO: DAEN/NAP-82040/FI28-75/05

MAY 1975

ACTION is neeeded

Watson and Lahaska Creeks originate in Central Buckingham Township, Bucks County, Pennsylvania, and join near Upper Mountain Road to form Mill Creek. Flowing in a southerly direction, Mill Creek empties into Neshaminy Creek near Rushland, Pennsylvania. The flood plains are mainly grassland, woodlands and cultivated fields with some commercial and residential buildings. Open undeveloped areas along Mill, Watson and Lahaska Creeks will come under increasing pressure for development. The devastating effects of flooding will increase unless action is taken.

Effective regulatory measures such as zoning ordinances and building codes can be designed to prevent increased flood damages. Flood proofing can reduce potential damages to properties already subject to flooding and additional works to modify flooding can also be a part of the long-run solution.

Mill, Watson and Lahaska Creeks' flood plains are not the only areas with flooding problems. Flood plain information has already been provided for many of several thousand flood-plagued communities. About 1,000 of those having FPI Reports by mid 1974 have adopted or strengthened regulations while 1,100 others have them under study. A total of 2,065 communities have used the FPI Reports in planning land use control.

Possible future flood heights at Watson Creek at the U. S. Rte. 202 Bridge

Possible future flood heights at Mill Creek at the Reading Railroad Bridge

This folder has been prepared for the Bucks County Planning Commission by the U.S. Army Corps of Engineers from data in the report "Flood Plain Information, Mill, Watson and Lahaska Creeks, Bucks County, Pennsylvania." Copies of the report and this folder are available upon request from the Bucks County Planning Commission, Bucks County Administration Building, Doylestown, Pennsylvania 18901.

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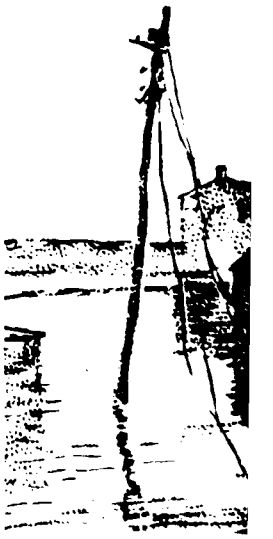
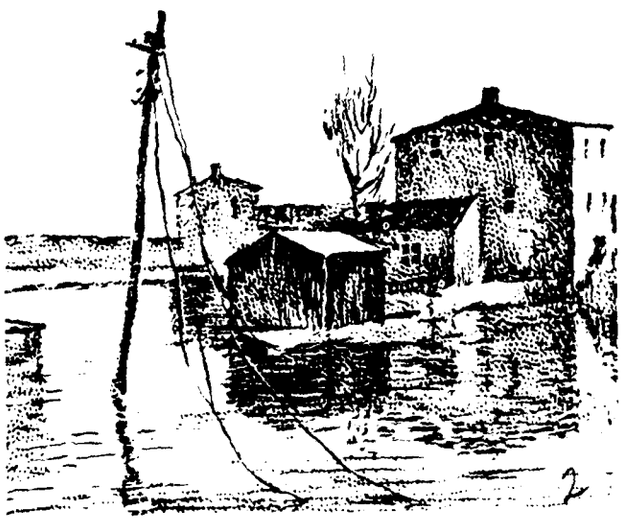


FLOODS
ON
MILL, WATSON AND LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA

ights of Watson Creek
te. 202 Bridge

Heights of Mill Creek
Railroad Bridge



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Data in the report "Flood
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er are available upon
County Planning Com-
Administration Building,
a 18901.

FLOODS

on MILL, WATSON AND LAHASKA CREEKS

BUCKS COUNTY, PENNSYLVANIA

POSSIBLE FUTURE F
ON MILL, WATSON AN
Elevation (Feet—Mea

Location	Large Flood (100 Year
Mill Creek	
Swamp Road	143.9
Forest Grove Road	181.0
New Hope Road	191.9
Watson Creek	
Pa. Rte. 263	232.7
Spring Valley Road	264.8
Mill Road	283.0
Lahaska Creek	
Pa. Rte. 413	219.2
Bycot Road	237.0
U.S. Rte. 202 and Pa. Rte. 263	251.9

This folder is an announcement of and supplement to the "Flood Plain Information (FPI) Report, Mill, Watson and Lahaska Creeks, Bucks County, Pennsylvania." The report has been prepared to emphasize the importance of considering flood potential and flood hazards in land use planning and to aid in management decisions concerning flood plain utilization.

Although communities of Bucks County along Mill, Watson and Lahaska Creeks have suffered damage from past floods, studies indicate that even larger floods can occur in the future. Emphasis is given to future floods in the FPI Report. Maps, profiles, and cross sections have been included to illustrate the possible extent and severity of future floods.

Included in this folder are photographs showing past and possible future flood heights at selected locations. The flood height is shown for a large flood, the Intermediate Regional Flood (IRF), one that occurs once in 100 years on the average, although it could occur in any year. Also indicated is the flood height that would be reached if a very large flood, a Standard Project Flood (SPF), should occur. The Standard Project Flood represents a reasonable upper limit of expected flooding in the study area.

Inside are sketches illustrating the horizontal and vertical relationships of flooded areas and a flood area map from the report showing the extent of both an Intermediate Regional Flood and a Standard Project Flood.

POSSIBLE FUTURE FLOOD HEIGHTS
ON MILL, WATSON AND LAHASKA CREEKS

Elevation (Feet—Mean Sea Level Datum)

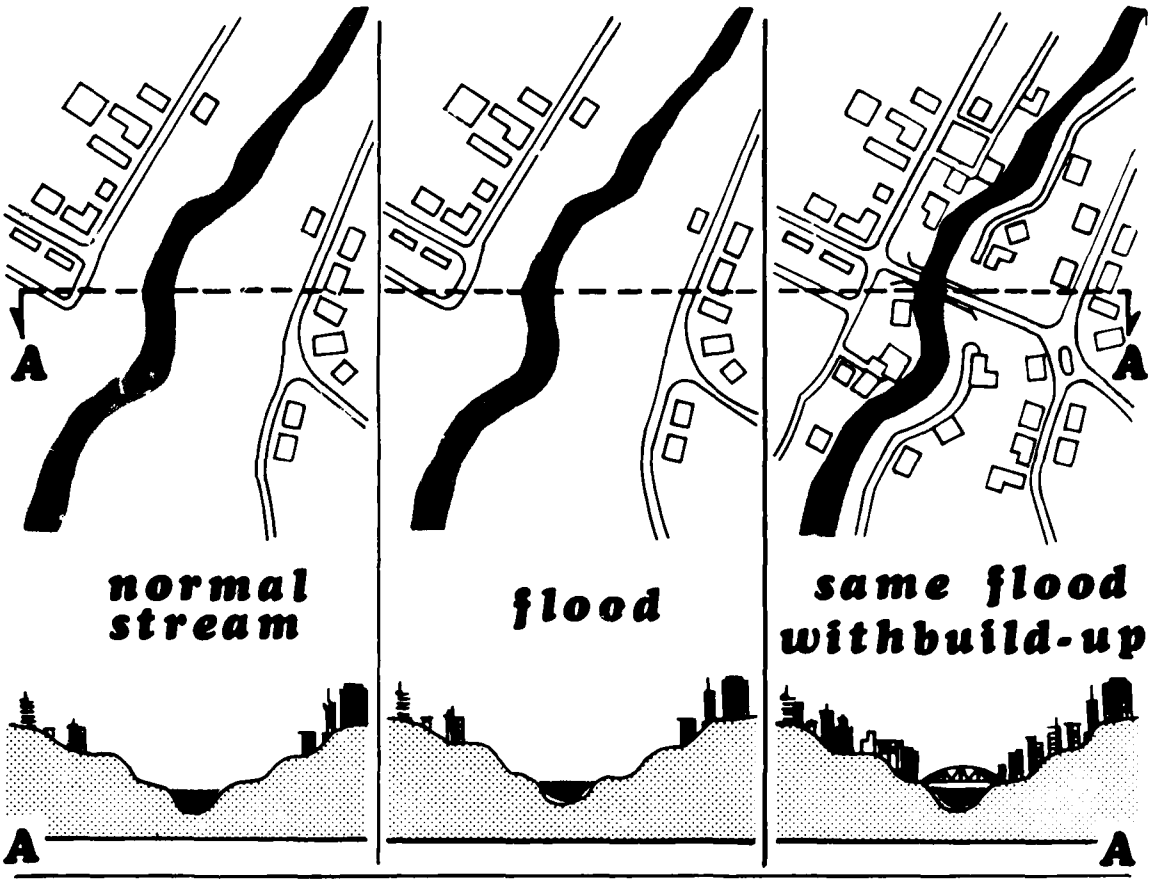
ation	Large Flood (100 Year)—IRF	Very Large Flood—SPF
Creek		
amp Road	143.9	145.4
est Grove Road	181.0	185.0
w Hope Road	191.9	194.2
tson Creek		
Rte. 263	232.7	235.7
ing Valley Road	264.8	268.0
Road	283.0	285.1
aska Creek		
Rte. 413	219.2	215.0
ot Road	237.0	238.7
. Rte. 202 and Pa. Rte. 263	251.9	257.2

is folder are photographs and possible future flood lected locations. The flood n for a large flood, the In- gional Flood (IRF), one that 100 years on the average, uld occur in any year. Also e flood height that would be ery large flood, a Standard (SPF), should occur. The ect Flood represents a rea- limit of expected flooding ea.

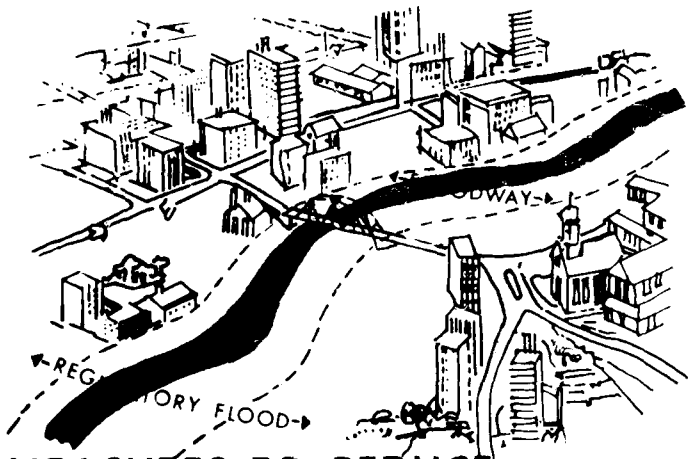
tches illustrating the hori- ical relationships of flooded ood area map from the re- the extent of both an Inter- nal Flood and a Standard

Possible future flood heights at Lahaska Creek at the Rte. 413 Bridge

BUILDING in the FLOOD PLAIN can make FLOODS WIDER and DEEPER



TOOLS of FLOOD PLAIN MANAGEMENT for the reduction of Flood Damage and H



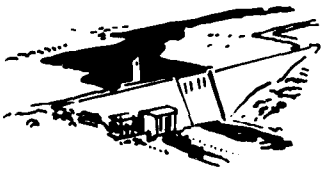
MEASURES TO REDUCE *VULNERABILITY TO FLOODS*

provide for a future with more freedom from flood damage, often at minor cost and with little adverse effect on the environment · · · · · ·

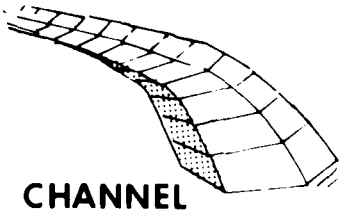
REGULATIONS
(ZONING, BUILDING CODES, SUBDIVISION)
• FLOOD PROOFING • RELOCATIONS •
• URBAN RENEWAL •

MEASURES TO MODIFY FLOODS

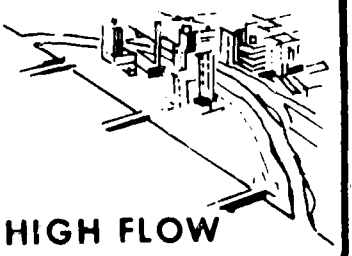
are often required to alleviate existing problems and sometimes to forestall future problems · · ·



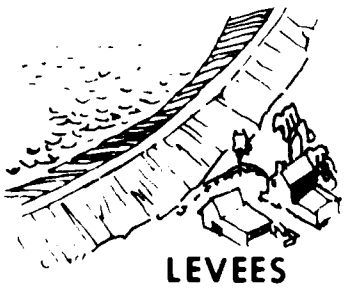
DAMS & RESERVOIRS



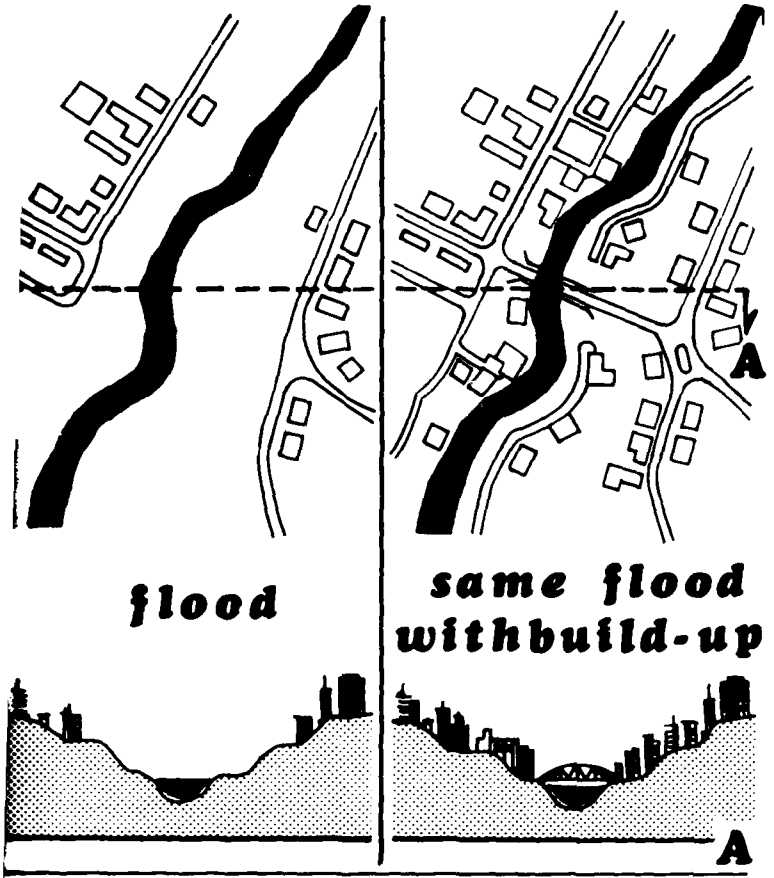
CHANNEL ENLARGEMENT



HIGH FLOW DIVERSION



LEVEES



flood

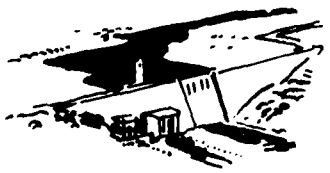
same flood with build-up

this ENCROACHMENT can change a Small Flood into a MAJOR FLOOD

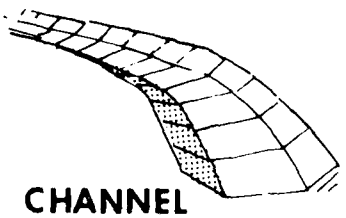
ENT for the reduction of Flood Damage and Human Suffering

MEASURES TO MODIFY FLOODS

are often required to alleviate existing problems and sometimes to forestall future problems . . .



DAMS & RESERVOIRS



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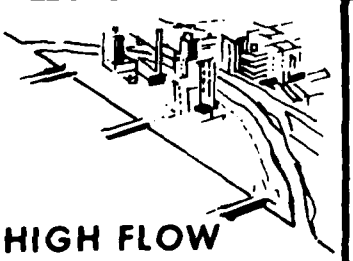

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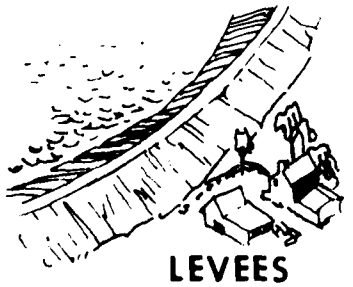


LEVEES

OTHER MEASURES

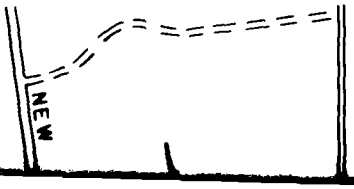
aid the Flood Plain occupant in coping with floods . . .

EDUCATION

TAX ADJUSTMENTS

FLOOD INSURANCE

WARNING & EMERGENCY PLANS



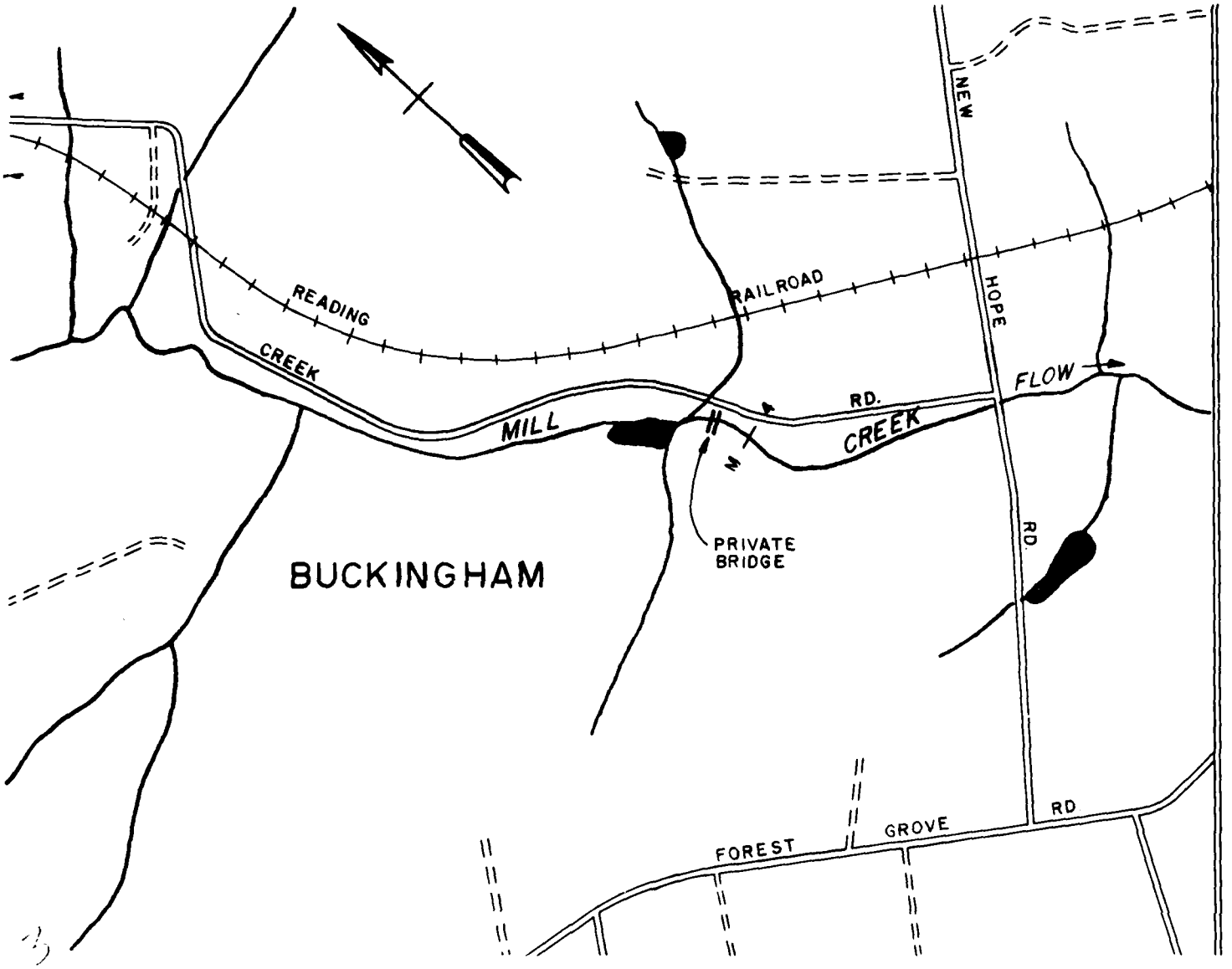
FLOOD PATTERNS for Mill, Watson &

adverse effect on the environment

REGULATIONS
(ZONING, BUILDING CODES, SUBDIVISION)
• FLOOD PROOFING • RELOCATIONS •
• URBAN RENEWAL •

HIGH FLOW DIVERSION

LEVEES



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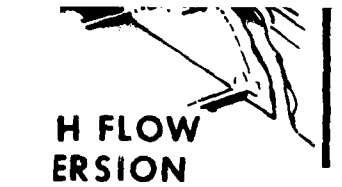
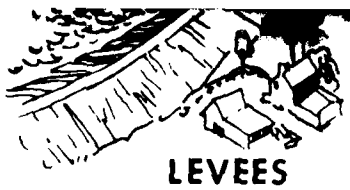
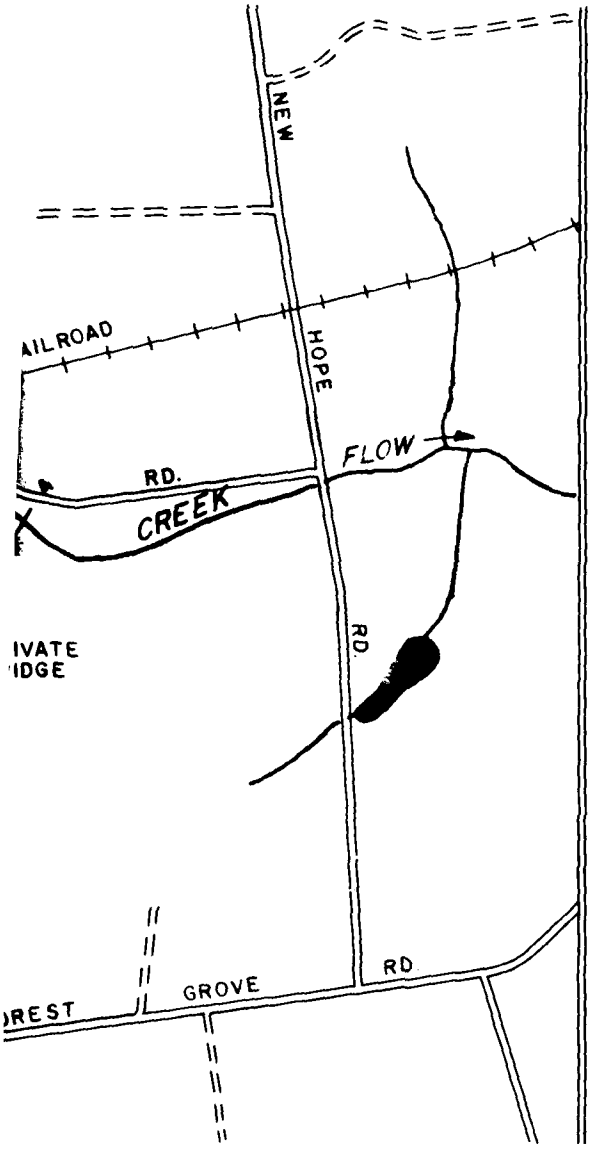




WARNING & EMERGENCY PLANS



FLOOD PATTERNS

for

Mill, Watson & Lahaska Creeks, Penna.

LEGEND

approximate limits of overflow

NORMAL STREAM

INTERMEDIATE REGIONAL FLOOD (IRF)

STANDARD PROJECT FLOOD (SPF)

PROFILES in the *Flood Plain Information Report* show elevations of these floods for the entire study area

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

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: DAEN/NAP-82040/FPI28-75/05	2. GOVT ACCESSION NO.: AD-A104 592
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Flood plain information, Mill, Watson, and Lahaska Creeks, Bucks County, Pa.	5. TYPE OF REPORT & PERIOD COVERED: Flood plain information
	6. PERFORMING ORG. REPORT NUMBER: DAEN/NAP-82040/FPI28-75/05
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: U.S. Army Engineer District Philadelphia, 2nd & Chestnut Sts., Philadelphia, PA 19106	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer District Philadelphia, 2nd & Chestnut Sts., Philadelphia, PA 19106	12. REPORT DATE: May 1975 13. NUMBER OF PAGES: 32
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Mill Creek, Pa.	Bucks County Planning Commission
Watson Creek, Pa.	Flood forecasting
Lahaska Creek, Pa.	Floods
Bucks County, Pa.	Flood plains

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

The portions of Bucks County, Pennsylvania covered in this report were subject to flooding from Mill Creek (Rushland, Pa.), Watson Creek and Lahaska Creek. Properties along these floodplains were damaged by floods of Aug. 1975, Aug. 1971 and June 1973. The study included a history of flooding in the Mill Creek watershed and described such floods thru maps, photographs, profiles and cross sections.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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 Bucks County Planning Commission. 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 for more current information.

CONTENTS

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CONTENTS (continued)

TABLES

CONTENTS (Continued)

PLATES

FIGURES

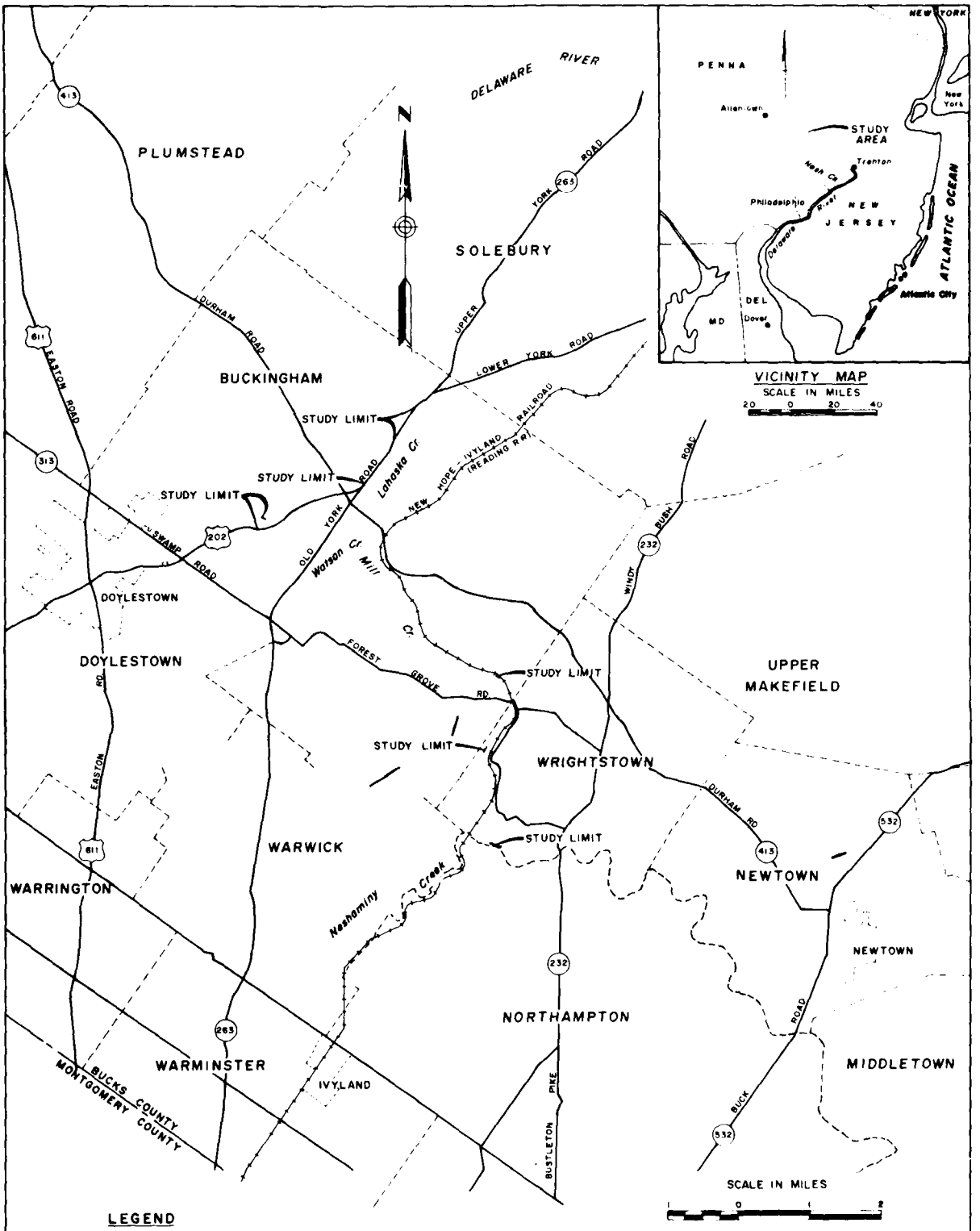

DELAWARE RIVER
PLUMSTEAD
SOLEBURY
BUCKINGHAM
DOYLESTOWN
DOYLESTOWN
UPPER MAKEFIELD
WRIGHTSTOWN
WARWICK
WARRINGTON
NEWTOWN
NEWTOWN
NORTHAMPTON
WARMINSTER
IVYLAND
MIDDLETOWN
BUCKS COUNTY
MONTGOMERY COUNTY
STUDY LIMIT
STUDY LIMIT
STUDY LIMIT
STUDY LIMIT
STUDY LIMIT
Lahaska Cr.
Watson Cr.
Mill Cr.
Neshaminy Creek
DURHAM ROAD
UPPER YORK ROAD
LOWER YORK ROAD
OLD YORK ROAD
NEW HOPE - IVYLAND (READING RR) RAILROAD
EASTON ROAD
SWAMP ROAD
FOREST GROVE RD.
WINDY BUSH ROAD
BUCK ROAD
PIKE
BUSTLETON
413
611
313
202
263
232
532
PENNA
NEW YORK
NEW JERSEY
MD
DEL
Allentown
Trenton
Philadelphia
New York
Dover
Atlantic City
STUDY AREA
ATLANTIC OCEAN
VICINITY MAP
SCALE IN MILES
20 0 20 40
SCALE IN MILES
0 1 2
LEGEND
RIVER/CREEK
WATERSHED BOUNDARY
U S ROUTE
STATE ROUTE
COUNTY LINE
TOWNSHIP LIMITS
CITY OR BORO LIMITS
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA
GENERAL MAP

PLATE I

PREFACE

The portions of Bucks County, Pennsylvania, covered in this report are subject to flooding from Mill Creek (Rushland, Pennsylvania), Watson Creek and Lahaska Creek. The properties on the flood plains along these streams are primarily agricultural with some scattered residential and commercial development and have been damaged by the floods of August 1955, August 1971, and June 1973. The open spaces in the flood plains which may come under pressure for future development are extensive. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding in the Mill Creek Watershed and identifies those areas that are subject to possible future floods. Special emphasis is given to these 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 control to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments including flood proofing which 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 Bucks County Planning Commission and indorsement of the Pennsylvania Department of Environmental Resources this report was prepared by the Philadelphia District Office of the Corps of Engineers, Department of the Army, under continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of the United States Geological Survey (USGS), Bucks County Planning Commission, Neshaminy Valley Watershed Association, and private citizens in supplying useful data for the preparation of this report are appreciated.

Additional copies of this report can be obtained from the Bucks County Planning Commission. The Philadelphia District Office of the Corps of Engineers, Department of the Army, 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

Little is known of the history of the lands of the Mill Creek Watershed prior to the arrival of William Penn and the establishment of the colony of Pennsylvania. Before settlement of the Lower Bucks County area by Penn, the lands were occupied by the Lenni-Lenape Indians.

In 1681, William Penn was granted land in the new world by King Charles II of England as payment for a debt owed to Penn's father. By 1720, the Germans and Scotch-Irish began settling in the central and upper portions of Bucks County to farm the fertile land. As their crops thrived, mills were constructed along the County's streams to grind the grain.

During the nineteenth century, farming became the principle industry of the area. It remained as such until the middle of the twentieth century when rapid suburban expansion brought industrial and residential development to the Lower Bucks County area. The vast undeveloped areas of the Mill Creek Watershed including the flood plains of Mill, Watson and Lahaska Creeks are expected to come under pressure for development with the Towns of Lahaska, Buckingham and Wycombe serving as cores for this development.

The Stream and Its Valley

Mill Creek, with its major tributaries of Watson and Lahaska Creeks, has a total drainage area of 21.9 square miles. Watson and Lahaska Creeks originate in central Buckingham Township, Bucks County, and generally flow in a southerly direction until they join to form Mill Creek a short distance upstream of Upper Mountain Road in Buckingham Township. Mill Creek also flows in a southerly direction and empties into Neshaminy Creek near Rushland, Pennsylvania. The watershed is rolling agricultural land with heavily wooded areas occupying the steeper, more unfavorable terrain. The flood plain is fairly narrow in the lower reach, being confined by the more rugged terrain, but widens on the upper reach as the land becomes rolling. The 6.07 mile study reach of Mill Creek has a uniform slope averaging 15 feet per mile.

Watson Creek, with a drainage area of 4.26 square miles, is a major tributary of Mill Creek. The flood plain is fairly wide in the lower reach with an average stream slope of 10 feet per mile, and narrows in the upper reach where the stream slopes an average of 39 feet per mile.

Lahaska Creek, the other major tributary of Mill Creek, has a drainage area of 6.97 square miles. The flood plain is similar to that of Mill Creek in that the lower reach is primarily wide rolling land while the upper reach becomes fairly narrow with steeper banks. The 2.41 mile study reach has a uniform slope averaging 17 feet per mile.

Two tributaries of Lahaska Creek, referred to as Tributaries 1 and 2 in this report, have drainage areas of 1.84 and 1.29 square miles, respectively. The flood plains of these tributaries are generally flat and become steeper in the upper reaches. Tributary 1, with a study reach of 0.41 mile, and Tributary 2, with a study reach of 0.37 mile, have a change in streambed elevation of approximately 10 feet and 7 feet, respectively. Drainage areas contributing to runoff at selected locations in the study area of Mill, Watson and Lahaska Creeks are shown in Table 1.

TABLE 1

DRAINAGE AREAS

Mill, Watson and Lahaska Creeks and Tributaries 1 and 2

Location	Mileage Above Mouth	Drainage Area	
		Tributary sq. mi.	Total (a) sq. mi.
Mill Creek			
Confluence with Neshaminy Creek	0.00	–	21.90
Robin Run	1.69	2.27	20.92
Unnamed Tributary downstream of Smith Road	3.00	1.36	15.97
Watson Creek	6.07	–	11.23
Lahaska Creek	6.07	–	6.97
Watson Creek			
Confluence with Mill Creek	0.00	–	4.26
Lahaska Creek			
Confluence with Mill Creek	0.00	–	6.97
Confluence with Tributary No. 1	0.69	1.84	6.10
Confluence with Tributary No. 2	1.56	1.29	3.54
Tributary No. 1			
Confluence with Lahaska Creek	0.00	–	1.84
Tributary No. 2			
Confluence with Lahaska Creek	0.00	–	1.29

(a) Includes tributary.

Developments in the Flood Plain

Most of the flood plain within the Mill Creek Watershed is rural and sparsely occupied with residential, agricultural and a few commercial properties. There are two separate areas on Mill Creek developed exclusively for recreational purposes and there is also one stone quarry. The flood plains of Watson and Lahaska Creeks are similar to that of Mill Creek with some scattered residential and agricultural properties occupying the primarily rural flood plain.

There is only one dam in the Mill Creek study area located on Lahaska Creek and it has no flood storage capacity.

In addition to the residential, commercial, agricultural and recreational buildings in the flood plain, state roads, local roads and utility lines would be subject to flooding. The many undeveloped areas of the Mill Creek Watershed are expected to come under pressure for development. This future growth will result in additional demands to utilize the flood plains of Mill, Watson and Lahaska Creeks and their tributaries.

FLOOD SITUATION

Sources of Data and Records

There are no stream gaging stations located within the study area; however, the United States Geological Survey maintains a gaging station on Neshaminy Creek at Langhorne, Pennsylvania, which has recorded maximum daily peak discharges from 1933 to the present. Information from this gage was utilized in evaluating the flood potential of Mill, Watson and Lahaska Creeks.

To supplement the records at the gaging station, newspaper files, historical documents and records were searched for information concerning past floods. These records have helped in developing knowledge of floods which have occurred in the Mill Creek Watershed.

Maps prepared for this report were based on a U.S. Geological Survey Quadrangle Sheet entitled "Buckingham, Pennsylvania," 1968. Structural data on bridges and culverts were obtained by field surveys performed by Corps of Engineers, Philadelphia District, personnel.

Flood Season and Flood Characteristics

Major floods have occurred in the study reaches of the Mill Creek Watershed during all seasons of the year with the greatest known flood occurring in August 1955. Floodflow stages can rise from normal flow to extreme flood peaks in a relatively short period of time with high velocities in the main channel of the streams.

In addition to floods caused by runoff from general rainfall, the study reaches of the Mill Creek Watershed are susceptible to hurricane activity and floods from snowmelt in combination with rainfall. Flood stages on Neshaminy Creek can create a "backwater effect" at the mouth of Mill Creek. This "backwater effect" can produce higher flood stages and a wider extent of flooding in the lower reach of Mill Creek than would occur due to floodflows on Mill Creek alone.

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 streams 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 floodflow increases, 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 load exceeds its structural capacity and the bridge is destroyed. The limited capacity of obstructive bridges or culverts, debris plugs at bridge waterway openings or a 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.

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 necessary to assume that there would be no accumulation of debris to clog any of the bridge or culvert openings in the development of the flood profiles.

Mill, Watson and Lahaska Creeks and their tributaries are spanned 29 times by bridges and culverts. Pertinent information on all bridges and culverts can be found in Table 4 on Page 13. Many of these bridges are obstructive to floodflows. As previously stated, the dam on Lahaska Creek will have no significant effect on floodflows.

Flood damage reduction measures - There are no existing or authorized flood control projects on Mill, Watson and Lahaska Creeks; however, communities located along the streams do have regulations regarding the use of flood plains. At the present time, Buckingham and Wrightstown Townships have, as a basis of their regulations, flood hazard mapping based on alluvial soil maps prepared by Bucks County. Both Townships expect to have a formal flood plain zoning ordinance in the near future. Buckingham and Wrightstown Townships have applied for flood insurance under the National Flood Insurance Program, and to remain eligible, they are required to adopt regulations governing future development in the flood plain.

Other factors and their impacts - The impact of flooding along Mill, Watson and Lahaska Creeks 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, businesses and industries valuable time to remove damageable materials from low-lying areas. Increased damages to downstream areas can 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 - The National Weather Service Branch of the National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions in the study area with stations at Philadelphia, Pennsylvania, and Trenton, New Jersey. Flood warnings and predicted flood peaks are issued by the NOAA flood forecasting centers at Harrisburg, Pennsylvania, and Trenton, New Jersey. In times of a flood emergency, the Bucks County Civil Defense Office maintains communications with the State Civil Defense Headquarters and the National Weather Service in order to establish a "floodwatch" during the earliest stages of a flood threat. Usual warnings are issued by these agencies to the inhabitants of the area through radio, television, and the local press.

Flood fighting and emergency evacuation plans - Although there are no formal flood fighting or emergency evacuation plans for the Mill Creek Watershed, provisions for alerting area residents through local communications media and coordinating operations for Bucks County are accomplished through the Bucks County Civil Defense Office. This Office coordinates flood fighting, evacuation and rescue activities on a county-wide basis with local agencies. Plans have been made by the county to provide emergency mass care centers for residents that have been displaced from their homes by floodwater. During past floods, assistance in carrying out rescue operations has been provided by the Naval Air Development Center at Johnsville, Pennsylvania, and the Willow Grove Naval Air Station in Horsham, Pennsylvania.

Material storage on the flood plain - Large portions of the flood plains of Mill, Watson and Lahaska Creeks are undeveloped at the present time and there is little or no material storage on the flood plains in the areas of existing development. In the future, as the flood plains come under increasing pressure for development, increased quantities of buoyant materials may be stored on the flood plains. Floatable materials from residential, commercial and industrial development may be carried away by floodflows and swept downstream to block bridge and culvert openings and create more hazardous flooding conditions.

PAST FLOODS

Summary of Historical Floods

Large floods have occurred in the Mill Creek Watershed in 1865, 1955, and 1971. There are no gage records available for streams studied within the watershed. However, the U.S. Geological Survey Gaging Station No. 4655, located on the main stem of Neshaminy Creek at Langhorne, Pennsylvania, recorded its peak flow on August 19, 1955. This peak flow reflects the greatest flood on Mill Creek in recent history.

Flood Records

Since no gage records are available for Mill, Watson and Lahaska Creeks, information on historical floods was obtained from stream gaging records at the U.S.G.S. Gage on the Neshaminy Creek at Langhorne, Pennsylvania.

To supplement the records at the gaging station, newspaper files, historical documents and records were searched for information concerning past floods. These records have helped in developing a knowledge of floods which have occurred on Mill, Watson and Lahaska Creeks. Crest stages for known floods at the gaging station on Neshaminy Creek at Langhorne, Pennsylvania, are shown in Table 2.

TABLE 2
FLOOD CREST ELEVATIONS
Neshaminy Creek
U.S.G.S. Gaging Station No. 4655 at Langhorne, Pennsylvania (a)

Date of Crest	Estimated Peak Discharge cfs	Stage (b) ft	Elevation (c) feet-mean sea level datum
August 19, 1955	49,300	22.8	63.4
June 30, 1973	35,450	19.0	59.5
August 23, 1933	30,000	17.3	57.9
July 23, 1938	24,800	15.9	56.5
November 9, 1972	21,800	15.0	55.6
November 26, 1950	21,700	14.9	55.5
August 28, 1971	20,700	14.7	55.3
June 2, 1946	20,500	14.5	55.1
September 13, 1971	19,900	14.3	54.9
September 13, 1960	19,400	14.4	55.0
March 7, 1967	16,600	13.0	53.6

(a) Drainage area equals 210 square miles.

(b) Overbank flooding begins at a stage of 7 feet as per U.S.G.S.

(c) Gage datum is 40.57 feet above mean sea level datum, 1929 adjustment.

Flood Descriptions

The following are descriptions of known large floods that have occurred in the vicinity of the Mill Creek Watershed.

July 17, 1865 - According to historical flood data compiled by the Neshaminy Valley Watershed Association, a flood that occurred on this date caused considerable damage in the Neshaminy Creek Basin. Although exact details of this flood are sketchy, it was thought to be the maximum flood in the unconfirmed historical records dating back to 1833 with the only occurrence of greater magnitude being the flood of August 18-19, 1955. The July 17, 1865 flood, resulting from a rainfall belt pattern of twenty miles in width, caused great destruction to many bridges in the county. In Doylestown, rainfall lasted about seven hours and totaled approximately five inches.

August 19, 1955 - On this date, Hurricane Diane brought nearly six inches of rainfall in eight hours to the study area just one week after Hurricane Connie had drenched the watershed. The resulting flood created havoc in Lower Bucks County. This flood was responsible for several deaths; flooded homes, streets and stores; and, also destroyed several thousands of dollars worth of crops.

August 28, 1971 - A fairly steady rainfall resulting from the passage of Tropical Storm Doria through the Bucks County area produced this sixth highest flood of record in the Neshaminy Creek Basin. Flooding was experienced along Mill Creek and caused some damage, but the flood level was less than that of August 19, 1955. Rain began falling late Thursday night and before ending early the following morning totaled more than six inches. A combination of the rain and wind flooded roads and basements, toppled trees and pulled down electric lines throughout the Bucks County area. Damage was estimated to be in the thousands of dollars.

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 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 could occur 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 and precipitation records and runoff characteristics for the stream under study. However, limitations in these records required analyses on a regional rather than a watershed basis. In determining the Intermediate Regional Flood for the Mill Creek Watershed, statistical studies were made using flood data from the U.S. Geological Survey gaging stations in close proximity of the ungaged study area. Peak flows thus developed for the Intermediate Regional Flood at selected locations in the study area are shown in Table 3.

Standard Project Flood

The Standard Project Flood is defined as a major flood that can be expected to occur from the most 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 3. Discharge hydrographs for the Standard Project Flood at various locations are shown on Plate 11. The relative water surface elevations for the Intermediate Regional Flood and the Standard Project Flood are shown on Plates 7 and 8.

TABLE 3

PEAK FLOWS FOR THE INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS

Location	Mileage Above Mouth	Drainage Area sq. mi.	Intermediate Regional Flood Discharge cfs	Standard Project Flood Discharge cfs
Mill Creek				
At the Mouth	0.00	21.9	7,000	14,500
Downstream of Robin Run Tributary	1.69	20.9	6,685	14,400
Unnamed Tributary downstream of Smith Road	3.00	16.0	5,337	11,600
Downstream of Watson Creek	6.07	11.2	3,990	8,500
Watson Creek				
At the Mouth	0.00	4.3	1,640	3,480
Downstream of Pa. Rte. 263	1.18	---	1,230	2,610
Downstream of U.S. Rte. 202	2.18	---	820	1,740
Lahaska Creek				
At the Mouth	0.00	7.0	2,630	5,630
Downstream of Tributary No. 1	0.69	6.1	2,345	5,000
Downstream of Tributary No. 2	1.56	3.5	1,380	3,020

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 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 Flood or Standard Project Flood on Mill, Watson and Lahaska Creeks would result in inundation of residential, commercial, and industrial sections 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 are ultimately 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 in the Mill Creek Watershed 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 and Standard Project Floods 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 20 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 Mill, Watson and Lahaska Creeks inundate a large portion of Buckingham and Wrightstown Townships and several small communities adjacent to the stream. The highest stages of flooding throughout the study area occur when the floodwaters from the Mill Creek meet with the high stages of Neshaminy Creek. The areas that would be flooded by the Intermediate Regional and Standard Project Floods include commercial, industrial, recreational and residential sections and the associated streets, roads, and private and public utilities in the study area. Considerable damage to these facilities would occur during an Intermediate Regional Flood. However, due to the wider extent and greater depths of flooding, higher velocity flow and longer duration of flooding during a Standard Project Flood, damage would be even more severe than during an Intermediate Regional Flood. Plates 7 and 8 show water surface profiles of the Intermediate Regional and Standard Project Floods. Depth of flow in the channel can be estimated from these illustrations. Typical cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the Intermediate Regional and Standard Project Floods, are shown on Plates 9 and 10.

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 elevations 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 is 1 dam within the study area which has no flood control capacity and it will not seriously alter flow characteristics of floodwaters. Of the 29 bridges and culverts crossing the streams in the study area, most of them are obstructive to the Intermediate Regional Flood and even more are obstructive to the Standard Project Flood. In some cases bridges may be high enough so as not to be inundated by floodflows; however, the approaches to these bridges may be at lower elevations and subject to flooding and rendered impassable. Table 4 lists water surface elevations at selected bridges and culverts that may be restrictive during floodflows.

TABLE 4

ELEVATION DATA

Bridges Across Mill Watson and Lahaska Creeks and Tributaries 1 and 2

Location	Mileage Above Mouth	Underclearance Elevation	Water Surface Elevation	
			Intermediate Regional Flood	Standard Project Flood
		feet-mean sea level datum	feet-mean sea level datum	
Mill Creek				
Swamp Road	0.60	139.8	143.9	145.4
Private Road	1.13	153.7	159.4	162.0
Private Road	1.21	156.1	161.4	165.0
Reading R.R.	1.34	167.5	162.4	165.8
Private Road	2.33	174.2	178.4	182.0
Forest Grove Road	2.64	179.9	181.0	185.0
Badge Smith Road	3.15	181.4	185.1	188.6
New Hope Road	3.66	188.7	191.9	194.2
Private Bridge	4.05	189.3	196.5	199.3
Lower Mountain Road	5.00	203.0	205.9	208.4
Upper Mountain Road	5.67	207.2	210.6	213.1
Watson Creek				
Private Road	0.05	208.8	213.2	215.0
Private Road	0.86	221.0	224.2	225.0
Pa. Rte. 263	1.18	237.8	232.7	235.7
Mill Road	1.86	259.0	259.7	260.0
Spring Valley Road	1.98	263.9	264.8	268.0
U.S. Rte. 202	2.18	278.8	277.3	281.8
Mill Road	2.24	281.1	283.0 (a)	285.1 (a)
Lahaska Creek				
Private Road	0.07	208.5	213.2	215.0
Pa. Rte. 413	0.50	217.0	219.2	220.2
Quarry Road	0.83	222.4	226.5	227.1
Bycot Road	1.63	231.9	237.0	238.7
Private Road	2.25	244.8	247.4	248.1
Private Road	2.33	249.2	249.0	250.1
U.S. Rte 202 and Pa. Rte. 263	2.41	253.9	251.9 (a)	257.2 (a)
Tributary No. 1				
U.S. Rte. 202 and Pa. Rte. 263	0.41	230.9	229.4 (a)	231.2 (a)
Tributary No. 2				
Private Road	0.09	233.6	236.3	238.0
Bycot Road	0.15	233.8	236.6	238.3
U.S. Rte. 202 and Pa. Rte. 263	0.38	240.4	238.3 (a)	239.1 (a)

(a) Downstream side of bridge.

Velocities of flow - Water velocities during floods depend largely on the size and shape of the cross sections, conditions of the stream, and the slope of the stream bed, 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 of the streams in the study area would be 4 to 10 feet per second. Water flowing at this rate is capable of causing severe erosion to stream banks and fill around bridge abutments and transporting large objects. Overbank flow in the study area would be 1 to 3 feet per second. Water flowing at 2 feet per second or less would deposit debris and silt. It is expected that velocity of flow during a Standard Project Flood would be slightly higher than during an Intermediate Regional Flood. Table 5 lists the Maximum Velocities that would occur in the main channel and overbank areas at selected locations on Mill, Watson and Lahaska Creeks during the Intermediate Regional and Standard Project Floods.

TABLE 5

MAXIMUM VELOCITIES

Mill, Watson and Lahaska Creeks and Tributaries 1 and 2

Location	Mileage Above Mouth	Maximum Average Velocities			
		Intermediate Regional Flood		Standard Project Flood	
		Channel ft/sec	Overbank (a) ft/sec	Channel ft/sec	Overbank (a) ft/sec
Mill Creek					
Cross Section Number:					
1	0.09	4.0	1.1	7.0	2.0
4	1.17	6.9	1.7	10.8	2.9
5	1.62	9.2	2.1	11.2	2.9
10	3.49	9.0	2.2	11.3	3.0
Watson Creek					
18	0.13	5.2	1.3	5.6	1.6
19	0.77	5.0	1.1	6.4	1.6
21	1.81	7.2	0.6	8.9	1.5
Lahaska Creek					
15	0.45	10.0	2.2	12.7	2.9
25	1.90	9.7	2.6	12.8	3.6
Tributary No. 1					
23	0.11	3.9	1.6	6.5	1.6
24	0.37	4.3	1.1	6.4	1.6
Tributary No. 2					
17	0.33	7.2	1.3	8.7	1.8

(a) Value given is the greater of the left and right overbank velocity.

Rates of rise and duration of flooding - Mill, Watson and Lahaska Creeks are susceptible to "flash" flooding from heavy rainfall associated with severe storm fronts--flooding that is characterized by a rapid rate of rise and relatively short duration. However, flooding may also occur from a series of rainfalls or from rainfall associated with hurricane activity that would probably have a slower rate of rise and longer duration. Table 6 gives the maximum rate of rise, height of rise (from bankfull stage to maximum floodflow level), time of rise, and duration of flooding for the Standard Project Flood at selected cross section locations on Mill, Watson and Lahaska Creeks. Standard Project Flood Hydrographs for Mill, Watson and Lahaska Creeks may be found on Plate 11.

TABLE 6

RATES OF RISE AND DURATION

Standard Project Flood

	Maximum Rate of Rise ft/hr	Height of Rise ft	Time of Rise hrs	Duration of Flooding hrs
Mill Creek				
Cross section 1	5.5	11.3	13.1	22.9
Cross section 14	1.5	5.6	10.0	23.0
Watson Creek				
Cross section 18	1.2	4.3	7.5	14.4
Lahaska Creek				
Cross section 16	1.4	3.7	8.0	15.2

Photographs, future flood heights - The levels that the Intermediate Regional and Standard Project Floods are expected to reach at selected locations in the study area are indicated on the following photographs.

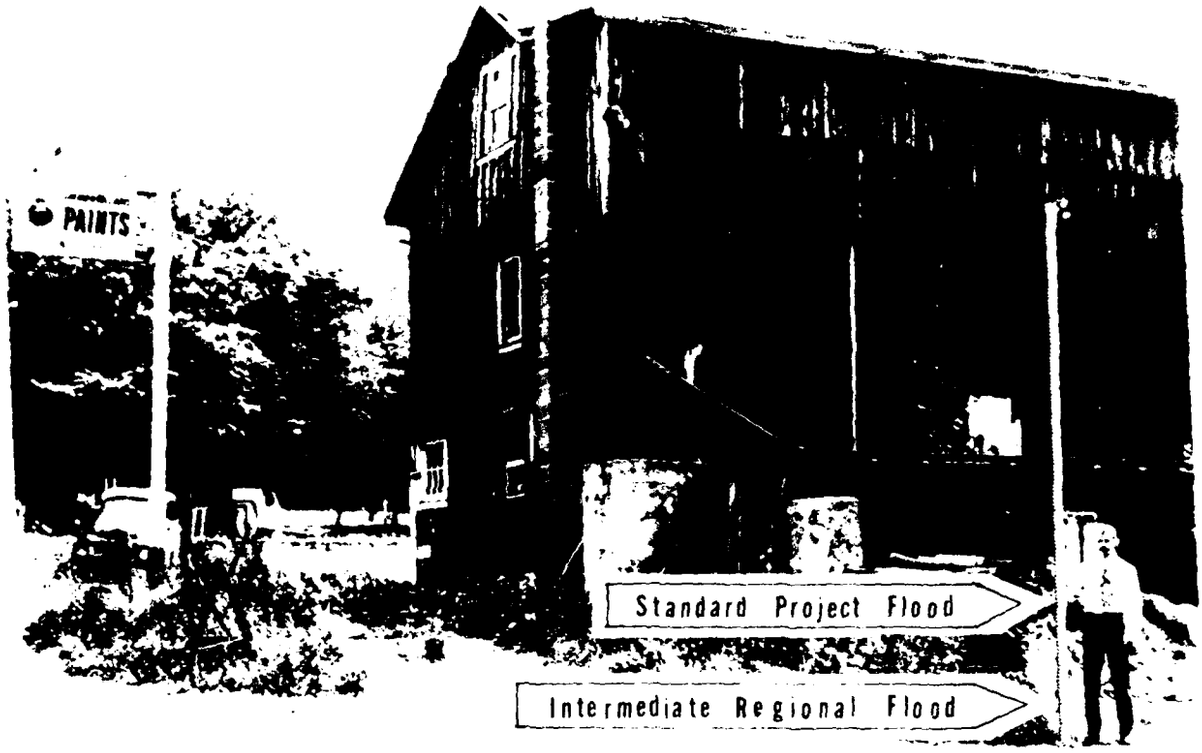


FIGURE 1 - Possible future flood heights of Mill Creek at the Buckingham Coal and Lumber Company

FIGURE 2 - Possible future flood heights of Mill Creek at the Reading Railroad Bridge

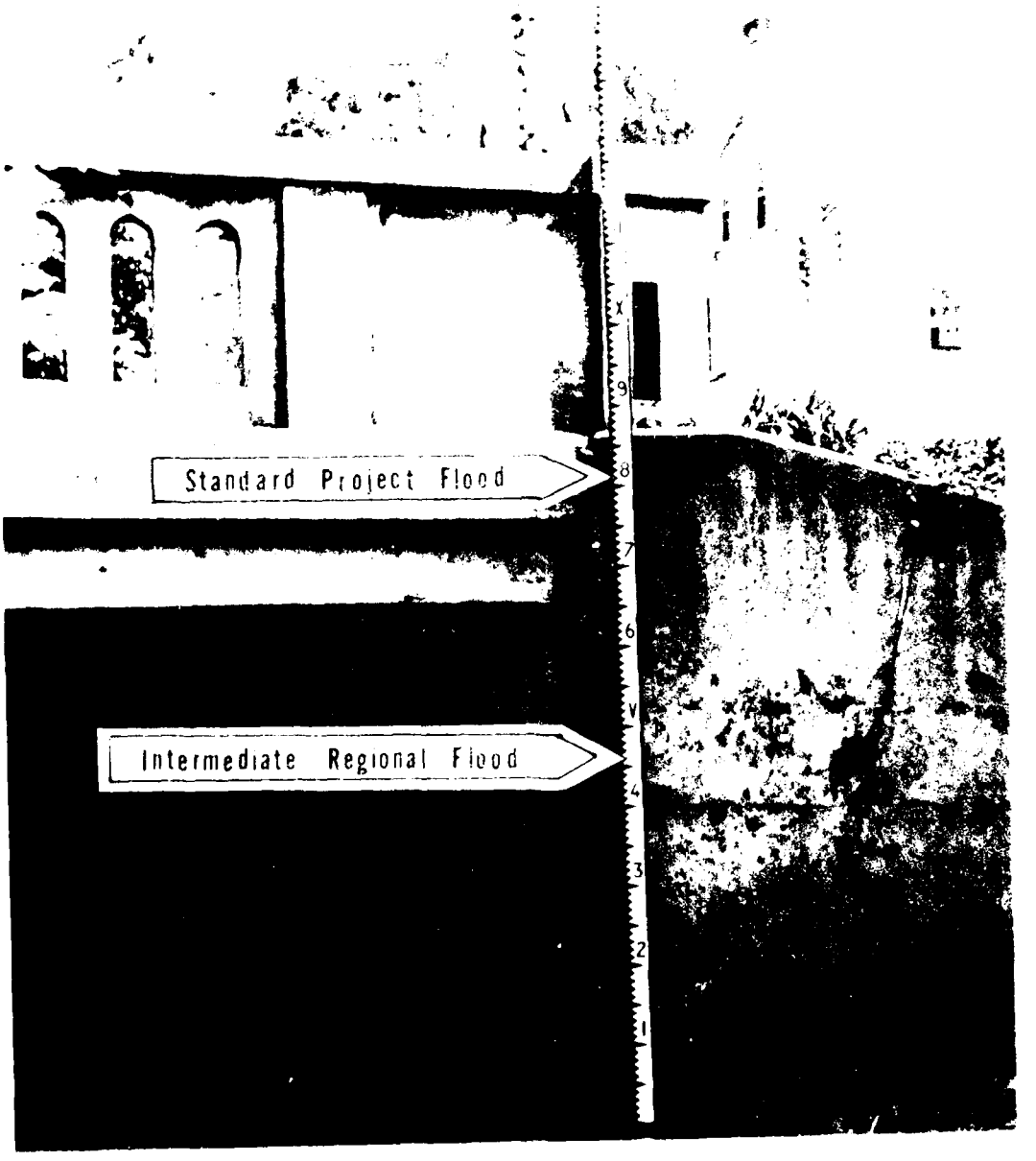


FIGURE 3


7
6
V
4
3
2
1
Standard Project Flood
Intermediate Regional Flood

FIGURE 4

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 streamflow, 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.

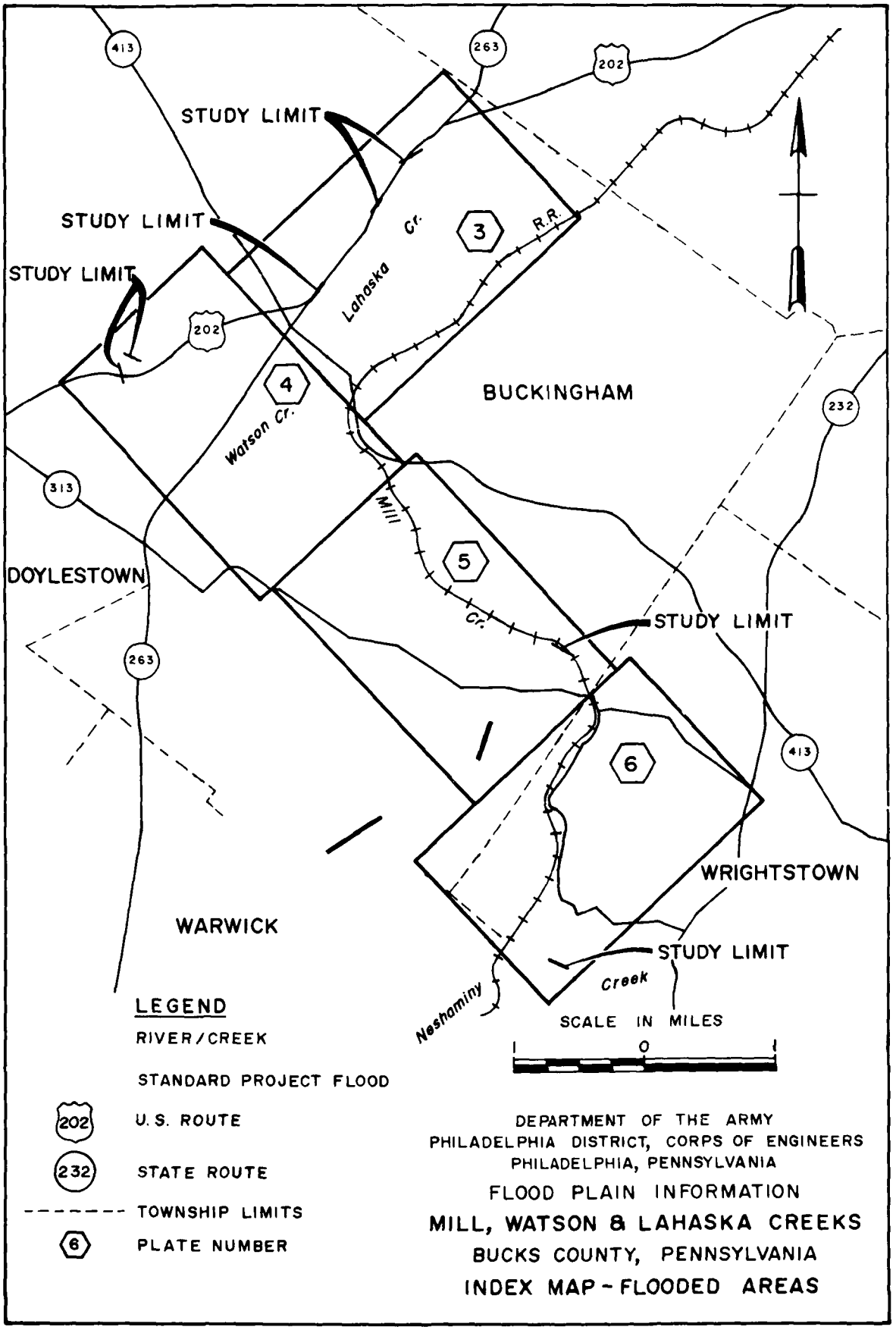
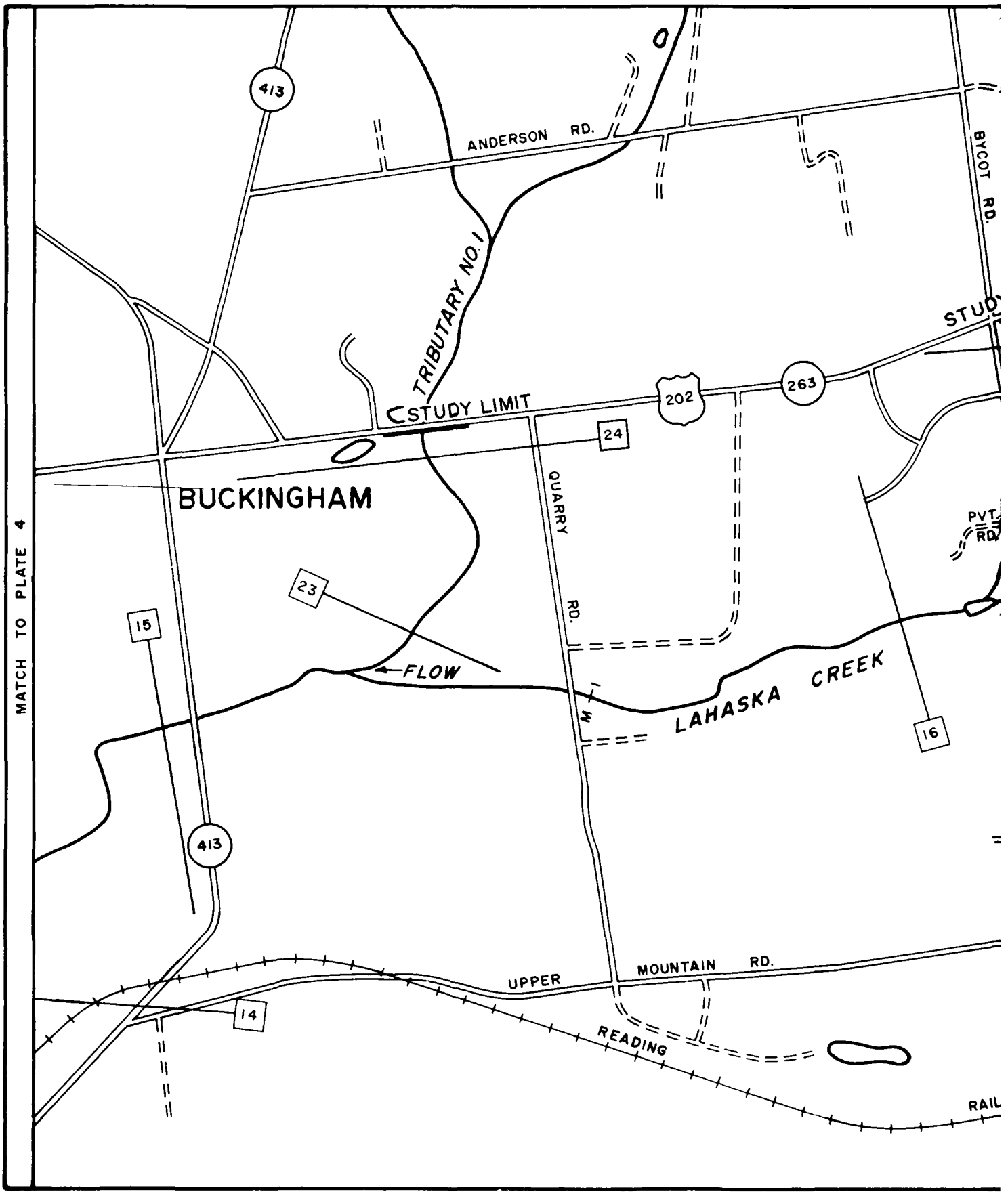
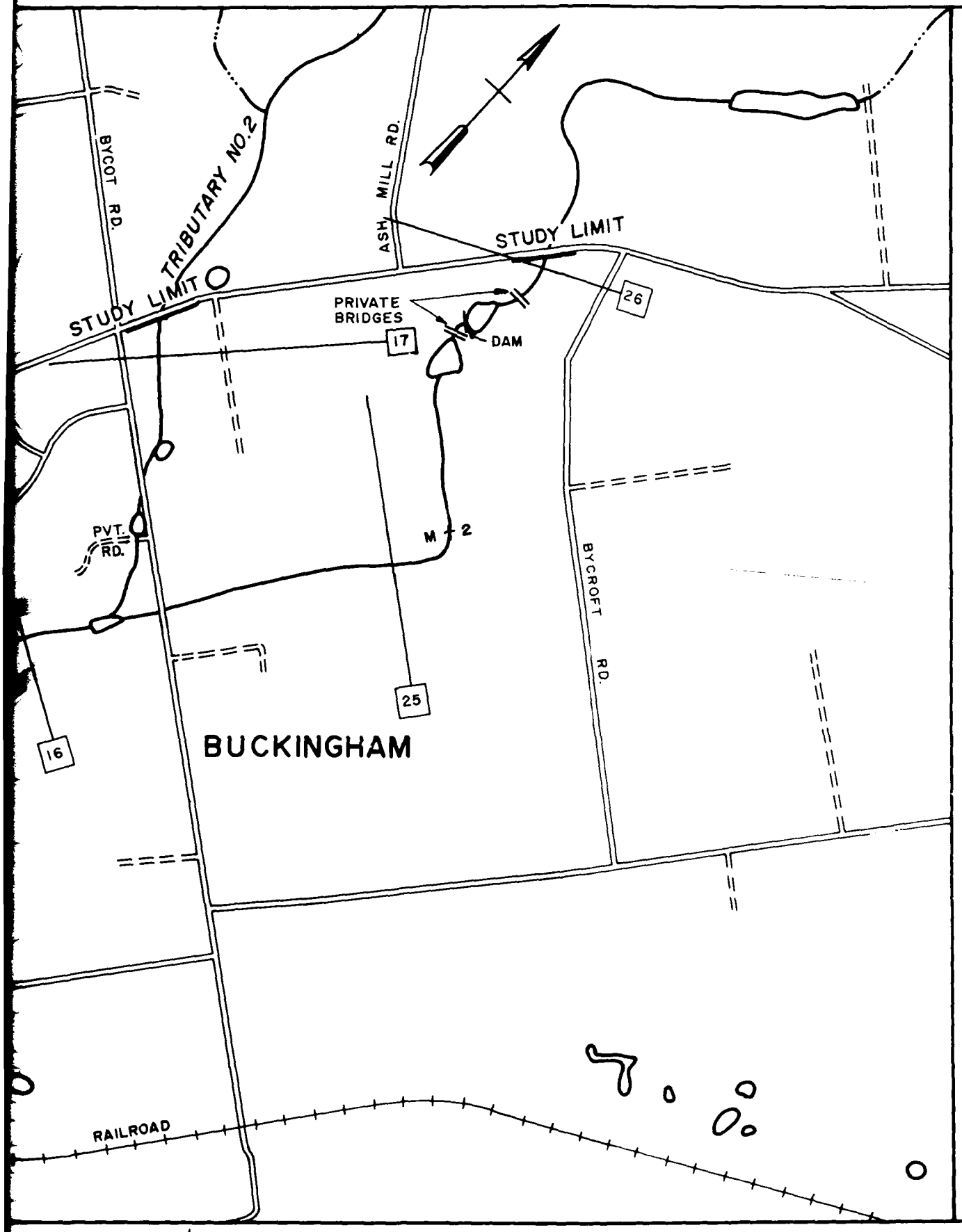

413
263
202
STUDY LIMIT
STUDY LIMIT
STUDY LIMIT
202
Lahaska Cr.
3
R.R.
4
Watson Cr.
BUCKINGHAM
232
313
Mill
Cr.
5
DOYLESTOWN
STUDY LIMIT
263
6
413
WRIGHTSTOWN
WARWICK
STUDY LIMIT
Neshaminy
Creek
SCALE IN MILES
0
1
LEGEND
RIVER/CREEK
STANDARD PROJECT FLOOD
202 U.S. ROUTE
232 STATE ROUTE
TOWNSHIP LIMITS
6 PLATE NUMBER
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA
INDEX MAP - FLOODED AREAS

PLATE 2


413
ANDERSON RD.
BYCOT RD.
TRIBUTARY NO. 1
STUDY LIMIT
202
263
24
BUCKINGHAM
QUARRY RD.
PVT. RD.
23
15
FLOW
LAHASKA CREEK
16
MATCH TO PLATE 4
413
UPPER MOUNTAIN RD.
14
READING
RAIL



M-1

17

202

263

NOTES

1. MAP BASED ON
SHEET BUCKING
AND ADJUSTMEN
ENGINEERS.

2. LIMITS OF OVE
ACTUAL LOCATI
IN THE REPORT

3. AREAS OUTSIDE
SUBJECT TO FL

4. CONTOUR INTE

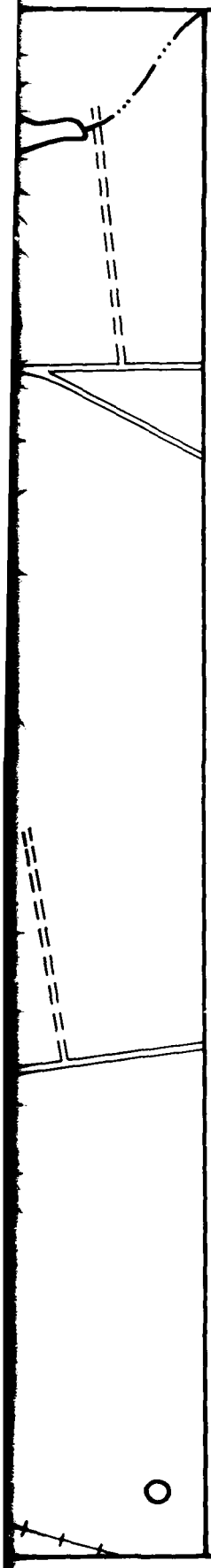
0

DEPA
PHILADELPHIA D
PHILAD

FLOOD

MILL, WA
BUCKS C

FL



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M + I — MILES ABOVE MOUTH

17 — CROSS SECTION

GROUND ELEVATION IN FEET SEA LEVEL DATUM

202 — U.S. ROUTE

263 — STATE ROUTE

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEET BUCKINGHAM, PA. 1968. 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 FLOODPLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF
4. CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

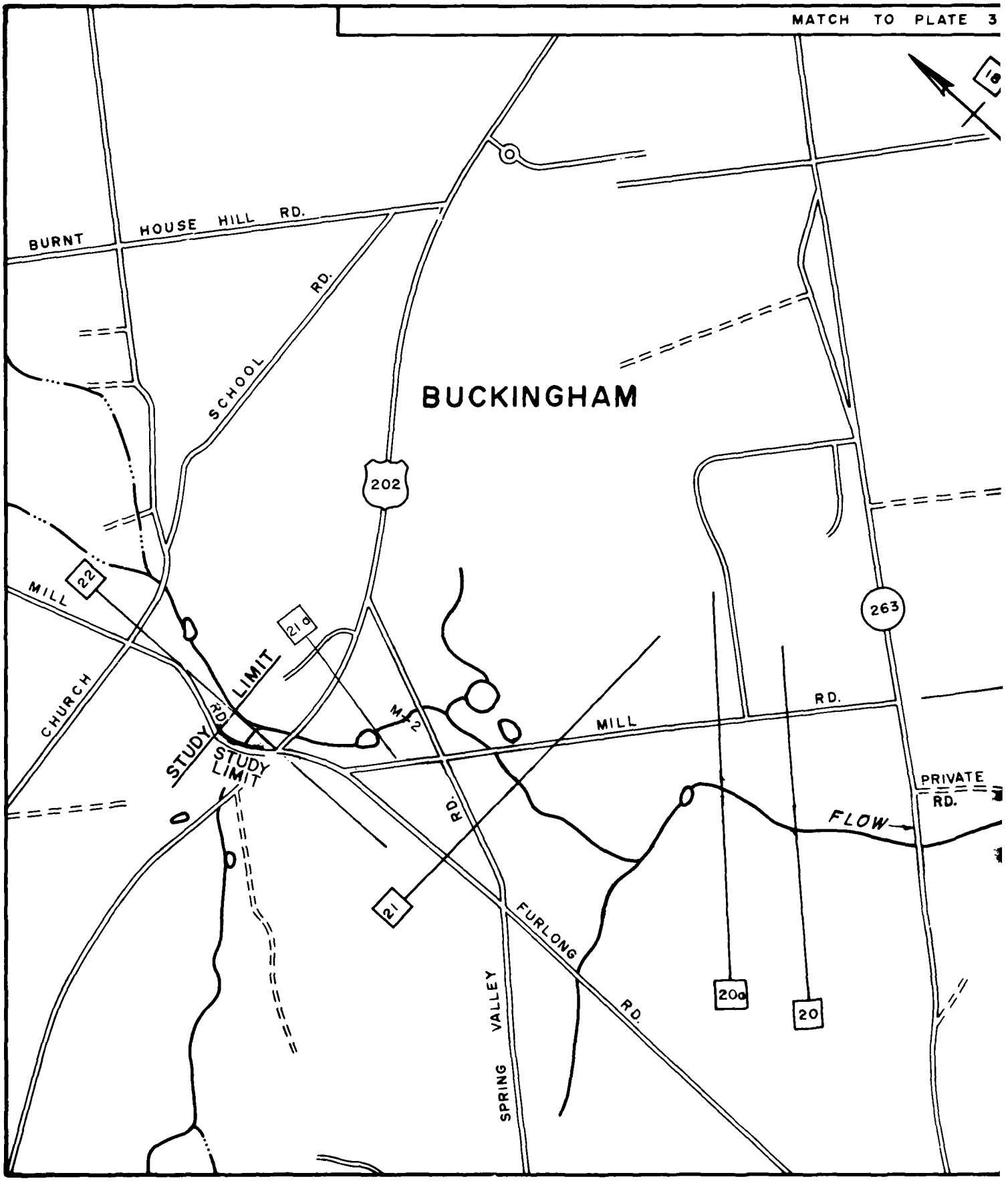
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

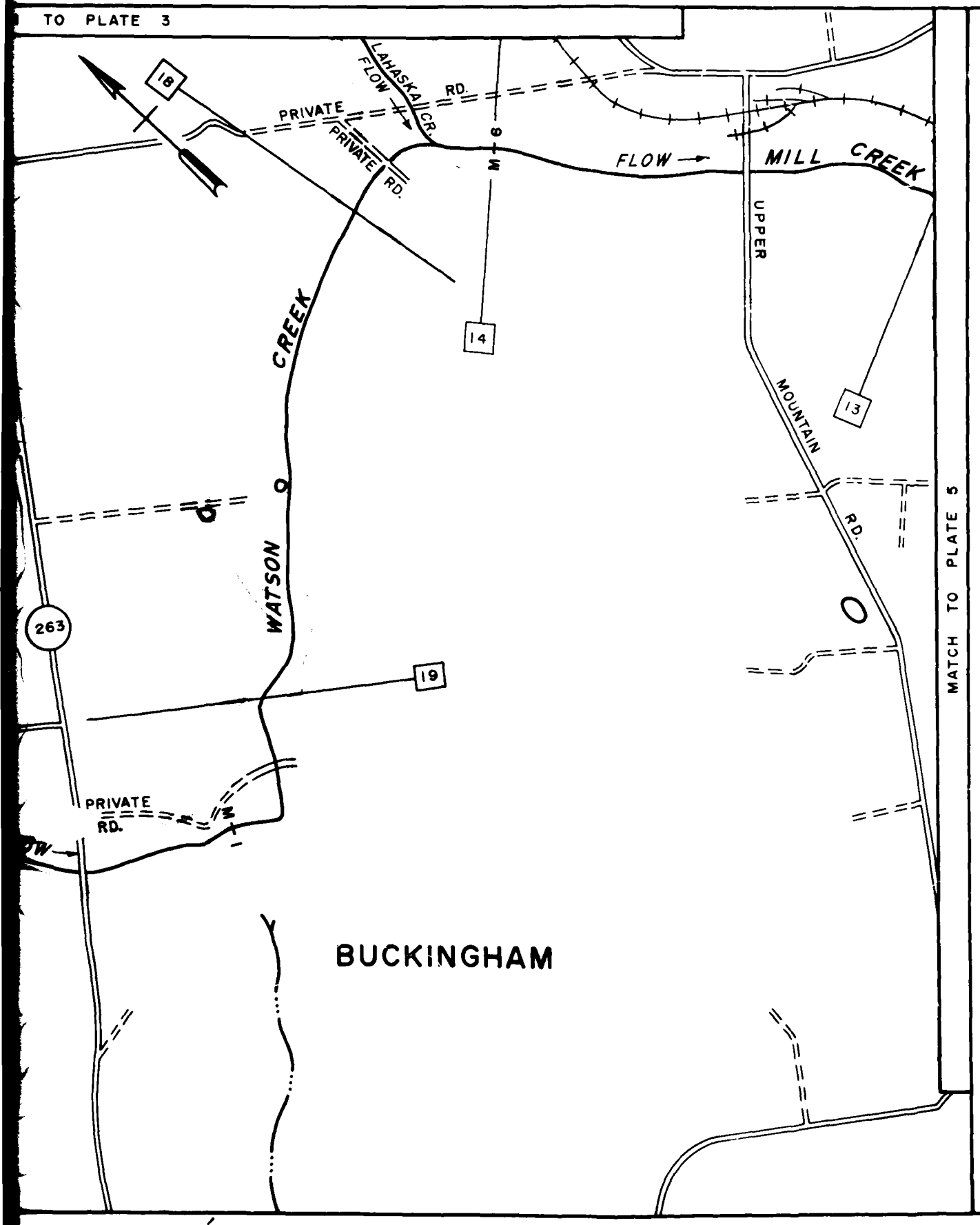
FLOOD PLAIN INFORMATION

MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA

FLOODED AREAS

PLATE 3


MATCH TO PLATE 3
BURNT HOUSE HILL RD.
SCHOOL RD.
BUCKINGHAM
202
22
MILL
CHURCH
STUDY LIMIT
STUDY LIMIT RD.
21a
M-2
MILL RD.
263
PRIVATE RD.
FLOW
21
SPRING VALLEY
FURLONG RD.
20a
20



M+6

14

202

263

NOTES

1. MAP BASED O
SHEET BUCKI
AND ADJUSTM
ENGINEERS.

2. LIMITS OF
ACTUAL LOCA
IN THE REPO

3. AREAS OUTSI
SUBJECT TO

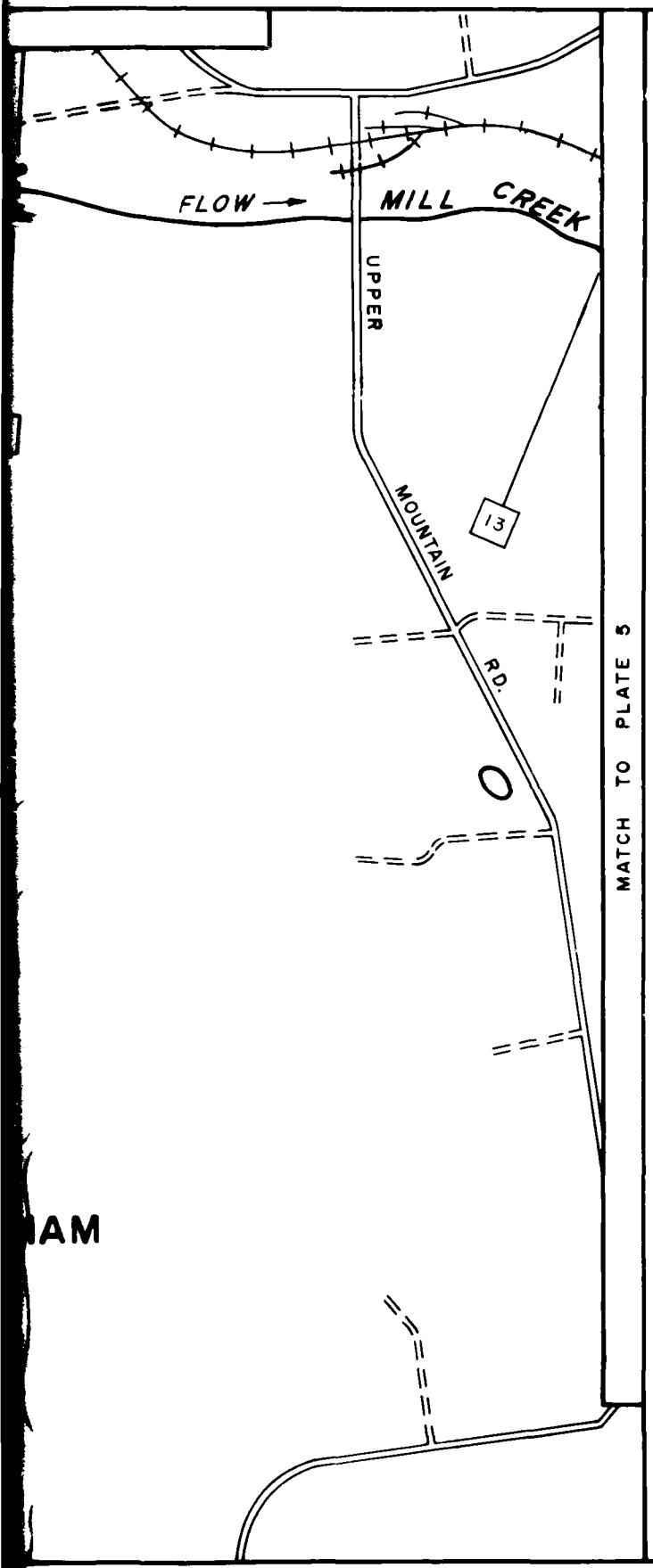
4. CONTOUR INT

0

DE
PHILADELPHIA
PHIL

FLOO

MILL, W
BUCKS



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M+6 — MILES ABOVE MOUTH

14 — CROSS SECTION

GROUND ELEVATION IN FEET SEA LEVEL DATUM

202 — U.S. ROUTE

263 — STATE ROUTE

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEET BUCKINGHAM, PA. 1968. 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 FLOODPLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

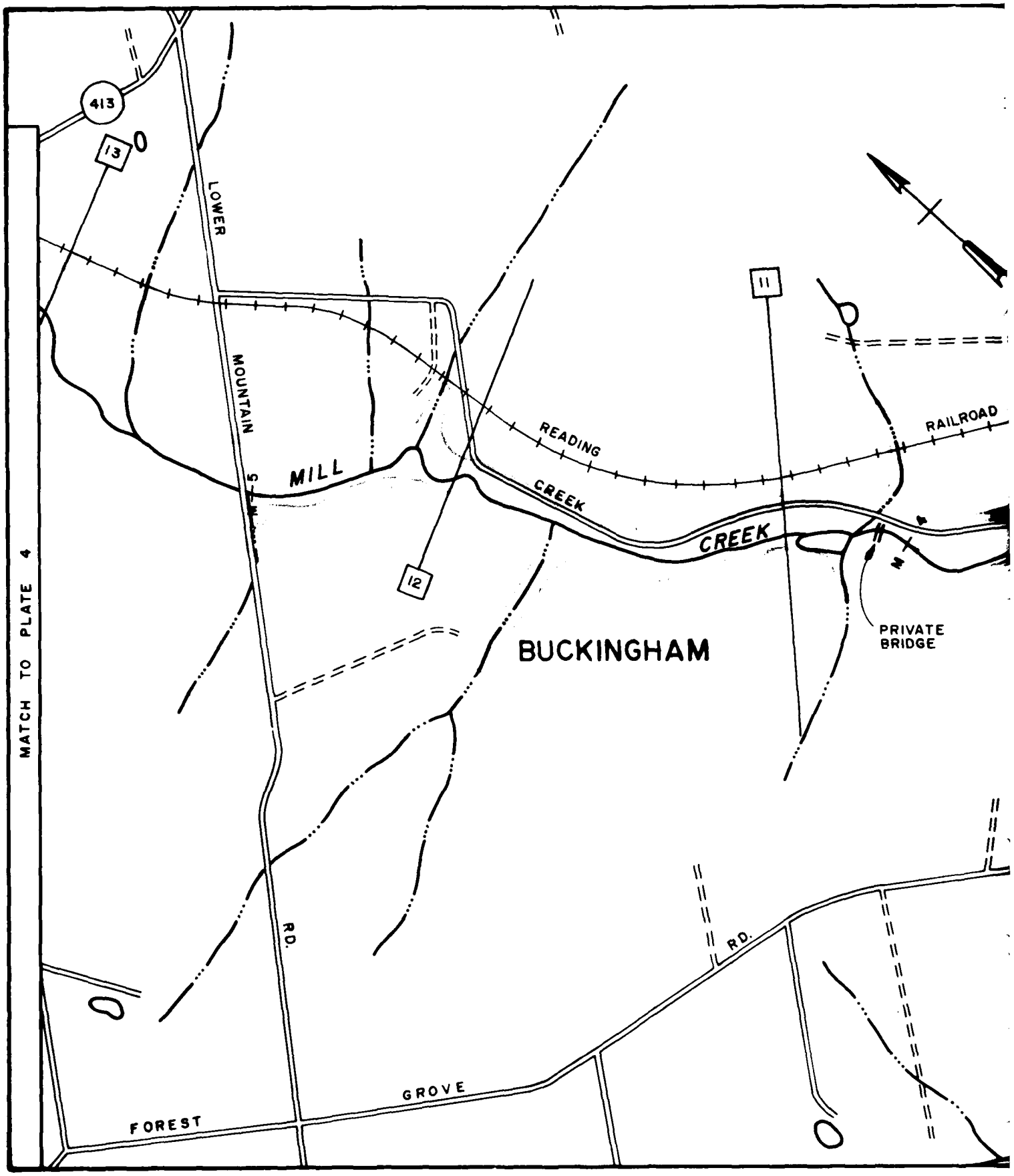
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION

MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA

FLOODED AREAS

PLATE 4


413
13
LOWER
MOUNTAIN
MILL
CREEK
READING
RAILROAD
CREEK
11
12
PRIVATE
BRIDGE
BUCKINGHAM
MATCH TO PLATE 4
RD.
RD.
GROVE
FOREST

NOTES

1. MAP BA
SHEET
AND ADJ
ENGINEE

2. LIMITS
ACTUAL
IN THE

3 AREAS
SUBJECT

4. CONTOUR

MATCH TO PLATE 6

M+4

11

413

PHILADELP

FL

MILL
BUC

RD.

CREEK

GROVE

BADGE SMITH RD.

RUN

ROBINS

FLOW

FOREST

9

10

RD.

DARK HOLLOW

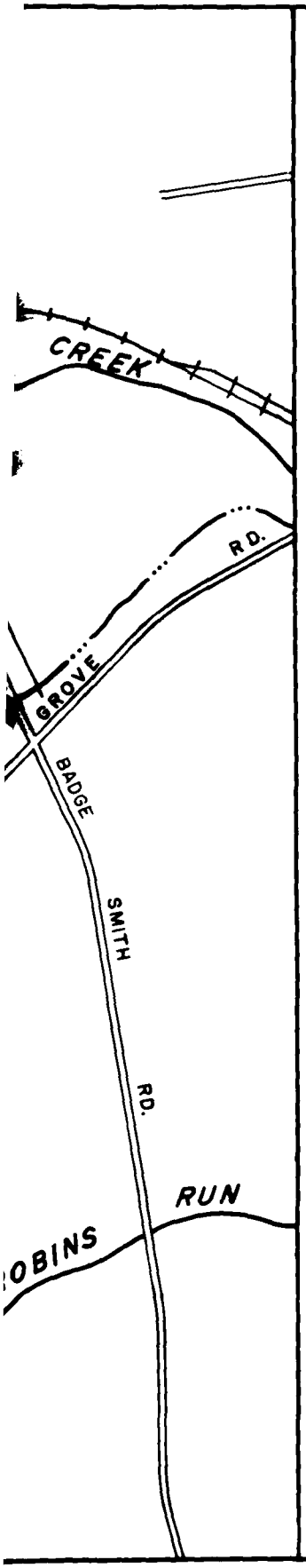
NEW HOPE RD.

FLOW

RAILROAD

RD.

PRIVATE
BRIDGE



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M+4 — MILES ABOVE MOUTH

11 — CROSS SECTION

GROUND ELEVATION IN FEET SEA LEVEL DATUM

413 — STATE ROUTE

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEET BUCKINGHAM, PA. 1968. ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
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SCALE IN FEET

0 800 1600

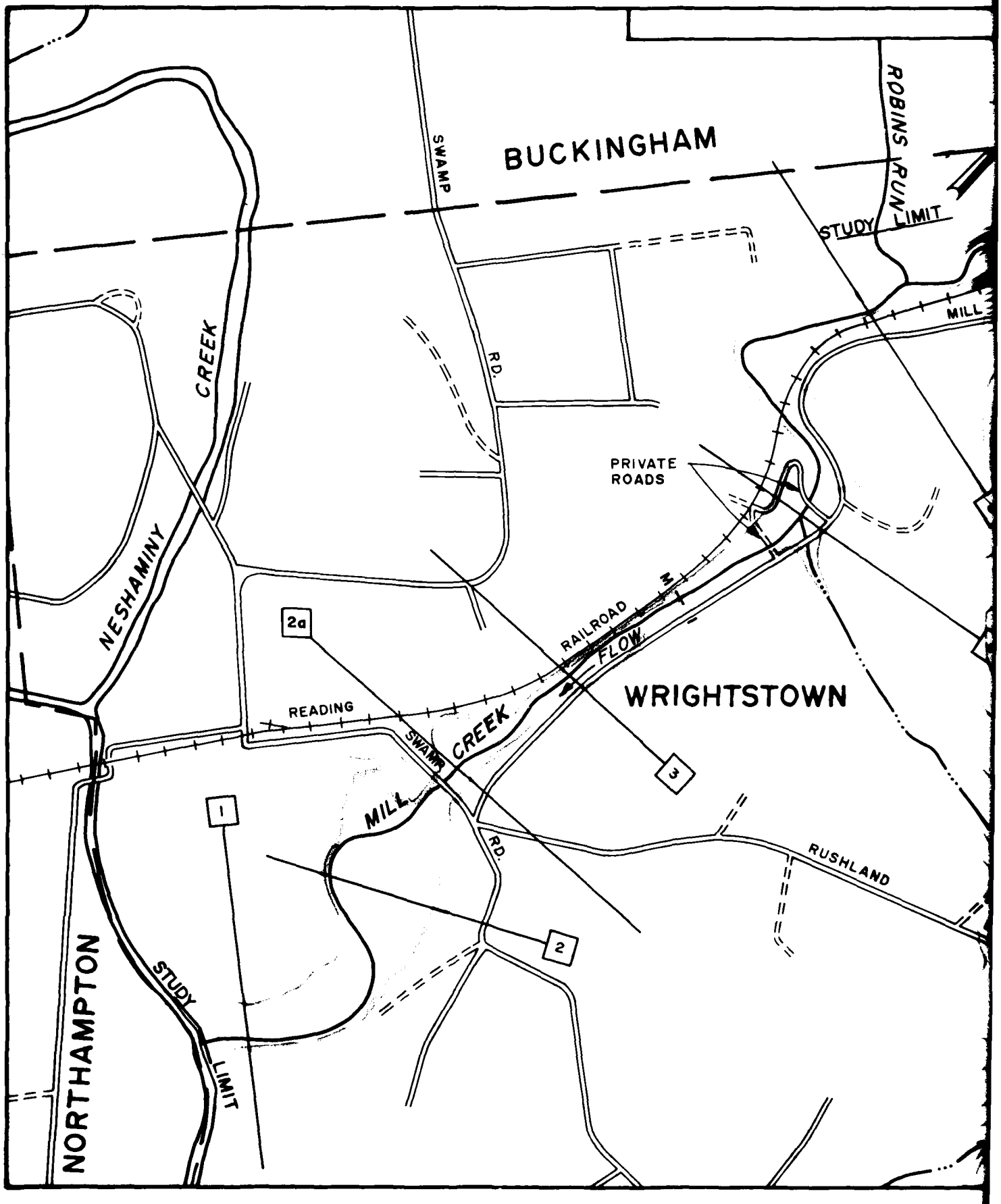
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

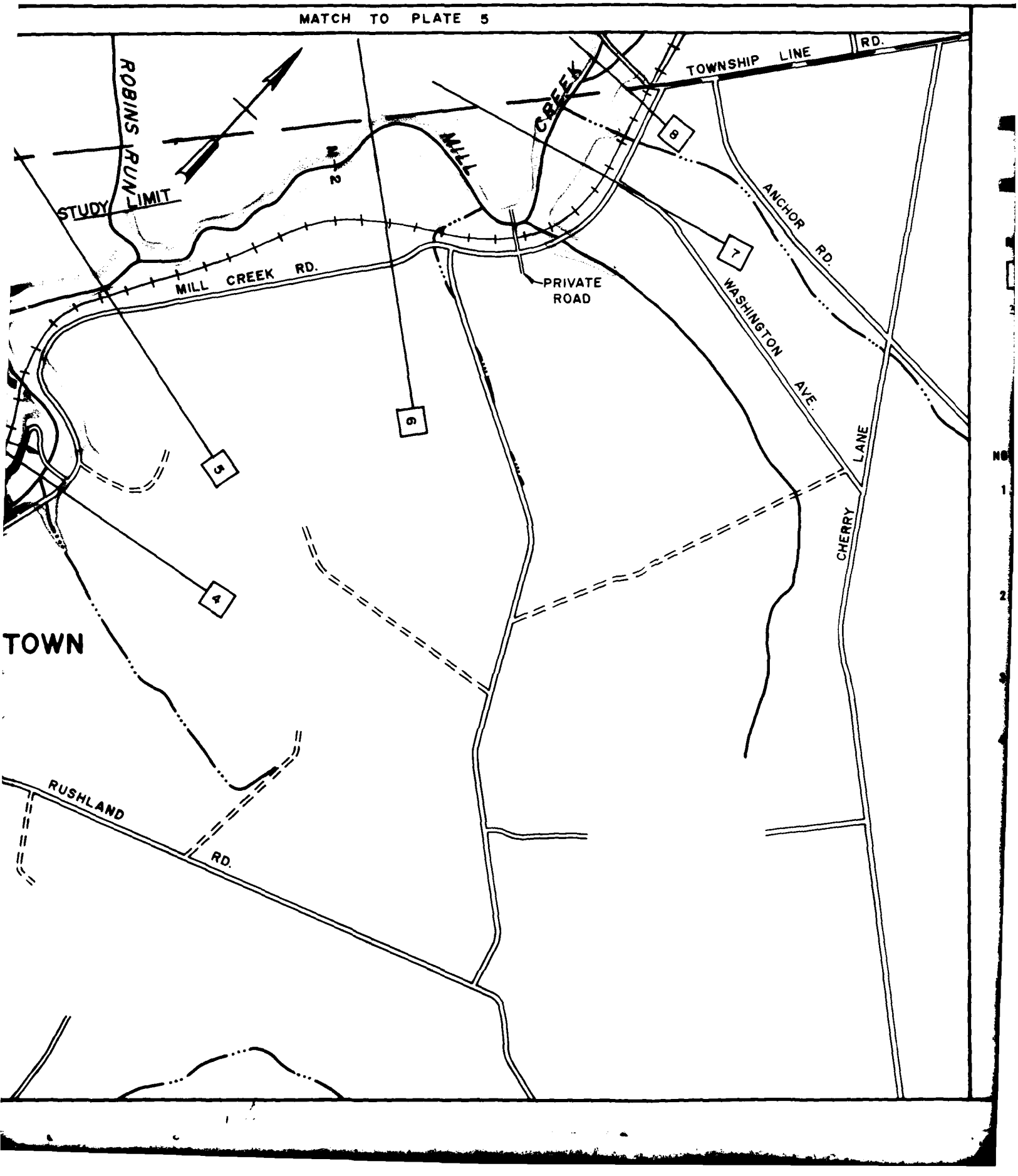
FLOOD PLAIN INFORMATION

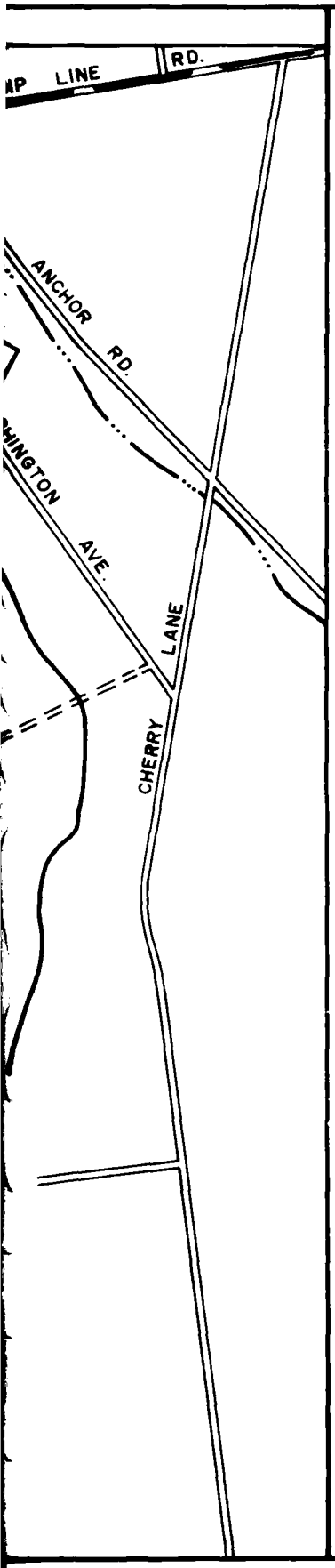
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA

FLOODED AREAS

PLATE 5


BUCKINGHAM
SWAMP
ROBINS RUN
STUDY LIMIT
MILL
RD.
CREEK
NESHAMINY
PRIVATE
ROADS
2a
RAILROAD
FLOW
WRIGHTSTOWN
READING
SWAMP CREEK
3
1
MILL
RD.
RUSHLAND
2
NORTHAMPTON
STUDY
LIMIT


MATCH TO PLATE 5
ROBINS RUN
STUDY LIMIT
MILL CREEK
TOWNSHIP LINE RD.
ANCHOR RD.
MILL CREEK RD.
PRIVATE ROAD
WASHINGTON AVE.
CHERRY LANE
TOWN
RUSHLAND RD.
3
4
5
6
7
8



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M + I — MILES ABOVE MOUTH

7 — CROSS SECTION

GROUND ELEVATION IN FEET
SEA LEVEL DATUM

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLE SHEET BUCKINGHAM, PA. 1968. ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
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3. AREAS OUTSIDE THE FLOODPLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. CONTOUR INTERVAL IS 20 FT.

SCALE IN FEET

0 800 1600

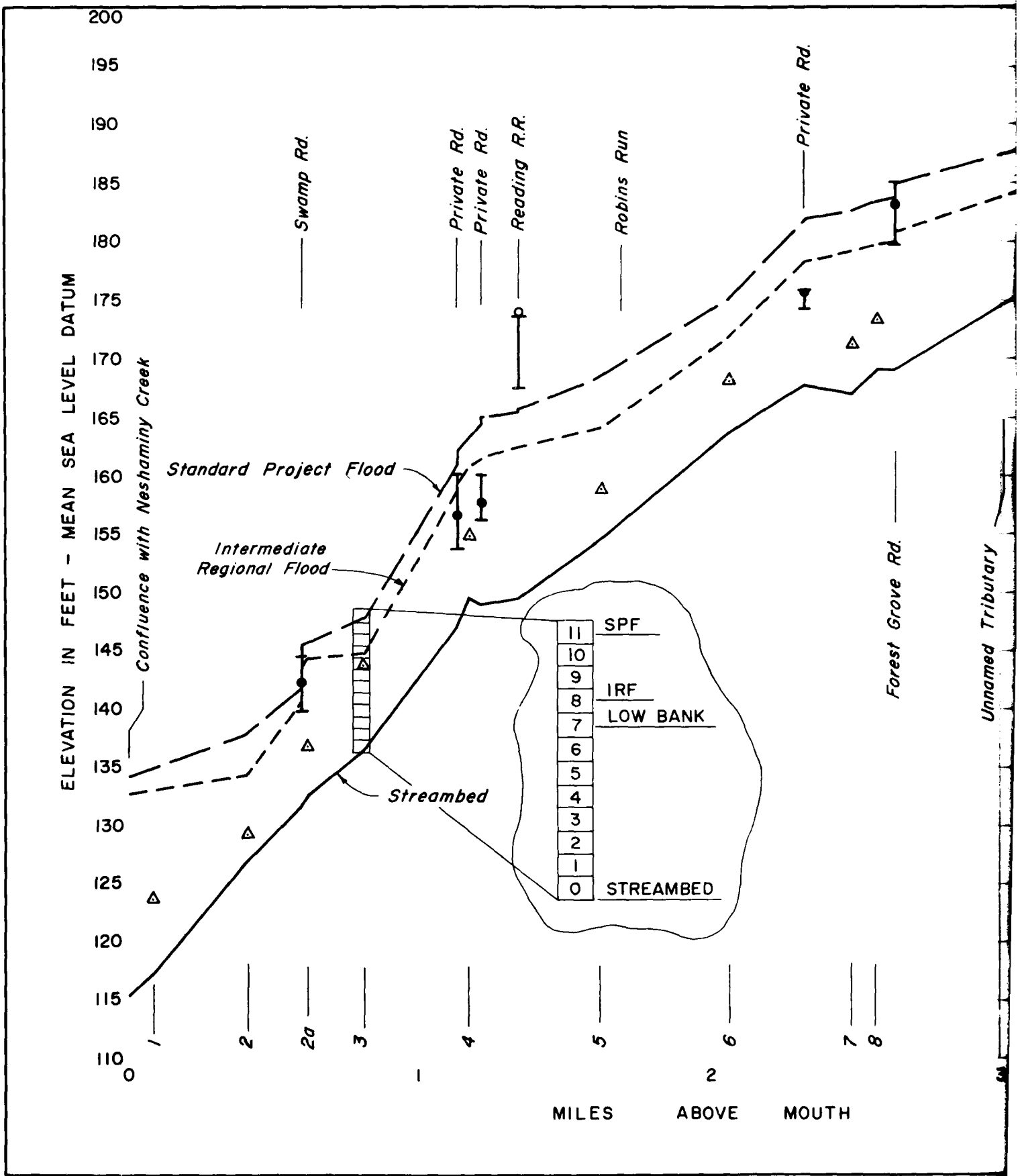
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

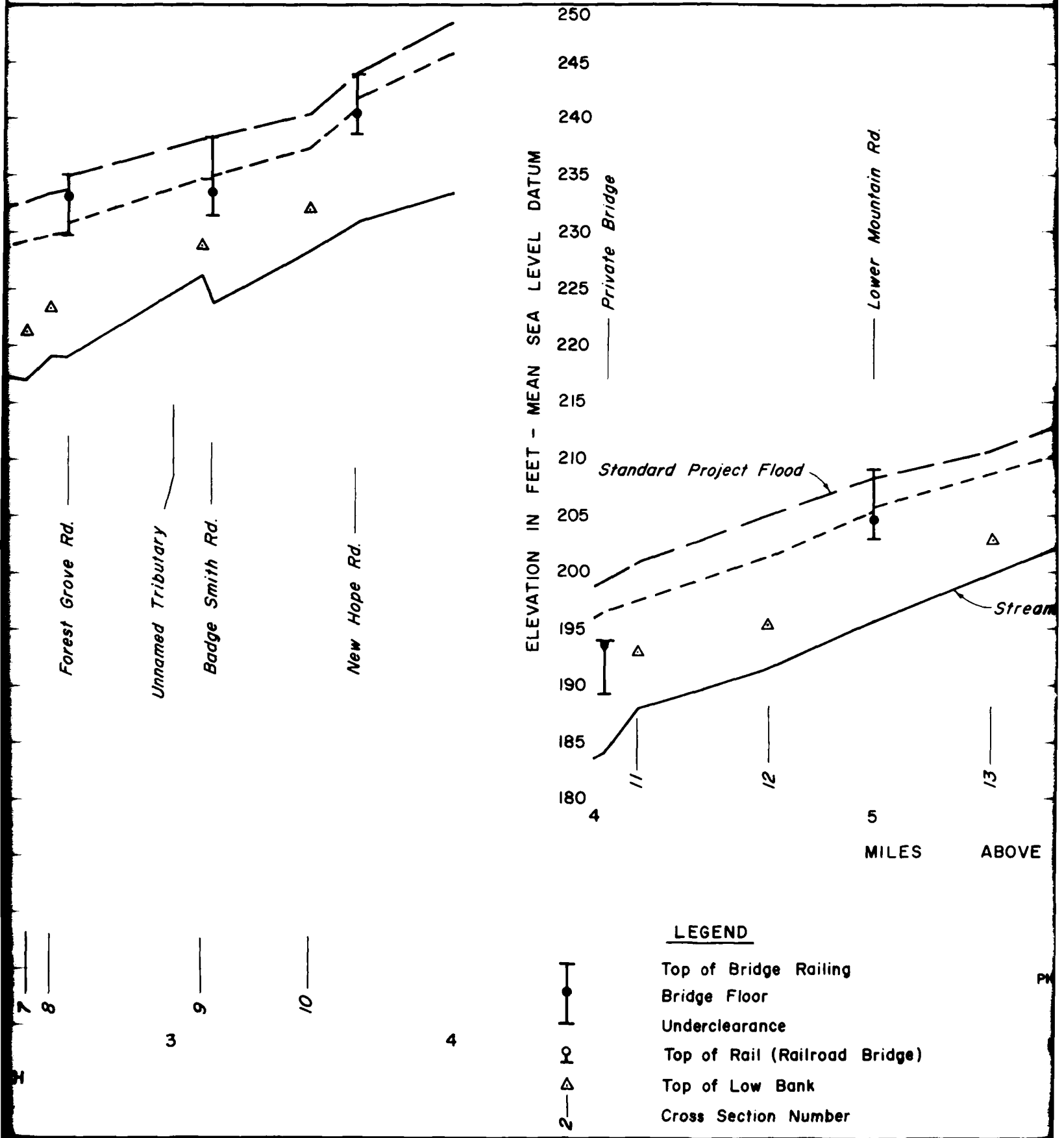
FLOOD PLAIN INFORMATION

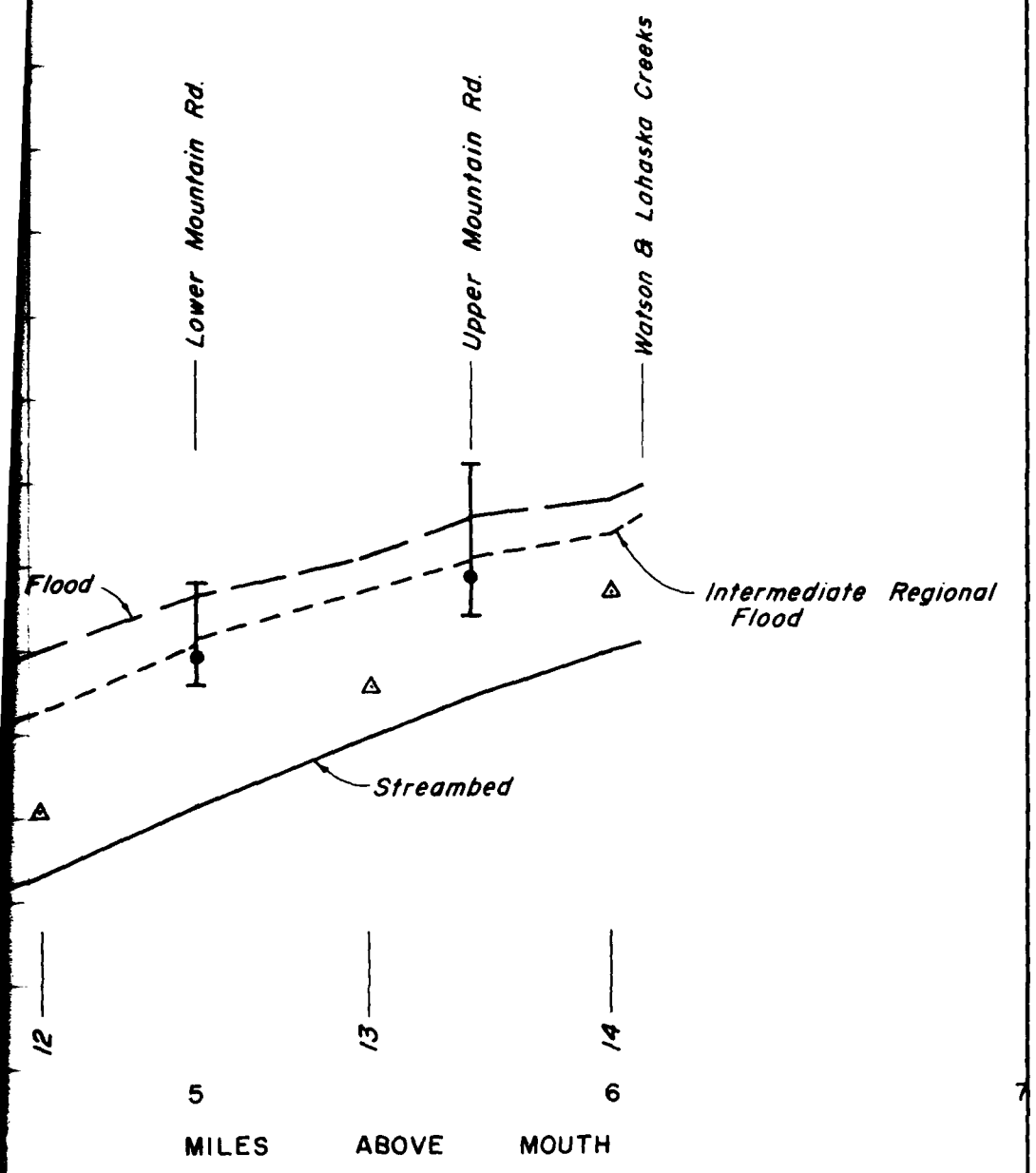
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PENNSYLVANIA

FLOODED AREAS

PLATE 6


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
200
195
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
Confluence with Neshaminy Creek
Swamp Rd.
Private Rd.
Private Rd.
Reading R.R.
Robins Run
Private Rd.
Standard Project Flood
Intermediate Regional Flood
Streambed
SPF
IRF
LOW BANK
STREAMBED
11
10
9
8
7
6
5
4
3
2
1
0
Forest Grove Rd.
Unnamed Tributary
1
2
2a
3
4
5
6
7
8
0
1
2
MILES ABOVE MOUTH

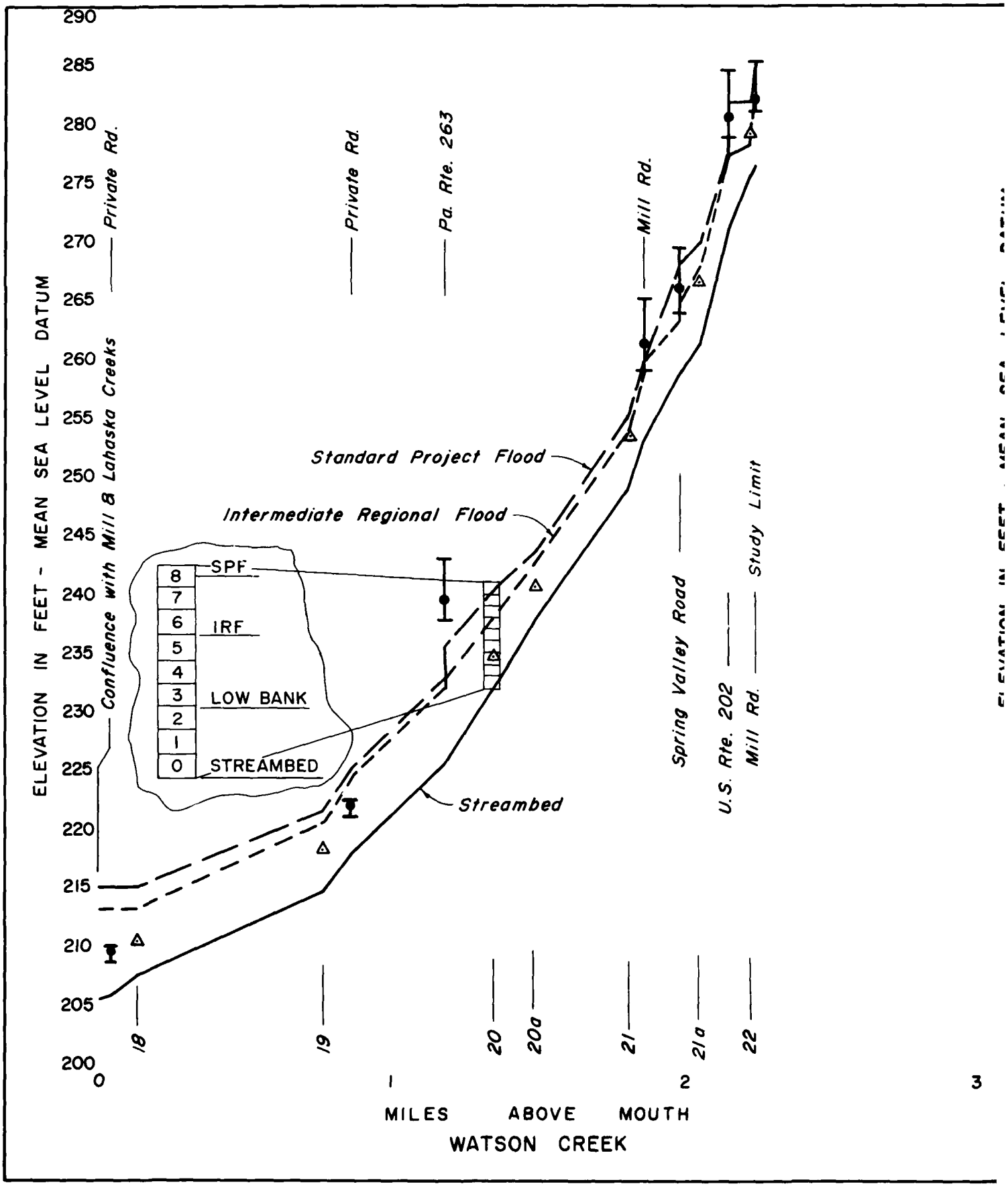

ELEVATION IN FEET - MEAN SEA LEVEL DATUM
250
245
240
235
230
225
220
215
210
205
200
195
190
185
180
Private Bridge
Lower Mountain Rd.
Standard Project Flood
Stream
Forest Grove Rd.
Unnamed Tributary
Badge Smith Rd.
New Hope Rd.
11
12
13
4
5
MILES
ABOVE
7
8
9
10
3
4
LEGEND
Top of Bridge Railing
Bridge Floor
Underclearance
Top of Rail (Railroad Bridge)
Top of Low Bank
Cross Section Number

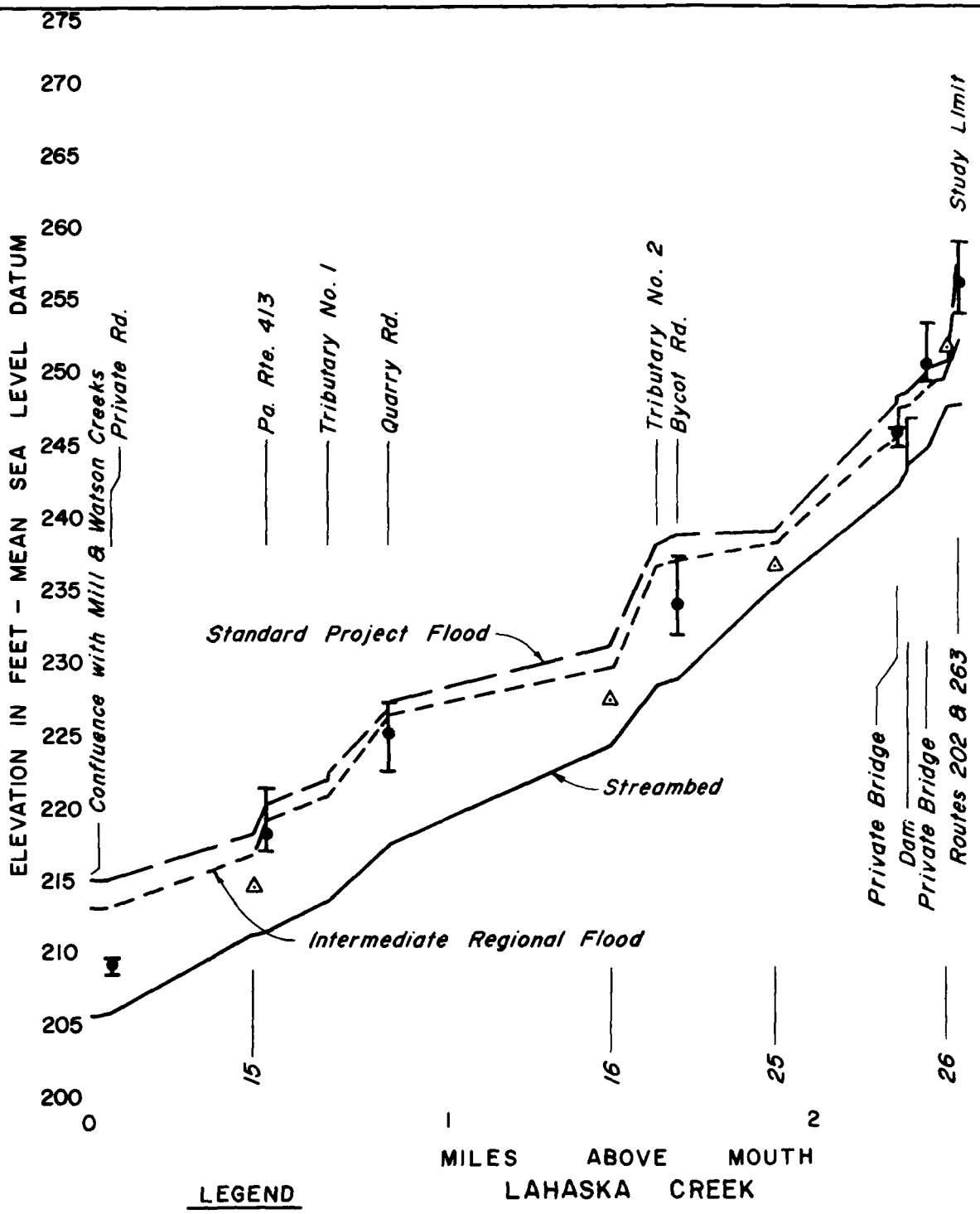


idge Railing
oor
rance
ail (Railroad Bridge)
ow Bank
ction Number

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PA.
HIGH WATER PROFILES
MILL CREEK

PLATE 7


ELEVATION IN FEET - MEAN SEA LEVEL DATUM
290
285
280
275
270
265
260
255
250
245
240
235
230
225
220
215
210
205
200
Confluence with Mill & Lahaska Creeks
Private Rd.
Private Rd.
Pa. Rte. 263
Mill Rd.
Spring Valley Road
U.S. Rte. 202
Mill Rd.
Study Limit
Standard Project Flood
Intermediate Regional Flood
Streambed
8
7
6
5
4
3
2
1
0
SPF
IRF
LOW BANK
STREAMBED
18
19
20
20a
21
21a
22
0
1
2
3
MILES ABOVE MOUTH
WATSON CREEK



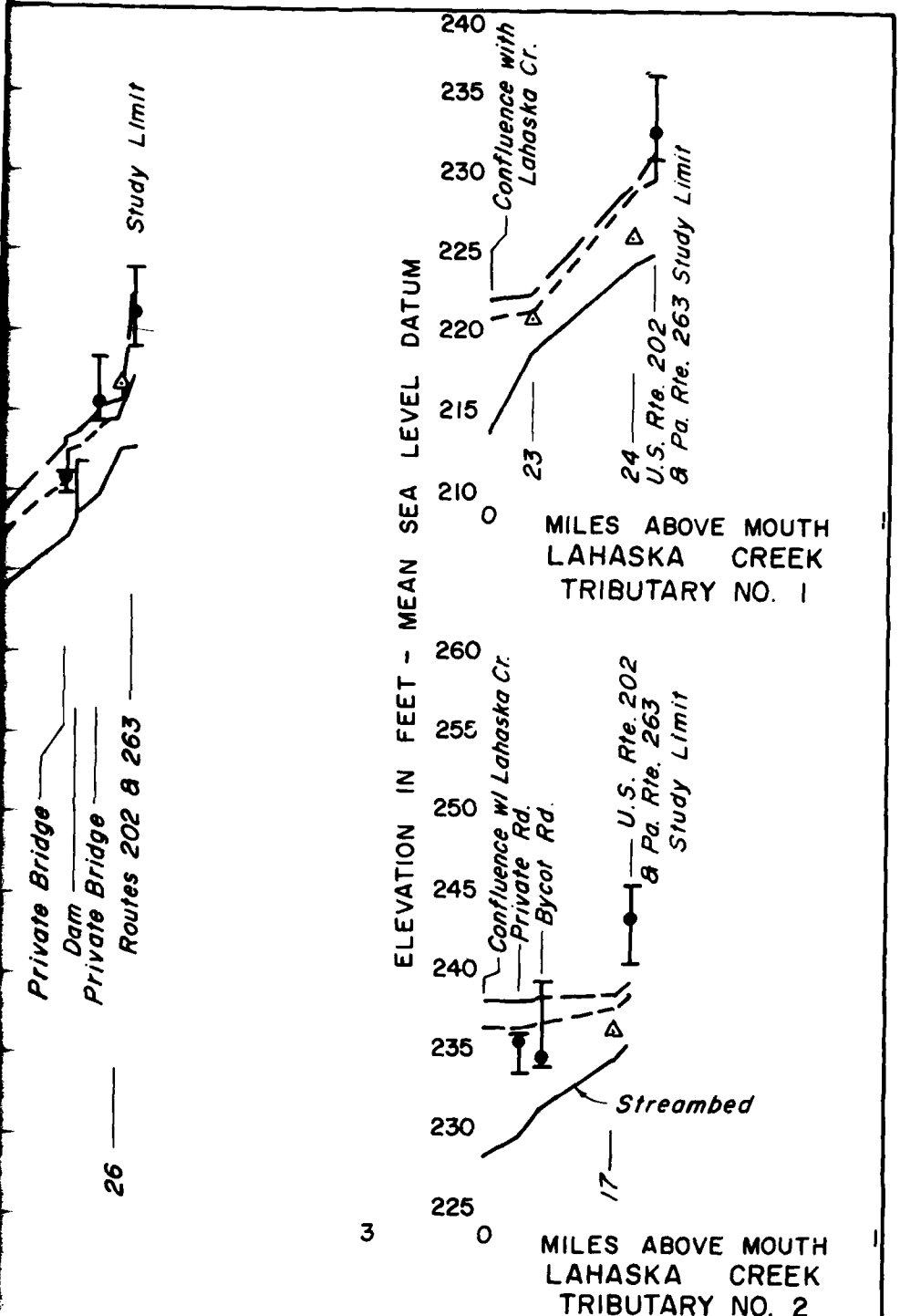
ELEVATION IN FEET - MEAN SEA LEVEL DATUM

PHILADEI

FL

MILL,

WA

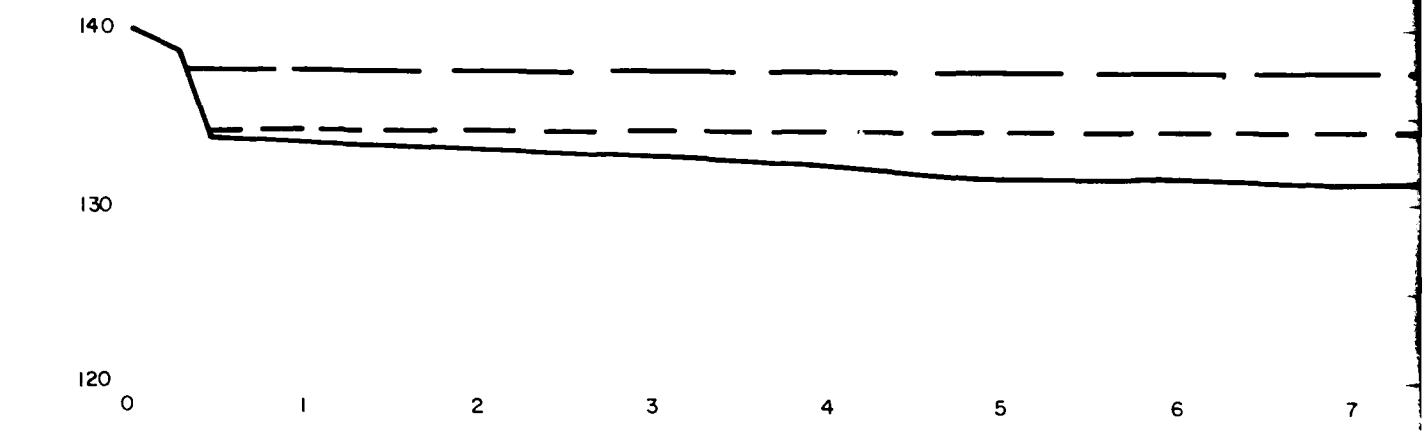


DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PA.

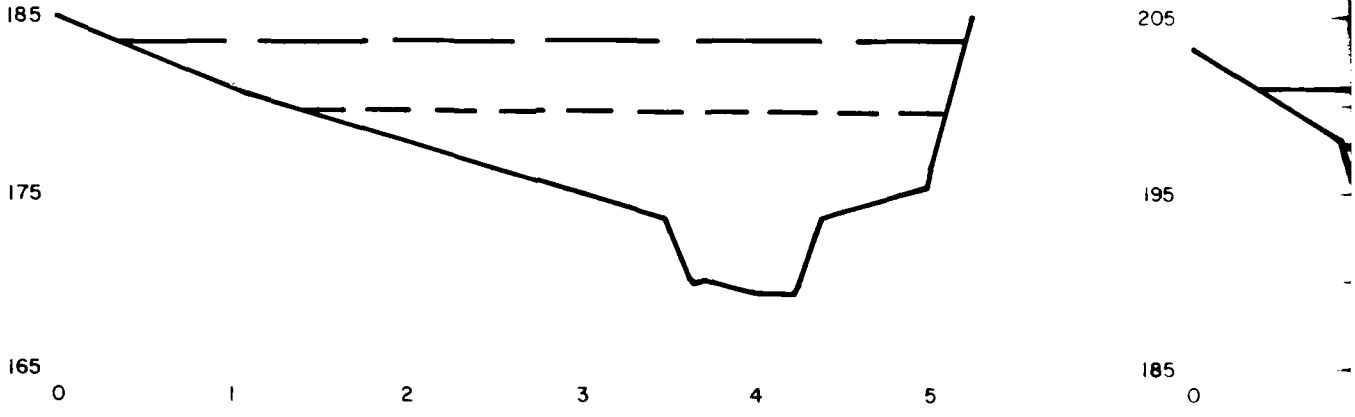
HIGH WATER PROFILES
WATSON & LAHASKA CREEKS

PLATE 8



CROSS SECTION NO.2
MILE 0.41

ELEVATION IN FEET SEA LEVEL DATUM



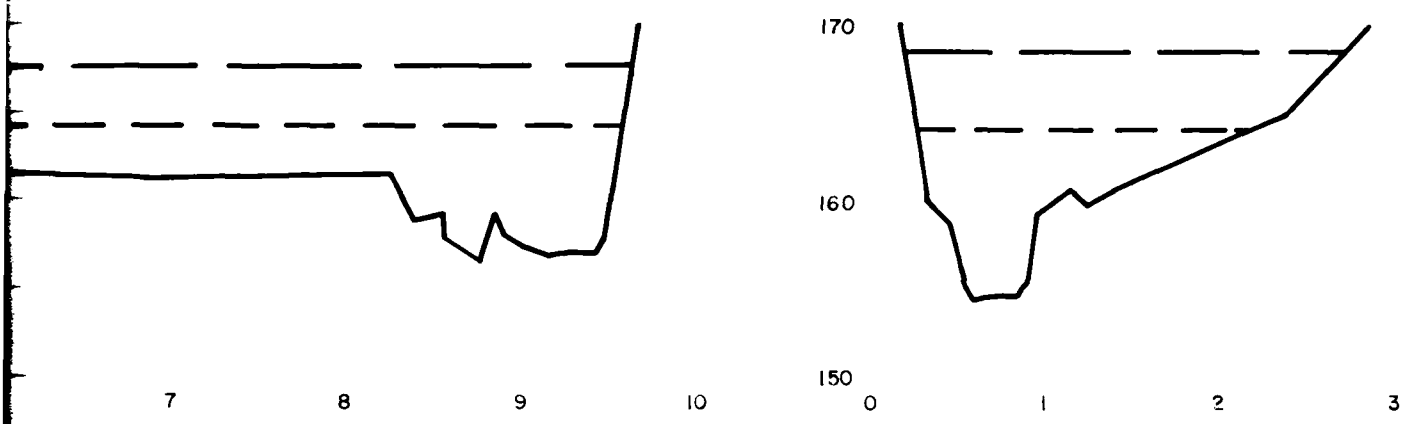
CROSS SECTION NO.8
MILE 2.57

HORIZONTAL

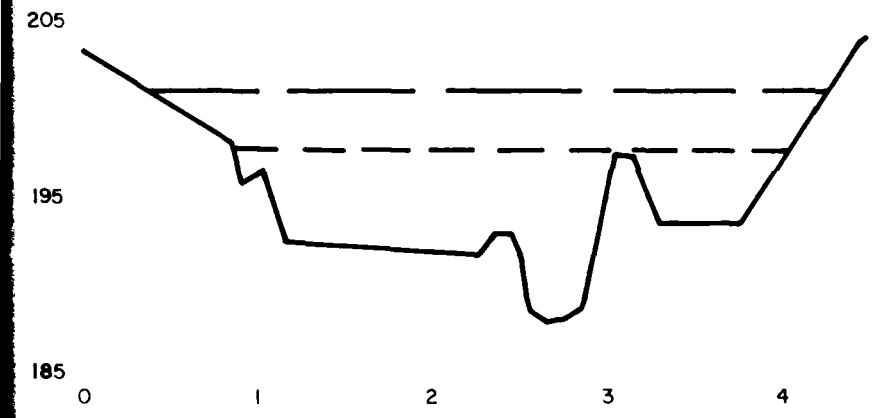
NOTE:

The additional 20 cross sections surveyed for this report and not shown in this report are on file at the Philadelphia District, Corps of Engineers and are available for inspection upon request

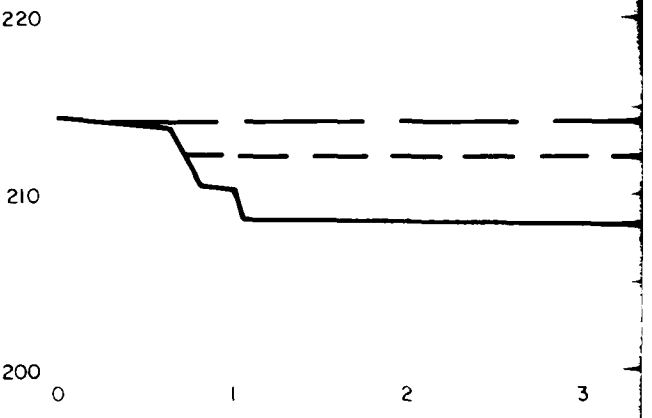
LEGEND



CROSS SECTION NO.5
MILE 1.62



CROSS SECTION NO.11
MILE 4.17



CROSS SECTION
MILE 6.00

HORIZONTAL DISTANCE IN HUNDREDS OF FEET

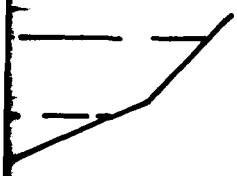
LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

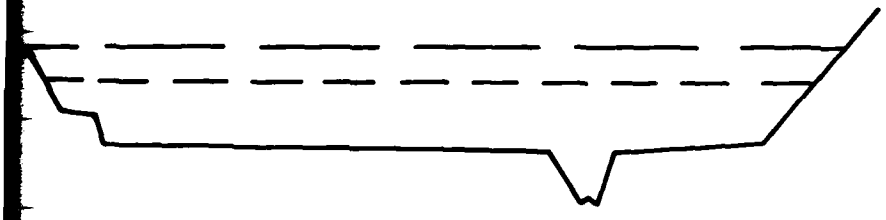
GROUND LINE

DEPAR
PHILADELPHIA
PHILAD
FLOOD
MILL, WAT
BU
SELECT



2 3

TION NO.5
1.62



1 2 3 4 5

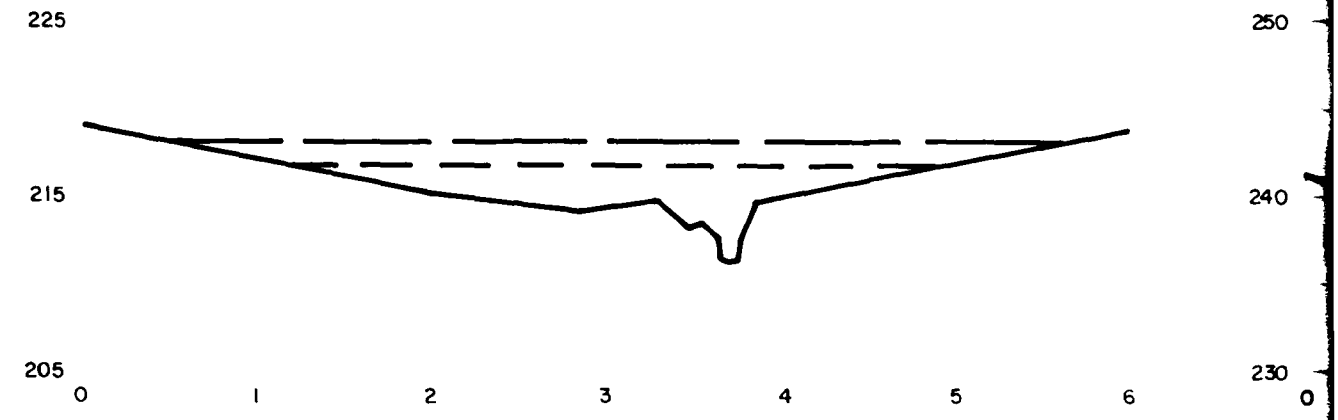
CROSS SECTION NO.14
MILE 6.00

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

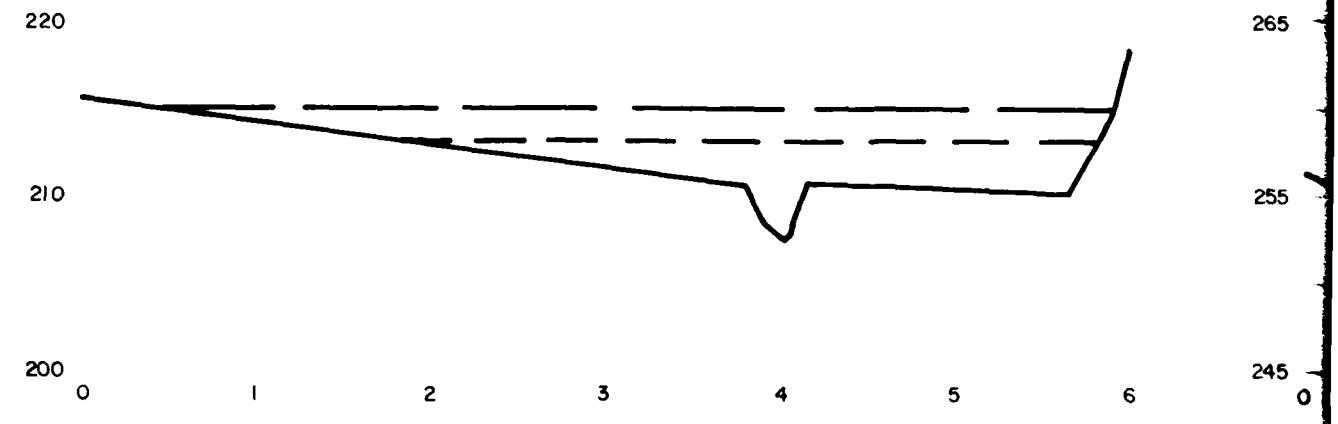
FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PA.

SELECTED CROSS SECTIONS
MILL CREEK

PLATE 9



LAHASKA CREEK
CROSS SECTION NO.15
MILE 0.45

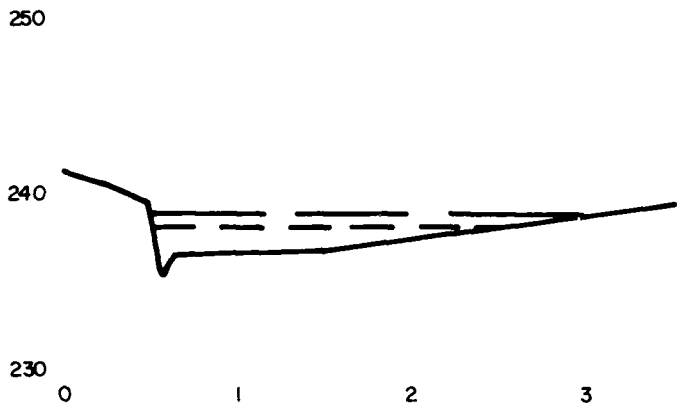


ELEVATION IN FEET SEA LEVEL DATUM

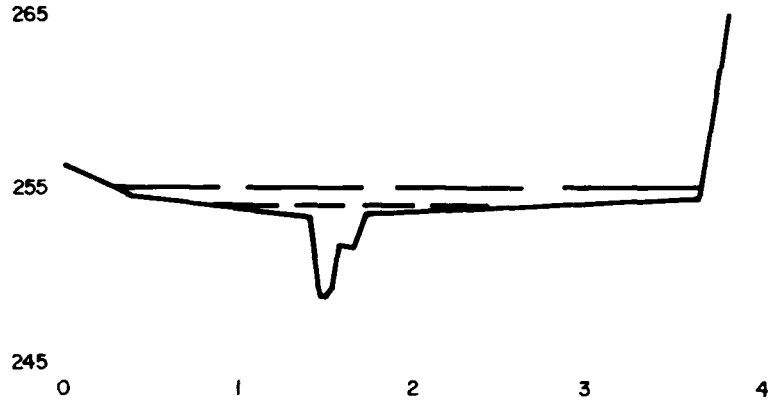
WATSON CREEK
CROSS SECTION NO.18
MILE 0.13

HORIZONTAL DISTANCE IN HUNDREDS

SEE PLATE NO. 9 FOR LEGEND AND NOTE



LAHASKA CREEK
CROSS SECTION NO.25
MILE 1.90



WATSON CREEK
CROSS SECTION NO.21
MILE 1.81

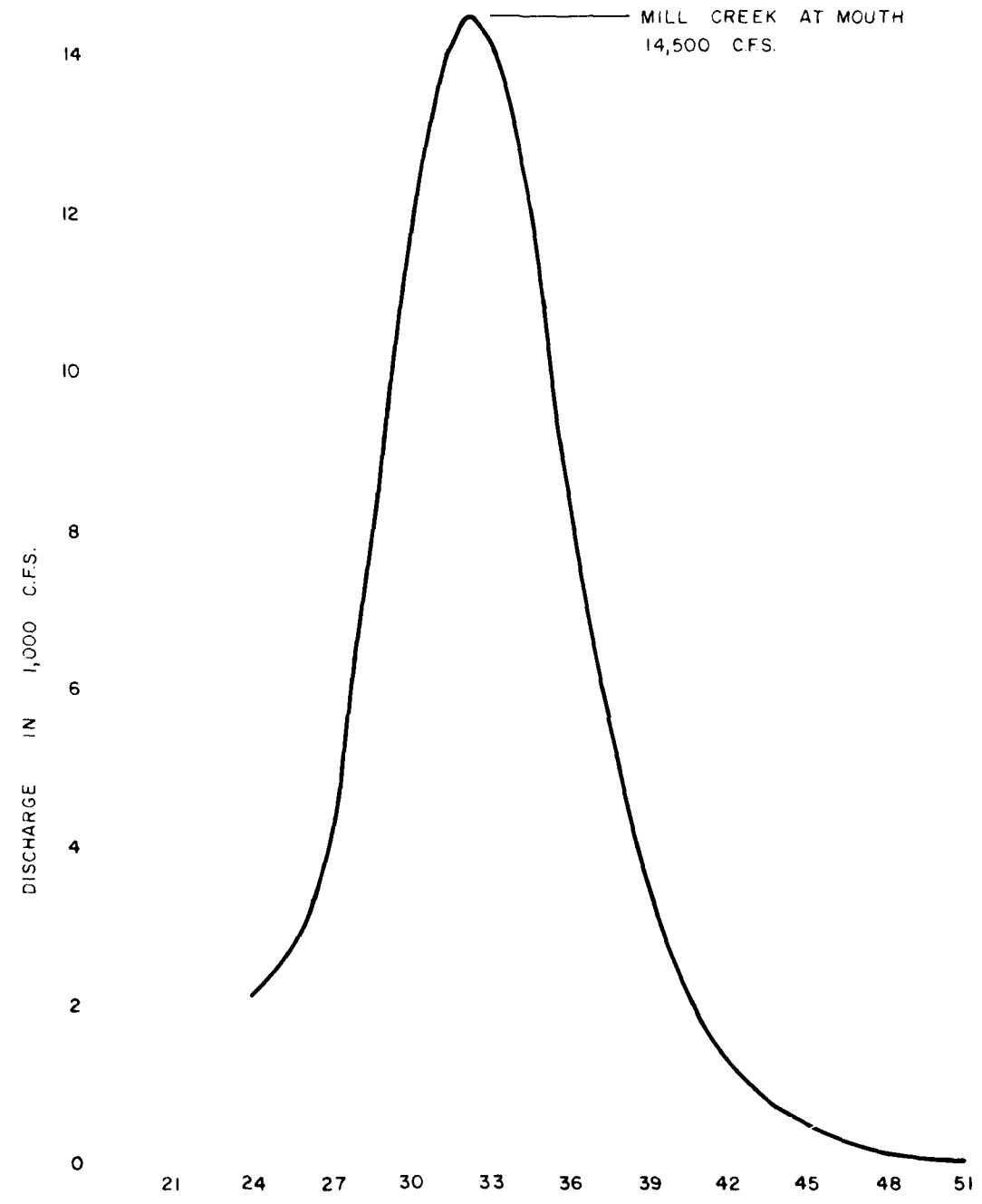
HUNDREDS OF FEET

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

FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY, PA.

SELECTED CROSS SECTIONS
WATSON & LAHASKA CREEKS

PLATE 10



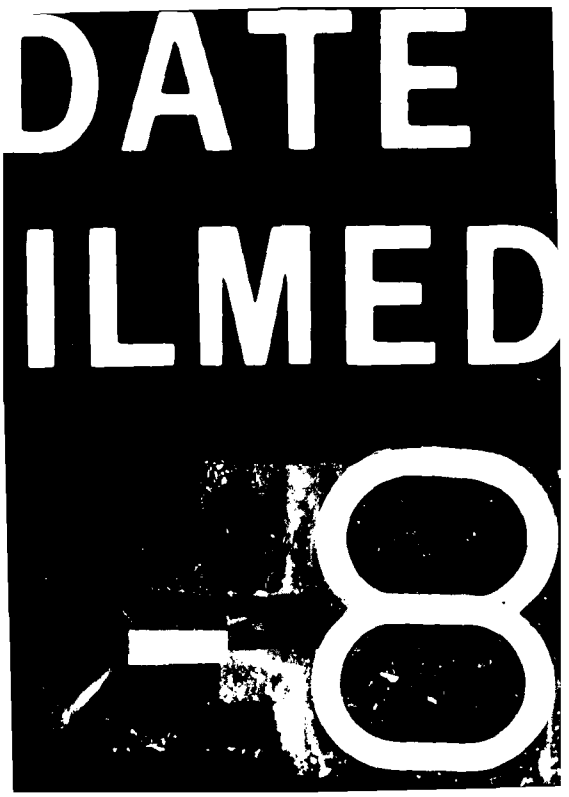
NOTES

DRAINAGE AREA	SQ. MI.
MILL CREEK AT MOUTH	21.90

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

FLOOD PLAIN INFORMATION
MILL, WATSON & LAHASKA CREEKS
BUCKS COUNTY PA.
STANDARD PROJECT FLOOD
HYDROGRAPH

PLATE II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ILMED
8