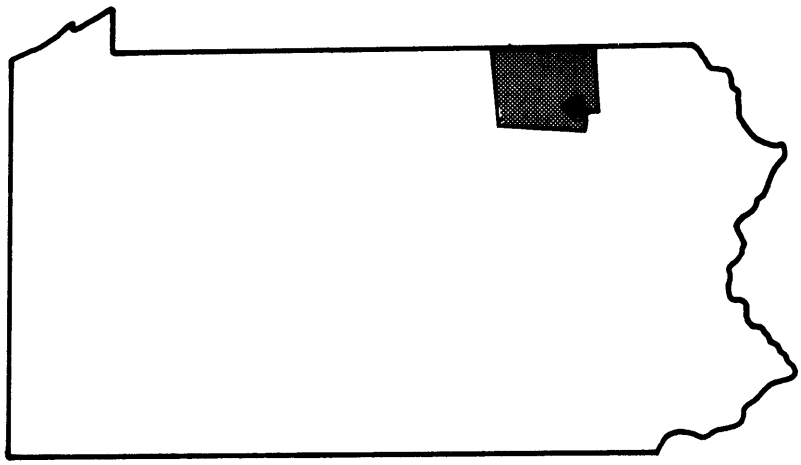
FLOOD INSURANCE STUDY

TOWNSHIP OF WYALUSING, PENNSYLVANIA
BRADFORD COUNTY



JULY 16, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 421126

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

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

Initial Flood Insurance Study Effective Date: July 16, 1990

Flood Insurance Study Revised:

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FLOOD INSURANCE STUDY
TOWNSHIP OF WYALUSING, BRADFORD COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Wyalusing, Bradford County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgments

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

The hydrologic and hydraulic analyses for this study were prepared by the Baltimore District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-86-E-2226, Project Order No. 27. This work was completed in September 1988.

1.3 Coordination

On December 12, 1985, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the COE (the study contractor), Bradford County, and the township to determine the streams to be studied by detailed methods. During the preparation of the study, various Federal, State, and local agencies were contacted to obtain available mapping, survey data, flood history information, and other hydrologic data. Those contacted included the following: the Township of Wyalusing, Bradford County, the Pennsylvania Departments of Transportation and Environmental Resources, the U. S. Geological Survey (USGS), the Soil Conservation Service (SCS), and the Susquehanna River Basin Commission (SRBC).

On August 24, 1989, a final CCO meeting was held with representatives of FEMA, the study contractor, and the township to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Wyalusing, Bradford County, Pennsylvania. The Borough of Wyalusing is located within the Township of Wyalusing but is not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

The Susquehanna River was studied by detailed methods from the downstream corporate limits to a point approximately 5.7 miles upstream of the confluence of Wyalusing Creek, at Homets Ferry. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through September 1993.

The following streams were studied by approximate methods: Billings Creek, Wyalusing Creek, Camp Creek, Brewer Creek, and a portion of the Susquehanna River. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Wyalusing.

2.2 Community Description

The Township of Wyalusing is located in the southeast corner of Bradford County, in northeast Pennsylvania, approximately 40 miles northeast of the City of Lock Haven. It is bordered by the Township of Herrick to the north, the Township of Standing Stone to the north and northwest, the Township of Stevens to the northeast, the Township of Tuscarora to the east, the Township of Wilmot to the south, the Township of Terry to the southwest, and the Township of Asylum to the west. The Susquehanna River flows through the township and has a drainage area of approximately 8,272 square miles at the confluence of Wyalusing Creek, approximately 6 miles downstream of the upstream corporate limits.

2.3 Principal Flood Problems

The principal source of flooding within the township is the Susquehanna River. There are no gages located on the Susquehanna River within the township and no data are available to provide information about the magnitude and severity of past flooding in the area. There are two USGS gages located outside the township that have a long period of record (gage No. 01531500, located on the Susquehanna River at the Bridge Street bridge in Towanda; and gage No. 01532000, located on Towanda Creek near Monroeton). According

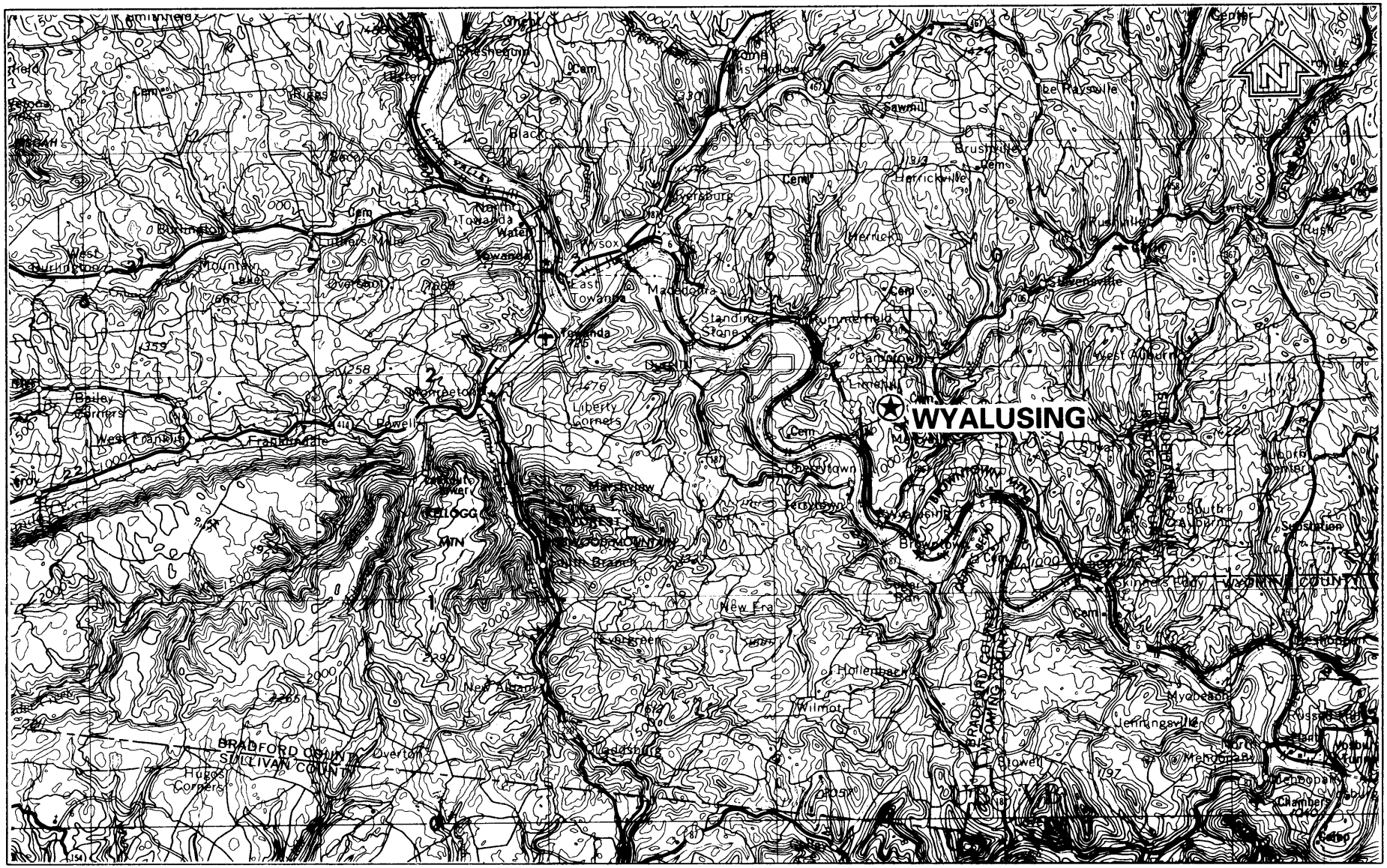


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF WYALUSING, PA

(BRADFORD CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

to data from these gages, the flood of June 24, 1972 (Hurricane Agnes) is the flood of record for the area. No attempts have been made to determine the return frequency for the June 24, 1972 flood for this area.

2.4 Flood Protection Measures

There are no flood protection structures existing or planned within the Township of Wyalusing.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

Flood-frequency discharge values for the Susquehanna River were determined using statistical analyses performed for the USGS stream gage at Meshoppen. A two-station comparison was performed for the gage at Meshoppen in accordance with procedures outlined in USGS Bulletin 17B (Reference 1). This analysis extended the 10-year period of record at Meshoppen by correlating it with the 96 years of record at Wilkes-Barre. All flows were adjusted to include the effects of upstream reservoirs. Using the 100-year peak discharges at Meshoppen and Towanda, and assuming that

$$Q\ 100 = CA^{x}$$

it was determined that in this river reach, $x = 0.58$. The 100-year peak discharges for ungaged points along the Susquehanna River between Towanda and Meshoppen were interpolated logarithmically, using the ratios of the drainage areas to the 0.58 power.

A summary of the drainage area-peak discharge relationships for the stream studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
SUSQUEHANNA RIVER		
Above confluence of Wyalusing Creek	8,272	219,400

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections used in the backwater analyses were obtained from field surveys and included stream and floodplain cross sections, as well as structural geometry of all bridges, culverts, and other hydraulic structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 2). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The starting water-surface elevation was obtained from the Flood Insurance Study for the Township of Wilmot (Reference 3). The results of the water-surface computations are tabulated for the selected cross sections for each stream segment (Table 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field reconnaissance of the stream and floodplain areas (References 4 and 5). The channel "n" values ranged from 0.025 to 0.037, and the overbank "n" values ranged from 0.060 to 0.100.

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

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION (ft. NGVD)
CROSS SECTION	DISTANCE[1] (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	
Susquehanna River											
A	0	707	222,588	7.99	156.67	4,955	2.48	930.93	10,457	1.51	669.35
B	2,140	567	198,891	9.74	643.78	28,508	2.77	277.69	10,601	3.20	669.81
C	3,880	1,070	227,778	6.30	337.69	8,846	1.74	105.78	1,375	1.41	671.17
D	7,820	750	223,455	8.41	384.81	14,154	2.22	32.18	391	1.45	671.82
E	11,730	614	209,158	8.48	1,110.63	27,610	1.66	70.14	1,231	1.49	673.05
F	17,450	815	215,416	7.44	1,392.05	20,396	1.47	80.18	2,188	2.14	674.52
G	22,550	715	214,521	8.60	796.28	20,848	1.87	158.67	2,631	1.72	676.07
H	24,750	463	180,692	10.05	1,036.44	55,646	2.67	125.15	1,662	1.74	677.13
I	30,490	1,264	215,722	6.11	110.02	1,275	2.05	142.32	2,403	1.78	679.52
J	32,180	664	200,617	8.80	110.20	1,240	2.07	586.18	17,543	2.39	679.83
K	34,220	593	202,707	9.65	107.22	1,612	2.14	587.27	15,080	2.39	680.53
L	36,090	527	202,502	10.16	129.15	1,899	2.12	644.54	14,999	2.40	681.19
M	38,990	626	194,172	8.55	169.43	2,011	1.81	869.83	23,217	2.03	682.76
N	42,970	899	214,998	7.22	324.18	2,980	1.78	44.67	1,421	2.00	684.03
O	46,720	509	201,776	10.14	424.74	15,217	2.64	43.39	2,407	2.80	685.02
P	50,230	501	196,912	10.12	538.33	19,222	2.69	45.32	3,266	3.22	686.47
Q	51,760	577	198,668	9.08	677.86	17,277	2.27	43.71	3,454	3.31	687.42
R	53,610	666	193,295	7.82	775.53	21,476	2.31	75.09	4,629	2.77	688.41
S	56,020	1,000	195,420	6.35	133.32	4,092	3.14	321.28	19,888	3.31	689.43

[1]Stream distance above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF WYALUSING,PA

(BRADFORD CO.)

REGULATORY DATA

SUSQUEHANNA RIVER

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the stream studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 6).

For the streams studied by approximate methods, the 100-year floodplain boundaries were delineated using the Flood Hazard Boundary Map for the Township of Wyalusing (Reference 7).

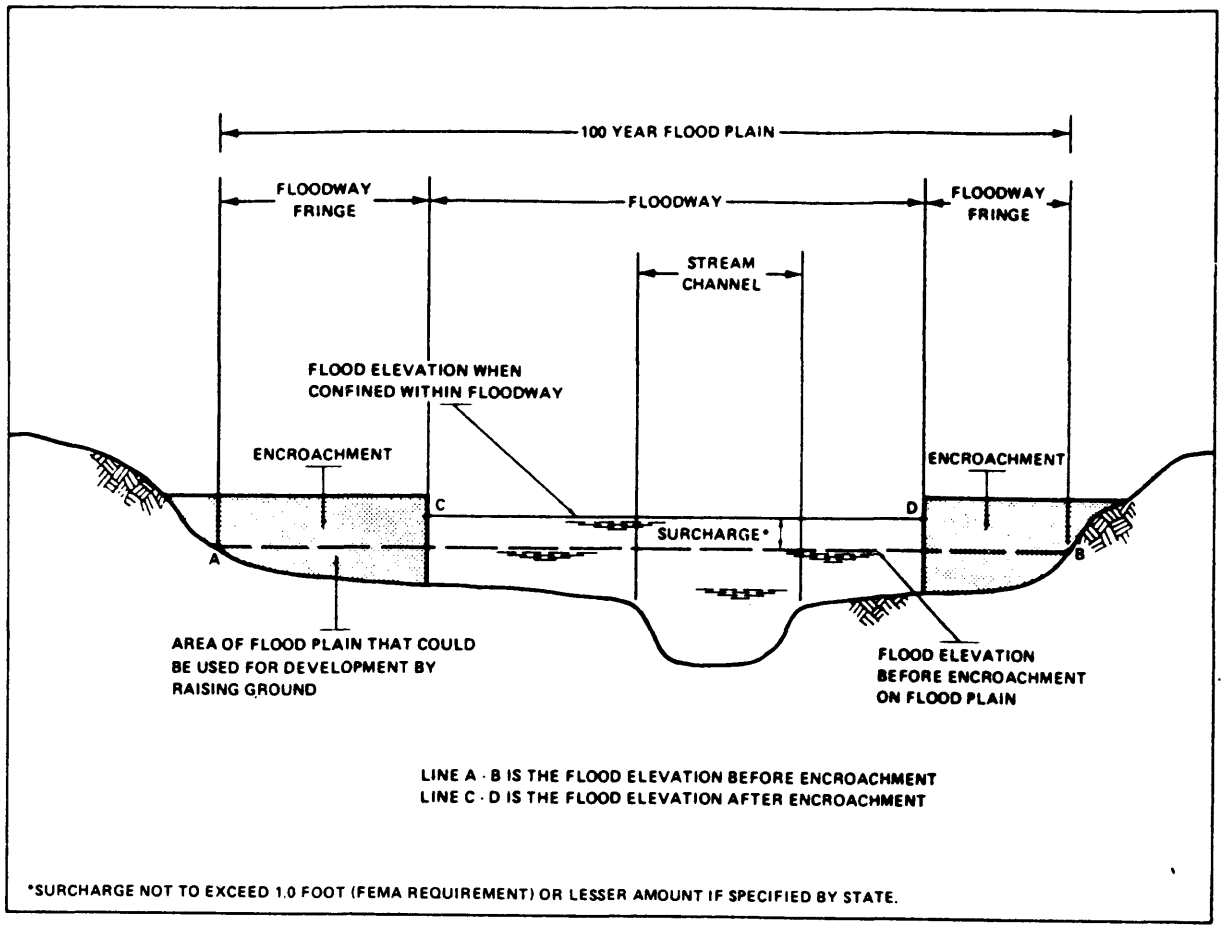
The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

No floodways were calculated as part of this study.



FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATIONS

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

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths

Zone X (continued)

are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

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

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the Borough of Wyalusing and the Townships of Wilmot and Terry (References 8, 3, and 9). The results of this study are in exact agreement with the results of those studies.

Because it is based on more detailed analyses, this study supresedes the Flood Hazard Boundary Map for the Township of Wyalusing (Reference 7).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

2. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, September 1982.

3. Federal Emergency Management Agency, Flood Insurance Study, Township of Wilmot, Bradford County, Pennsylvania, Washington, D. C., July 16, 1990.

4. Ven Te Chow, Open-Channel Hydraulics, New York, McGraw-Hill, 1959.

5. U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1849, Roughness Characteristics of Natural Channels by Harry H. Barnes, Jr., Washington, D. C. 1967.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Wyalusing, Pennsylvania, 1969; Laceyville, Pennsylvania, 1945, Photorevised 1969.

7. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Wyalusing, Bradford County, Pennsylvania, May 28, 1976.

8. Federal Emergency Management Agency, Flood Insurance Study, Borough of Wyalusing, Bradford County, Pennsylvania, Washington, D. C., July 16, 1990.

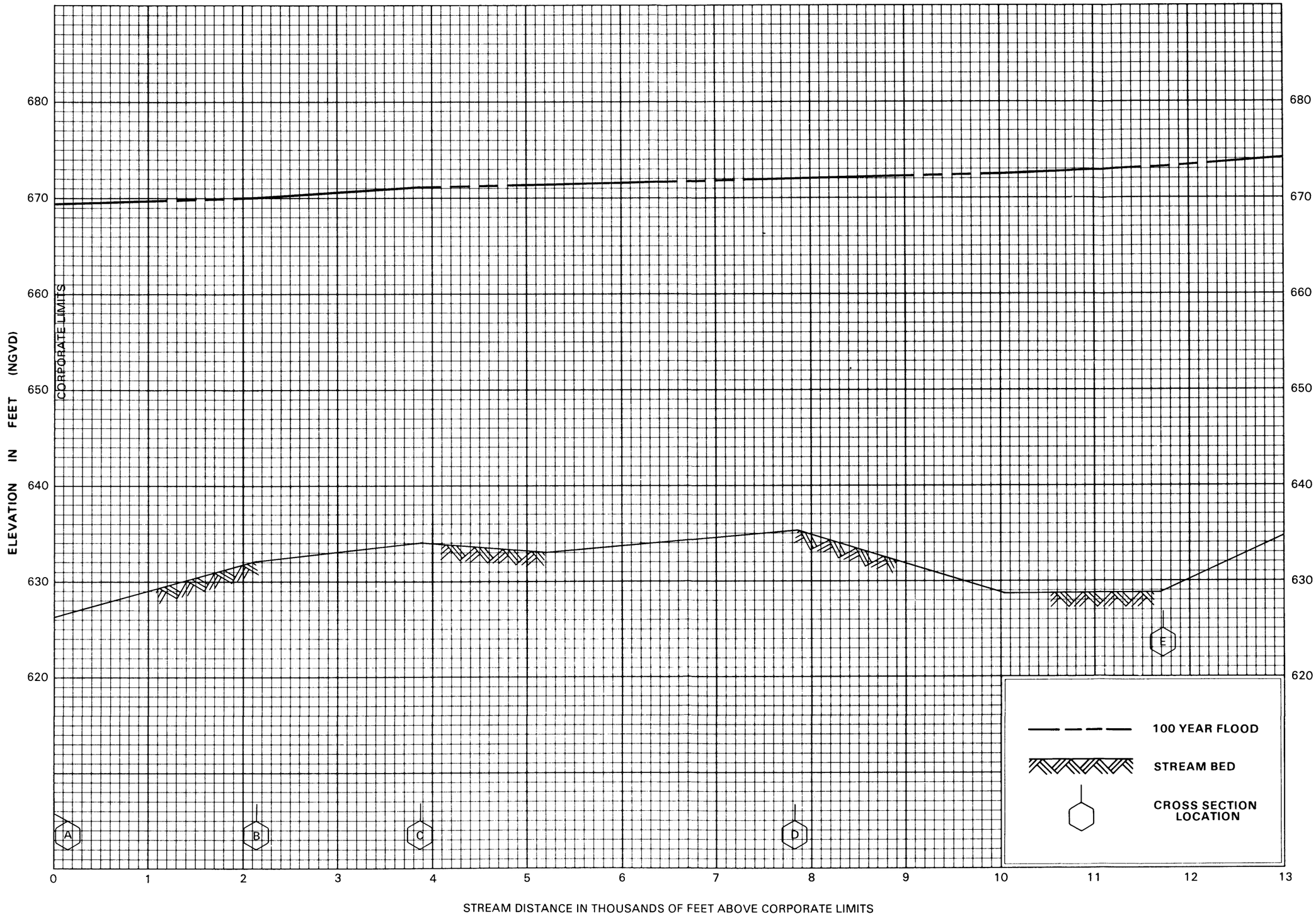
9. Federal Emergency Management Agency, Flood Insurance Study, Township of Terry, Bradford County, Pennsylvania, Washington, D. C., June 18, 1990.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	05	694.23	X cut in southwest corner of rock doorstep of two-story wood frame building (formerly State Store - Liquor Store), approximately 36 feet northwest of centerline of State Route 2025, approximately 100 feet northeast of centerline of railroad crossing, and approximately 6 feet southeast of southwest corner of building.
RM 2	05	774.88	West corner of tombstone, marked Anna, approximately 44.7 feet northwest of centerline of State Route 2025, approximately 10 feet west of southeast corner of Homet family tombstone.
RM 3	05	690.17	Vertical X cut in west face of west concrete post (approximately 6 X 4 inches X 8.7 feet above ground, approximately 25 feet northwest of centerline of railroad tracks, approximately 87 feet southeast of centerline of State Route 2025.
RM 4	05	682.89	X cut in northwest corner of concrete porch of back entrance of one-story wood frame house, approximately 9 feet northeast of northwest corner of house, approximately 70 feet west of centerline of private drive, approximately 184 feet south of centerline of railroad tracks, and approximately 200 feet south of State Route 2025.
RM 5	05	683.67	Vertical X cut in concrete post of railroad transmission box (nonexistent), approximately 2.85 feet above ground, approximately 26 feet east of centerline of railroad tracks, and approximately 300 feet north along railroad tracks from Wyalusing Rocks scenic overlook.
RM 6	10	683.55	X cut in concrete post for railroad fuse-box, approximately 3.6 feet above ground, approximately 27 feet east of centerline of railroad, approximately 2,100 feet north along railroad tracks from corporate limits.

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 7	10	678.73	X cut in north corner of southeast (downstream left bank) abutment of railroad bridge over Wyalusing Creek, approximately 22 feet south of centerline of railroad tracks, approximately 75 feet east of centerline of Wyalusing Creek.
RM 8	10	678.88	Standard tablet, stamped USCGS x 55, set vertically in north abutment face of State Route 387 bridge over railroad tracks, approximately 440 feet southeast of State Route 6 and State Route 387 intersection.
RM 9	10	677.561	Standard tablet, stamped USCGS x 53 1934, in northwest corner of pad of railroad transformer box (nonexistent), marked by witness post, approximately 440 feet east from State Route 387 along railroad.
RM 10	10	674.84	X cut in southwest corner of concrete pad of railroad transformer box (nonexistent), approximately 10.5 feet northeast of centerline of railroad tracks, approximately 105 feet southeast of centerline of State Route 6, approximately 376 feet southeast of railroad exchange.
RM 11	10	669.91	Flush with top of letter T in word Between, on Friedenshutten (Moravian Society) monument, on side facing railroad tracks, approximately 185 feet south of railroad tracks.
RM 12	10	650.38	X cut in northeast corner of stone slab, fifth slab west of east side of abandoned foundation, approximately 120 feet northwest of edge (left bank) of the Susquehanna River.
RM 13	10	670.22	Vertical X cut in concrete post, approximately 3 X 7 inches X 7 feet 7 inches, used for transmission box for railroad, approximately 3.5 feet above ground, approximately 13 feet west of centerline of railroad tracks, approximately 200 feet northeast of railroad mile marker 232.



FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF WYALUSING, PA

(BRADFORD CO.)

01P

FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF WYALUSING, PA

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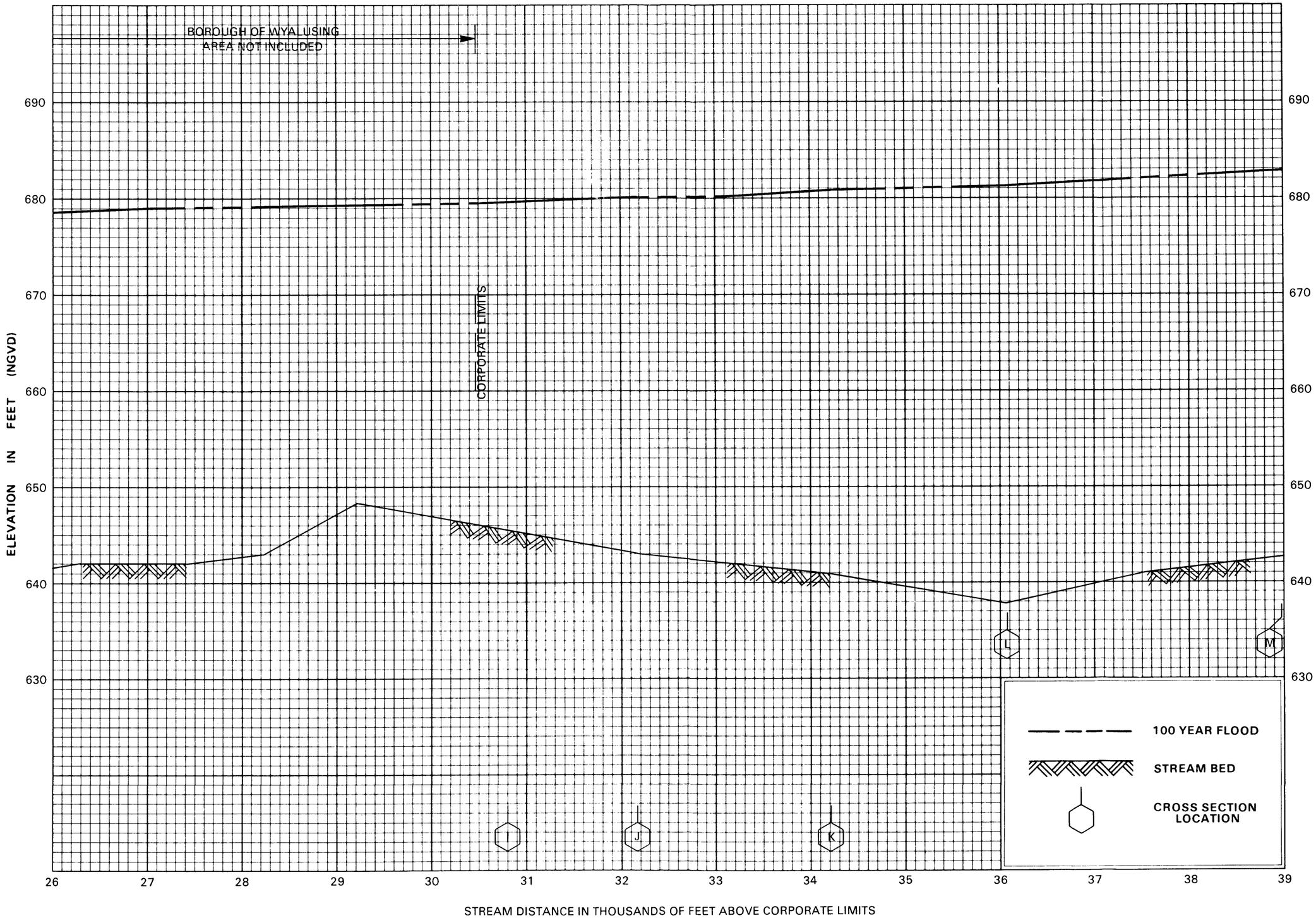
02P



FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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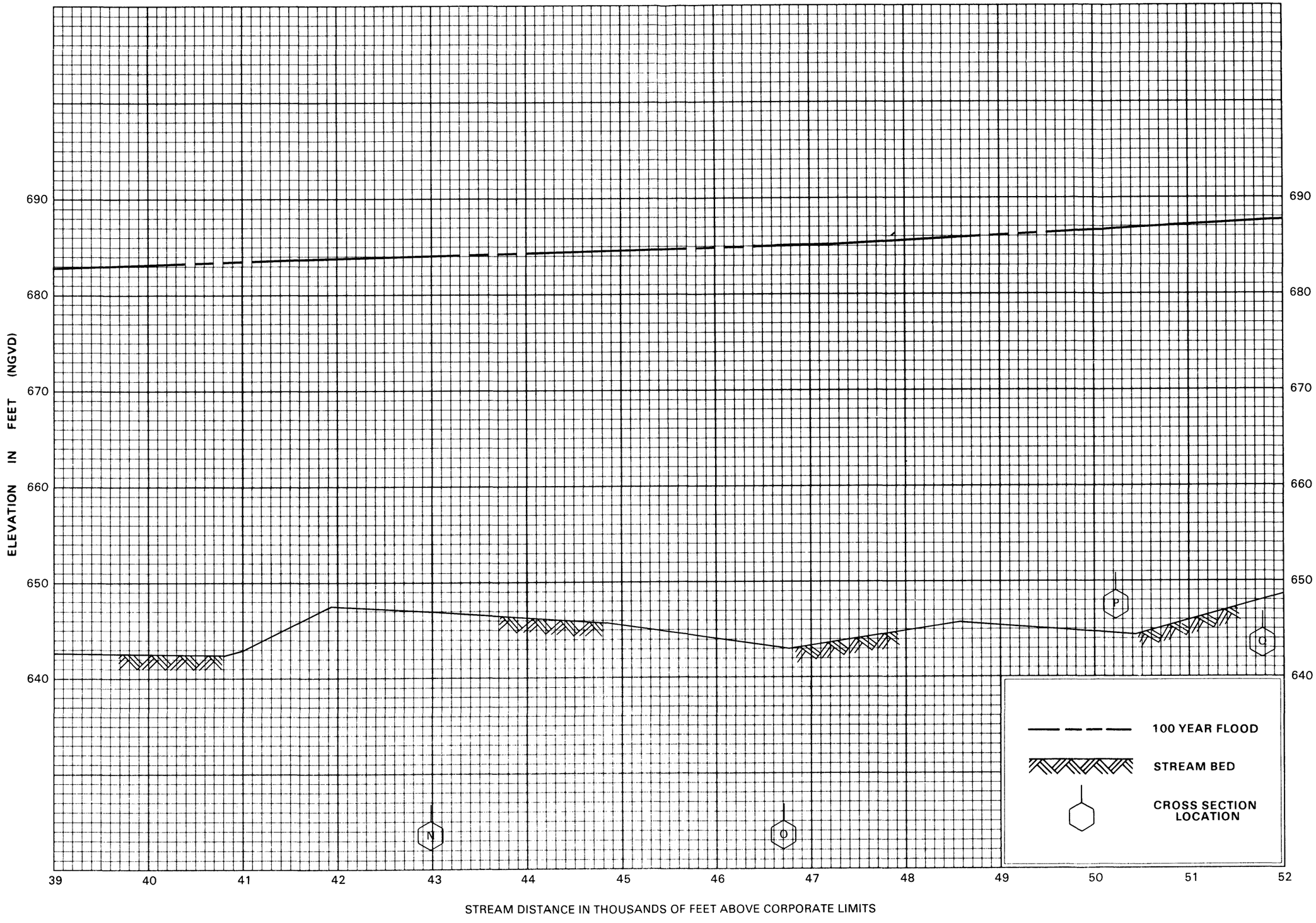
03P



FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF WYALUSING, PA

(BRADFORD CO.)

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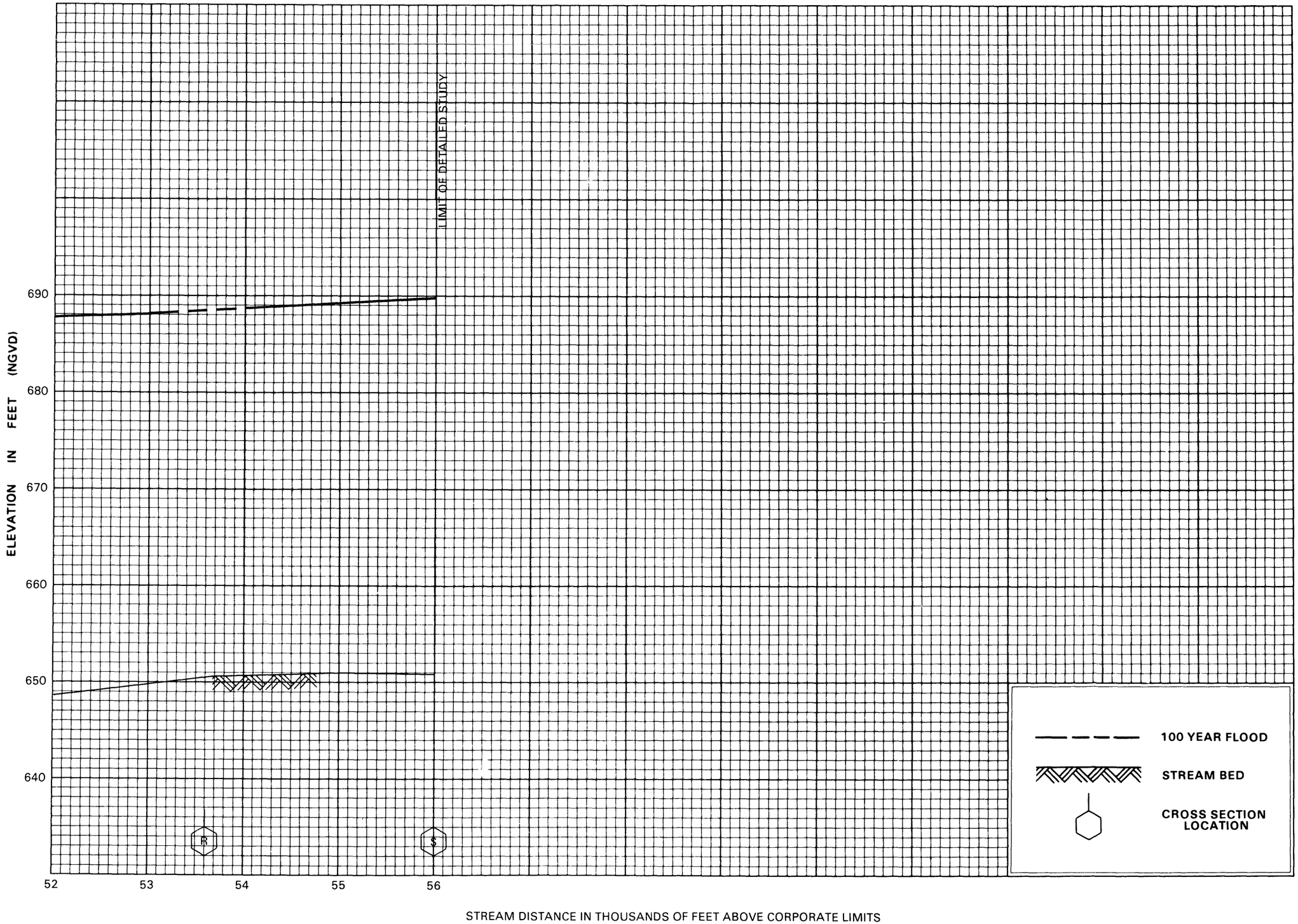

FLOOD PROFILES

SUSQUEHANNA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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