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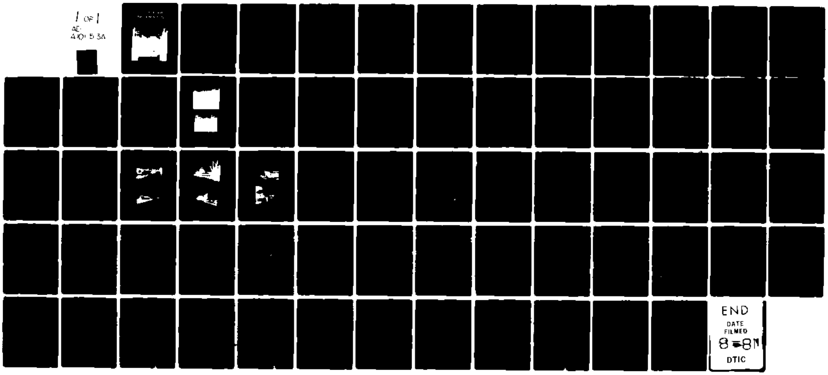
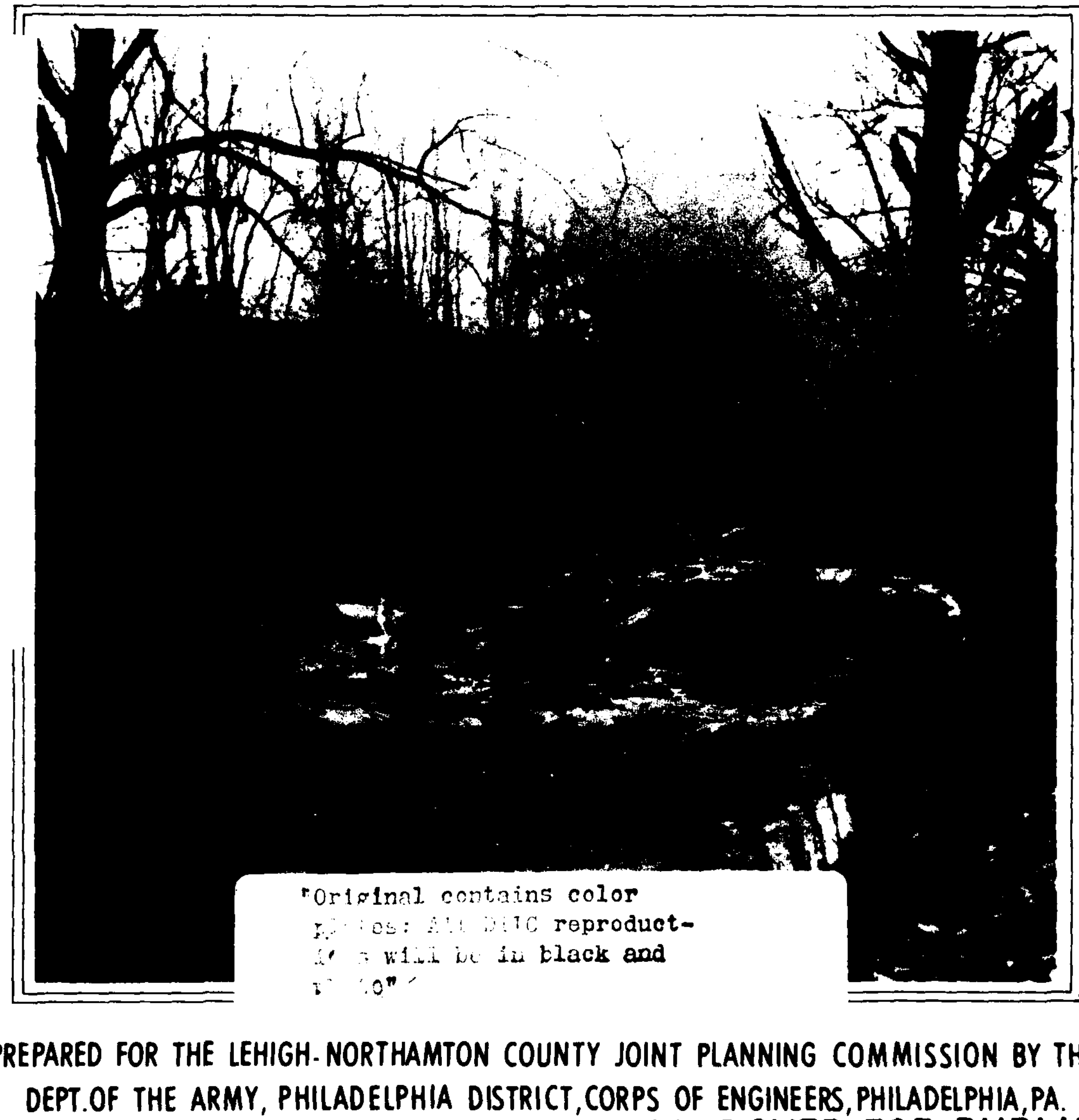


LEVEL II

FLOOD PLAIN INFORMATION

LITTLE BUSHKILL CREEK AND SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA



PREPARED FOR THE LEHIGH-NORTHAMTON COUNTY JOINT PLANNING COMMISSION BY THE DEPT. OF THE ARMY, PHILADELPHIA DISTRICT, CORPS OF ENGINEERS, PHILADELPHIA, PA.

APRIL 1973

REPT. NO: DAEN/NAP-82040/FPI20-73/04

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

This report studied the flooding conditions and areas in Northampton County (Pa.) around Plainfield and Palmer Townships and the Boroughs of Nazareth and Stockertown along the Little Bushkill and Shoeneck Creeks.

It included information about flood potential and flood hazards and identified those areas which may be subject to future floods. Special emphasis was given to technical data thru the use of 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 Lehigh-Northampton County Join 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.

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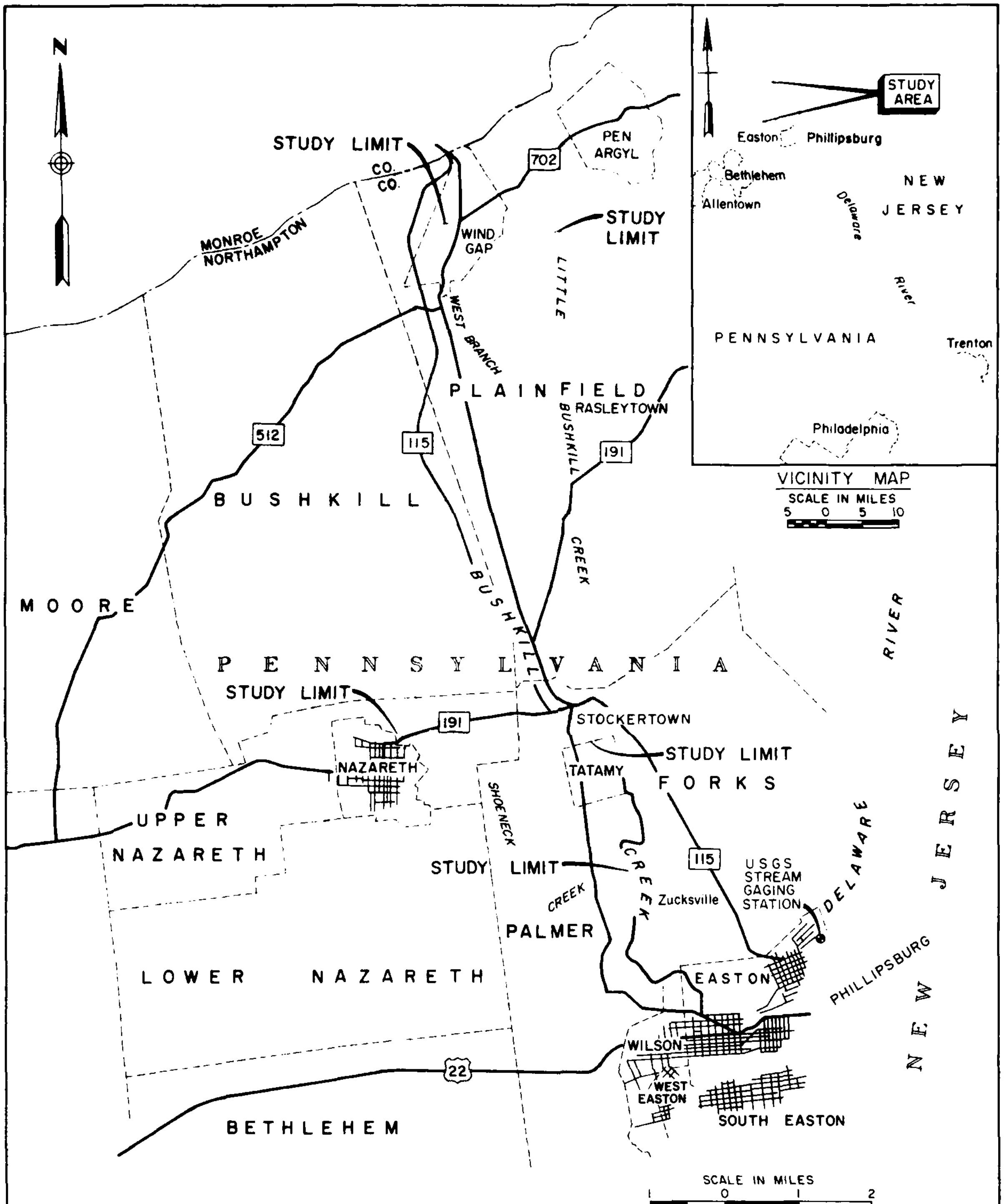


LEGEND

22	U S HIGHWAY
191	STATE HIGHWAY
	TOWNSHIP OR CITY LIMITS
	COUNTY LINE
	WATERSHED BOUNDARY
	STREAM

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

GENERAL MAP

APRIL 1973

PLATE 1

PREFACE

In Northampton County, portions of Plainfield and Palmer Townships and the Boroughs of Nazareth and Stockertown are subject to flooding from either the Little Bushkill or Shoeneck Creeks. These two tributaries of Bushkill Creek have contributed to floods along the Bushkill which have damaged commercial and residential properties in the past. There is much open flood plain area along the Little Bushkill and Shoeneck Creeks that may come under pressure for development. Although large floods have occurred in the past, studies indicate that even larger floods could occur in the future.

This report presents information about flood potential and flood hazards because this knowledge is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding along Little Bushkill and Shoeneck Creeks 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 those 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 Lehigh-Northampton Counties Joint Planning Commission and endorsement of the Pennsylvania Department of Environmental Resources, 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, Lehigh-Northampton Counties Joint Planning Commission 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 Lehigh-Northampton Counties Joint Planning Commission. The Philadelphia District Office, upon request, will provide technical assistance to planning agencies and interested individuals 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 area known today as Northampton County was first occupied by three different tribes of the Lenni-Lenape or Delaware Indians. The Indians established few permanent settlements in the area but did utilize the stream banks, particularly at the junction of streams, for their encampments. The first European settlers reportedly arrived in the area in the 1680's, and the entire area was opened up for settlement following the famous Walking Purchase of 1737, by which the whole of Northampton County and some additional territory was purchased from the Indians.

Small settlements appeared along the banks of the streams and rivers where water power and transportation were available. One such settlement built along the banks of the Little Bushkill Creek was Stockertown, named for Andrew Stocker who built a tavern there about 1790. An abundance of natural resources in the area such as iron ore, anthracite coal, limestone and zinc provided the economic thrust for development. The opening of the Delaware and Lehigh Canals in the 1820's provided a close commercial link between Northampton County and the large metropolitan area of Philadelphia. In the past, transportation facilities and proximity to large cities such as Philadelphia and New York gave the county a distinct industrial advantage. If past trends continue and the population of Northampton County continues to increase, suburban and rural areas, including sites along Little Bushkill and Shoeneck Creeks, will experience increased development. Table 1 shows the increase in population in Northampton County that has occurred since 1950.

TABLE 1

POPULATION OF NORTHAMPTON COUNTY, PENNSYLVANIA

Year	Population
1950	185,243
1960	201,412
1970	213,022

The Stream and Its Valley

The Little Bushkill Creek has its origin south of the town of Pen Argyl in Plainfield Township. It flows southerly 8.1 miles to its confluence with Bushkill Creek in the Borough of Stockertown. A major unnamed tributary to Little Bushkill Creek (called the West Branch in this study) originates in the Borough of Wind Gap and flows southeasterly 3.9 miles to its confluence with Little Bushkill Creek below the community of Rasleytown. The characteristics of the Little Bushkill Creek watershed vary within its 17.5 square mile area. The watershed includes portions of Blue Mountain near Wind Gap in addition to rolling hills and grassland, cultivated fields, and wooded lots. The stream slopes an average of 34 feet per mile and throughout its length the stream banks are overgrown with brush and trees. In fact, the name "Bushkill," which was bestowed on the creek by the early Dutch explorers, means "Bushy Stream."

Shoeneck Creek originates near the small Community of Schoeneck in Upper Nazareth Township, just north of Nazareth, Pennsylvania. The creek flows 6.4 miles in a southeasterly direction, first, through a suburban section of Nazareth and then through rolling hills and cultivated fields of Lower Nazareth and Palmer Townships. Shoeneck Creek converges with Bushkill Creek north of the small community of Zucksville. The Shoeneck Creek drains an area of 13.8 square miles and slopes an average of 30 feet per mile.

The climate is characterized by moderately warm summers, with temperatures occasionally rising above 85 degrees, and cool winters, with temperatures dropping below 20 degrees. The annual precipitation over the watershed averages 45 inches; seasonal snowfall is quite variable in the area, ranging from less than 10 to more than 60 inches.

Drainage areas for the watersheds of Little Bushkill, West Branch, and Shoeneck Creeks are shown in Table 2. Watershed boundaries for Little Bushkill and Shoeneck Creek can be found on the general map, Plate 1.

TABLE 2
DRAINAGE AREAS
Little Bushkill, West Branch Little Bushkill and Shoeneck Creeks

Location	Mileage Above Mouth	Drainage Area	
		Tributary sq. mi.	Total sq. mi.
Little Bushkill Creek			
At the mouth	0	–	17.5
Confluence with Unnamed Tributary	3.30	1.4	13.0
Confluence with West Branch	5.49	4.2	9.8
Confluence with Unnamed Tributary	5.94	1.7	5.5
West Branch Little Bushkill Creek			
At the Mouth	0	–	4.2
T-646 Bridge	1.50	–	3.4
Pa. Rt. 512 Bridge	2.77	–	2.2
Cross Section No. 23	3.83	–	1.0
Shoeneck Creek			
At the Mouth	0	–	13.8
Confluence with Unnamed Tributary	2.02	3.5	11.7
Confluence with Unnamed Tributary	3.43	2.7	6.3

Developments in the Flood Plain

Most of the flood plain of Little Bushkill Creek is rural and undeveloped. Many areas are utilized for agricultural purposes with other areas remaining as open fields and wooded lots. Several small communities, comprised of only a few residential or farm buildings, are located along the stream. Upstream of its confluence with Bushkill Creek, the Little Bushkill enters the Borough of Stockertown, where several residential buildings can be found on flood plain land. The West Branch Little Bushkill Creek begins in the Borough of Wind Gap, where residential development is also encroaching on the flood plain.

Like the Little Bushkill, most of the flood plain of Shoeneck Creek is rural and undeveloped. Its headwaters are located in a residential section of the Borough of Nazareth where numerous residential buildings can be found along the flood plain. Further downstream, the creek passes by a sewage treatment plant and then divides open fields and farm land before converging with Bushkill Creek above the small community of Zucksville.

In addition to the residential, agricultural, and limited commercial development in the flood plains of Shoeneck and Little Bushkill Creeks, associated streets, roads and utilities, including a sewage treatment plant, may be subject to flooding and subsequent damage. Further development of the flood plains can be expected to occur as suburban and rural areas of Northampton County come under increasing pressure for development.

FLOOD SITUATION

Sources of Data and Records

There are no stream gaging stations located on Little Bushkill, Shoeneck or Bushkill Creeks. Although the United States Geological Survey (U.S.G.S.) does maintain a stream gaging station on the Delaware River at Easton, the gage does not reflect flooding conditions on Bushkill, Little Bushkill or Shoeneck Creeks. Therefore, to compile information on past flood occurrences and stages in the study area, it was necessary to search historical documents, newspapers and flood records, and to interview local residents for their personal knowledge and experience of past floods.

Rainfall records for particular floods in this area are limited since the rainfall gaging stations were only recently established. The closest precipitation gage with a long period of record is at the National Weather Service Station located at Phillipsburg, New Jersey, across the Delaware River from Easton, Pennsylvania. Rainfall measurements associated with historical flood events obtained by this station are tabulated in Table 3.

TABLE 3
PRECIPITATION AT PHILLIPSBURG, NEW JERSEY

Occurrence	Amount of Precipitation Inches	Time Period
December 1901	7.22	1 Month
October 9-10, 1903	7.21	12 Hours
July 10, 1945	6.20	3 Hours
August 11 - 14, 1955	7.24	4 Days
August 18 - 19, 1955	6.01	2 Days

Maps prepared for this report were based on U.S. Geological Survey Quadrangle Sheets entitled "Easton, New Jersey-Pennsylvania, 1956"; "Nazareth, Pennsylvania, 1964"; and, "Wind Gap, Pennsylvania, 1960." Structural data on bridges and culverts were obtained by field surveys performed by Corps of Engineers, Philadelphia District, personnel. Bench mark leveling and cross section information was provided by an architect-engineering firm under contract to the Corps of Engineers.

Flood Season and Flood Characteristics

Floods have occurred in the study area of Little Bushkill and Shoeneck Creeks during all seasons of the year. Significant runoff from snowmelt and heavy rains cause the spring floods. The fall floods are usually caused by runoff from general rainfall over the drainage basin on ground that has been previously saturated.

Little Bushkill and Shoeneck Creeks are susceptible to floods from general rainfall over the drainage basin and from heavy rainfall associated with thunderstorm or hurricane activity. Flood events can vary from the moderate durations and volumes of runoff that might follow a series of general rainfalls to the more localized, short duration, "flash" floods generally associated with thunderstorms.

Factors Affecting Flooding and Its Impact

Obstructions to floodflows - Natural obstructions which could impede floodflows in floodway areas include trees, brush, and other vegetation growing along the stream banks. Man-made encroachments such as bridges, dams, and culverts can also restrict flows and create more extensive flooding than would otherwise occur. Photographs representative of natural obstructions to flood flows are shown in Figure 1 and 2.

During floods, trees and other debris may be carried downstream to collect on bridges and other obstructions to flow. The accumulation of debris greatly reduces the already limited capacity of obstructive bridges and culverts, resulting in increased flooding upstream. As floodflows increase, masses of debris may be dislodged to surge downstream until another obstruction is encountered. The accumulation of debris against a bridge may impose loads exceeding its structural capacity and cause it to fail. In addition, erosion of culvert entrances and bridge approach embankments can occur with possible damage to the overlying roadbed.

In general, obstructions intensify the flooding situation by causing overbank flows, with possible damage to or destruction of bridges and culverts, flooding in unpredictable areas, and increasing velocities of flow immediately downstream. Because the extent or location of the accumulation of debris is impossible to predict, it was necessary to assume, for the purposes of this report, that no debris would accumulate to clog any of the bridges or culvert openings.

Little Bushkill and Shoeneck Creeks are spanned by 39 bridges and pass through 10 culverts. Many of these structures are obstructive to floodflows. Pertinent information on all bridges and culverts can be found in Table 6. The 2 dams located on Little Bushkill and Shoeneck Creeks have no flood control capacities and they will not significantly alter the flow of floodwaters.

Flood damage reduction measures - There are no existing or authorized flood control projects on the Little Bushkill or Shoeneck Creeks. However, Plainfield Township

FIGURE 1 - Debris in Little Bushkill Creek upstream of County Bridge 219. During floods this debris may be carried downstream to block bridge and culvert openings.

FIGURE 2 - Debris in the channel of Little Bushkill Creek upstream of Township Road 633. Debris such as this reduces the capacity of the stream channel and results in higher flood flows.

has enacted flood plain zoning ordinances specifically for the reduction of flood damages, and Palmer Township is in the process of adopting updated zoning ordinances that will include provisions governing the use of flood plain land. Palmer Township has become eligible for flood insurance under the emergency program sponsored by the Federal Insurance Administration of the Department of Housing and Urban Development, and to continue eligibility the township is required to pass zoning ordinances and building codes which will affect all future construction in the flood plain. These regulations will help to limit the future damages caused by flooding.

Other factors and their impacts - Efficient flood warning and forecasting systems can give homeowners and businesses valuable time to remove damageable materials from low-lying areas. Damages to downstream areas can also be reduced if buoyant 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 reduce the incidence of personal injury and death.

Flood warning and forecasting - The National Weather Service Branch of the National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions at Easton, Pennsylvania. Emergency bulletins on anticipated severe weather conditions and possible flooding are issued at regular intervals by the National Weather Service to city officials, radio stations, television stations, and the local press media for further dissemination to residents of the area.

Flood fighting and emergency evacuation plans - Although there are no formal flood fighting or emergency evacuation plans for the Northampton County area, provisions for alerting area residents and coordinating operations of city and county public service agencies in time of emergency are accomplished through the Northampton County Civil Defense Office. This office maintains communication with State Civil Defense Headquarters and the National Weather Service at its control center. During earliest stages of a flood threat, they establish a flood watch along Bushkill Creek and its tributaries.

PAST FLOODS

Summary of Historical Floods

Because there are no stream gaging stations on either Little Bushkill or Shoeneck Creeks, little data or history of past floods is available. However, Bushkill Creek has a recorded flood history dating back to 1777. The most severe floods of record occurred on the following dates: January 8, 1841; June 5, 1862; October 3, 1869; March 2, 1902; October 10-11, 1903; July 9, 1945; and, August 19, 1955. The largest flood of record occurred on Bushkill Creek on July 9, 1945. The second largest flood of record, which affected the lower reach of the Bushkill, occurred on August 19, 1955. The third largest flood of record also occurred on the lower reach of Bushkill Creek on October 10-11, 1903, but the flood stage was five feet below that of the August 19, 1955, flood.

While this record of flooding on Bushkill Creek is not entirely representative of the flood history of Little Bushkill and Shoeneck Creeks, it does give an indication as to the historical frequency with which floods have occurred in the area.

Flood Records

As previously stated, there are no streamflow records for Little Bushkill or Shoeneck Creeks. However, information is available concerning flood discharges on nearby streams. Known flood discharges on streams in the vicinity of Little Bushkill and Shoeneck Creeks can be found in Table 4.

TABLE 4

KNOWN FLOOD DISCHARGES ON STREAMS IN THE VICINITY OF LITTLE BUSHKILL AND SHOENECK CREEKS

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge cfs
Jordan Creek	Allentown, Pa.	75.8	June 23, 1972	19,700[a]
			August 19, 1955	9,520
Little Lehigh Creek	Allentown, Pa.	80.8	June 22, 1972	17,500[a]
			July 28, 1969	3,020
McMichaels Creek	Stroudsburg, Pa.	65.3	August 18, 1955	5,740
Monocacy Creek	Bethlehem, Pa.	44.5	July 10, 1945	5,200

(a) Preliminary Estimate.

Flood Descriptions

Although no newspaper accounts of flooding on Little Bushkill Creek or Shoeneck Creeks should be located, the following excerpts from accounts of flooding on Bushkill Creek give an indication of the extent and severity of floods that occurred in the area.

Flood Descriptions

October 3, 1869 - Information based on newspaper accounts that are on file in the Easton Public Library indicate that a general rainfall over Bushkill Creek, Lehigh and Delaware River basins created flooding conditions throughout the general area.

EXCERPTS FROM THE EASTON SENTINEL, OCTOBER 7, 1869,[a]
RELATIVE TO THE FLOOD OF OCTOBER 3, 1869

A Heavy Rainstorm
Great Flood in All Our Rivers
Immense Destruction of Property
Railroads Damaged and Canals Washed Away

Rain commenced falling here about midnight Saturday night last, and continued, without intermission, until about seven o'clock on Monday morning. The *Delaware*, Lehigh, Bushkill and other smaller streams in this vicinity, commenced rising during Sunday night, and by noon on Monday they presented more the appearance of rushing, roaring, seething cataracts than quiet, modest rivers and rivulets.

The Bushkill was perfectly furious during Sunday night and Monday morning and made a clean sweep of everything along its banks, causing a greater destruction of property than it has done at any one time since what is remembered as the "hog freshet" which occurred more than thirty years ago, and was called the hog freshet from the vast number of hogs that were carried away from the numerous distilleries that then lined its banks.

EXCERPTS FROM THE EASTON WEEKLY ARGUS, OCTOBER 7, 1869[a]
RELATIVE TO THE FLOOD OF OCTOBER 3, 1869

Freshet in the Bushkill - This stream was never known to be so high even by the "Oldest Innabitant." The Cemetery bridge was swept away during the night and the arch bridge near Butz's Mills is choked up with lumber and driftwood and in great danger of being carried away. Mr. Uhler lost three valuable rafts washed out of the mouth of the stream into the Delaware. The lowlands along the stream are under water and the pumpkins are taking a trip by water in great profusion.

July 9, 1945 - The most severe flood in the history of Bushkill Creek occurred on July 9, 1945. Severe summer thunderstorms accompanied by torrential rainfall caused much property damage, loss of life, building destruction, and interruption of utility services. The magnitude of this flood was somewhere between the Intermediate Regional Flood and the Standard Project Flood. The following newspaper excerpts provide a graphic description of this flood:

(a) Simulated from newspaper clippings.

EXCERPTS FROM THE EASTON EXPRESS, JULY 10, 1945,[a] RELATIVE TO THE FLOOD OF JULY 9, 1945

The rainfall in the three hour deluge, which started heavily, about 8 p.m. totalled 6.2 inches, more than one-seventh of a year's average.

A number of campers and motorists in the section between Aluta and Belfast had close calls last night during the severe electrical storm as Bushkill Creek was turned into a raging torrent by the cloudburst, a number of bridges being swept away.

The heaviest damage on the Pennsylvania side of the river was caused to industries and homes along Bushkill Creek, which surged upward on what was believed the worst flash flood in that stream's history. At some points, the creek rose 10 feet in two hours.

The creek for miles was lined with jagged lumber testifying to the damage done to the houses and other structures above, dozens of which must have been washed away. Many cars were washed way, some of which were seen lying in or along the creek, or jammed against trees.

Bushkill Park, with water still flowing through it late this morning, appeared severely damaged. Cottages above the park, as well as those in the park, were washed away, or twisted wreckage. Park concessions and amusements all appeared wrecked.

A group of 25 Girl Scouts from Bethlehem and 10 adult attendants and advisors had narrow escapes from being swept into the angry waters of Bushkill Creek at the famous old camping grounds at Henry's Woods. For more than five hours the party was marooned there, the raging stream which grew rapidly from a meandering brook into a rampaging river making it impossible for men or boats to get at the group.

Considerable damage was done to bridges across the Bushkill, most of which are owned by Northampton County. Front Street bridge was broken in two, with the main pier apparently undermined.

Railroad traffic was delayed by washouts and damaged bridges. Many automobiles, caught in deep water, were washed for some distance.

Another sanitary sewer to suffer was the main trunk line from West Ward and Wilson Borough, which snapped off where it crosses Bushkill Creek on a bridge above the dam near Dietrich Road. The bridge was not washed away, but it appeared bent, and was jammed with wreckage.

At its height, the Bushkill flood reached the coping of the bridge west of 4th Street.

August 18 - 19, 1955 – Many damaging floods on the lower Bushkill were caused by a combination of rainfall on the Bushkill's watershed and a backwater condition from peak flood stages on the Delaware River. In August 1955, the second most severe flood of record was caused by this combination of conditions. Torrential rains of Hurricane Diane, preceded one week before by the heavy rainfall of Hurricane Connie, caused a flood disaster on the entire east coast of the United States. Severe flood damage and destruction occurred on the flood plain of Bushkill Creek in the City of Easton. The following special report and newspaper excerpts vividly describe this flood event:

EXCERPTS FROM THE EASTON EXPRESS, AUGUST 19, 1955[a]

Bushkill Creek, which had its own damaging flood, was being backed by Delaware into portions of downstream Easton by mid-day.

On Bushkill St. - Water had reached Second St. and covered the entrance to the Lehigh Valley Thruway.

Many bridges were knocked out along surging creeks, and several important river bridges were closed. Low level area highways were closed.

Boats manned by members of the chapter's (referring to Easton Chapter of Red Cross) disaster committee spent the entire day evacuating families. The homeless were for the most part residents of South Third St. vicinity, Bushkill Drive and North Delaware Avenue.

Bushkill Creek receded rapidly yesterday after ripping its valley savagely Thursday night with a flood approaching its 1945 level.

(a) Simulated from newspaper clippings

Last night, the creek from the section below Dietrich Road was backed up to an unprecedented level by the booming Delaware Flood. Bushkill Drive was under water most of the way from cemetery bridge. The water completely covered the dam near Dietrich Rd. All houses and industries near the creek below Lehigh Valley Thruway crossing were entered.

EXCERPTS FROM A SPECIAL REPORT ENTITLED "DIANE DROWNS DELAWARE VALLEY" AUGUST 18 - 19, 1955 PUBLISHED BY THE EASTON EXPRESS, EASTON, PA.

The week preceding the disastrous days of August 18 and 19, 1955, were filled with fog, drizzle, and drenching rain. The swollen rivers and streams received on August 18 varied additional rainfall of 12 to 19 inches from Hurricane Diane's outer fringe. The saturated soil could absorb no more of the downpour.

Gentle rivers and streams became surging monsters that devoured all in their path. Bridges, roads, railroads, and buildings were swept away. Hurricane Diane delivered the Delaware Valley one of its worst disasters. More than 100 lives were lost and damages past the 100 million dollar mark. The devastation was so great that the President declared the afflicted region a "major disaster area."

President Eisenhower flew over the stricken area and directed the Federal Civil Defense Administration to initiate emergency flood relief measures.

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occured 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 Little Bushkill Creek and Shoeneck Creek 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 records, precipitation records, and runoff characteristics of a watershed with similar physiographical features. In determining the Intermediate Regional Flood for Little Bushkill and Shoeneck Creeks, statistical studies were made using data from U.S.G.S. gaging stations on other streams throughout the Easton-Allentown, Pennsylvania, area. Peak flows from the Intermediate Regional and Standard Project Floods at selected locations on Little Bushkill and Shoeneck Creeks are shown in Table 5.

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 Intermediate Regional and the Standard Project Floods at selected locations on Little Bushkill and Shoeneck Creeks are shown in Table 5. Discharge hydrographs for the Standard Project Flood at the mouths of Little Bushkill, West Branch, and Shoeneck Creeks are shown on Plate 15. The water surface profiles for the Intermediate Regional Flood and the Standard Project Flood are shown on Plates 9 through 12.

TABLE 5
PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS

Location	Mileage Above Mouth	Intermediate Regional Flood Discharge cfs	Standard Project Flood Discharge cfs
Little Bushkill Creek			
At the Mouth	0	3,130	7,700
Downstream of Confluence with Unnamed Tributary	3.30	2,680	7,290
Upstream of Confluence with Unnamed Tributary	3.30	2,500	6,650
Downstream of Confluence with West Branch Little Bushkill	5.49	1,980	5,400
Upstream of Confluence with West Branch Little Bushkill	5.49	1,300	3,500
Downstream of Unnamed Tributary	5.94	1,250	3,380
Upstream of Unnamed Tributary	5.94	940	2,380
West Branch Little Bushkill Creek			
At the Mouth	0	1,050	2,150
At T-646 Bridge	1.50	870	1,570
At Pa. Rt. 512 Bridge	2.77	630	1,120
Shoeneck Creek			
At the Mouth	0	2,555	7,000
Downstream of Confluence with Unnamed Tributary	3.43	1,410	3,860
Upstream of Confluence with Unnamed Tributary	3.43	920	2,200

Frequency

A frequency curve of flow versus recurrence interval was constructed on the basis of computed flows up to and including the 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 frequency curve thus derived, which is available on 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, developments in the flood plain, depth and duration of flooding, velocity of flow, and rate of rise. An Intermediate Regional Flood or Standard Project Flood on Little Bushkill Creek or Shoeneck Creek would result in inundation of residential, commercial, and agricultural areas. Floodwater, flowing at high velocity and carrying floating debris, could create hazardous conditions for persons or vehicles attempting to cross flooded areas. In general, floodwater that is three or more feet deep and flows at a velocity of three or more feet per second could easily sweep an adult person off his feet; this creates a definite danger of injury or drowning. Rapidly rising and swiftly flowing water may trap persons in homes that are ultimately destroyed or in vehicles that are ultimately submerged or floated. Water lines can be ruptured by deposits of debris or the force of floodwaters, thus creating the possibility of loss or contamination of domestic water supplies. Health hazards could be caused by pollution from damaged sanitary sewer lines and sewage treatment plants. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded areas and flood damages - The Little Bushkill Creek and Shoeneck Creek study areas are shown on Plate 2 which is also an index map in Plates 3 through 8. Areas that would be flooded by the Intermediate Regional and Standard Project Floods are shown in detail on Plates 3 through 8. 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, areas that would be flooded by the Intermediate Regional and Standard Project Floods include agricultural and residential properties and associated streets, roads, public and private utilities. Considerable damage to these facilities could 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 9 through 12 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 together with the water surface elevation and lateral extent of the Intermediate Regional and Standard Project Floods are shown on Plates 13 and 14.

Obstructions - During floods, debris collection at bridges or culverts could restrict floodflow and cause greater water depths (backwater effect) upstream of 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, maps of the 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. As previously indicated, the 2 low dams within the study area have no flood control capacities nor will they seriously alter flow characteristics of floodwaters. Many of the bridges and culverts are obstructive to the Intermediate Regional Flood. A greater number are obstructive to the Standard Project Flood. In some cases, bridges may be high enough so as not to be directly inundated by floodflows; but the bridge approaches at lower elevations may be flooded and render the bridge impassable. Table 6 lists underclearance and water surface elevations for all bridges and culverts crossing Little Bushkill, West Branch Little Bushkill, and Shoeneck Creeks.

TABLE 6
ELEVATION DATA
Bridges Across Little Bushkill, West Branch Little Bushkill and Shoeneck Creeks

Location	Mileage Above Mouth	Underclearance Elevation	Water Surface Elevation[a] Intermediate Regional Flood	Water Surface Elevation[a] Standard Project Flood
		feet-msld	feet-msld	
Little Bushkill Creek				
Lehigh and New England R.R.	0.06	340.4	339.4	343.8
Center St. (Pa. Rt. 115)	0.50	354.5	355.0	360.3
Lefevre St.	0.70	363.2	361.7	365.2
Private Rd.	1.45	386.2	386.6	389.7
Private Rd.	1.76	393.5	391.9	394.2
Township Rd. No. 619	2.55	408.6	406.4	413.5
Township Rd. No. 623	3.30	432.1	431.4	436.8
Erie-Lackawanna R.R.	3.96	447.2	449.1	453.2
Pa. Rt. 191	3.98	449.6	450.6	456.1
Township Rd. No. 609	4.54	461.6	463.5	464.2
Erie-Lackawanna R.R.	4.55	460.4	464.2	464.7
Township Rd. No. 629	5.75	494.4	497.3	499.8
Erie-Lackawanna R.R.	6.30	514.0	517.4	518.1
Township Rd. No. 633	6.61	536.0	529.2	532.9
Township Rd. No. 635	7.17	549.8	551.6	552.8
Pa. Legislative Rt. 48036	7.22	566.2	566.4	569.5
Erie-Lackawanna R.R.	7.61	586.1	584.9	590.5

TABLE 6 (Continued)
ELEVATION DATA
Bridges Across Little Bushkill, West Branch Little Bushkill and Shoeneck Creeks

Location	Mileage Above Mouth	Underclearance Elevation	Water Surface Elevation[a] Intermediate Regional Flood	Standard Project Flood
		feet-msld	feet-msld	
Little Bushkill Creek (continued)				
Township Rd. No. 641-Study Limit	8.10	609.7	612.5	614.1
West Branch Little Bushkill Creek				
Erie-Lackawanna R.R.	0.12	491.6	491.2	495.7
Township Rd. No. 629	0.47	514.2	515.1	516.9
Pa. Legislative Rt. 48036	1.02	554.6	553.9	556.1
Township Rd. No. 646	1.50	597.1	594.6	596.3
Township Rd. No. 636	2.51	674.6	672.8	674.7
South Broadway-Pa. Rt. 512	2.77	685.1	686.8	687.6
Male St.	2.97	695.1	691.9	693.6
Second St.[b]	3.21	693.3	696.6	697.0
West St.[b]	3.66	710.6	712.6	712.9
Mechanic St.[b]	3.70	719.9	722.2	722.4
Center St.[b]	3.78	730.0	732.1	732.4
Shoeneck Creek				
Private Rd.	0.01	276.0	278.6	281.4
Lehigh Valley R.R.	0.04	279.0	282.9	284.8
Private Rd.	0.63	299.2	301.1	303.0
Tatamy Rd.	0.65	303.4	305.9	308.8
Private Rd.[b]	0.83	304.0	308.2	310.1
Private Rd.	1.62	315.6	320.3	322.6
Van Buren Rd.[b]	1.92	321.9	324.6	326.2
Private Rd.	2.37	327.8	330.3	331.3
Pa. Rt. 33	2.93	351.7	333.4	336.4
Hollo Rd.	3.01	338.0	339.2	340.7
Access Rd. to Nazareth Township Sewage Treatment Plant	3.48	346.4	346.7	347.4
Nazareth Rd.[b]	3.84	354.9	359.8	360.4
Lehigh and New England R.R.	3.91	358.7	361.4	364.7
Private Rd.[b]	4.33	366.7	369.4	370.2
Friendensthal Ave.	5.30	400.6	402.2	402.9
Erie-Lackawanna R.R.	5.37	406.2	406.8	407.2
Liberty St.[b]	5.75	413.8	416.7	418.0
Chestnut St.[b]	5.77	419.4	421.1	422.1
E. Lawn Rd.	6.07	445.7	446.4	448.6
W. Saint Elmo St.	6.30	460.2	463.5	464.2

(a) Elevations are given for the upstream side of the bridge.
(b) Culvert.

Velocities of flow - Water velocities during floods depend largely on the size and shape of stream cross sections, conditions of the stream channel, and the bed slope, all of which vary on different streams and at different locations on the same stream. During an Intermediate Regional Flood, typical velocities of main channel flow on Little Bushkill Creek would vary from 7 to 12 feet per second. On Shoeneck Creek, typical velocities for main channel flow during an Intermediate Regional Flood would vary from 5 to 10 feet per second.

Reaches of streams affected by backwater conditions would exhibit slower velocities, while those areas where floodflows are constricted would exhibit higher velocities. It is also expected that velocities of flow during a Standard Project Flood would be somewhat higher than during an Intermediate Regional Flood. Table 7 lists the maximum velocities that would occur on Little Bushkill, West Branch, and Shoeneck Creeks during the Intermediate Regional and Standard Project Floods at selected cross section locations.

TABLE 7
MAXIMUM VELOCITIES
Little Bushkill, West Branch Little Bushkill and Shoeneck Creeks

Location	Mileage Above Mouth	Intermediate Regional Flood		Standard Project Flood	
		Channel	Overbank	Channel	Overbank
		feet per second		feet per second	
Little Bushkill Creek					
Cross Section 2	0.42	11.3	6.4	14.0	8.4
Cross Section 6	2.03	10.7	5.1	13.0	6.9
Cross Section 10	4.86	9.2	4.3	11.7	6.3
Cross Section 13	6.19	7.9	3.1	9.7	4.4
West Branch Little Bushkill Creek					
Cross Section 18	1.08	6.6	2.7	7.7	3.9
Cross Section 20	2.88	6.2	1.8	7.5	2.8
Cross Section 23	3.83	4.2	0.6	6.0	1.0
Shoeneck Creek					
Cross Section 2	0.62	7.7	3.2	9.6	5.1
Cross Section 3	1.02	5.2	3.5	7.5	5.1
Cross Section 4	1.55	9.2	5.1	10.9	6.7
Cross Section 12	4.66	5.1	2.5	6.3	3.5

Rates of rise and duration of flooding - Little Bushkill and Shoeneck 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 8 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 Little Bushkill, West Branch, and Shoeneck Creeks. Standard Project flood hydrographs for Little Bushkill, West Branch and Shoeneck Creeks may be found on Plate 15.

TABLE 8
RATES OF RISE AND DURATION
Standard Project Flood

Location	Maximum Rate of Rise (ft/hr)	Height of Rise (ft)	Time of Rise (hrs)	Duration of Flooding (hrs)
Little Bushkill Creek				
Cross Section 2	0.7	5.5	10.0	43.0
Cross Section 6	1.5	6.5	8.0	34.0
Cross Section 13	0.6	4.4	7.5	28.0
Shoeneck Creek				
Cross Section 5	0.9	5.9	8.5	34.0
West Branch Little Bushkill Creek				
Cross Section 18	0.5	2.1	8.0	35.5
Cross Section 20	0.8	3.5	7.5	35.5
Cross Section 23	1.2	2.4	7.0	30.0

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

FUTURE 3 - Future flood heights of Little Bushkill Creek at Lefevre Street, Stockertown, Pa.

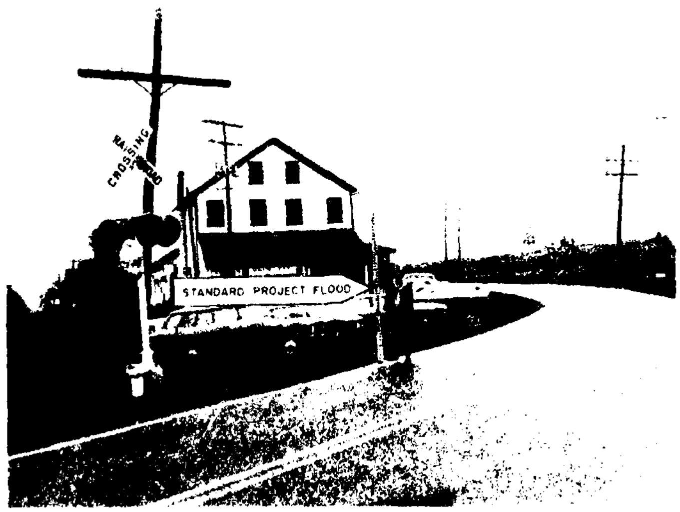


FIGURE 4 - Future flood height of Little Bushkill Creek on Pa. Rt. 191, Edleman, Pa.

FIGURE 5 - Future flood heights of Little Bushkill Creek at the Plainfield Township Road 629 bridge.

FIGURE 6 - Future flood heights at the Tatamy Road bridge on Shoeneck Creek.

FIGURE 7 - Future flood heights at the Van Buren Road bridge on Shoeneck Creek.

FIGURE 8 - Future flood heights at the North Liberty Street bridge on Shoeneck Creek.

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 speific 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.

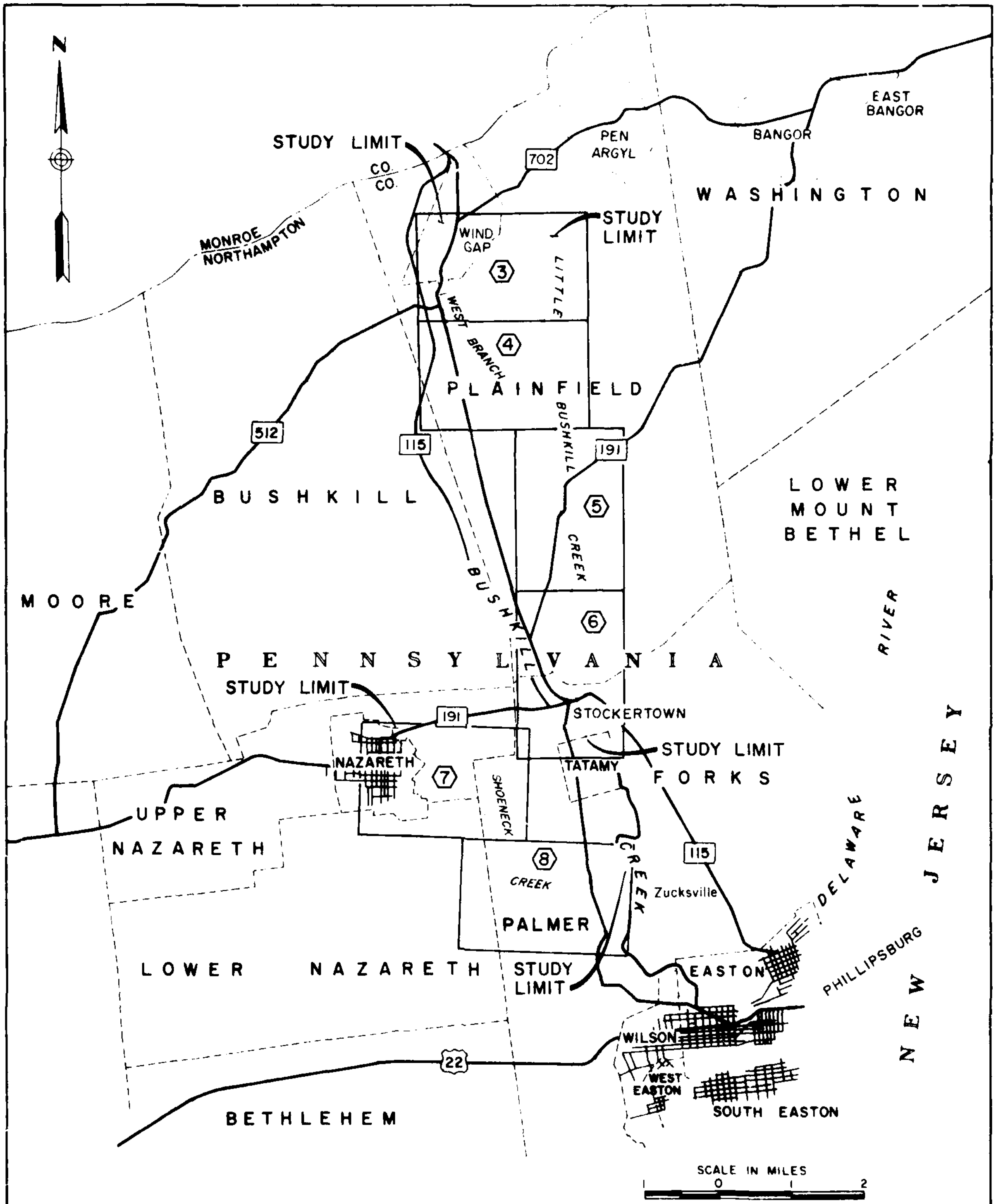
Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general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



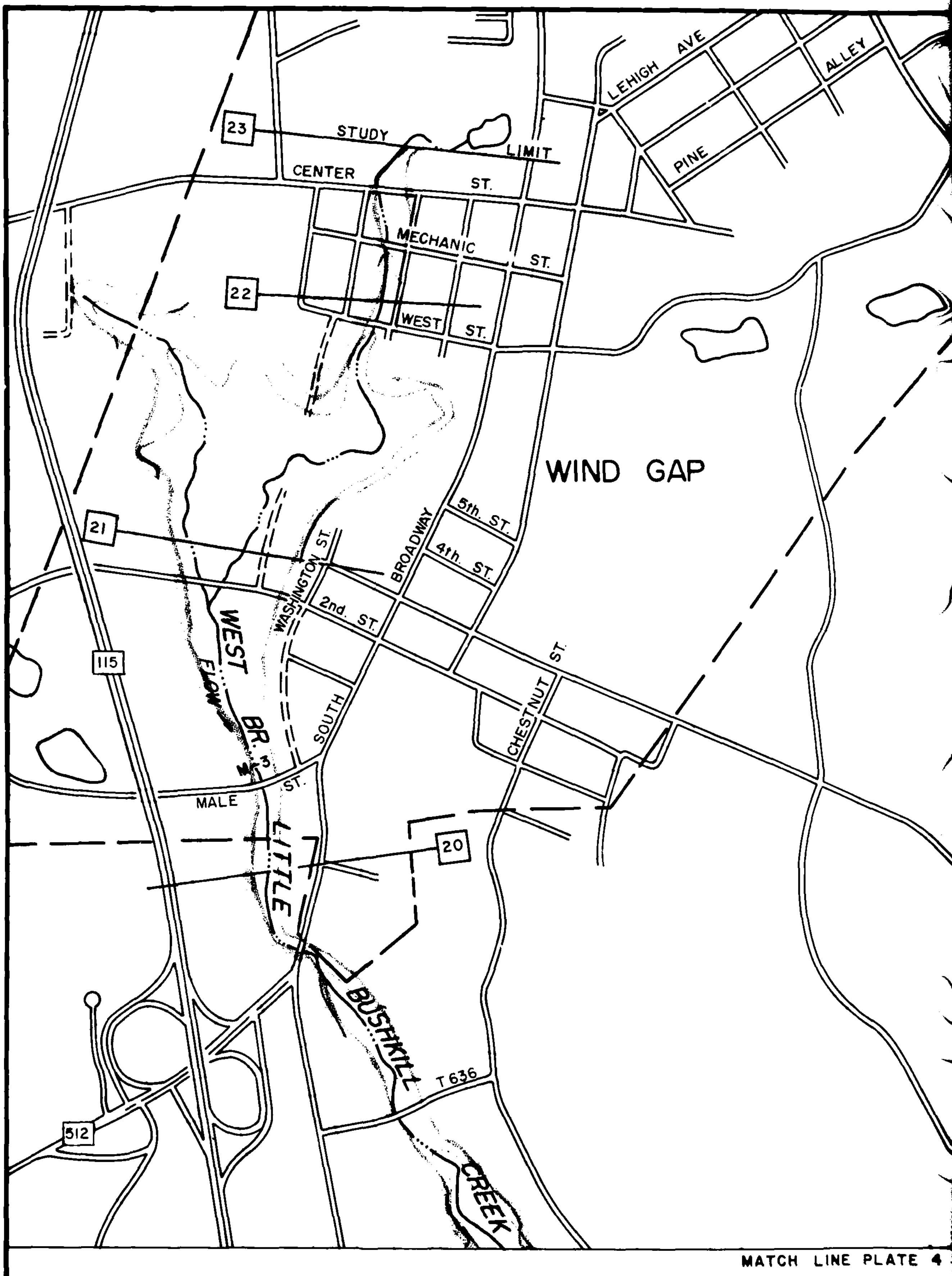
LEGEND

(3) PLATE NUMBER

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

INDEX MAP - FLOODED AREAS

APRIL 1973



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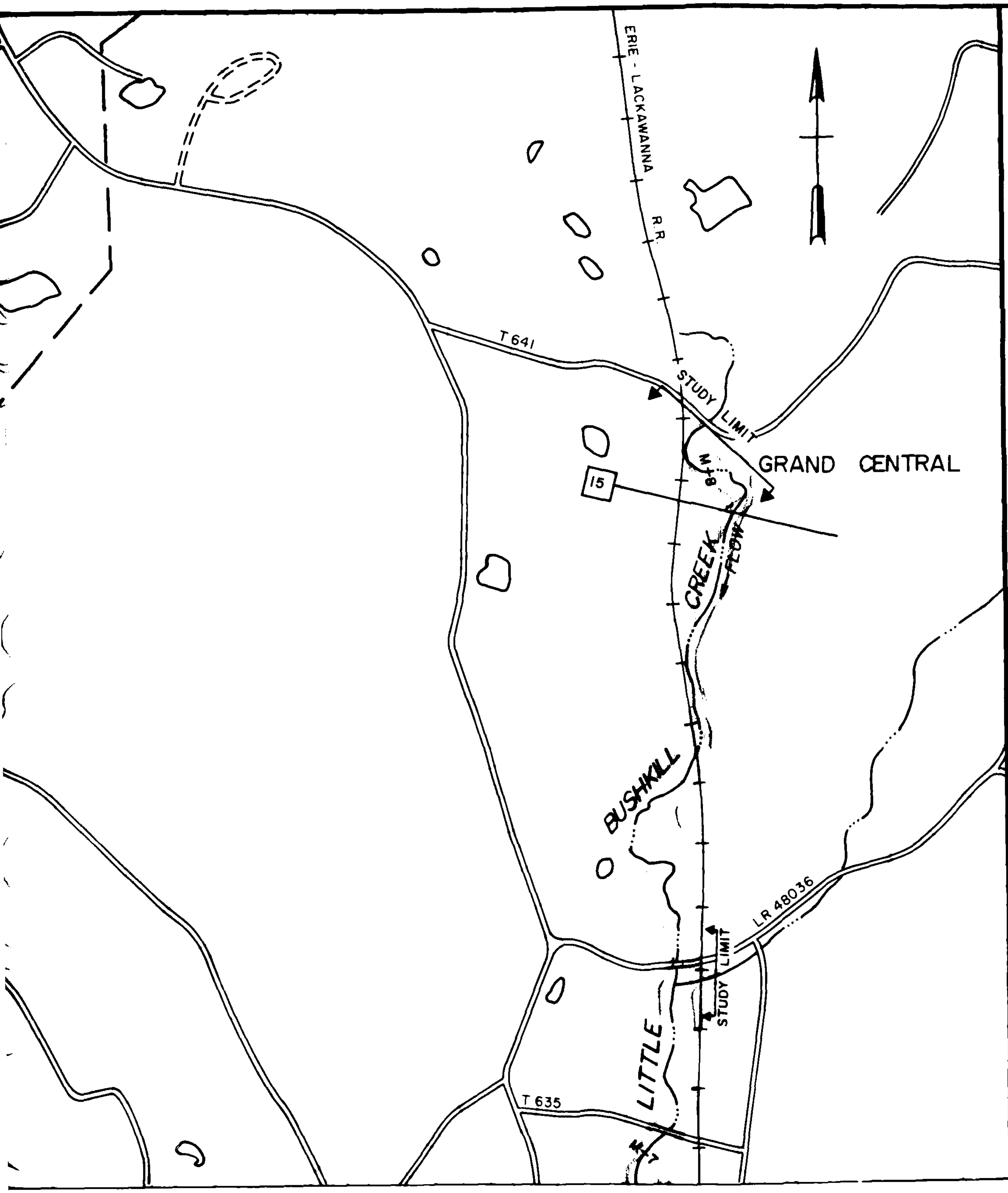

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— — —	TOWNSHIP OR BORO LIMITS	

NOTES

1. MAP BASED ON U S G S 7.5 MIN QUADRANGLES EASTON PA N J 1955, NAZARETH, PA 1964 WIND GAP, PA 1955 MINOR ADDITIONS AND MODIFICATIONS MADE BY CORPS OF ENGINEERS

2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT

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PLATE 5


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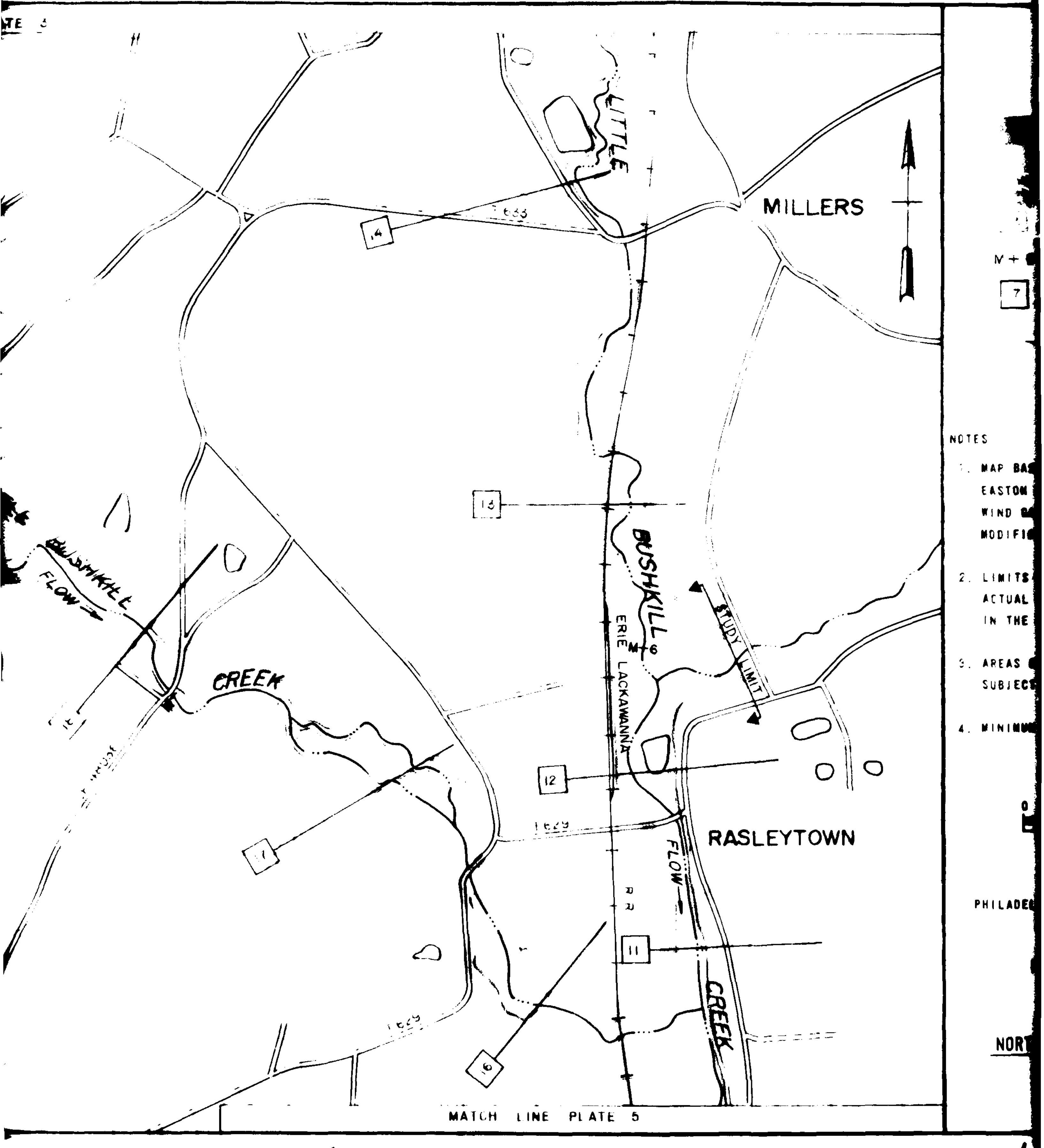

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17 CROSS SECTION

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

NOTES

1. MAP BASED ON U.S G.S 7.5 MIN. QUADRANGLES. EASTON PA N.J 1956, NAZARETH, PA 1964, WIND GAP, PA 1960. MINOR ADDITIONS AND MODIFICATIONS MADE BY CORPS OF ENGINEERS

2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT

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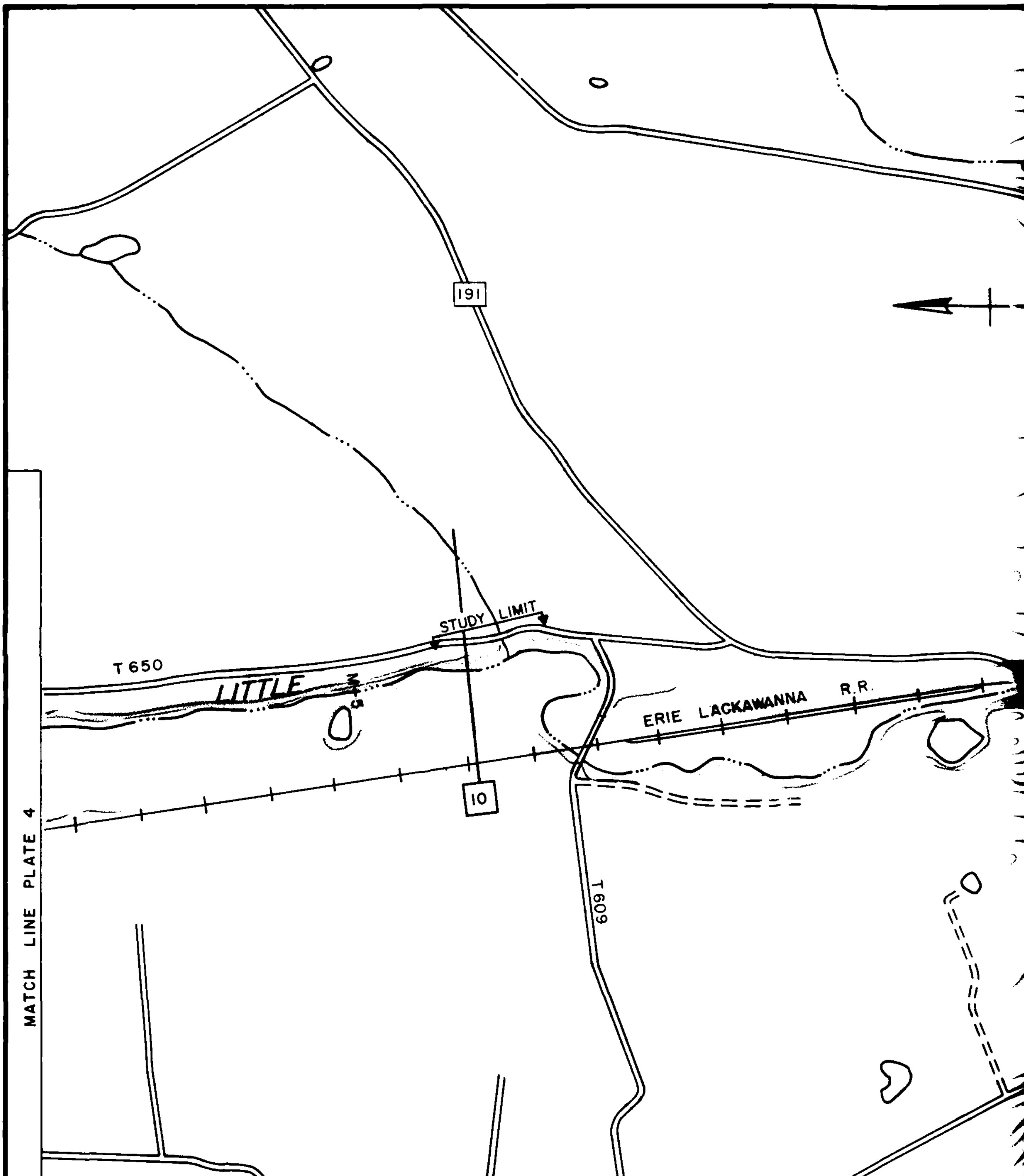
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

FLOODED AREAS
APRIL 1973

PLATE 4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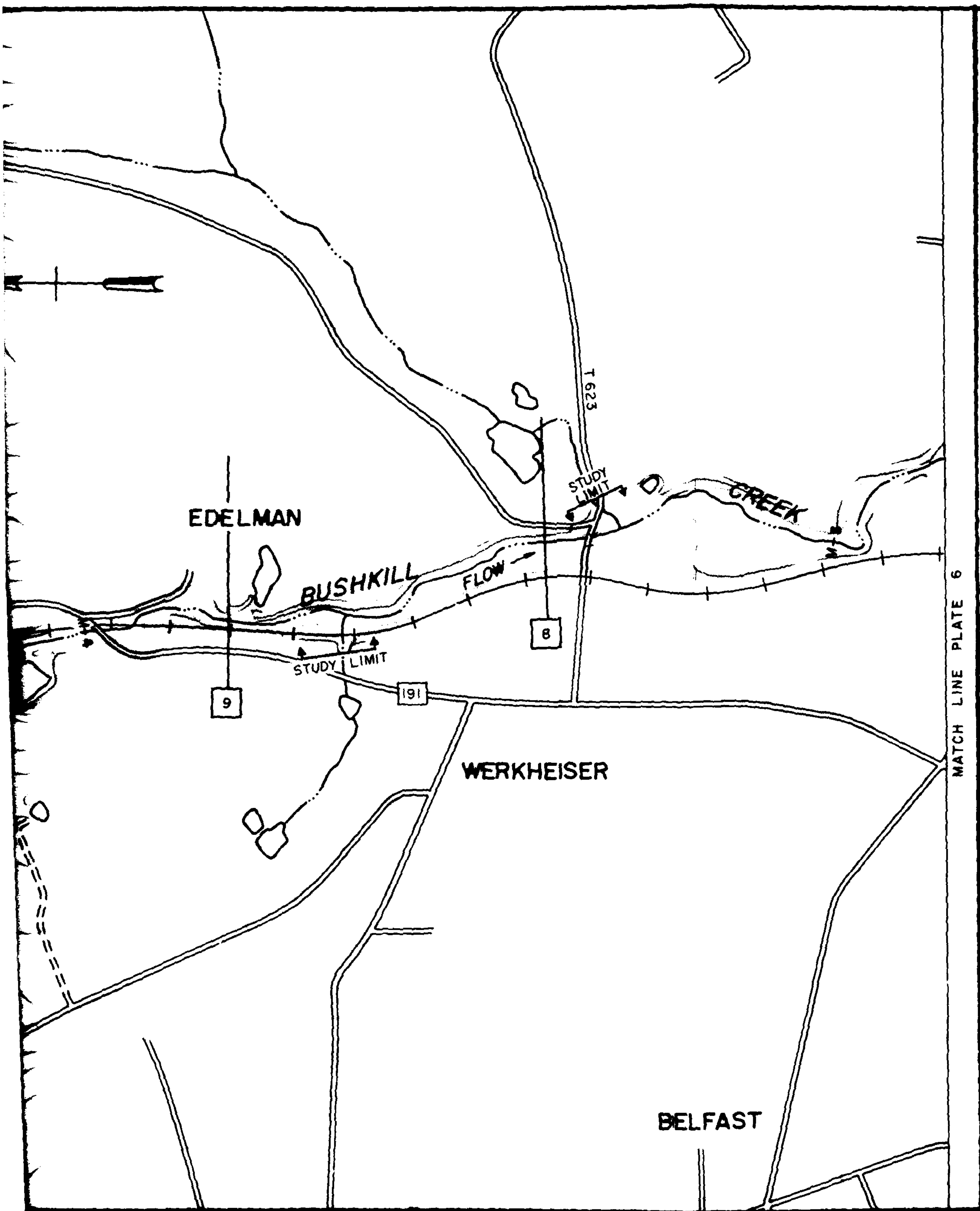

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GROUND ELEVATION IN FEET (U.S.C. G.S. 1929 ADJ.) SEA LEVEL DATUM

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ND GAP, PA. 1960. MINOR ADDITIONS AND
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SCALE IN FEET

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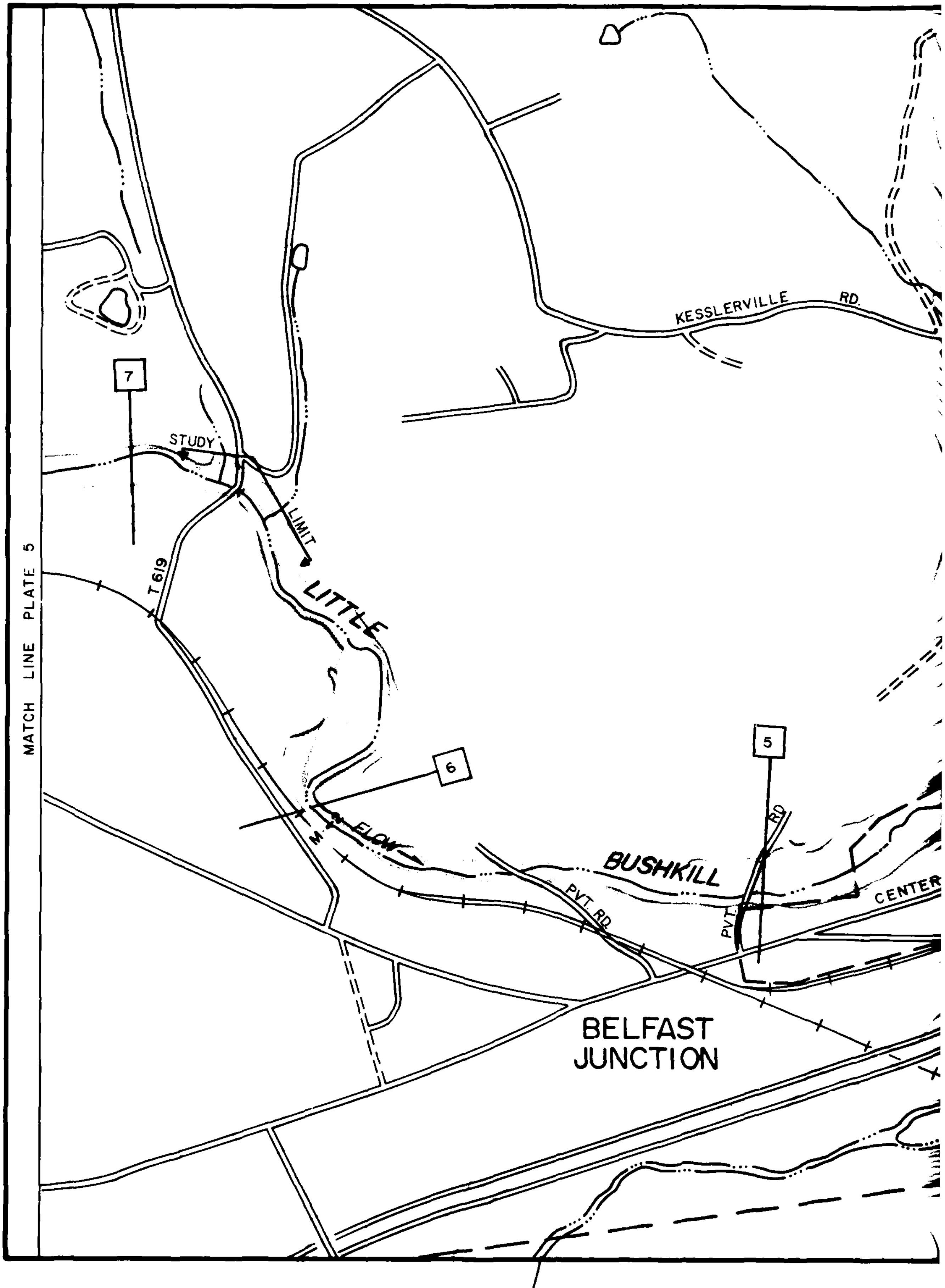
DEPARTMENT OF THE ARMY
LADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
ORTHAMPTON COUNTY, PENNSYLVANIA

FLOODED AREAS

APRIL 1973

PLATE 5



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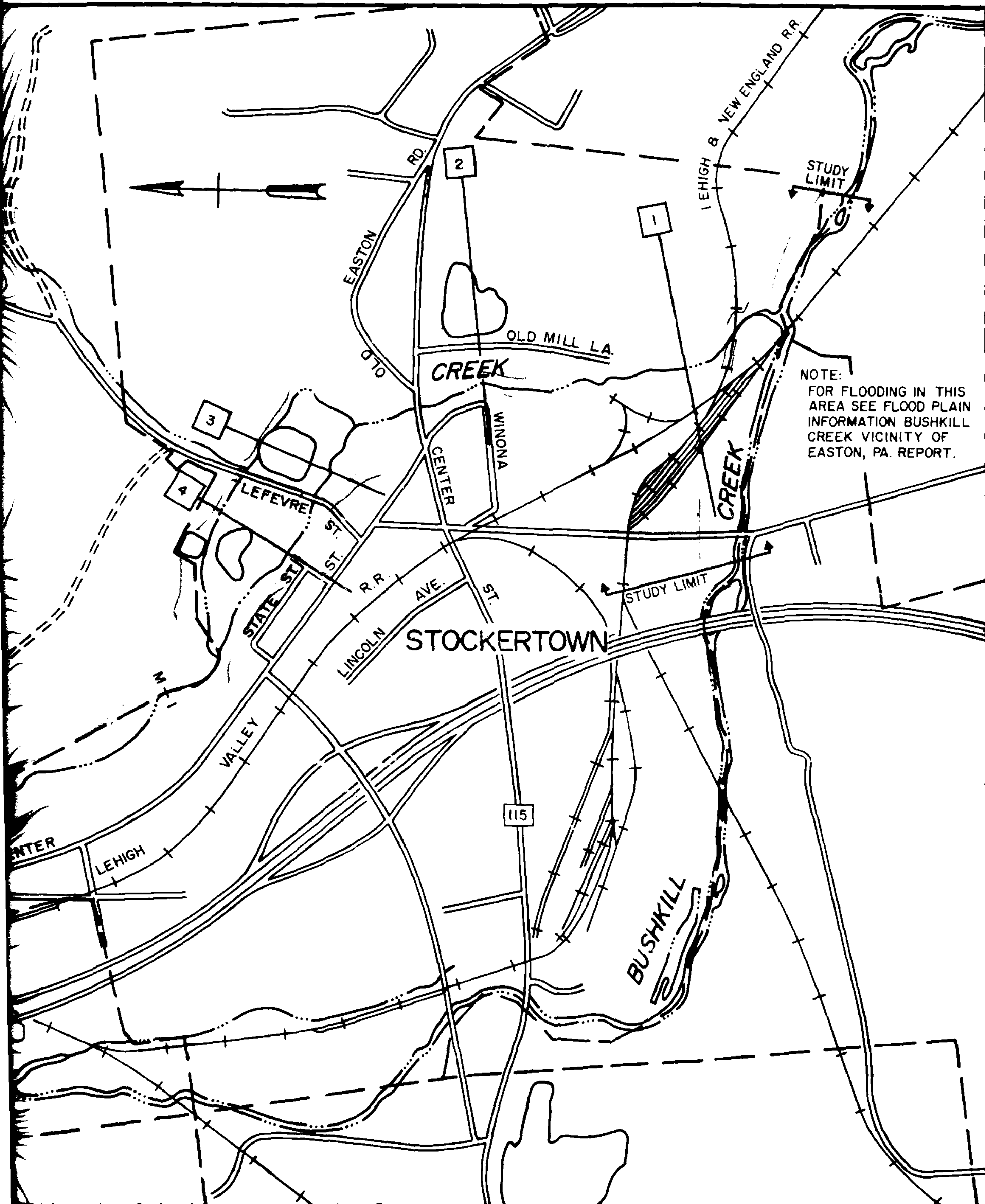

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GROUND ELEVATION IN FEET (U.S.C. G.S. 1929 ADJ.) SEA LEVEL DATUM

TOWNSHIP OR BORO LIMITS

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MITS OF OVERFLOW SHOWN MAY VARY FROM TUAL LOCATION ON GROUND AS EXPLAINED THE REPORT.

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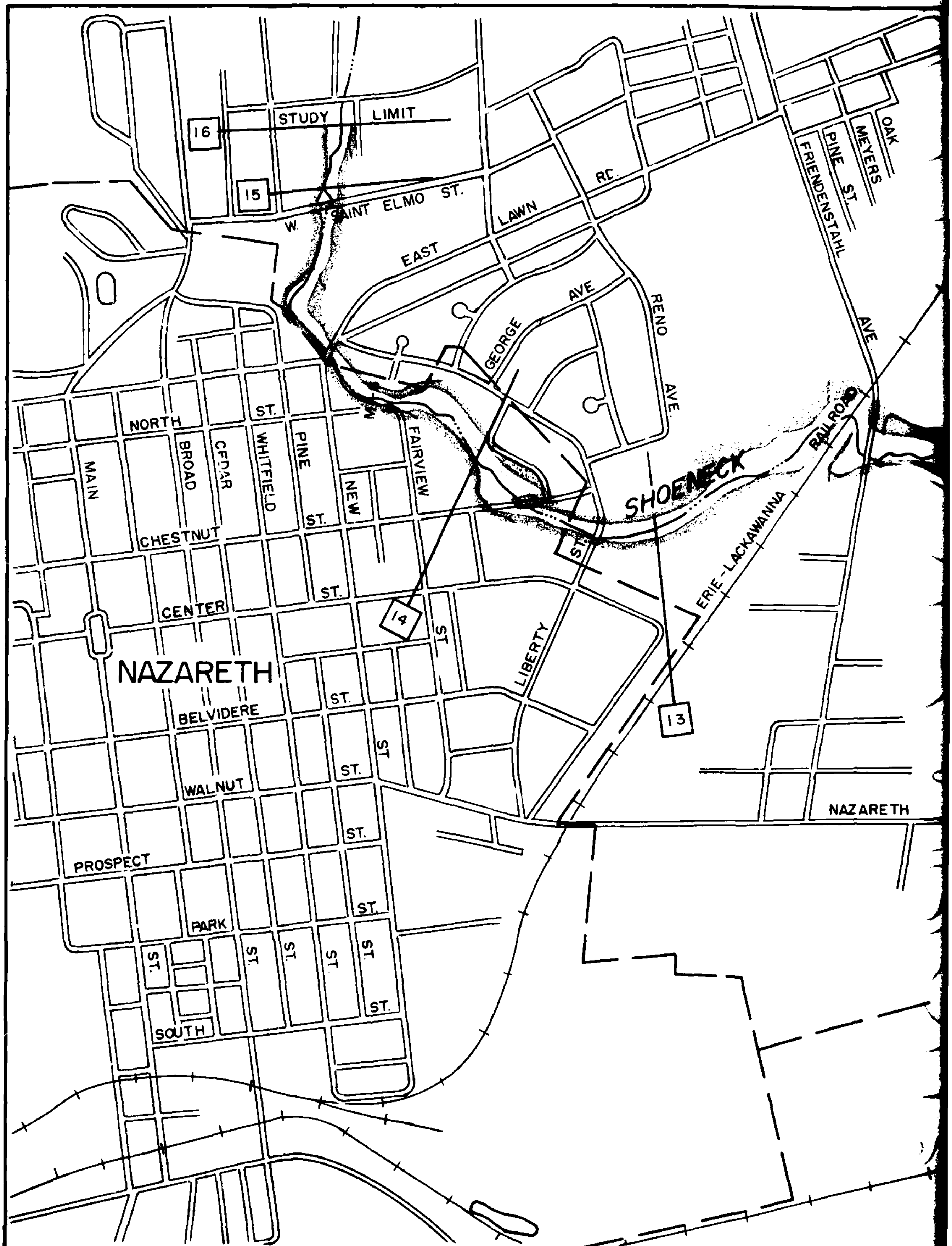
DEPARTMENT OF THE ARMY
LADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

FLOODED AREAS

APRIL 1973

1 3 PLATE 6



STUDY LIMIT
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W. SAINT ELMO ST.
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RENO AVE
FRIENDENSTAHL AVE
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OAK
NORTH ST.
MAIN
BROAD
CEDAR
WHITFIELD
PINE
NEW
FAIRVIEW
CHESTNUT ST.
CENTER ST.
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ST.
NAZARETH
BELVIDERE ST.
LIBERTY
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WALNUT ST.
PROSPECT ST.
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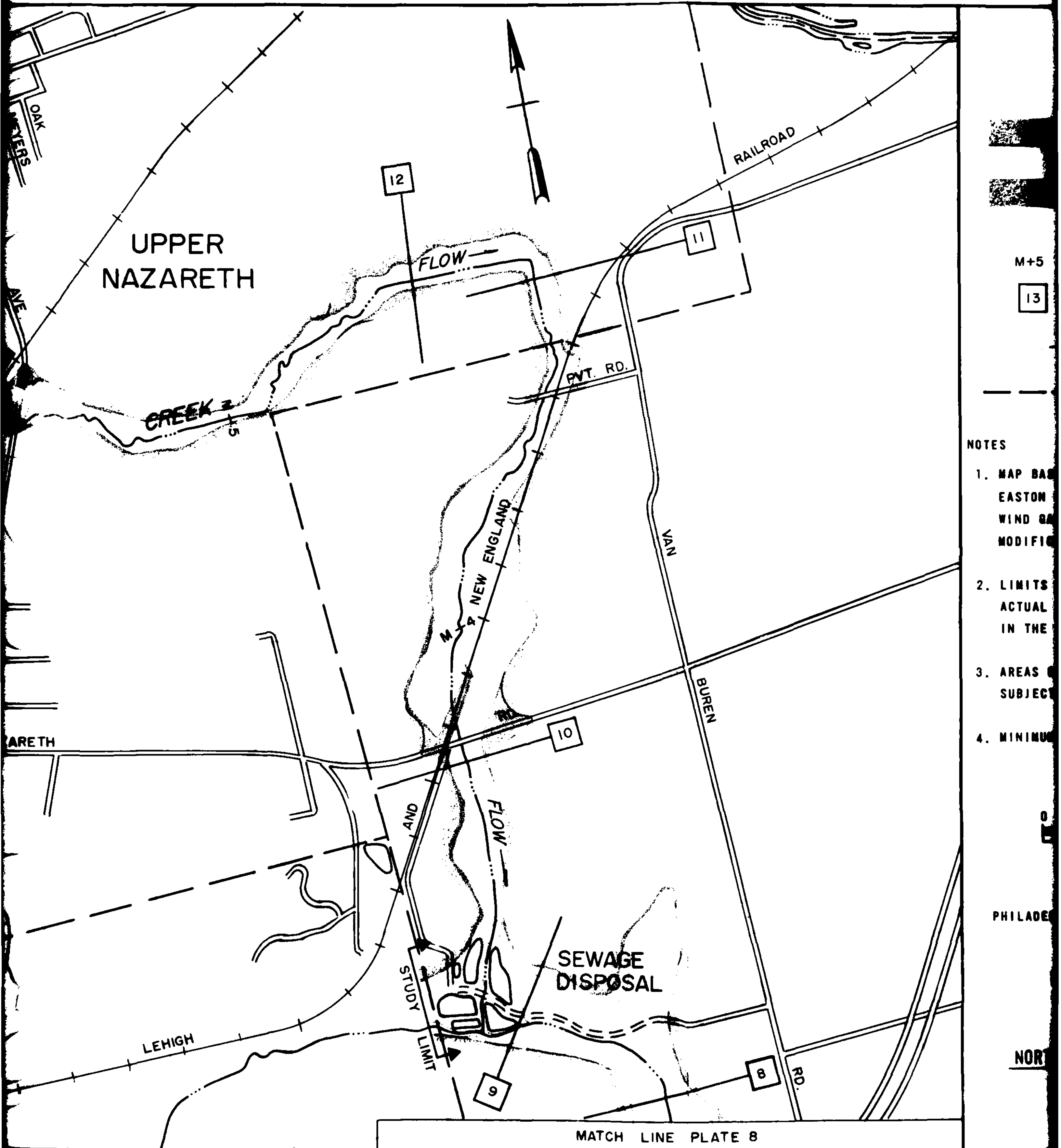
RAILROAD
ERIE-LACKAWANNA
13
NAZARETH



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MEYERS
AVE.
RAILROAD
12
11
FLOW
CREEK
+5
PVT. RD.
VAN
NEW ENGLAND
M+4
BUREN
RD.
10
ZARETH
AND
FLOW
SEWAGE
DISPOSAL
STUDY
LIMIT
LEHIGH
9
8
RD.
MATCH LINE PLATE 8
M+5
13
NOTES
1. MAP BAS
EASTON
WIND GA
MODIFI
2. LIMITS
ACTUAL
IN THE
3. AREAS
SUBJECT
4. MINIMU
PHILADE
NORT

1

2

LEGEND

OVERFLOW LIMITS

	INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M+5	MILES ABOVE MOUTH
13	CROSS SECTION
	GROUND ELEVATION IN FEET (U.S.C. G.S. 1929 ADJ.) SEA LEVEL DATUM
— — —	TOWNSHIP OR BORO LIMITS

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLES: EASTON PA.-N.J. 1956, NAZARETH, PA. 1964, WIND GAP, PA. 1960. MINOR ADDITIONS AND MODIFICATIONS 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

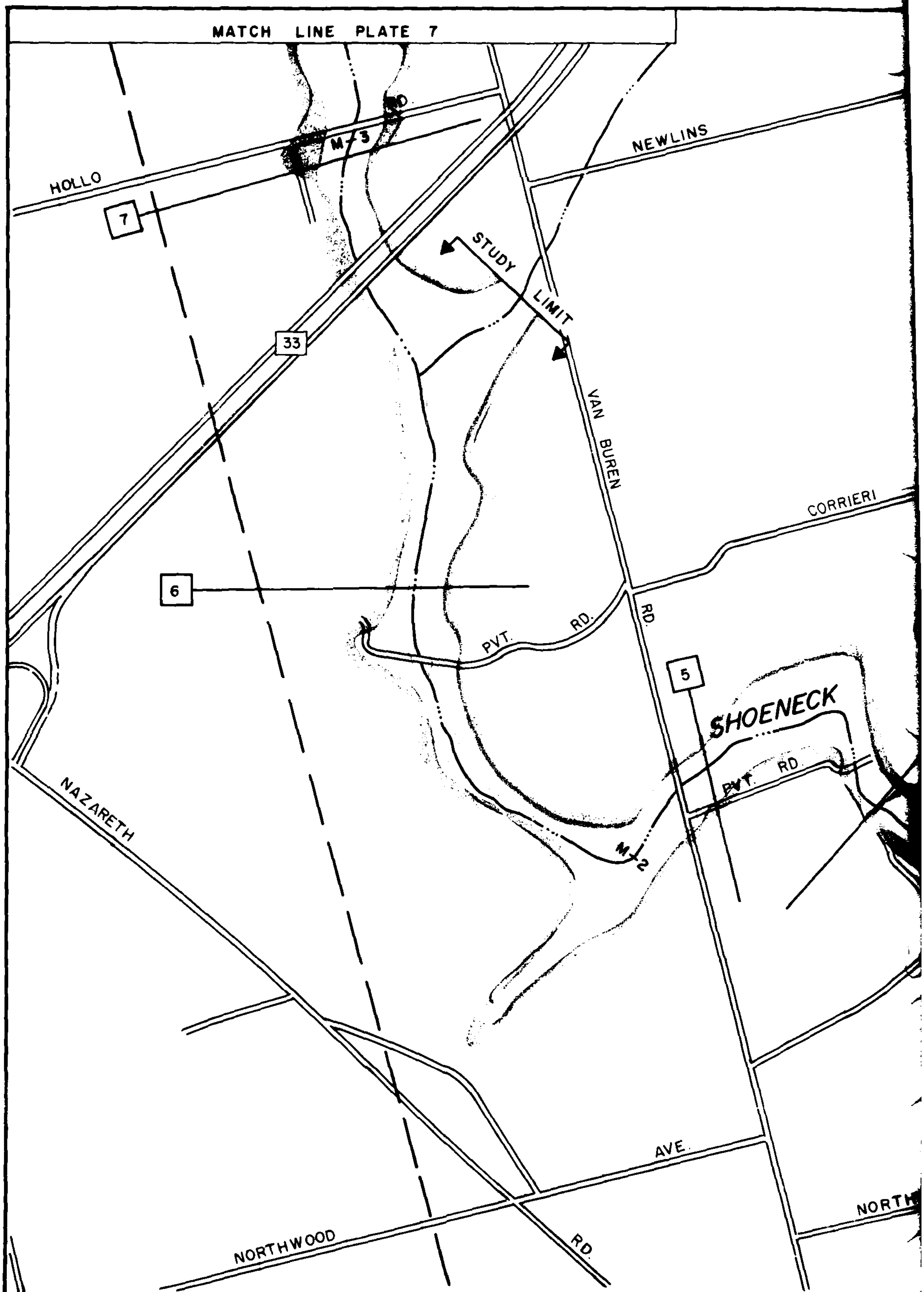
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

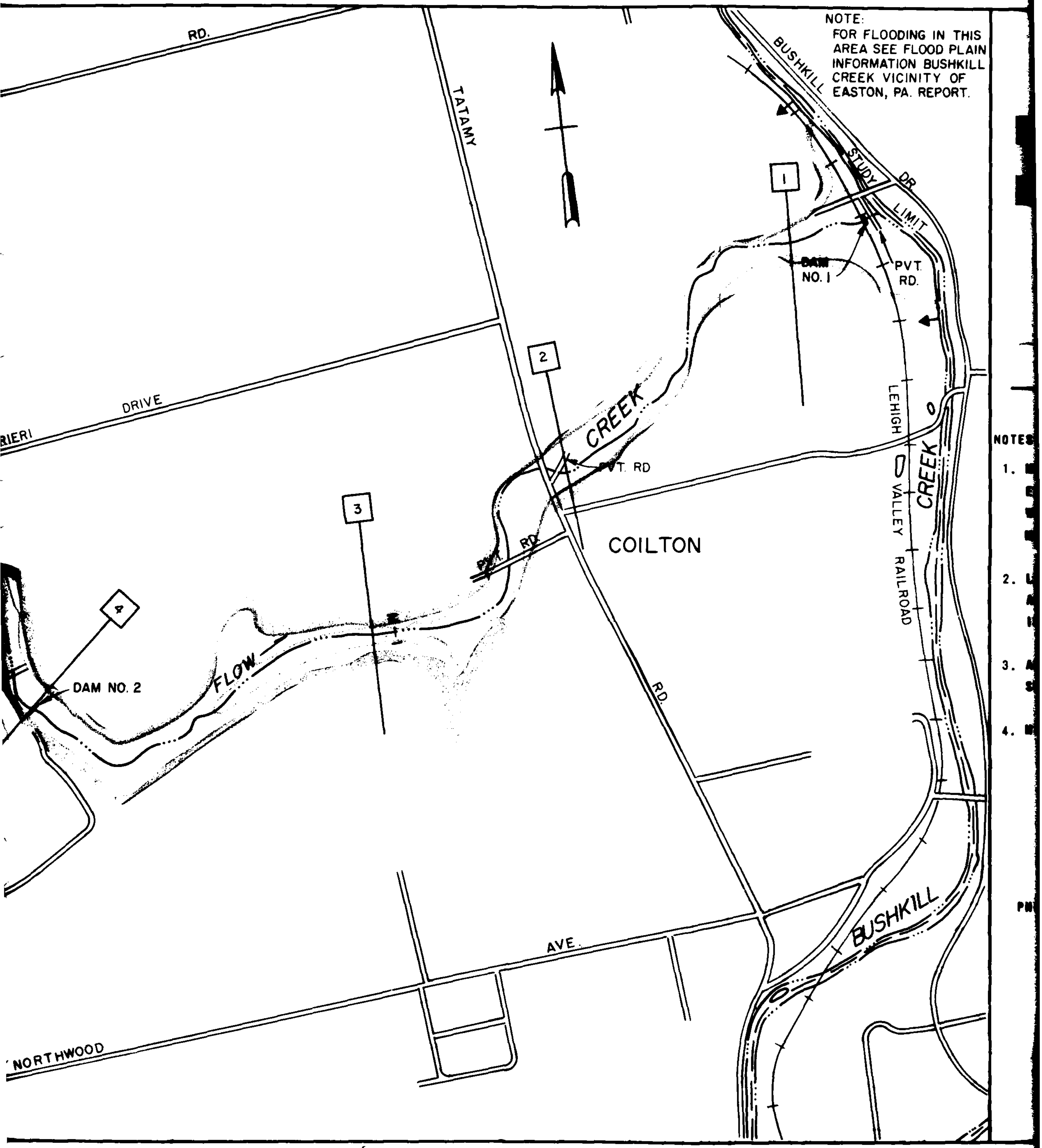
FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK & SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

FLOODED AREAS

APRIL 1973

PLATE 7


MATCH LINE PLATE 7
HOLLO
RD
M-3
NEWLINS
7
STUDY LIMIT
33
VAN BUREN RD.
CORRIERI
6
PVT. RD.
5
SHOENECK
PVT. RD.
M-2
NAZARETH RD.
AVE.
NORTHWOOD
NORTH



NOTE:
FOR FLOODING IN THIS AREA SEE FLOOD PLAIN INFORMATION BUSHKILL CREEK VICINITY OF EASTON, PA. REPORT.
RD.
TATAMY
BUSHKILL
STUDY
LIMIT
DR.
DAM NO. 1
PVT. RD.
DRIVE
RIERI
CREEK
PVT. RD
LEHIGH VALLEY RAILROAD
CREEK
COILTON
PVT. RD
DAM NO. 2
FLOW
RD.
AVE.
NORTHWOOD
BUSHKILL
1
2
3
4
NOTES
1.
2.
3.
4.

LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

33 STATE ROUTE

M + I MILES ABOVE MOUTH

7 CROSS SECTION

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

TOWNSHIP OR BORO LIMITS

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN. QUADRANGLES: EASTON PA.-N.J. 1956, NAZARETH, PA. 1964, WIND GAP, PA. 1960. MINOR ADDITIONS AND MODIFICATIONS 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

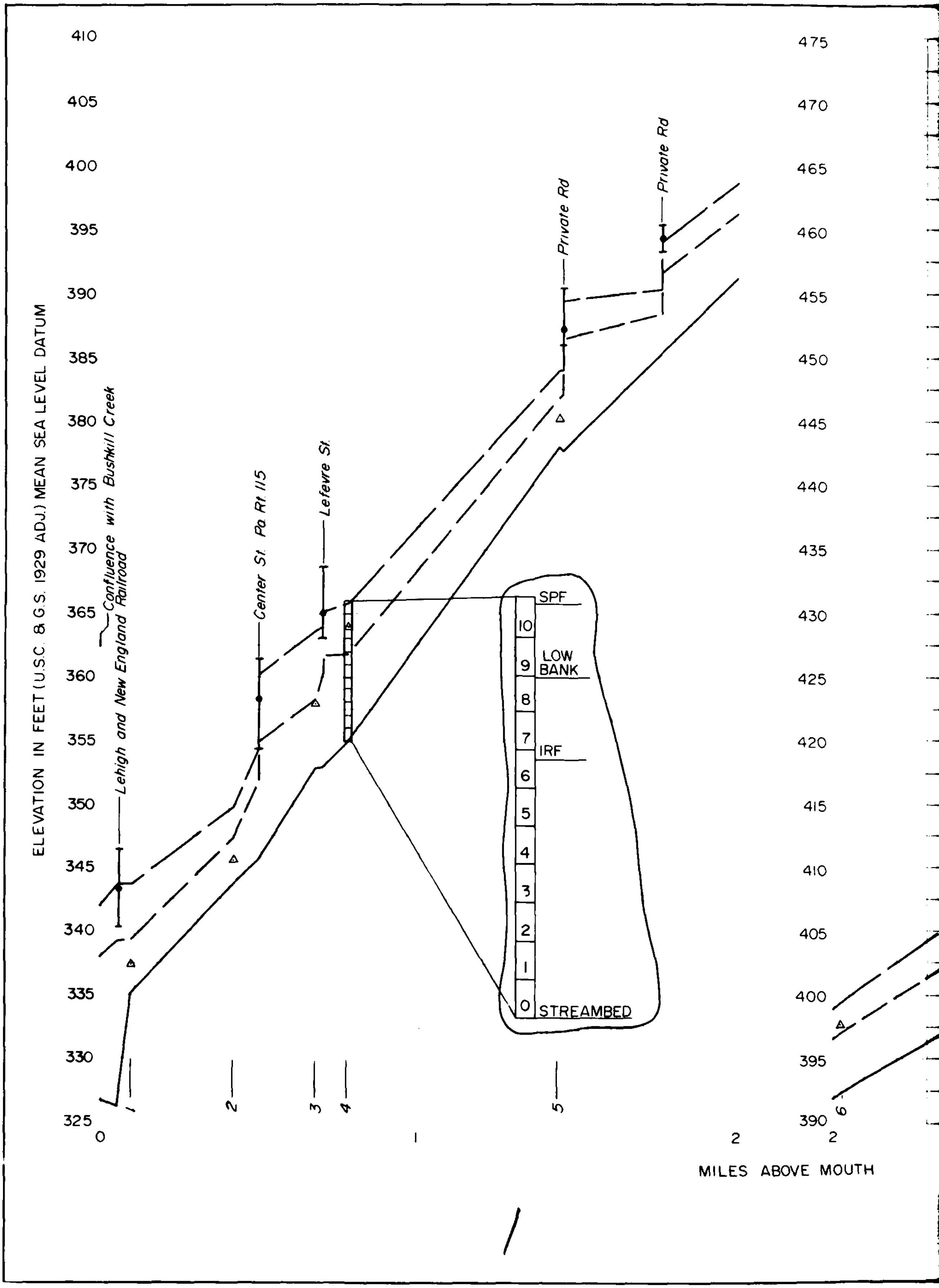
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA

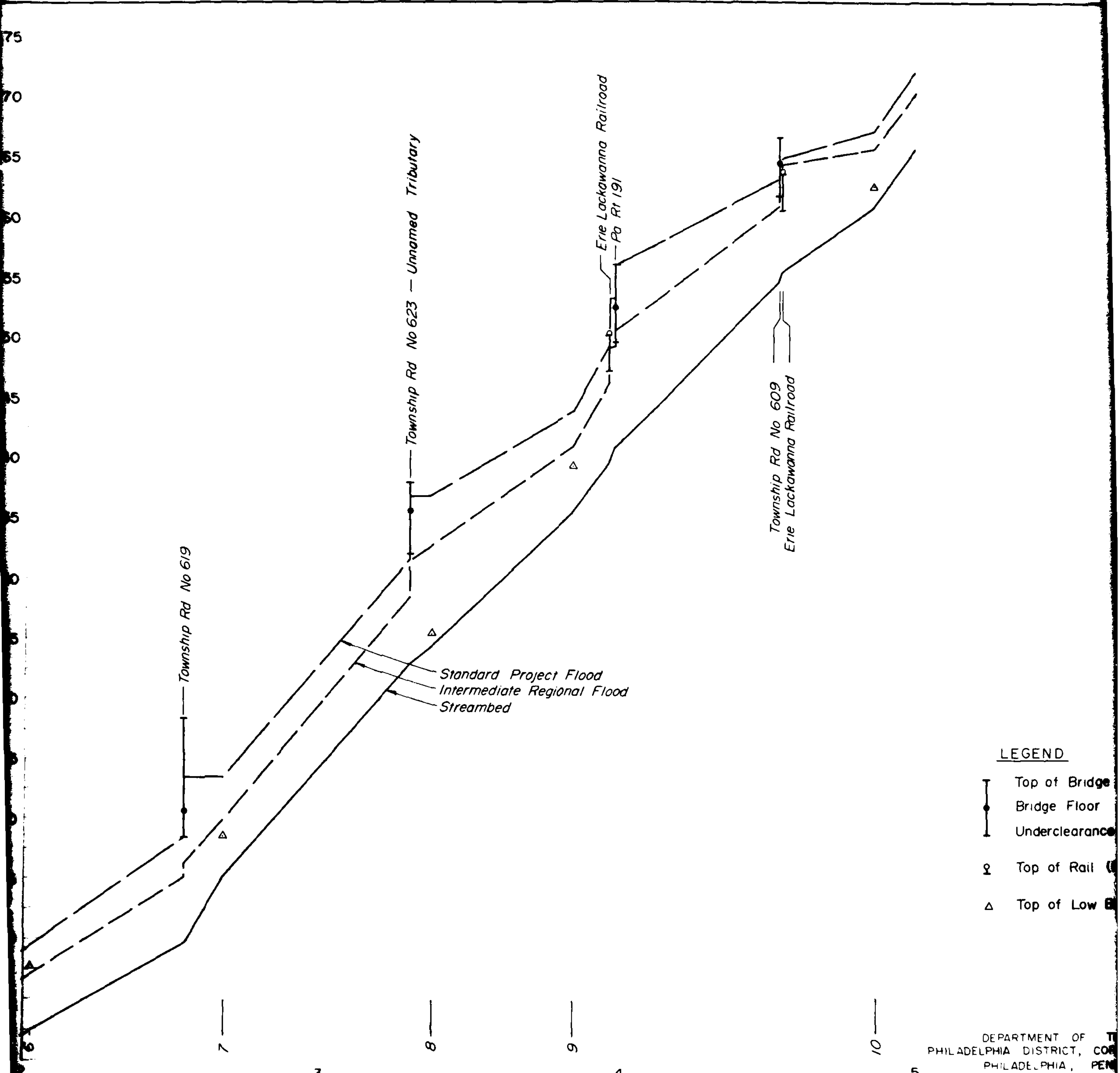
FLOODED AREAS

APRIL 1973

1 3 PLATE 8



ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
Confluence with Bushkill Creek
Lehigh and New England Railroad
Center St. Pa Rt 115
Lefevre St.
Private Rd
Private Rd
SPF
LOW BANK
IRF
STREAMBED
10
9
8
7
6
5
4
3
2
1
0
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
1
2
3
4
5
6
0
1
2
2
MILES ABOVE MOUTH



NOTE:
FOR CONTINUATION OF LITTLE BUSHKILL CREEK PROFILE SEE PLATE 10.

DEPARTMENT OF T
PHILADELPHIA DISTRICT, CO
PHILADELPHIA, PEN
FLOOD PLAIN INF
LITTLE BUSHKI
& SHOENECK
NORTHAMPTON COUNTY
HIGH WATER
LITTLE BUSHKIL
APRIL 197

2

1

GEND

op of Bridge Railing

ridge Floor

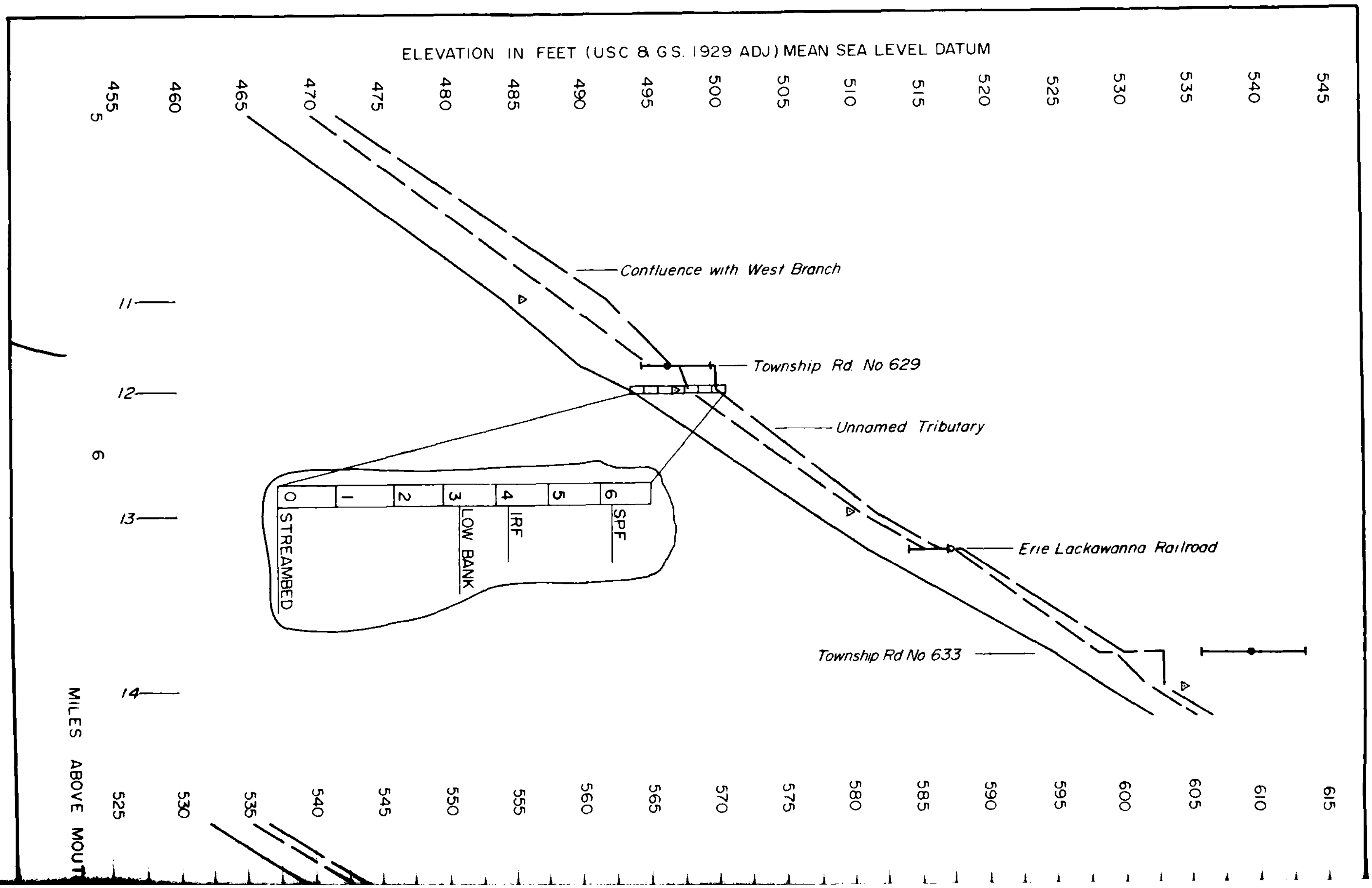
nderclearance

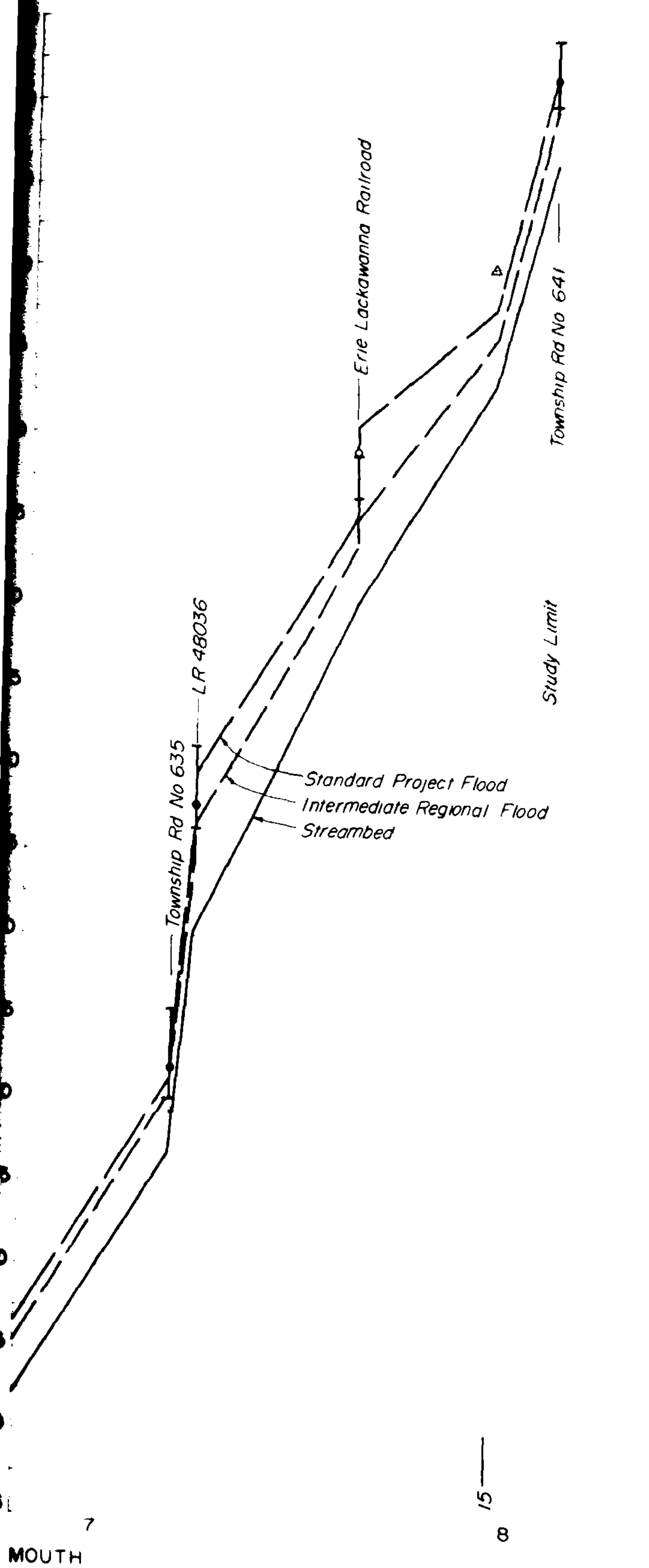
op of Rail (Railroad Bridge)

op of Low Bank

TMENT OF THE ARMY
DISTRICT, CORPS OF ENGINEERS
ELPHIA, PENNSYLVANIA
PLAIN INFORMATION
LE BUSHKILL CREEK
SHOENECK CREEK
TON COUNTY, PENNSYLVANIA
WATER PROFILE
E BUSHKILL CREEK
APRIL 1973

PLATE 9


ELEVATION IN FEET (USC & GS. 1929 ADJ) MEAN SEA LEVEL DATUM
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
Confluence with West Branch
Township Rd. No 629
Unnamed Tributary
Erie Lackawanna Railroad
Township Rd No 633
0 STREAMBED
1
2
3 LOW BANK
4 IRF
5
6 SPF
5
11
12
6
13
14
MILES ABOVE MOUT
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615



LEGEND

Top of Bridge Railing
Bridge Floor
Underclearance

Top of Rail (Railroad Bridge)

Top of Low Bank

NOTE·
FOR CONTINUATION OF LITTLE BUSHKILL CREEK PROFILE SEE PLATE 9.

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

FLOOD PLAIN INFORMATION

LITTLE BUSHKILL CREEK

& SHOENECK CREEK

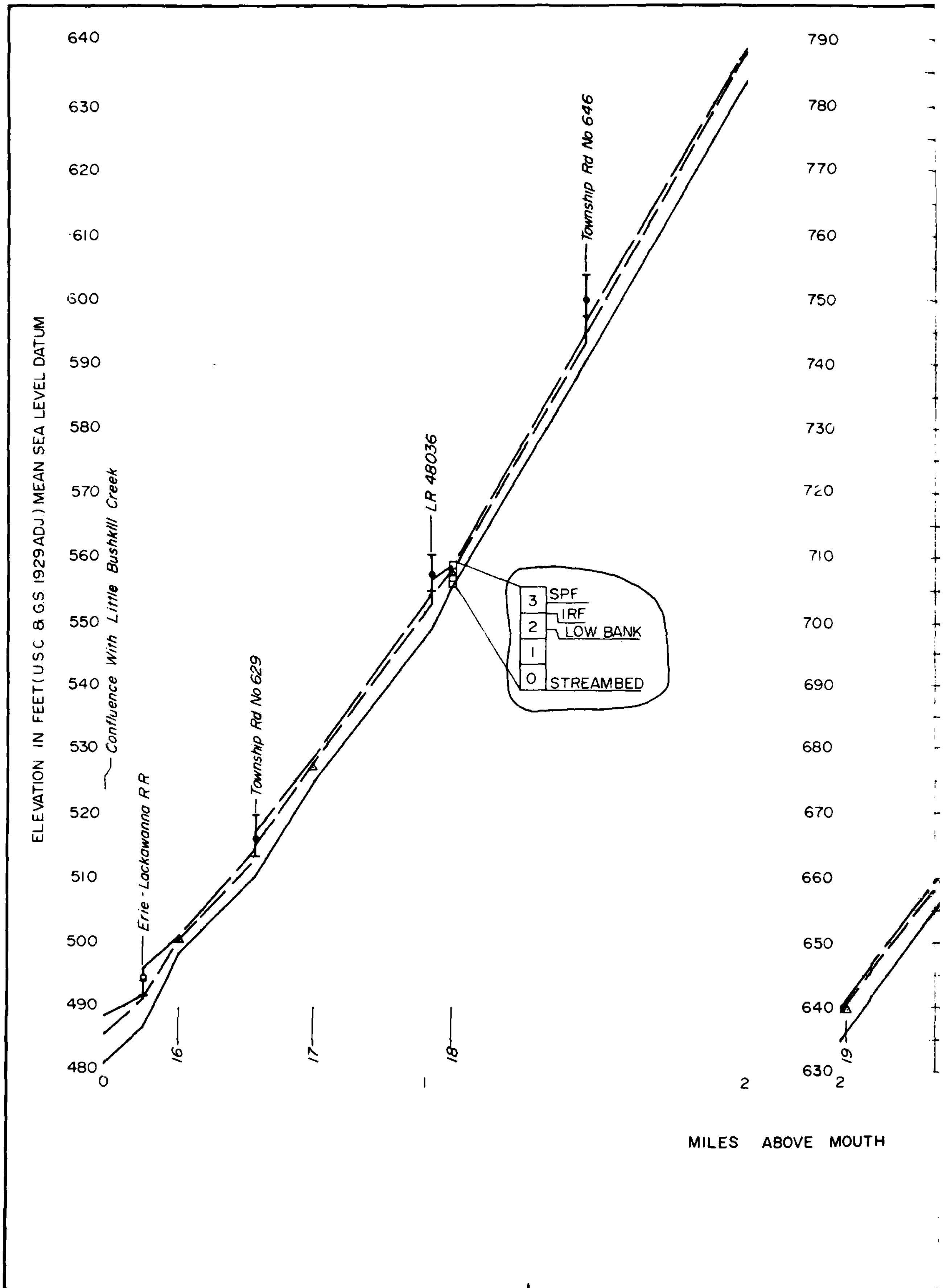
NORTHAMPTON COUNTY, PENNSYLVANIA

HIGH WATER PROFILE

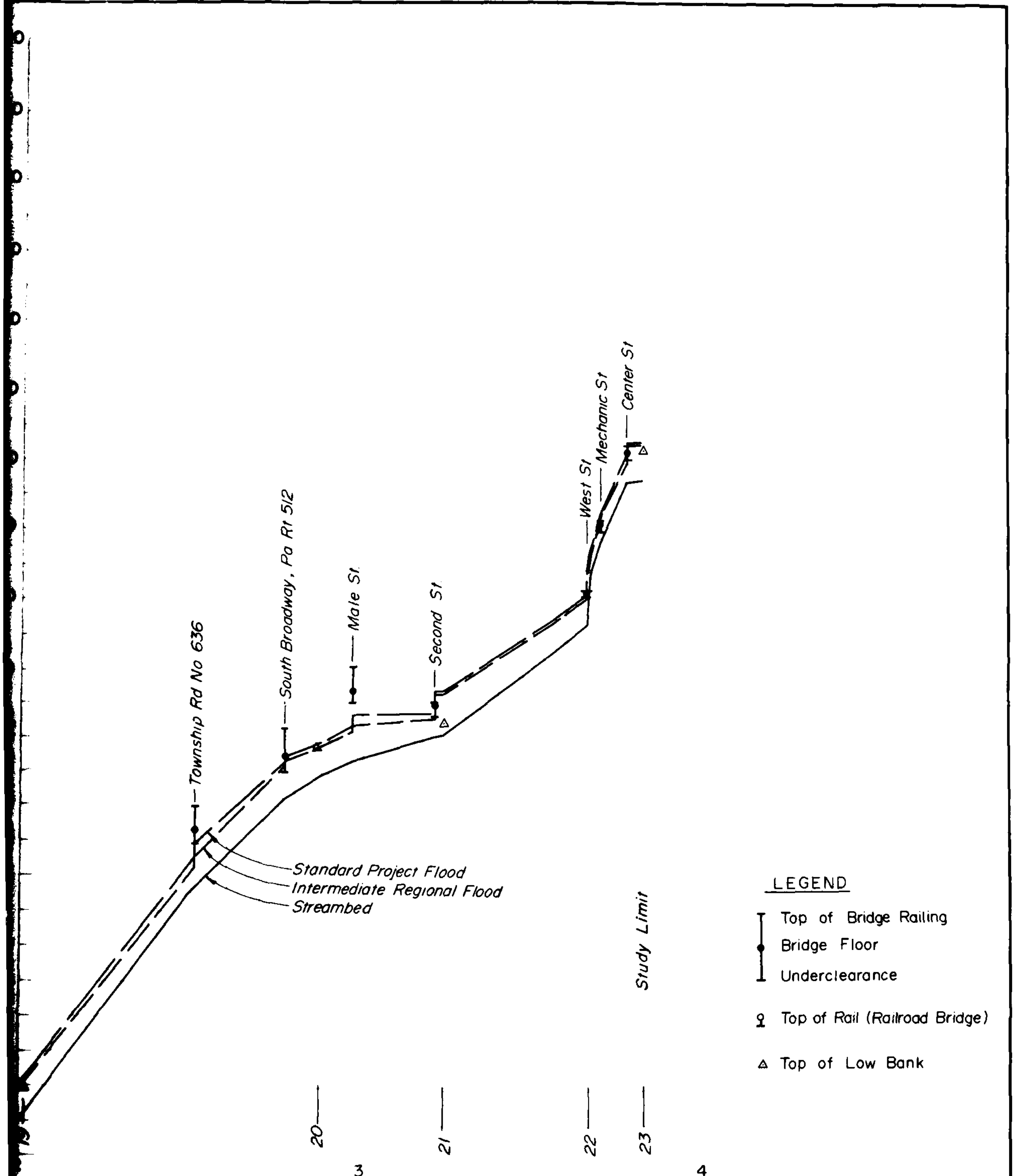
LITTLE BUSHKILL CREEK

APRIL 1973

PLATE 10



ELEVATION IN FEET (U S C & G.S. 1929 ADJ) MEAN SEA LEVEL DATUM
640
630
620
610
600
590
580
570
560
550
540
530
520
510
500
490
480
790
780
770
760
750
740
730
720
710
700
690
680
670
660
650
640
630
Confluence With Little Bushkill Creek
Erie - Lackawanna R R
Township Rd No 629
LR 48036
Township Rd No 646
3 SPF
2 IRF
LOW BANK
1
0 STREAMBED
16
17
18
19
0
1
2
2
MILES ABOVE MOUTH



UTH

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

FLOOD PLAIN INFORMATION

LITTLE BUSHKILL CREEK

& SHOENECK CREEK

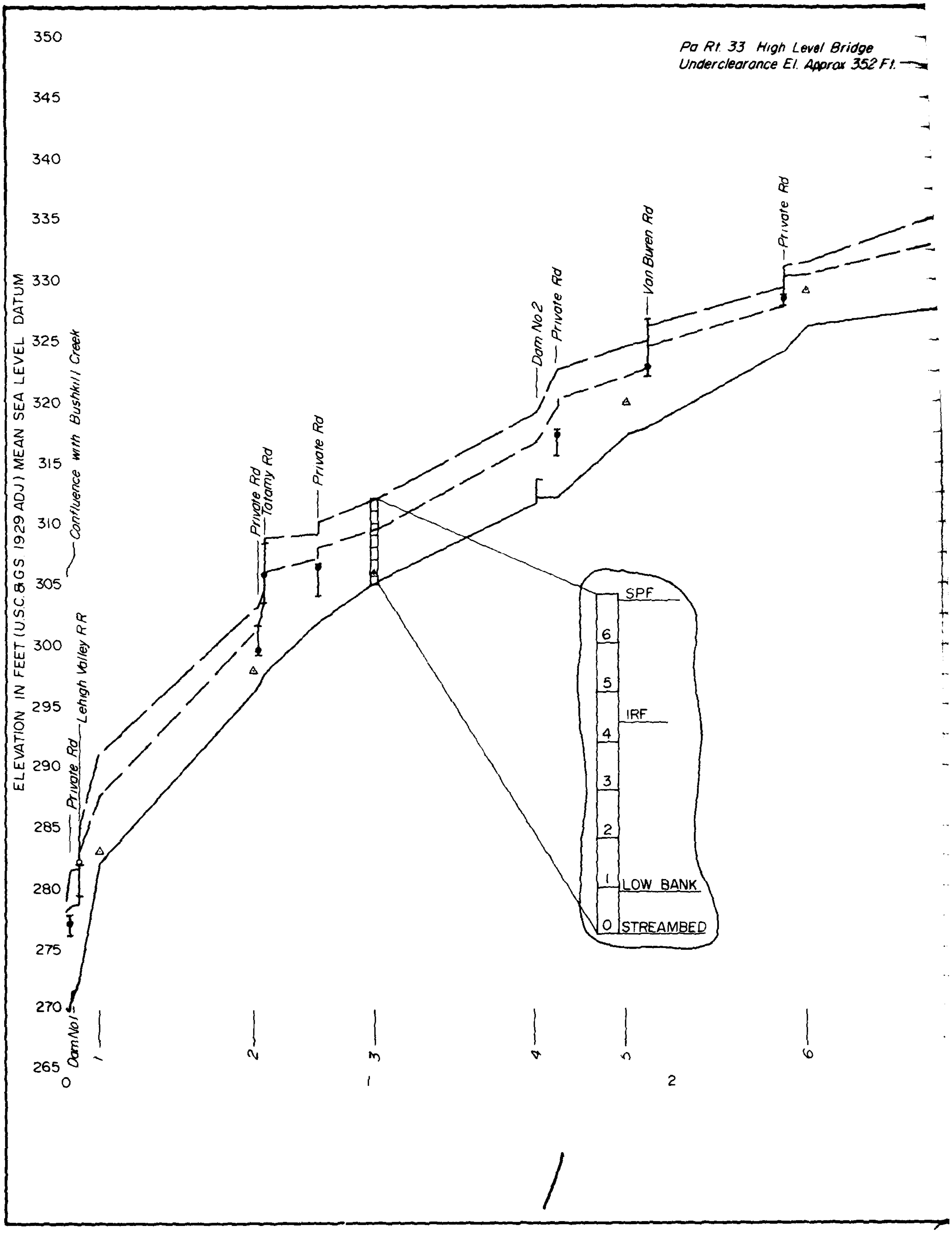
NORTHAMPTON COUNTY, PENNSYLVANIA

HIGH WATER PROFILE

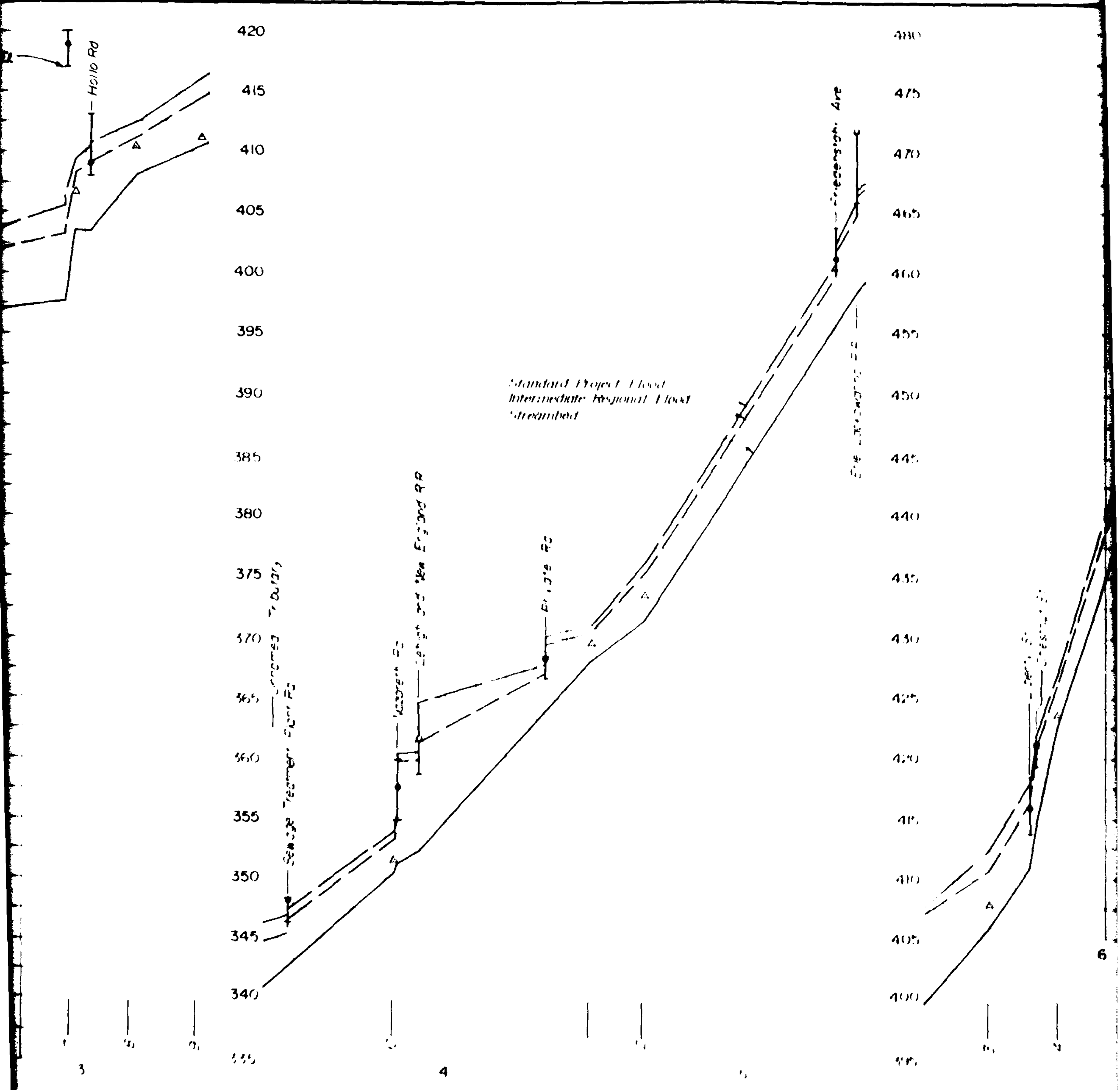
WEST BRANCH
APRIL 19

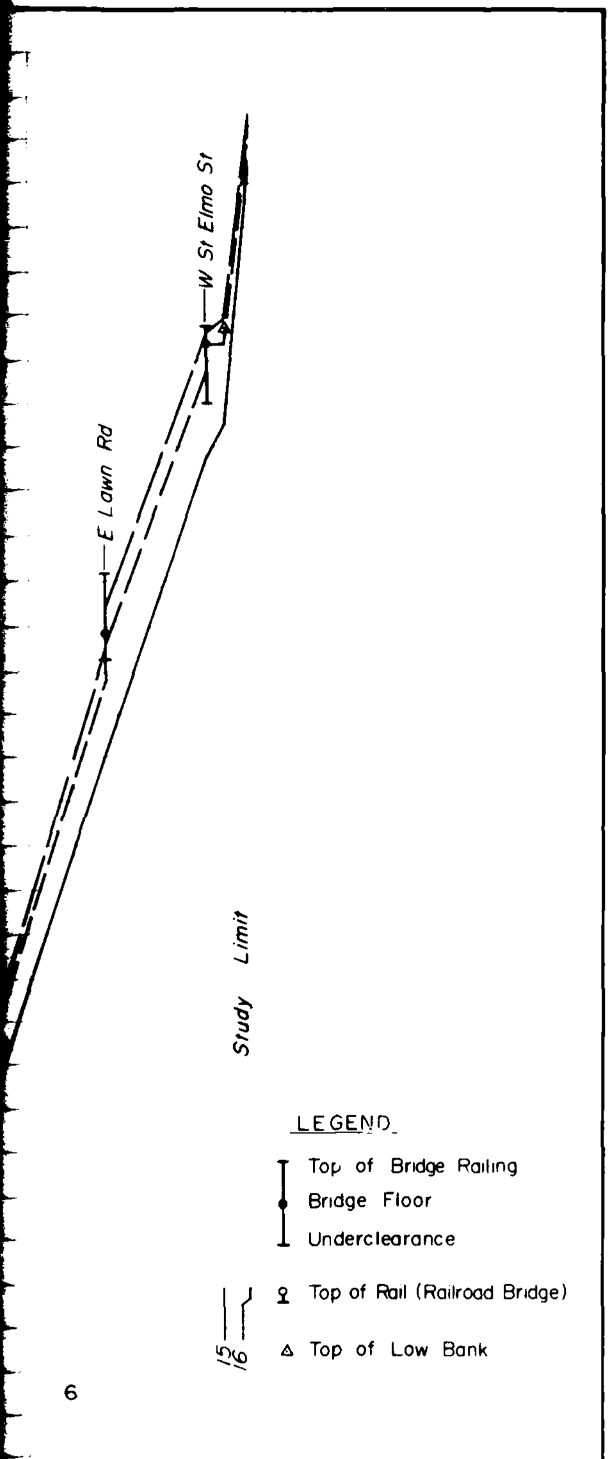
1 2

PLATE II



ELEVATION IN FEET (U.S.C.&G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
350
345
340
335
330
325
320
315
310
305
300
295
290
285
280
275
270
265
Pa Rt. 33 High Level Bridge
Underclearance El. Approx 352 Ft.
Confluence with Bushkill Creek
Private Rd
Lehigh Valley R.R.
Private Rd
Tatamy Rd
Private Rd
Dam No 2
Private Rd
Van Buren Rd
Private Rd
SPF
IRF
LOW BANK
STREAMBED
6
5
4
3
2
1
0
Dam No 1
1
2
3
4
5
6
0
1
2


Hollo Rd
Standard Project Flood
Intermediate Regional Flood
Streambed
Greensight Ave
Bridge Rd
420
415
410
405
400
395
390
385
380
375
370
365
360
355
350
345
340
480
475
470
465
460
455
450
445
440
435
430
425
420
410
405
400
3
4
6



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

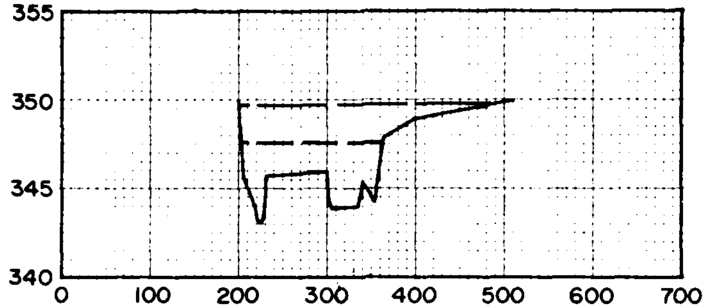
FLOOD PLAIN INFORMATION

LITTLE BUSHKILL CREEK
& SHOENECK CREEK

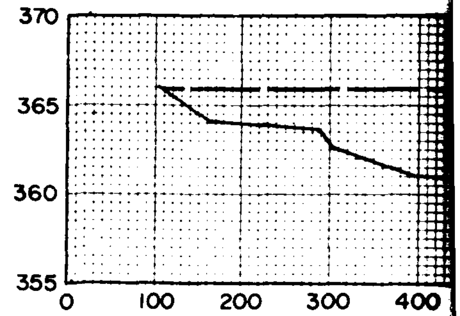
NORTHAMPTON COUNTY, PENNSYLVANIA

HIGH WATER PROFILE
SHOENECK CREEK
APRIL 1973

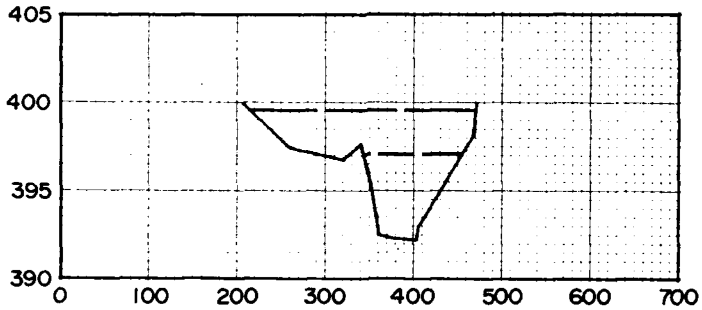
ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) SEA LEVEL DATUM.



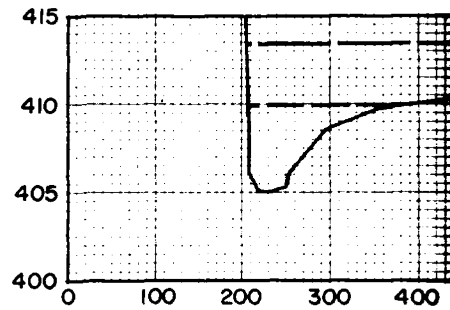
LITTLE BUSHKILL CREEK
CROSS SECTION NO. 2
MILE 0.42



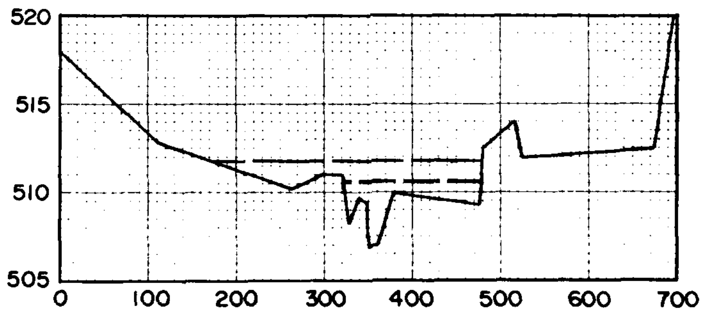
LITTLE BUSHKILL
CROSS SECTION N
MILE 0.78



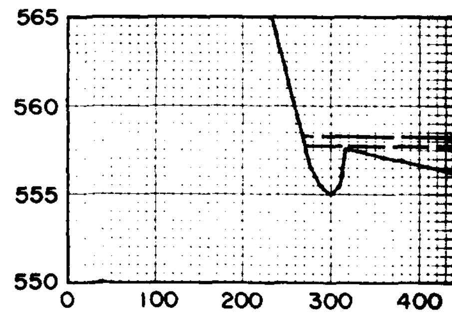
LITTLE BUSHKILL CREEK
CROSS SECTION NO. 6
MILE 2.03



LITTLE BUSHKILL
CROSS SECTION
MILE 2.6

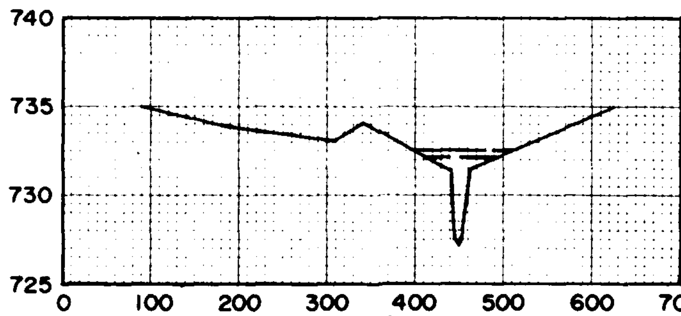


LITTLE BUSHKILL CREEK
CROSS SECTION NO. 13
MILE 6.19



WEST BRANC
CROSS SECTION N
MILE 1.08

HORIZONTAL DISTANCE



WEST BRANCH CROSS SECTION NO. 23
MILE 3.83

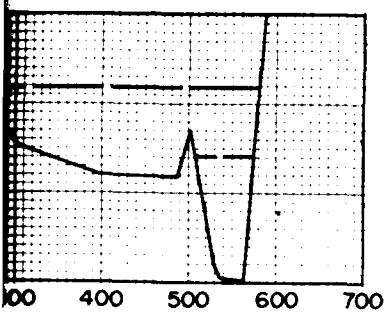
NOTES:

THE 13 SECTIONS ON LITT
WEST BRANCH NOT SHOWN
FILE AT THE PHILADELPHIA
ENGINEERS AND ARE AVAILA
UPON REQUEST.

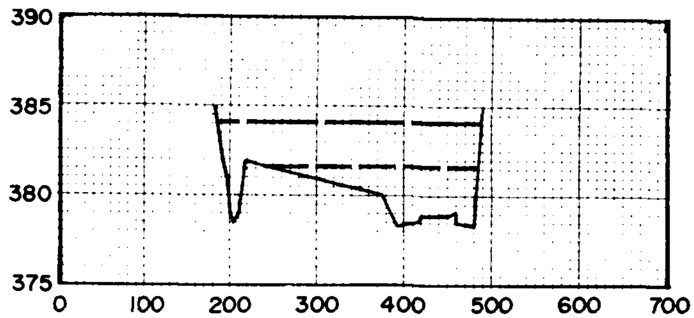
CROSS SECTIONS TAKEN L

LEGEND

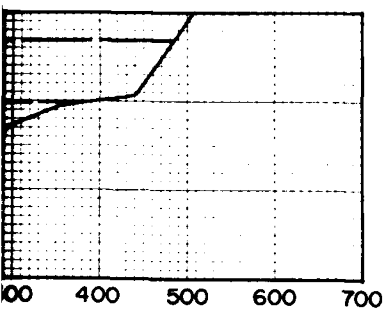
- ——— STANDARD P
— — — INTERMEDIAT
——— GROUND LIN



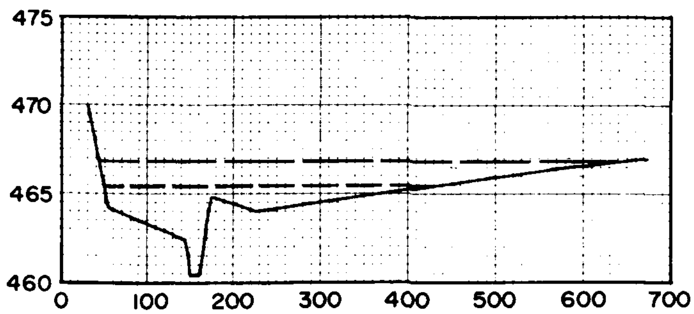
: BUSHKILL CREEK
SECTION NO. 4
MILE 0.78



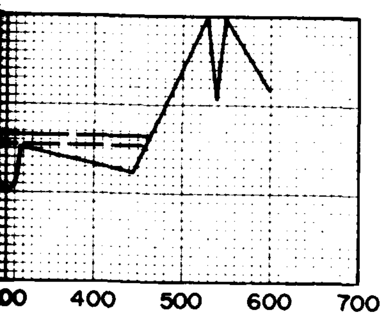
LITTLE BUSHKILL CREEK
CROSS SECTION NO. 5
MILE 1.44



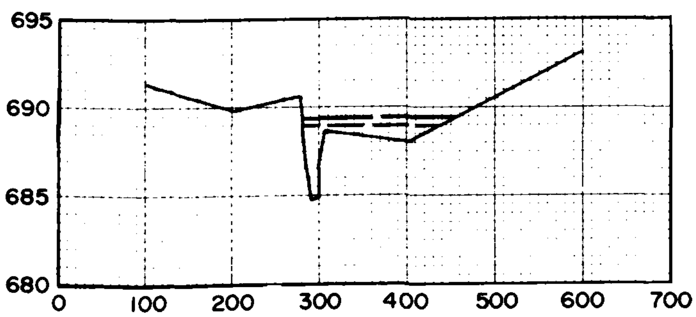
: BUSHKILL CREEK
: SECTION NO. 7
MILE 2.68



LITTLE BUSHKILL CREEK
CROSS SECTION NO. 10
MILE 4.86



EST BRANCH
SECTION NO. 18
MILE 1.08



WEST BRANCH
CROSS SECTION NO. 20
MILE 2.88

DISTANCE IN FEET

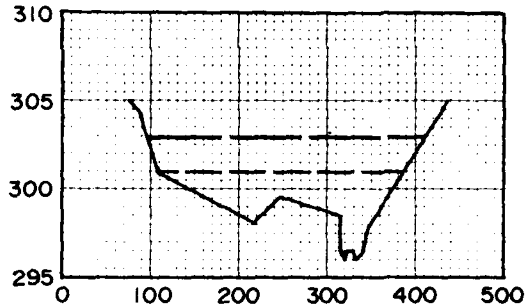
ONS ON LITTLE BUSHKILL CREEK AND
OT SHOWN IN THIS REPORT ARE ON
ILADELPHIA DISTRICT, CORPS OF
ARE AVAILABLE FOR INSPECTION

ONS TAKEN LOOKING DOWNSTREAM.

LEGEND
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
GROUND LINE

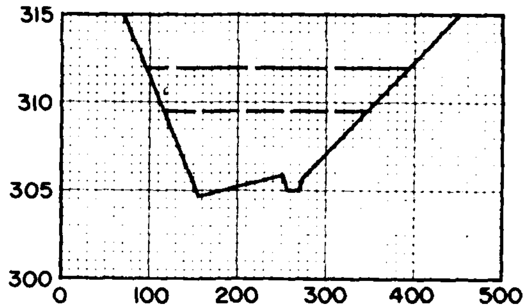
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY, PENNSYLVANIA
SELECTED CROSS SECTIONS
LITTLE BUSHKILL CREEK & WEST BRANCH
APRIL 1973

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



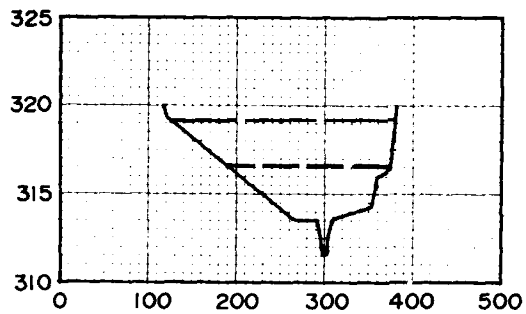
CROSS SECTION NO. 2

MILE 0.62



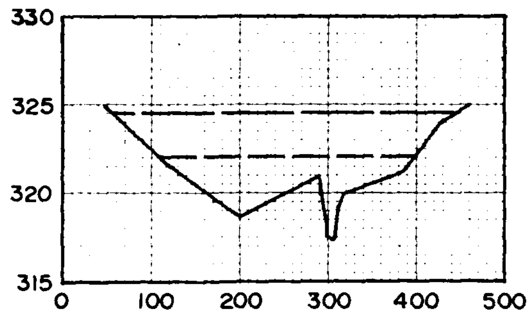
CROSS SECTION NO. 3

MILE 1.02



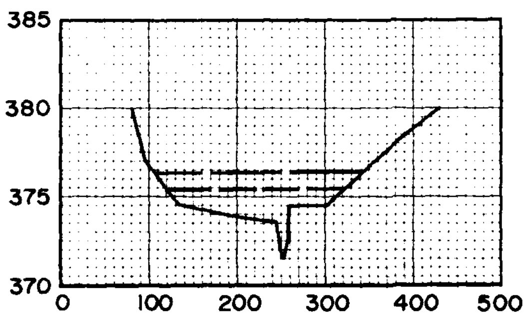
CROSS SECTION NO. 4

MILE 1.55



CROSS SECTION NO. 5

MILE 1.85



CROSS SECTION NO. 12

MILE 4.66

HORIZONTAL DISTANCE IN FEET

NOTES:

THE 11 SECTIONS ON SHOENECK CREEK NOT SHOWN IN THIS REPORT ARE ON FILE AT THE PHILADELPHIA DISTRICT, CORPS OF ENGINEERS AND ARE AVAILABLE FOR INSPECTION UPON REQUEST.

CROSS SECTIONS TAKEN LOOKING DOWNSTREAM.

LEGEND

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

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

FLOOD PLAIN INFORMATION

LITTLE BUSHKILL CREEK

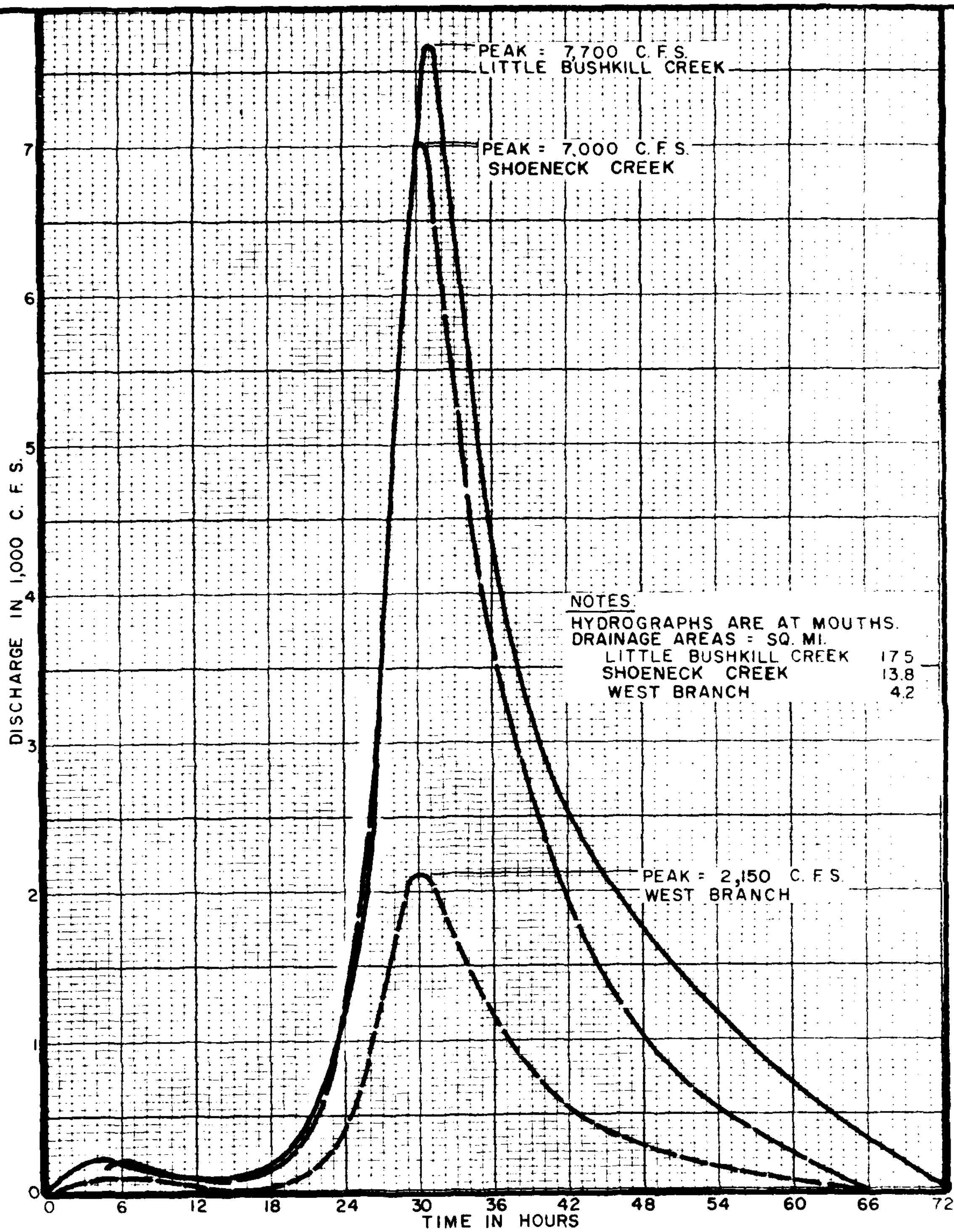
& SHOENECK CREEK

NORTHAMPTON COUNTY, PENNSYLVANIA

SELECTED CROSS SECTIONS

SHOENECK CREEK

APRIL 1973



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

FLOOD PLAIN INFORMATION
LITTLE BUSHKILL CREEK
& SHOENECK CREEK
NORTHAMPTON COUNTY
PENNSYLVANIA
STANDARD PROJECT FLOOD
HYDROGRAPHS
APRIL 1973

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8