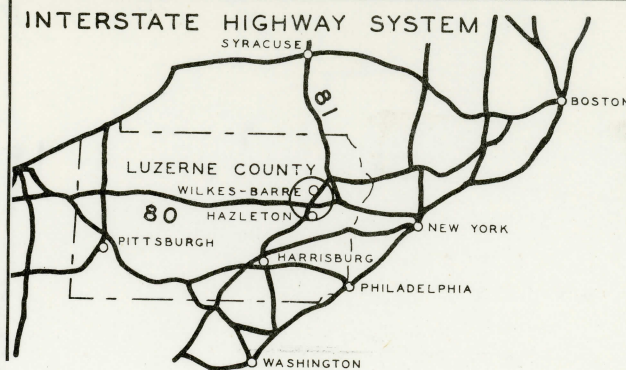


Flood Recovery Task Force, Inc. Flood Control
Report: Tropical Storm Agnes, 1973 December.

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M E M O R A N D U M

TO: Community Leaders In The Wyoming Valley

FROM: Luzerne County Planning Commission and the Economic Development Council
of Northeastern Pennsylvania

SUBJECT: WILBUR SMITH REPORTS.

DATE: July 2, 1974

Enclosed for your information and files are complimentary copies of the four (4) Wilbur Smith final reports of a Sketch Plan For The Wyoming Valley. They are as follows:

Planning and Development Considerations.
An Analysis Of Educational Facilities.
Flood Control Report.
Planning and Development Considerations.
(Small summary report of the three above).

These reports were subsidized by the Department of Housing and Urban Development, the Appalachia Regional Commission and the Economic Development Administration.

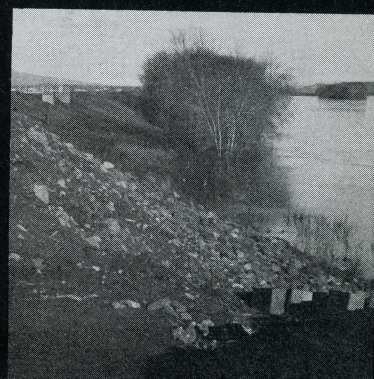
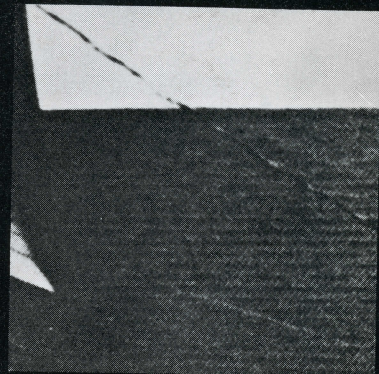
They represent the thinking of many community leaders in the Valley , as well as the County Planning Commission and Economic Development Council.

Extra copies of the Summary Brochure are available in quantity, and a limited supply of the other reports, upon request.

EH/mss
Enc:

Flood Control Report

TROPICAL STORM AGNES • WYOMING VALLEY, PENNSYLVANIA



WILBUR SMITH AND ASSOCIATES

TITLE: Flood Control Report Tropical Storm Agnes,
Wyoming Valley, Pennsylvania

AUTHOR: Wilbur Smith and Associates,
Consulting Planners and Engineers
Planning Division
Columbia, South Carolina

SUBJECT: An analysis of the Effect of Tropical Storm
Agnes on the Wyoming Valley, Pennsylvania

DATE: December 8, 1973

PLANNING AGENCIES: Economic Development Council of Northeastern
Pennsylvania
Luzerne County Planning Commission

SOURCE OF COPIES: Economic Development Council of Northeastern
Pennsylvania
P. O. Box 777
Avoca, Pennsylvania 18641

Luzerne County Planning Commission
Luzerne County Courthouse
Wilkes-Barre, Pennsylvania

HUD Regional Office Library
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Philadelphia, Pennsylvania

HUD PROJECT NUMBER: CPA-PA-03-26-1048/ARC-73-84

SERIES NUMBER: 2 (of 3)

NUMBER OF PAGES: 26

ABSTRACT: The flood control report investigates the levels
and degree of damage of past floods and relates
the causes for the extensive flooding during
Tropical Storm Agnes. Recommendations are
given for future prevention of flooding during
a 100-year flood. An analysis of work performed
by the Army Corps of Engineers and their future
proposals was also prepared.

Wilbur Smith and Associates

TRANSPORTATION AND URBAN PLANNING CONSULTANTS

212 SOUTH 17TH STREET

Philadelphia, Pa. 19103

December 8, 1973

Mr. Edward Grossman

Executive Director

Economic Development Council

of Northeastern Pennsylvania

Pocono, Pennsylvania

Flood Control Report

Tropical Storm Agnes

Wyoming Valley, Pennsylvania

Mr. Edward Heiselberg, Director

Lucerne County Planning Commission

County Courthouse

Wilkes-Barre, Pennsylvania

Prepared for

Economic Development Council

of Northeastern Pennsylvania

Enclosed you will find the printing of the Flood Control

Report for the Wyoming Valley, Pennsylvania. The final of the

Planning and Development Report have also been forwarded.

Lucerne County Planning Commission

It has been our pleasure to work with the various members of

each staff over the preceding year. Each member has added invaluable

information that has been incorporated into this study.

Respectfully submitted,

WILBUR SMITH AND ASSOCIATES

Prepared by

Wilbur Smith and Associates

December, 1973

-PA-

Wilbur Smith and Associates

TRANSPORTATION AND URBAN PLANNING CONSULTANTS

313 SOUTH 17TH STREET

Philadelphia, Pa. 19103

December 8, 1973

Mr. Howard Grossman
Executive Director
Economic Development Council
of Northeastern Pennsylvania
Avoca, Pennsylvania

Mr. Edward Heiselberg, Director
Luzerne County Planning Commission
County Courthouse
Wilkes-Barre, Pennsylvania

Dear Sirs:

Enclosed you will find the final printing of the Flood Control Report for the Wyoming Valley, Pennsylvania. The finals of the Planning and Development Considerations and the School Facilities Report have also been forwarded.

It has been our pleasure to work with the various members of each staff over the preceding year. Each member has added invaluable information that has been incorporated into this study.

Respectfully submitted,

WILBUR SMITH AND ASSOCIATES

ACKNOWLEDGEMENT

We wish to express our gratitude for the great assistance received from the Economic Development Council of Northeastern Pennsylvania and the Luzerne County Planning Commission during completion of the work involved in the Planning and Development Considerations for the Wyoming Valley, Pennsylvania. We wish to also thank the various Redevelopment Agencies, public officials and private individuals that have made our data gathering simpler and whose help and friendships have been most rewarding. We would also like to thank the many private citizens of the Valley and the Citizen Committees that have given us their help and understanding. Finally, our thanks are extended to the individuals within the State and Federal agencies that have helped us during the course of this study, these include:

Pennsylvania Department of Community Affairs;

Pennsylvania Office of State Planning and Development;

Federal Regional Council;

U. S. Department of Housing and Urban Development;

Army Corps of Engineers;

Economic Development Administration; and,

Appalachian Regional Commission.

We would like to offer a special thanks to Howard J. Grossman and Leonard W. Ziolkowski of the Economic Development Council of Northeastern Pennsylvania and Edward Heiselberg of the Luzerne County Planning Commission whose help has been most appreciated throughout the study.

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On June 23, 1972, tropical storm Agens hit northeastern Pennsylvania, causing one of the most devastating natural disasters in the nation's history. More than 25,000 homes were inundated and hundreds of businesses were destroyed or seriously damaged. Numerous roads and public facilities were damaged or destroyed. Every municipality in the Wyoming Valley from Pittston to Nanticoke in Luzerne County was affected. The impact was widened as the clean-up began: emergency housing in nearby communities subjected their services to sudden strain, sanitary landfills were prematurely exhausted by gargantuan amounts of debris; construction workers were in heavy demand, while unemployment soared, and decent housing, in short supply before the flood, became non-existent.

In addition to this staggering impact on the urban heartland of northeastern Pennsylvania, the wet weather preceding the flood and the widespread flash flooding which occurred during the storm left few areas of the seven-county region untouched. Agriculture was disrupted over most of the region and tourism was adversely affected also. The impact of the flood was not only regional in geography, it was also regional because of the inter-dependence of the devastated areas-economically and socially-with the "linear city" which extends from Carbondale to Nanticoke.

In order to evaluate the magnitude of the devastation, the Economic Development Council of Northeastern Pennsylvania (EDCNP) undertook a series of quick surveys to determine the amount of business and residential damage inflicted upon the hardest hit communities in the Wyoming Valley. By collecting this information the EDCNP hoped that the magnitude of damage could be better determined to initiate programs geared to the area. These early reports were distributed to legislators, federal, state and local officials and nonprofit agencies.

The immense regional impact necessitated a regional response. Cooperation was required among citizens, local governments, authorities, legislators, non-profit organizations and private businesses, as well as close liaison with Commonwealth and Federal agencies. A coordinated plan of action had to be adopted which would allow the region's institutions to combine their efforts and efficiently accomplish what was needed.

By the middle of August 1972, it was determined that a planning and development strategy and concept plan should be developed for the Wyoming Valley in order to help the various private and public corporations and agencies rebuild the communities and the economic base of the Wyoming Valley.

On August 28, 1972, the Economic Development Council of Northeastern Pennsylvania was officially notified by Mr. A. Edward Simon, Director of the Office of State Planning and Development, that it was designated as the "lead agency" in the preparation of a Disaster Recovery and Comprehensive Development Plan for the Region and for the coordination of all sub-regional planning efforts and plans within the framework of state-wide disaster recovery and comprehensive planning in Pennsylvania.

The EDCNP and the Luzerne County Planning Commission jointly responded to this need by reviewing the capabilities and availability of 20 nationally and internationally known consultant firms. After an initial "talent search" it was jointly decided that 12 firms should be formally contacted to respond to a joint Request For Proposal (RFP) for the Wyoming Valley Plan.

The five firms selected were interviewed on November 8, 1972 and shortly thereafter the consulting firm, Wilbur Smith and Associates, was hired.

In the ensuing months the EDCNP created several committees in an attempt to provide inputs to the Wyoming Valley Plan and also to review and comment on the draft reports

of the consultant. Some of the committees created were a Human Resources Committee composed of various social service agency representatives in the region; a Planning and Development Committee composed of various planning and industrial development agency representatives in Luzerne County; and a Governmental Affairs Committee, composed of local elected officials and municipal administrators of the municipalities directly affected by the flood.

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FLOOD CONTROL

Flood History

Accurate flood records of the Susquehanna River in the Wyoming Valley have been maintained only since the middle 1800's. Additional data which appear to be consistent with the more accurate records date back to 1784. Table 1 reflects this information for all floods above 25 feet on the Market Street gage in Wilkes-Barre. Including the flood caused by Storm Agnes, the 25-foot stage has been exceeded 34 times since 1784.

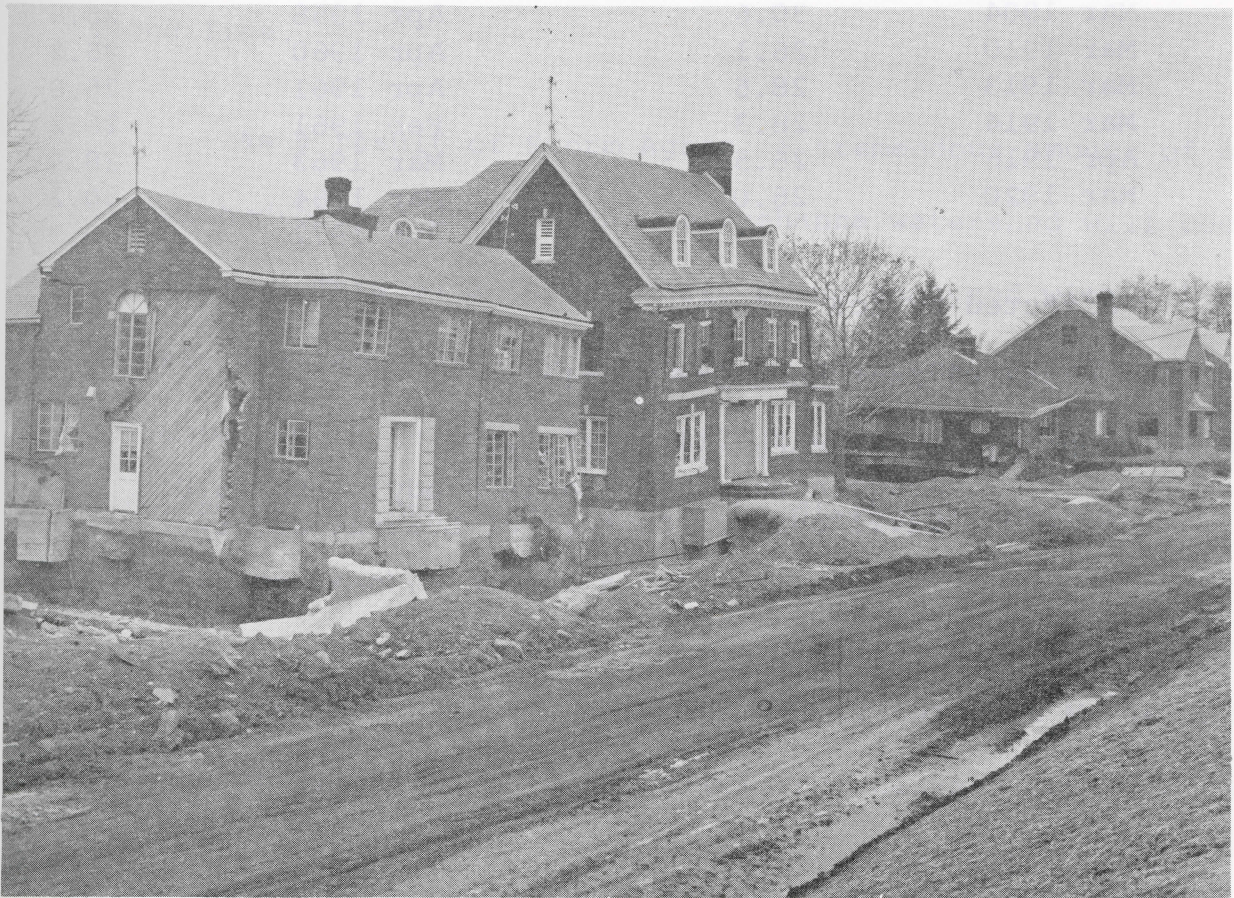


TABLE 1

HISTORICAL FLOOD DATA, WILKES-BARRE, PENNSYLVANIA
MARKET STREET GAGE

<u>DATE</u>	<u>GAGE</u>	<u>DATE</u>	<u>GAGE</u>
Mar 1784	30.0*	Feb 1925	25.1
Oct 1786	29.0	Apr 1929	26.4
Apr 1807	30.0	Jul 1935	25.4
May 1833	28.0	Mar 1936	28.8
Mar 1865	33.1	Mar 1936	33.1
Jan 1891	26.8	Apr 1940	31.5
Mar 1893	28.7*	Dec 1942	27.4
Mar 1895	27.0*	Jan 1943	29.6
Jan 1899	25.0	May 1946	32.0
Dec 1901	27.0	Mar 1948	28.8
Mar 1902	31.4	Oct 1955	26.5
Feb 1904	25.7*	Mar 1956	28.2
Mar 1904	30.6	Apr 1958	26.8
Mar 1910	26.1	Apr 1960	25.2
Mar 1913	28.5	Apr 1961	25.0
Mar 1914	28.3	Feb 1961	26.2
Apr 1916	26.5	Mar 1963	28.9
Mar 1920	26.0	Mar 1964	30.2
		Jun 1972	40.9

*Affected by ice.

0 = 512.07 Feet Mean Sea Level.

SOURCES: U. S. Corps of Engineers.
Susquehanna River Basin Study; June 1970.
Civil Defense Council of Luzerne County.

Immediately available information on the extent of storm damage in the Wyoming Valley in past years is very limited. It is estimated that the damage from the 1936 flood, the previous major flood of record prior to Agnes, amounted to about \$9,450,000. Subsequent floods, with the single exception of Agnes, have caused minor damage primarily because of the construction of the protective dikes in the area. The damage caused by Agnes has not been accurately assessed but has been estimated to be in excess of one billion dollars in the Wyoming Valley. The area flooded by Agnes is delineated on Figure 1, as well as the location of the existing levees and the preliminary 100 year flood line.

As a result of Storm Agnes, a tremendous amount of additional hydrologic data in the Susquehanna watershed will become available. This data is currently being analyzed with all previously available data by a number of agencies. Analysis is not expected to be completed until January of 1973. Particularly affected by the new data will be the discharge frequency curves for various reaches of the river.

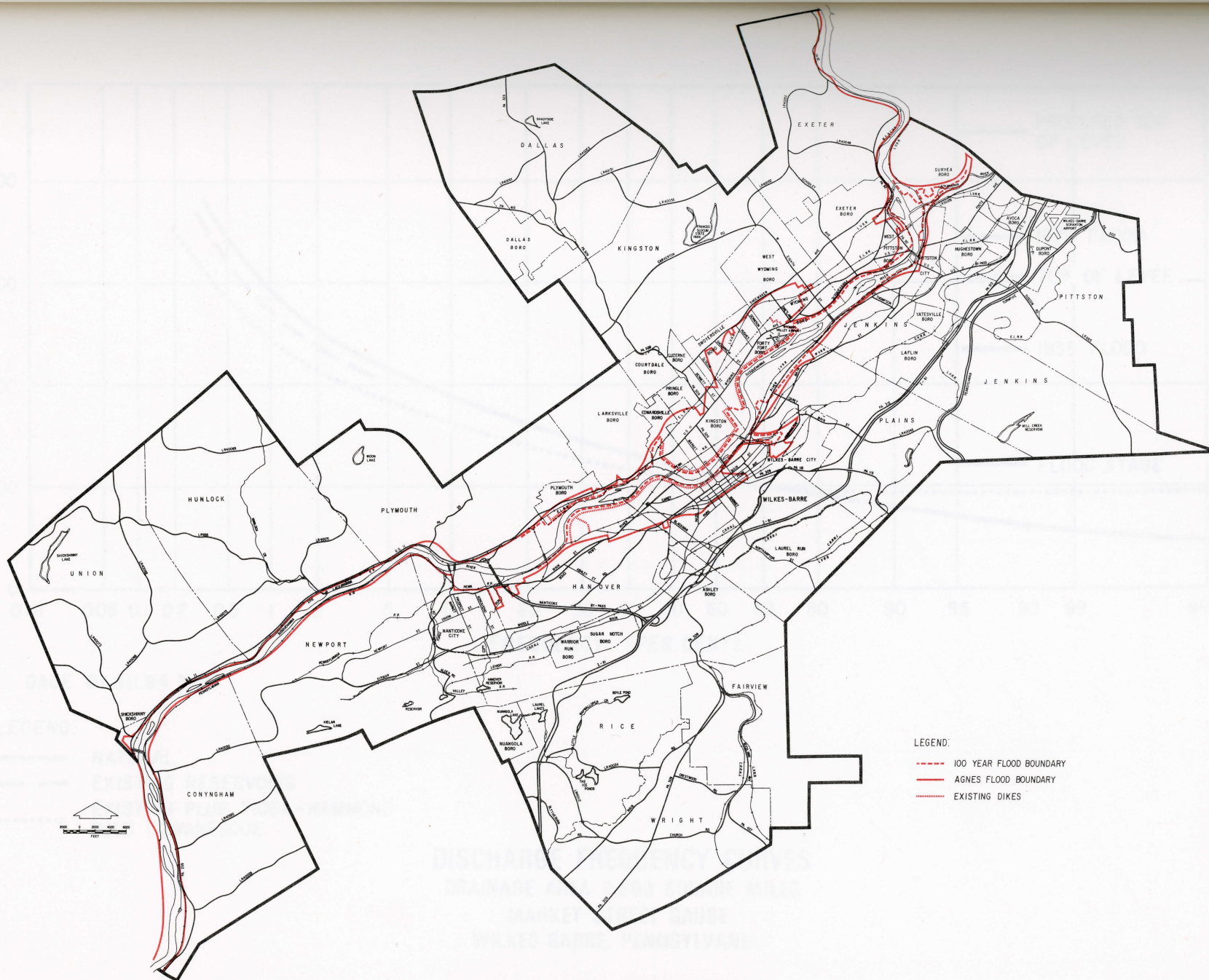
Figure 2, the discharge frequency curve at Market Street, Wilkes-Barre, is based on a preliminary analysis and is subject to continued refinement. It is, however, believed to be

sufficiently accurate for purposes of this report. Some of the principal points to be noted from this curve are these:

- 1) The 1936 flood flow of 232,000 cubic feet per second (cfs.) or by the data then available was initially believed to be about a hundred-year storm and then over the years as additional data became available was interpreted to be a fifty-year storm, and is now believed to be about a 33-year storm;
- 2) Storm Agnes at 345,000 cfs. is believed to be a 175 to 200-year storm;
- 3) 290,000 cfs. is determined to be the hundred-year storm.

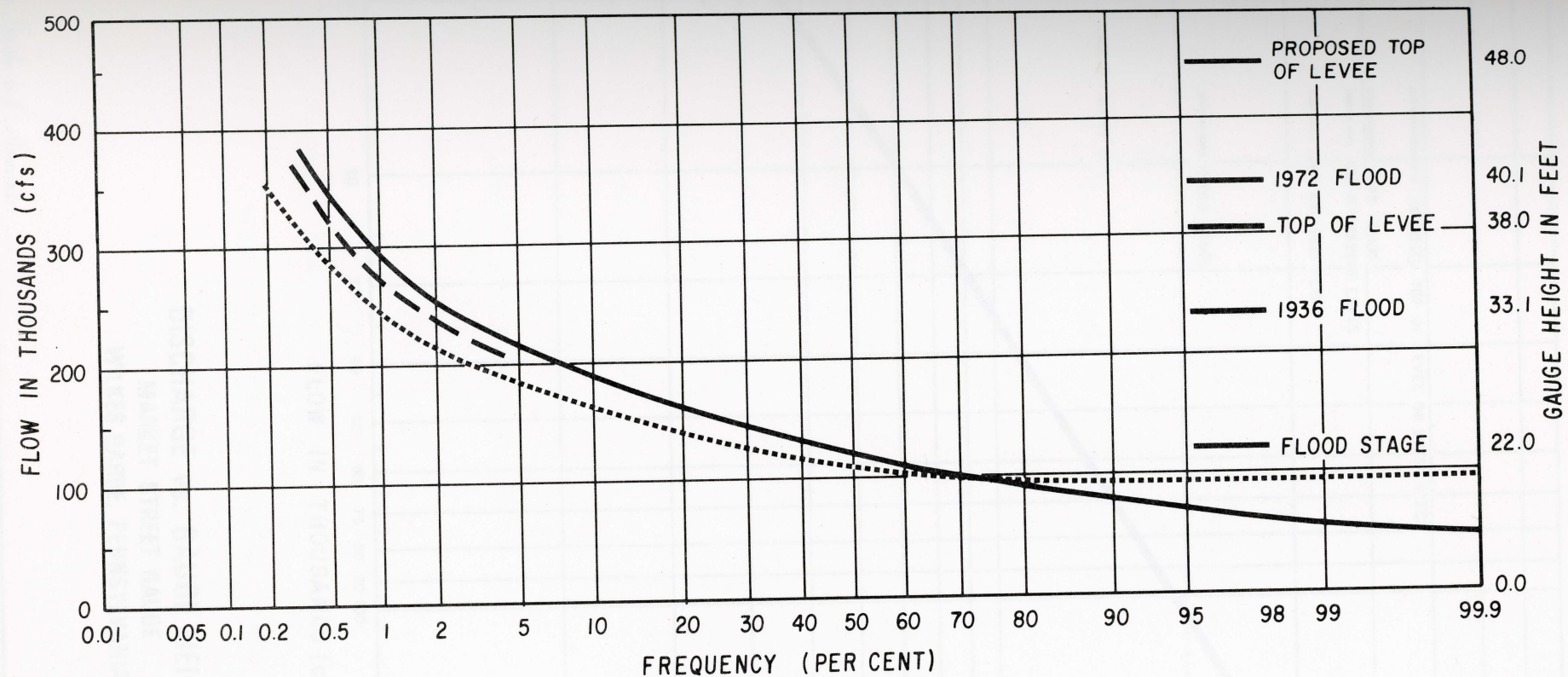
Figure 2, in addition to the natural discharge frequency curves, also displays curves indicating the effect of the existing reservoirs plus the two which have been approved for construction for the higher discharge values on the Susquehanna at Wilkes-Barre.

Figure 3 plotted on log probability paper shows the relationship between discharge and the gage elevation at Market Street.



FLOOD AREA BOUNDARY

FIGURE 1

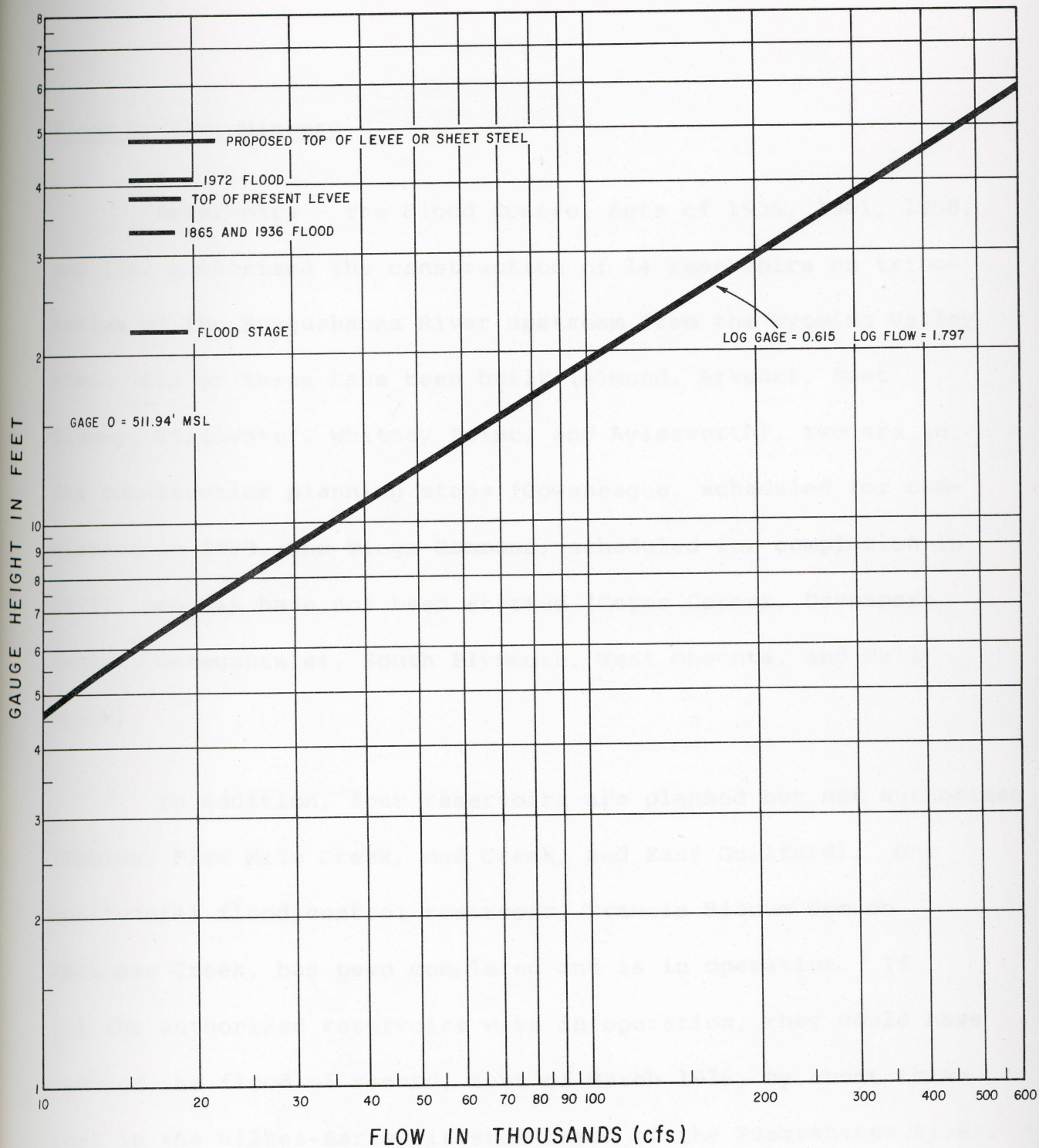


GAGE 0 = 511.94 MSL

LEGEND:

- NATURAL
- - - EXISTING RESERVOIRS
- EXISTING PLUS TIOGA-HAMMOND PLUS COWANESQUE

DISCHARGE FREQUENCY CURVES
 DRAINAGE AREA 9,960 SQUARE MILES
 MARKET STREET GAUGE
 WILKES-BARRE, PENNSYLVANIA



DISCHARGE vs. GAUGE HEIGHT
MARKET STREET GAUGE
WILKES-BARRE, PENNSYLVANIA

Flood Control History

Reservoirs - The Flood Control Acts of 1936, 1941, 1958, and 1962 authorized the construction of 14 reservoirs on tributaries of the Susquehanna River upstream from the Wyoming Valley area. Six of these have been built (Almond, Arkport, East Sidney, Stillwater, Whitney Point, and Aylesworth), two are in the construction planning stage (Cowanesque, scheduled for completion in 1979, and Tioga-Hammond, scheduled for completion in 1977), and six have not been started (Copes Corner, Davenport Center, Genegantslet, South Plymouth, West Oneonta, and Fall Brook).

In addition, four reservoirs are planned but not authorized (Fabius, Five Mile Creek, Mud Creek, and East Guilford). One non-federal flood control reservoir, Francis Slocum Dam on Abrahams Creek, has been completed and is in operation. If all the authorized reservoirs were in operation, they could have reduced the flood of record, that of March 1936, by about three feet in the Wilkes-Barre-Pittston reach of the Susquehanna River. Table 2 reflects some data on these reservoirs.

TABLE 2

FEDERAL FLOOD CONTROL DAM
AND RESERVOIR PROJECTS

NAME	STREAM	PURPOSE	DRAINAGE AREA Sq. Mi.	HEIGHT Ft.	MAXIMUM FLOOD CONTROL STORAGE Ac. Ft.
<u>Completed</u>					
East Sidney	Ouleout Cr.	F.C., R	102	130	31,750
Whitney Point	Otsellic R.	F.C., R	255	95	81,400
Almond	Canacadea Cr.	F.C., R	56	90	14,240
Arkport	Canisteo R.	F.C.	30.5	113	7,950
Stillwater	Lackawanna R.	F.C., W.S.	36.8	77	11,657
Aylesworth	Aylesworth Cr.	F.C.	6.2	90	1,700
<u>In preconstruction planning or under construction</u>					
Tioga-Hammond	Tioga R. and Crooked Cr.	F.C., R	280 (T) 122 (H)	140 (T) 121.5 (H)	120,064*
Cowanesque	Cowanesque R.	F.C.	298	154	95,490
<u>Authorized</u>					
Copes Corner	Butternut Cr.	F.C.	118	75	37,900
Davenport Center	Charlotte Cr.	F.C.	164	100	52,500
Genegantslet	Genegantslet Cr.	F.C.	95	104	30,195
S. Plymouth	Canasawacta Cr.	F.C.	58	125	18,500
W. Oneonta	Otsego Cr.	F.C.	108	86	34,500
Fall Brook	Fall Brook	F.C.	4.1	67	1,400
<u>Non-Federal Flood Control Reservoir</u>					
Francis Slocum Dam	Abrahams Cr.	F.C.	6.1	51	2,400
F.C. - Flood Control		W.S. - Water Supply			
R. - Recreation		* Real Estate Acquisition Only			

Source: Susquehanna River Basin Study, June, 1970.

Levees and Appurtenances

History of Levee System - As a result of the damages

caused by the 1936 flood, Congress authorized four major flood control projects for the Wyoming Valley, Kingston-Edwardsville, Plymouth, Swoyersville-Forty Fort, and Wilkes-Barre and Hanover Township. Costs incurred by the Corps of Engineers and the year each project was completed are shown in Table 3. Cost-benefits are listed in Table 4. Principal elements of these projects are 72,330 feet of levees and 13 pumping stations. The projects were designed to contain the 1936 flood discharge of 232,000 cfs. with three feet of free-board and an additional two feet to provide for subsidence. The net result of this additional height, according to the Corps of Engineers, is a protection factor equal to a 100-year flood.

It should be noted at this time that the Federal Government through the Corps of Engineers provides funds only for capital construction of authorized local protective works. Local responsible governments must provide funds for right-of-way acquisitions, for modifications or demolition of structures and for complete operation and maintenance.

TABLE 3
COSTS OF LOCAL FLOOD PROTECTION PROJECTS

<u>PROJECT</u>	<u>FEDERAL COST.</u>	<u>ESTIMATED LOCAL COST</u>	<u>TOTAL COST*</u>	<u>YEAR COMPLETED</u>
Kingston-Edwardsville	\$ 5,072,900	\$ 379,000	\$ 5,451,900	1943
Plymouth	1,911,700	117,000	2,028,700	1948
Swoyersville-Forty Fort	2,718,700	283,000	3,001,700	1957
Wilkes-Barre & Hanover Township	<u>4,486,500</u>	<u>216,000</u>	<u>4,702,500</u>	1952
TOTAL	\$14,189,800	\$ 995,000	\$15,184,800	

* Costs to June 1968

Source: Susquehanna River Basin Study; June 1970.

TABLE 4
COSTS - BENEFITS, FOR CONSTRUCTED WORKS
ANNUAL CHARGES, ANNUAL BENEFITS, AND BENEFIT-COST RATIOS

TABLE 4
COSTS - BENEFITS, FOR CONSTRUCTED WORKS
ANNUAL CHARGES, ANNUAL BENEFITS, AND BENEFIT-COST RATIOS

PROJECT	C O S T S					B E N E F I T S		
	Total* Federal & Non-Fed Costs	Annual Charges 50 yrs@2-1/2 (.03526)	Operation & Maint	Total Annual Charges	Years in Service	Benefits to June '68	Annual Benefits	B-C Ratio
Swoyersville- Forty Fort	\$ 3,001,700	\$106,000	\$13,000	\$119,000	11	\$ 2,300,000	\$ 209,000	1.8
Kingston- Edwardsville	5,451,900	192,000	18,000	210,000	25	44,000,000	1,760,000	8.4
Wilkes-Barre & Hanover Twp	4,702,500	166,000	20,000	186,000	26	27,400,000	1,054,000	5.7
Plymouth	2,028,700	72,000	8,000	80,000	20	4,700,000	235,000	2.9
Total	\$15,184,800	\$536,000	\$59,000	\$595,000	-	-	\$3,258,000	5.5

Source: U.S. Army Corps of Engineers

In addition to the levees and attendant pumping stations, other ancillary appurtenances and flood control structures have been provided by both the federal and local governments. To cite



a few, there are impounding basins, pressure conduits, drainage conduits and pressure relief gates, debris dams on small streams, concrete flood walls and channel straightening on creeks and small streams in the area. They are outlined in more detail in the references.

Over the years as damage and mine subsidence have occurred to the levees, both the federal and local governments have executed spasmodic repairs.

Effects of Storm Agnes - Prior to Storm Agnes in November 1970, the Corps of Engineers had completed a review study on restoring the flood protection system to its as--built condition. Before it could be implemented, Agnes struck, and as noted in Figure 3, the levee was topped by three feet adjacent to Market Street and by similar amounts throughout the entire levee system.



Topping and the breaking of the levees occurred at six vulnerable locations: Wilkes-Barre Solomon Creek Pumping Station, Wilkes-Barre Connecting Railroad Bridge, Wilkes-Barre Riverside Drive and Charles Street, Swoyersville-Forty Fort Cemetery, Kingston Edwardsville-Loveland Avenue Pumping Station, and Plymouth at Ferry Street.

These breeches have been repaired by the Corps of Engineers with federal emergency funds. Repair costs were approximately \$2,700,000. Closures were completed by the beginning of August. Final drying out and repairs to the pumping stations were completed by the end of November, 1972. Temporary emergency pumps were in position to perform if required.

Using OEP funds available under PL 91-606, the Corps of Engineers is expediting the implementation of their 1970 study (Reference 2) to restore the system to the design condition. Table 5 lists the projects, the costs and the construction schedule. As of December 5, 1972, the schedule was on target. The Corps feels that when the normal spring floods arrive, the restored levees will accommodate the 100 year flood of 290,000 cfs.

During the repair of the levees, there was a difference of opinion between the Luzerne County Office of Civil Defense

TABLE 5
WYOMING VALLEY
LOCAL FLOOD CONTROL PROJECT RESTORATION-PHASE II

LOCATION & DESCRIPTION	ESTIMATED CONSTRUCTION COST	ADVERTISING	BID OPENING	AWARD	COMMENCE WORK	COMPLETE WORK
<u>Wyoming Valley</u> (Commencement of work, with the exception of Addy Asphalt's Contract is contingent upon receipt of acceptable local assurances requested on 17 November 1972)						
<u>Wilkes-Barre</u>						
Levee Raising West End Road to Fellows Ave.	(a)	29 Sep 72	10 Oct 72	11 Oct 72	14 Oct 72	12 Dec 72
Sheet Piling at Riverside Drive	1,000,000	12 Dec 72	10 Jan 73	15 Jan 73	15 Jan 73	15 Mar 73
Fill on Landside of Piling					Apr 73	30 Jun 73
Remaining Work for Complete Restoration	(b)	Apr 73	May 73	May 73	Jun 73	(b)
<u>Kingston-Edwardsville</u>						
Levee Raising Pierce Street to Market Street	(a)	29 Sep 72	10 Oct 72	11 Oct 72	14 Oct 72	12 Dec 72
Underseepage cutoff at Loveland Pumping Station (Modification of Addy Asphalt Contract)	75,000	To be negotiated			15 Dec 72	Jan 73
Remaining Work for Complete Restoration	(b)	Apr 73	May 73	May 73	Jun 73	(b)
<u>Swoyersville-Forty Fort</u>						
Levee Raising near Wyoming Avenue	(a)	29 Sep 72	10 Oct 72	11 Oct 72	14 Oct 72	12 Dec 72
Levee at Cemetery Area near Buried Sheet Piling	500,000	To be negotiated		27 Dec 72	29 Dec 72	15 Mar 73
Repair of Closure Structure at Erie- Lackawanna Railroad	50,000	21 Dec 72	11 Jan 73	25 Jan 73	1 Feb 73	15 Mar 73
Bank Stabilization near Mohawk Street	Cost Est. Pending	30 Nov 72	21 Dec 72	29 Dec 72	2 Jan 73	1 Jun 73 (c)
Remaining Work for Complete Restoration	(b)	Apr 73	May 73	May 73	Jun 73	(b)
<u>Plymouth</u>						
Remaining Work for Complete Restoration	(b)	Apr 73	May 73	May 73	Jun 73	(b)

- (a) Under Contract in Amount of \$251,300 Awarded to Addy Asphalt Co. Work Underway
(b) Scope Not Yet Determined
(c) Work to be Sequenced to Provide Stabilized Bank for Design Flood by 15 March

Source: Flood Control Wyoming Valley, Baltimore District,
U.S. Army Corps of Engineers, November, 1972.

and the Corps of Engineers over the nature and quality of repairs. At the environmental public hearing held on December 5, 1972 at Wilkes-Barre their differences seemed to be mostly resolved.



The repair work being done at the Forty Fort Cemetery still offers problems. Both horizontal and vertical displacement of the fill is occurring as the repairs are being made. Close

watch on this area is being maintained by the Corps. Reference
4 contains the details of the Corps solution to this problem
which appears to be a prudent one.

Evaluation of Additional Flood Control Protection

Susquehanna River Basin Commission - The Susquehanna
River Basin Study (Reference 1) prepared by the Susquehanna
River Basin Coordinating Committee, the predecessor to the cur-
rent Susquehanna River Basin Commission is an all-encompassing
document on the management of the water resources of the Susque-
hanna Basin. It contains a great deal of valuable information
on flood control that is of help to planners in the Wyoming
Valley. Like all of the pre-Agnes documents, the data and pro-
grams contained therein have been surpassed by Storm Agnes and they
must be reviewed with this in mind. In particular, flood damage
assessment figures and hydrologic data are out of date. The
Commission is reassessing the document and is currently preparing
broad policy objectives and guidance for the management of the
water resources of the basin.

Under the agreements and statutes creating the Commission,
all organizations planning projects affecting the water resources

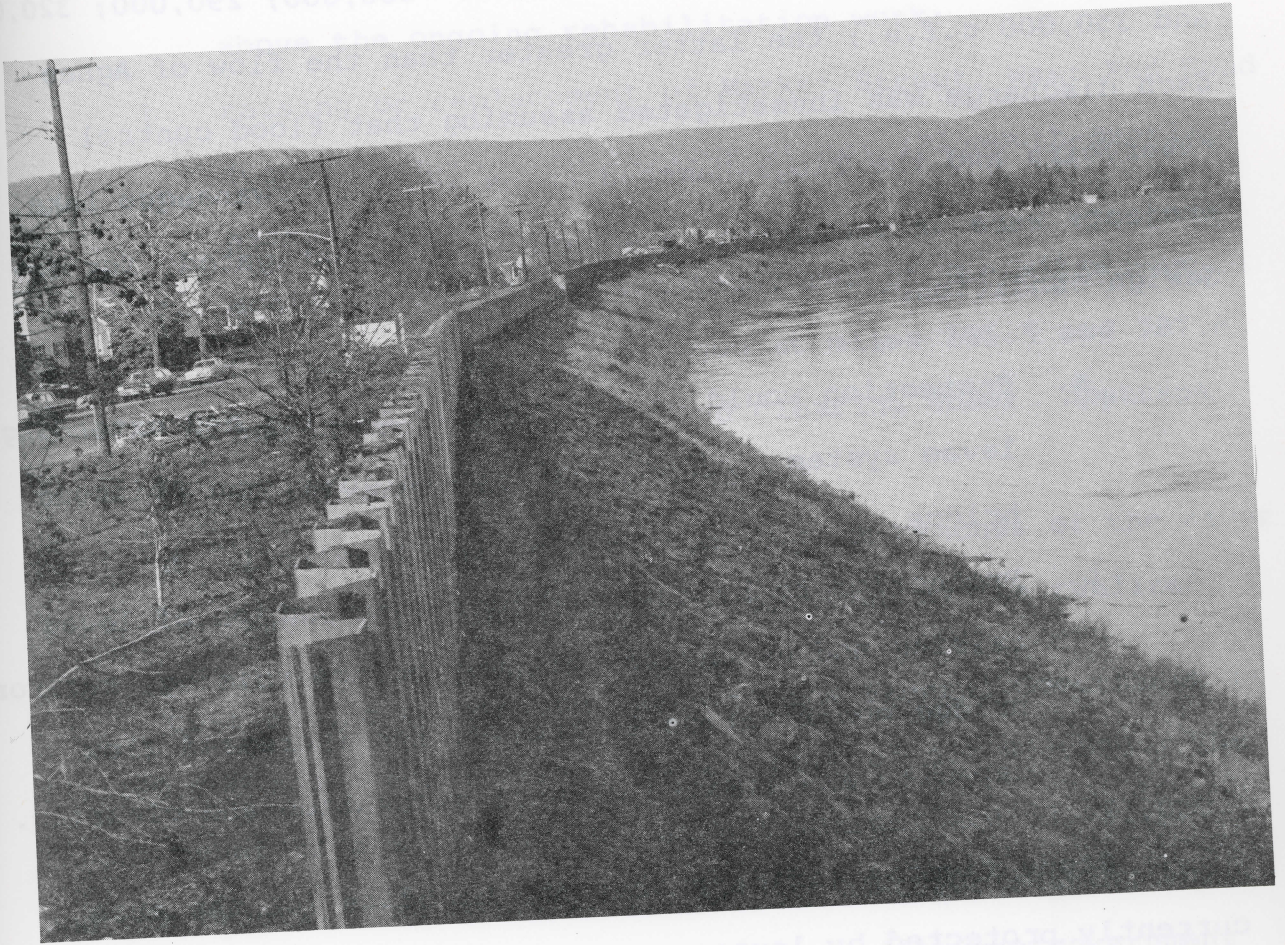
of the Susquehanna must submit them to the Commission for review and concurrence.

With this overview, all flood control projects prepared by various governmental agencies should be compatible with all others, as well as other water users in the basin, before legislative bodies authorize the projects.

Corps of Engineers - The Corps of Engineers has released some preliminary information after a first review of the data from Storm Agnes. An analysis of the information indicates:

- 1) That the design flood of 1936 (232,000 cfs.) for the current levee system was about a 33-year storm; and,
- 2) That the current levee system after repairs and restoration are completed in the spring of 1973 will be capable of accommodating a hundred-year storm (290,000 cfs.). As a result, the Corps has released a preliminary map outlining the flood plain in the Wyoming Valley (the land which has a one percent chance of being flooded in a given year) as that area between the levees on either side of the river, and the non-leveed, or unprotected areas, subject to 100 year flood potential.

A review of the data contained on Figures 2 and 3 substantiates these conclusions. It will be noted that at Market Street the levees provide about five feet of freeboard for the 1936 flood, three feet for normal safety purposes and two feet for subsidence. For the hundred-year flood (290,000 cfs.) one



foot of freeboard would be provided. With the headwater reservoir in operation, an additional foot of freeboard is provided. The completion of Cowanesque and Tioga-Hammond will provide

another foot to a foot and a half for a total of three to three and a half feet of freeboard.

The Baltimore District of the Corps of Engineers has completed a study to provide additional flood protection for the Valley. Four discharges were reviewed: 260,000; 290,000; 320,000; and 350,000 c.f.s.; the latter greater than the flow of Agnes. Each discharge was investigated assuming that flood control reservoirs and the Tioga-Hammond Lakes and the Cowanesque Lake projects were in operation, discharge was investigated, for two design conditions:

- a. Protection would be achieved by raising and extending the levee system without modifying highway and railroad bridge.
- b. Protection to be achieved by a combination of levee raising and extension, highway bridge raising, railroad bridge modification to provide for increased flow capacity and limited channel excavation and clearing.

Study figures indicate that the benefits for the area currently protected by levees exceed the cost of a project, even for a flow of 350,000 c.f.s. However, potential increased damage impact upon unprotected areas must be considered in any cost/benefit flood protection analysis.

The Corps of Engineers, after reviewing alternatives studied, testimony presented at the December 5, 1972 public meeting, and comments received from the environmental impact statement, has recommended:

- a. raising the existing levees from two to three feet above the ongoing rehabilitation work;
- b. raising or replacement of Market Street, West End Road (Carey Avenue), and Fellows Street (Plymouth-Breslau) highway bridges;
- c. modification of the substructures of The Wilkes-Barre Connecting Railroad bridges at miles 185.5 and 187.8 and channel excavation and clearing under, upstream, and downstream of the bridges;
- d. limited local channel clearing in reaches of the river where substantial stage reductions can be realized.

Cost of the recommended plan to the Federal Government is \$29,200,000 and a non-Federal (local) cost of \$32,943,000. The annual benefits are \$4,236,000, annual charges are \$3,481,000, and the benefit-cost ratio is 1.2 to 1. Cost for raising the bridges will be a capital cost assessed against the government responsible for their operation and maintenance. Federal assistance, however, may be available from Department of Transportation.

It is believed that four or five years will elapse before construction could start on the Corps project to provide additional flood protection for the Valley. The study is a complicated one with many impacted areas to consider and with



many potential alternative solutions. In addition to its effect on the Valley, the Corps must study the effect of any solution on upstream and downstream reaches of the river. Review by various local, regional, state and federal agencies as well as

the congressional process of authorization and funding will require time. Continuous pressure must be maintained on involved agencies lest time dull the memories of Agnes and the project lose its impetus.

Should the Corps study find that there is no permissible basis for recommending flood protection structures for those areas currently unprotected, the alternative of providing protection by locally sponsored and funded projects is always available. The problem of providing local funds then presents itself. Will the citizens affected feel strongly enough about protection to tax themselves to provide it? There is also the possibility of urban renewal and open space funding for protection purposes. Both approaches are currently being utilized in the Rapid City, South Dakota disaster area.

The length of time required to determine any flood protection for those areas not now protected evidently precludes them from being eligible for redevelopment loans. This will, of course, depend upon how federal flood plain policies are administered by various federal agencies.

Flood Warning System

The flood warning system in the Wyoming Valley worked well during Tropical Storm Agnes. However, the Luzerne County Civil Defense Agency is of the opinion that both rainfall measurement and flood communications could be improved upriver in New York. The result of such improvements would be an earlier and more accurate account of flooding possibilities in the Valley during critical periods. These improvements are under analysis by Civil Defense at the present time.

Operation and Maintenance of the Flood Control System

The responsibility for operation and maintenance of the local flood control system in Luzerne County is as follows: Wilkes-Barre City, Plymouth Borough and Hanover Township each maintains its individual levee system. Kingston and Edwardsville Boroughs have a joint arrangement. The county maintains the levees and flood control gates at Forty Fort and Exeter Boroughs. This multiplicity of responsibility did not appear to be a drawback during Storm Agnes. However, for simplicity of organization and control, it seems highly desirable to consolidate the responsibility under Luzerne County. (1)

Conclusions and Recommendations

The following observations are based on interviews and reports which are preliminary in substance at this point in time. As has been noted by analysts engaged in Agnes flood evaluations, more detailed studies during the next year may result in significant changes to current assumptions, which could initiate new recommendations. With this in mind, the following conclusions and recommendations are presented for initial planning activities.

Conclusions

- 1) The immediate emergency repairs to the local flood protection structures are satisfactory;
 - 2) When the current repairs and restorations of the flood protection structures to their pre-flood design condition are complete in the spring of 1973, the levees in conjunction with proper operation of the upstream reservoirs will be able to accommodate a hundred-year flood of 290,000 cfs;
-
- (1) This recommendation has been reviewed by various County agencies and the Luzerne County Board of Commissioners. For the County position on this item, refer to Appendix A.

- 3) The hundred-year flood plain has now been delineated as the area between the levees. Additionally, a preliminary 100-year flood plain line for non-leveed areas (with the exception of Shickshinny) has been presented by the Corps. Therefore, there should be no question that those built up areas protected by the levees are now eligible for HUD and SBA rehabilitation loans;
- 4) The Corps of Engineers study for additional local flood protection in the Wyoming Valley will probably not be completed and ready for construction for at least five years;
- 5) The current flood warning system in the Wyoming Valley is satisfactory; but upriver measurement and warning improvements need to be explored; and,
- 6) A detailed flood plain and flood control information system is needed to more effectively assess redevelopment and rehabilitation alternatives and constraints along the river.

Recommendations

- 1) That the Corps of Engineers be urged expedite repair and rehabilitation of the local flood control works to the 100 year flood protection level;

- 2) That the Corps of Engineers be urged to complete their study for increased flood protection for both protected and unprotected areas in the Wyoming Valley as rapidly as possible;
- 3) That when the foregoing study is complete, support be given to the option most beneficial to the area;
- 4) That the responsibility for operating and maintaining the flood control system in the Wyoming Valley be consolidated under the Luzerne County government;
- 5) That HUD and other federal agencies engaged in flood assistance efforts state publicly, and in writing their specific policies relating to public investment in unprotected areas within the 100-year flood plain; particularly with respect to federal financial assistance.
- 6) That SBA in future disaster efforts be required to coordinate with local officials, prior to dispensing individual rehabilitation loans. The indiscriminate granting of such loans in the Wyoming Valley, particularly in unprotected flood plain areas, has resulted in serious constraints to developing safer and better land utilization in flooded areas;

- 7) That local officials take specific and public positions regarding development and redevelopment in unprotected 100-year flood plain areas within their jurisdictions; and,
- 8) That consideration be given to removing the shrubs and trees on the islands in the river to accelerate water ice flow.

APPENDIX A

Director
Luzerne County Planning Commission
County Court House
Scranton, Pa.

In reference to our telephone conversation regarding the maintenance of the flood protection system, I have been advised that alternative methods of handling maintenance of this system have arrived at what appears to be the best method at this time. I have also discussed this with the County Commissioners and they agree with the following:

- (1) Luzerne County will accept a supervisory responsibility for the entire existing levee system and any additional work done by the U. S. Army Corps of Engineers.
- (2) Luzerne County will act as contracting agent for all maintenance work on the levee system, the cost of said work to be borne by each municipality. This authority would be with the County; contracts would be with the individual municipalities.
- (3) Luzerne County will offer emergency assistance, including administrative help where said help is required, in times of emergency or otherwise unusual conditions.
- (4) Luzerne County will assume responsibility for all surveying, mapping and engineering work required in connection with the projects as established by the U. S. Army Corps of Engineers.
- (5) Luzerne County will assume responsibility for all correspondence, inspections and related work as required by the U. S. Army Corps of Engineers.

COUNTY COMMISSIONERS
EDMUND
FRANK P.
ETHEL A.

7) That local officials take specific and public positions regarding development and redevelopment in the area.

*NOTE: The following letter has been reprinted with permission of the Luzerne County Planning Commission.

Mr. J.
Luzerne
Luzerne
Wilkes-Barre

Dear Sir:

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EDMUND C. WIDEMAN, JR., Chairman

FRANK P. CROSSIN

ETHEL A. PRICE

J. L. CHURNETT, JR.
COUNTY ENGINEER



LUZERNE COUNTY

WILKES-BARRE, PENNSYLVANIA

ROAD AND BRIDGE DEPARTMENT

December 22, 1972

Mr. Ed Heiselberg, Director
Luzerne County Planning Commission
Luzerne County Court House
Wilkes-Barre, Pennsylvania

Re: Flood Protection
System, Luzerne
County

Dear Mr. Heiselberg:

In reference to our telephone conversation today concerning maintenance of the flood protection system; I have considered several alternative methods of handling maintenance of this system and have arrived at what appears to be the best method at this time. I have also discussed this with the County Commissioners and they concur with the following:

(1) Luzerne County will accept a supervisory responsibility for the entire existing levee system and any additions made hereto by the U. S. Army Corps of Engineers.

(2) Luzerne County will act as contracting agent for contract maintenance work on the levee system, the cost of said maintenance to be borne by each municipality. This authority would be only procurement; contracts would be with the individual municipalities concerned.

(3) Luzerne County will offer emergency assistance, training and administrative help where said help is required on an interim basis under emergency or otherwise unusual conditions.

(4) Luzerne County will assume responsibility for all surveying, mapping and engineering work required in connection with the requirements as established by the U. S. Army Corps of Engineers.

(5) Luzerne County will assume responsibility for all correspondence, inspections and related work as required by the U. S. Army Corps of Engineers.

It will be the responsibility of each municipality to maintain the system as recommended by the County, pay all costs of maintenance, handle all emergency operations at control gates and pumping stations and to generally cooperate with Luzerne County in the total maintenance project.

The municipal responsibility will in general be identical to that which exists presently with the U. S. Government. Functional changes in supervision, engineering and administration as indicated above will require the approval of all municipalities prior to execution of an agreement.

Thank you very much.

Very truly yours,



John L. Churnetski, P.E.
Luzerne County Engineer

JLC/wd

REFERENCES

- 1) Susquehanna River Basin Study with appendices, June 1970, prepared by the Susquehanna River Basin Study Coordinating Committee.
- 2) Northeast Flood Study, Susquehanna River, Pa., prepared by the Baltimore District, U.S. Army Corps of Engineers.
- 3) Preliminary Draft Environmental Statement, Wyoming Valley Flood Control Susquehanna River, Pa., prepared by the Baltimore District, U.S. Army Corps of Engineers.
- 4) Flood Control Wyoming Valley, a handout prepared by the Baltimore District, U.S. Army Corps of Engineers.
- 5) Drainage and Flood Control Report of the Wilkes-Barre/Hazleton Metropolitan Area of Pennsylvania, prepared by the Luzerne County Planning Commission, 1961.

Standardize All References as Follows:

- 1) Name of company, Agency or business: "Title of Study," complete date, volume or number.

LIST OF CONTACTS

Nicholas Souchik; Luzerne County Civil Defense

Edward Heiselberg; Director, Luzerne County Planning Commission

Robert Bielo; Susquehanna River Basin Commission

Harold Nelson; Corps of Engineers - Baltimore District

Leonard Ziolkowski; Director of Planning - Northeast Pennsylvania
Economic Development Council

WILBUR SMITH AND ASSOCIATES

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