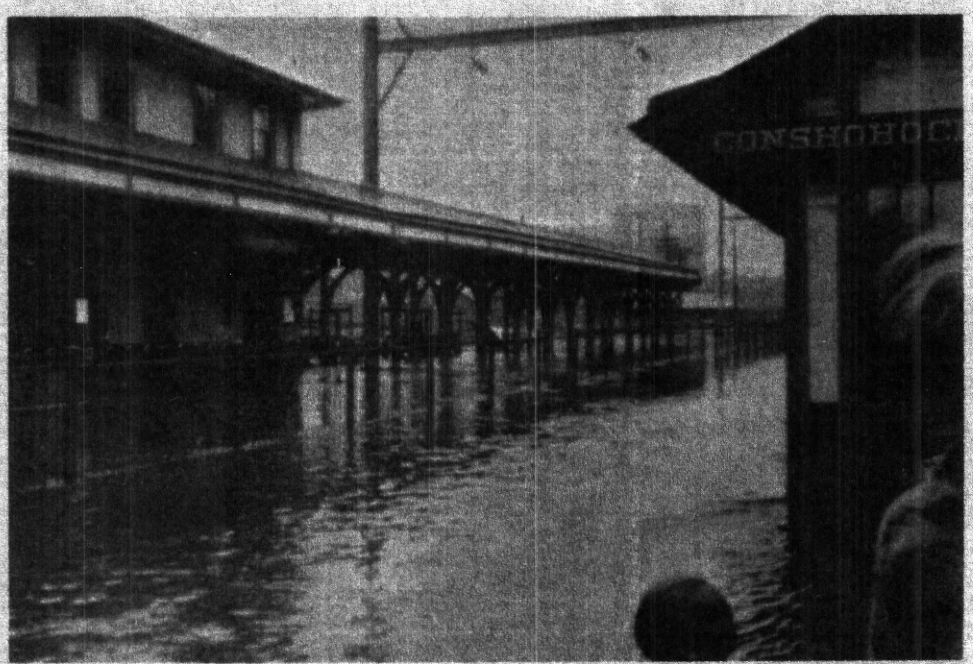
EXTENT AND FREQUENCY OF INUNDATION OF SCHUYLKILL RIVER FLOOD PLAIN FROM CONSHOHOCKEN TO PHILADELPHIA, PENNSYLVANIA

By A. T. Alter



UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Prepared in cooperation with
DELAWARE RIVER BASIN COMMISSION

Harrisburg, Pennsylvania
March 1966
Open-file report

COVER PICTURE

Flood of August 24, 1933
in Reading Railway station at
Conshohocken, Pa. Photograph
courtesy of John Wood Company.

OFR 66-2

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PREFACE

This is the second of two reports on flood inundation prepared in 1964-65 for the Delaware River Basin Commission. The first is Extent and Frequency of Floods in the Vicinity of Easton, Pa. - Phillipsburg, N. J. by George M. Farlekas. This report presents data on the frequency, extent, and depth of flooding of the lower Schuylkill River from Plymouth Dam in Conshohocken to the mouth of Wissahickon Creek in Philadelphia.

This flood inundation study is part of a program financed through a cooperative agreement between the Delaware River Basin Commission and the U.S. Geological Survey, Water Resources Division. The report was prepared under the direction of R. E. Steacy, district engineer, U.S. Geological Survey, Harrisburg, Pa.

The streamflow data for the Schuylkill River have been collected under a cooperative agreement between the U.S. Geological Survey and the Department of Forests and Waters, Commonwealth of Pennsylvania during the periods 1919-21, and 1931 to date; the Water Department, City of Philadelphia; and the Corps of Engineers, U.S. Army. In addition, records and additional data were obtained from the Montgomery County Planning Commission; Allen Wood Steel Company; Philadelphia Electric Company (West Conshohocken Gas Plant); John Wood Company, Ford and Kendig Company, C. and D. Battery Company, all of Conshohocken; Philadelphia Steel and Iron Corporation, Quaker Chemical Corporation, of Whitemarsh Township; Hamilton Paper Company of Miquon;

Container Corporation of America, Connerly Container Corporation, Mt. Vernon Machine Shop, Mrs. Paul's Frozen Foods, Wood Manufacturing Company and Philadelphia Canoe Club, all of Philadelphia; and from many local residents of Conshohocken, Spring Mill, Miquon and Gladwyne in Montgomery County and the Shawmont, Manayunk and Falls sections of Philadelphia.

CONTENTS

ILLUSTRATIONS

(Plate 1 is in pocket)

ILLUSTRATIONS

TABLES

EXTENT AND FREQUENCY OF INUNDATION OF SCHUYLKILL RIVER FLOOD PLAIN FROM CONSHOHOCKEN TO PHILADELPHIA, PENNSYLVANIA

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INTRODUCTION

Purpose and Scope

Information on flood conditions plays an important part in the development and use of river valleys. This report presents maps, profiles, and flood-frequency relations developed from past flood experience on the Schuylkill River from Conshohocken to Philadelphia, Pa. The maps and profiles are used to define the areal extent and depth of flooding of the August 24, 1933, and August 19, 1955, floods. The flood of October 4, 1869, which is the greatest flood known on the lower Schuylkill River, is presented on the flood profile and on the ten cross sections. The area inundated by the 1869 flood is not defined because insufficient data are available and because hydrologic and hydraulic conditions have undoubtedly changed to such an extent that such a definition would have little present significance. The basic flood data were prepared to aid individuals, organizations, and governmental agencies in making sound decisions for the safe and economical development of the lower Schuylkill River valley. Recommendations for land use, or suggestions for limitations of land use, are not made in this report.

The responsibility for planning for the optimum land use in the flood plain and the implementation of flood-plain regulations to achieve such optimum use rests with the State and local interests. The preparation of this report was undertaken after consultation with representatives of the Philadelphia City Planning Commission and the Montgomery County Planning Commission who expressed the need for flood-plain information and their willingness to consider flood-plain regulations.

The area covered by this report extends downstream along the Schuylkill River from Plymouth Dam in Conshohocken to the mouth of Wissahickon Creek in Philadelphia. Flooding along Wissahickon Creek is not included in the report. The reach studied extends from 13.0 miles to 21.0 miles upstream from the river mouth. All river distances used in the report are river miles upstream from the mouth of the Schuylkill River as used by the Corps of Engineer, U.S. Army and by the U.S. Geological Survey (Bogart, 1960, p. 194). For the convenience of users a tabulation of river miles of selected points upstream from the mouth of the Schuylkill River is included at the end of this report (table 1).

The River

The Schuylkill River in its lower reaches consists of a series of pools behind dams originally built in conjunction with the Schuylkill Canal. The dam farthest downstream is Fairmount Dam in Philadelphia, 8.7 miles upstream from the mouth. The pool behind Fairmount Dam extends upstream six miles to the Green Lane Bridge which is 14.5 miles

upstream from the mouth. There is a short open channel below Flat Rock Dam which is 15.9 miles upstream from the mouth. The pool behind Flat Rock Dam extends upstream almost five miles to the Fayette Street bridge in Conshohocken, from which a short open channel extends to the Plymouth Dam 21.0 miles upstream from the mouth. The open reaches of channel just below Plymouth and Flat Rock Dams were formerly bypassed by the Schuylkill Canal which had a series of locks to permit canal boats to go around the rapids in the open reaches of the river. The canal has not been used since about 1917 (White and Lindholm, 1950, p. 12). The section of the canal below Plymouth Dam has been mostly filled except for reaches of stagnant pools. The section below Flat Rock Dam is still partly maintained, but only has enough water flowing through it to avoid stagnation. There has been considerable settling of culm (coal dust sediments) from the coal mines upstream behind the dams. In recent years the culm deposits have been reduced with corresponding lowering of the flood-crest elevation as a result of the Schuylkill project impounding and desilting basins, and of dredging of the culm deposits behind the dams (See dredging of the Schuylkill River).

The Flood Plain

The channel of the Schuylkill River through the reach under study is flanked by rather steep and high banks. At low and medium stages there is no flooding, but at high stages there is extensive flooding of industrial plants at Conshohocken and on the island between the Schuylkill River and canal in Manayunk. Some idea of the extent and

depth of flooding may be obtained from the photographs included in this report (figs. 1-10). For comparative purposes photographs are shown of the same areas at the present time under non-flood conditions. Three pictures (figs. 1, 3, 5) were taken by the John Wood Company as the water started to recede from the August 24, 1933, flood. They give some idea of conditions in the industrial area of Conshohocken. Two pictures (figs. 7, 9) are of the August 19, 1955, flood, taken by the Corps of Engineers, U.S. Army. Figure 7 shows the Reading Railway station in Spring Mill after the water has receded over two feet. Figure 9 shows the Plymouth Dam still drowned out even though the river has receded two feet.

At high stages there is also flooding of houses and summer cottages along the Schuylkill River in the Shawmont Section of Philadelphia and in Miquon and Gladwyne in Montgomery County.

METHOD OF ANALYSIS

Data Available

Gage Records

A standard chain gage was maintained at mile 20.6 on the bridge between Conshohocken and West Conshohocken from June 1914 to May 1916, reestablished in October 1921 and discontinued in December 1922. Unpublished flood studies were made by Hosmer and Shade in 1915. A staff gage on the right side of the bridge was read at various times from 1933 to 1952 by the Engineering Department of the John Wood Company. The staff gage was tied to sea level on June 2, 1964. The Schuylkill River at this point has a drainage area of 1,795 square miles.

From the studies by Hosmer and Shade, the staff-gage readings, information furnished by local firms, and use of the flood profile, a table was made showing floods on the Schuylkill River at the Fayette Street bridge in Conshohocken (table 2).

A recording gage has been maintained at mile 54.3 on the Hanover Street bridge in Pottstown from 1928 to date. The river at this point has a drainage area of 1,147 square miles.

A recording gage has been maintained at mile 8.7 at the Fairmount Dam in Philadelphia from 1932 to date. A bar graph showing the gage height of known floods exceeding 12.0 feet at this site is shown as figure 11. The river at this point has a drainage area of 1,893 square miles.

Field Investigation

Field investigation in the summer and fall of 1964 gathered information on flood-crest elevations, areal extent of inundation, low-water surface elevation, cross sections, and other miscellaneous data. All elevations were tied to mean sea level by levels to bench marks.

Investigation of flood records on the Schuylkill River at Reading going back to 1757 indicate that the flood of September 2, 1850, was the highest flood of record on the middle Schuylkill River (Busch and Shaw, 1960, p. 59-60). Field investigation near Conshohocken disclosed highwater lines of most of the major floods whittled in a post in Frankenfield's Mill in Spring Mill. The highest of these lines was that of October 4, 1869, at an elevation of 58.28 feet above mean sea level. The September 2, 1850 flood reached an elevation of 56.88 feet at Spring Mill, which ranks it slightly higher than that

of February 28, 1902, and the second highest since 1757. The February 28, 1902, flood (56.16 feet above mean sea level) was the highest in this century; slightly higher than the August 24, 1933, flood. The September 2, 1850, flood has not been plotted on the profile, tabulated in the list of floods of the Schuylkill River at Conshohocken, or defined on the flood-frequency curve because it is only defined by one point, the mark in Frankenfield's Mill in Spring Mill. In Busch and Shaw's Report of Floods in Pennsylvania it is not mentioned at Philadelphia, but only at Reading. In the absence of more information, it was felt that the February 28, 1902, flood could be used in its place as the 1902 flood was only 0.72 feet lower at Frankenfield's Mill in Spring Mill. Flood crest elevations that have been established at various points on the Schuylkill River are tabulated in table 3.

Detailed maps of the study area prepared by the U.S. Geological Survey are available. The Geological Survey maps are $7\frac{1}{2}$-minute topographic quadrangle sheets at a scale of 1:24,000, or 1 inch equals 2,000 feet. The titles and dates of publication of the topographic quadrangles used are: Norristown, 1952 and Germantown, 1952.

Levels were run to all points in the summer of 1964 and all high-water marks, staff gages, cross sections and other elevations tied to mean sea level, datum of 1929. Throughout this report mean sea level elevation, datum of 1929, has been used for all data based on U.S. Coast and Geodetic Survey bench marks. Vertical control was maintained by a double line of levels tied to all the bench marks along the reach. To aid the user of this report, a list of bench marks

used while obtaining field data is given in table 4.

Magnitude and Frequency of Floods

There were no active gaging stations within the study reach; therefore, it was decided to develop a flood-frequency relationship for the Schuylkill River at the Fayette Street bridge in Conshohocken (mile 20.5). For a short time, a chain gage was maintained at this site and a staff gage was read at high water from 1933 to 1952. This site is also in one of the areas of major flood damage. The drainage area is 1,795 square miles.

The flood-frequency relationship was prepared using the regional curves defined by Tice (1958) for the main stem of the Schuylkill and Delaware Rivers. The curve was compared with a correlation of flood elevations at Conshohocken against frequency obtained from the Fairmount Dam gage in Philadelphia, 11.8 miles downstream. Eleven floods were correlated and the results were reasonable consistent. The flood-frequency relation is shown as figure 12. The flood-crest elevations of the eleven correlated floods at the Fayette Street bridge in Conshohocken are also plotted on figure 12. A tabular listing of these floods with their recurrence interval is shown in table 2. The 1869 flood having a crest elevation of 61.7 feet at Conshohocken has a recurrence interval greater than 200 years from the flood-frequency curve (see fig. 12). Because the accuracy of the flood-frequency relation decreases as the recurrence interval becomes longer, extrapolation of flood-frequency curves is not recommended.

As applied to flood events recurrence interval is the average interval of time within which a given flood height will be equaled or exceeded once. The recurrence interval does not imply periodicity. For floods having recurrence intervals greater than 10 years, the recurrence interval is virtually inversely related to the chance of a given flood elevation being equaled or exceeded in any one year. Thus, the 25-year flood has a 4 percent (1 in 25) chance of being equaled or exceeded in any one year. At Conshohocken, for example, a flood that reaches an elevation of 59.2 feet is said to have a 50-year recurrence interval (see fig. 12). A 59.2-foot gage height could be equaled or exceeded tomorrow, again next month, and again next year, but over a long period of time, the interval between occurrences of a flood of this magnitude or greater will average 50 years.

The general relationship between recurrence interval and flood elevation on the Schuylkill River at Conshohocken is tabulated below:

Recurrence Interval (Years)	Elevation above mean sea level (feet)	Nearest historical flood to this recurrence interval
100	60.2	Feb. 28, 1902
50	59.2	Aug. 24, 1933
25	58.0	Nov. 25, 1950
15	57.2	July 9, 1935
10	56.5	Sept. 12, 1960
5	55.1	Nov. 22, 1952
2.33	53.3	-

Modification of Flood Elevations Due to Major Flood-Control Structures

The Corps of Engineers has made studies on the modification of flood elevations on the Schuylkill River due to the Blue Marsh flood-

control project. The Blue Marsh Project proposes a dam on Tulpehocken Creek with an estimated completion date of 1971. In the present study these modifications have been applied to the Schuylkill River at Conshohocken based on the U.S. Geological Survey frequency studies. The resulting modification is modest, lowering the peak of 15-year or higher floods at Philadelphia by only 0.2 to 0.4 foot, and at Conshohocken by 0.3 to 0.7 foot.

The modified flood elevations for the Schuylkill River at Conshohocken have been plotted on the flood-frequency relation curve for Conshohocken, figure 12.

Flood Profiles

The profiles of floods along the Schuylkill River (fig. 13) have been constructed from high-water marks and from information provided by local residents and surveyed in the summer of 1964. Elevations of the low-water surface were obtained on October 9, 1964. Some industries read staff gages in time of high water and, where practicable, these gages have been tied to sea level elevation and the high-water readings utilized. Table 3 contains a listing of the high-water marks used.

Most of the information and floodmarks were obtained for the floods of August 24, 1933, and August 19, 1955; the former because it caused extensive damage in Conshohocken, Gladwyne, Miquon and in the Manayunk section of Philadelphia, and the latter because it was the most recent high flood.

Sufficient marks were obtained for the floods of October 4, 1869,

(highest of historical record) and February 28, 1902, to plot the approximate flood profile, following the general shape of profiles for the 1933 and 1955 floods. A single mark was obtained on the September 1850 flood. Profiles are not shown for the September 1850 flood because it was only slightly higher than the 1902 flood, and insufficient information was available for determining a reliable profile. A 17-year flood (July 9, 1935) was selected to be shown on the profile as an example of a low flood, but one severe enough for people to note high-water marks. The profile is based on two high-water marks and the general shape of the profiles for the 1933 and 1955 floods.

The low-water profile of the water surface on October 9, 1964, has been plotted on the same sheet for comparative purposes.

At flood stages the Plymouth Dam is, for all practical purposes, drowned out although there is undoubtedly a great deal of turbulence at the dam. A photograph (fig. 9) taken by the Corps of Engineers, U.S. Army, during the August 19, 1955, flood shows the Plymouth Dam still drowned out even though the stage has fallen over two feet. Flat Rock Dam is too high to be drowned out, there being a considerable drop even at the highest stages.

At high stages there appears to be a constriction near the Green Lane bridge and Reading Railway bridge in Manayunk. A considerable drop in flood elevation was indicated from high-water marks of both the 1933 and 1955 floods.

USE OF FREQUENCY AND PROFILE RELATIONS

Use can be made of this report to show areas that would be flooded at specific frequencies and the depth of flooding.

For example, a flood at an elevation of 59.2 feet at the Fayette Street bridge in Conshohocken (equal to the August 24, 1933, flood) is approximately a 50-year flood (that is, two floods equal to or exceeding 59.2 feet can be expected in 100 years, on the average). The extremely irregular distribution of floods on the Schuylkill River is illustrated by figure 11, showing floods above 12.0-foot gage height at the Fairmount Dam gage in Philadelphia. Between 1942 and 1950 (9 years) there were four floods over 12.0-foot gage height. In a similar 9-year period (1956-64) there were no floods over 12.0-foot gage height. Twelve feet was used as the base because 12 feet represents the bankfull stage at Fairmount Dam (Busch and Shaw, 1960, p. 65).

Areal Extent of Flooding

The approximate areas inundated during the floods of August 24, 1933, and August 19, 1955, are shown on plate 1. The areas are marked on a composite map made from the $7\frac{1}{2}'$ quadrangles for Norristown and Germantown and enlarged by the U.S. Geological Survey. Inundated areas shown on tributaries are those that would be flooded by backwater from the Schuylkill River only. More severe flooding on the small streams than that shown could result from heavy local thunderstorms.

The areal extent of flooding for any frequency of flood can be obtained in the following manner:

1. Determine the flood elevation for Conshohocken from the flood-frequency curve, figure 12.

2. Locate the relative position of the selected flood with respect to the known floods plotted on the profile. For example, a 20-year flood would have a flood elevation of 57.6 feet at the Fayette Street bridge in Conshohocken. This is about one-third of the elevation difference between the 1935 flood and the 1955 flood.

3. Determine the river mileage of the selected point from the inundation map and locate the flood elevation at this point from the profile.

4. Locate the point where the computed water surface elevation intercepts the ground surface.

In general, floods greater than that of August 24, 1933, will cause little additional areal inundation, but will cause a greater depth of flooding and higher currents with a corresponding increase in damage.

Depth of Flooding

The depth of flooding can be estimated by subtracting the ground elevation at any studied point from the water-surface elevation obtained from the profile in the above manner. A general idea of the depth of the flooding can also be obtained from the nearest cross section of the ten that are illustrated in figures 14-19.

In the reach above Flat Rock Dam there may be considerable variation in depth of flooding depending upon how much culm has accumulated at the time of the flood. The August 24, 1933, flood occurred after a period of considerable deposit, whereas the August 19, 1955, flood occurred soon after the pool had been dredged.

Dredging of the Schuylkill River

One of the special features encountered in the study of the Schuylkill River is the effect of culm deposits and of dredging these

deposits. Although in recent years closing of many mines and the construction of Schuylkill River impounding and desilting basins has reduced the effect of culm deposits, dredging operations have had a considerable effect on the floods along the lower Schuylkill River.

The Schuylkill River Restoration Project was initiated by the Brunner Act giving authority and power to the Sanitary Water Board of the Pennsylvania Department of Health to stop pollution entering the streams, and the Desilting Act - No. 441 of June 4, 1945, granting funds to the Water and Power Resources Board of the Department of Forests and Waters for the removal of accumulated wastes deposited in the streams. The desilting project involved the dredging of 24 million cubic yards of culm deposits in a 76-mile reach upstream from Norristown by the Commonwealth of Pennsylvania, completed by mid-1951, and the dredging of 10 million cubic yards of culm deposits in the 16-mile reach between Norristown and Philadelphia by the Federal Government in the early 1950's. Examination of the profiles of the various floods on the Schuylkill River (fig. 13) indicates that in the reach between the Fayette Street Bridge in Conshohocken and Flat Rock Dam, the August 19, 1955, flood was lower than would have been expected in comparison with other floods. The author feels this lowering was due to the dredging of this reach just before the 1955 flood. In procuring data for plotting cross sections, advantage was taken of the culm surveys made by the Schuylkill Project Office of the Department of Forests and Waters at Port Kennedy. Boat surveys probing the depth of culm above Plymouth Dam were conducted in

1960 and from Flat Rock Dam to just below the Fayette Street bridge in Conshohocken in the summer of 1964. The results of these surveys have been incorporated in the cross sections above Flat Rock and Plymouth Dams.

Limitations of Data

The data presented in this report can be useful in the safe and economical development of the lower Schuylkill Valley, but the limitations of the data should be understood.

One of the limitations in the accuracy of the data is the difficulty of obtaining accurate flood elevations many years after the occurrence of the flood studied. Much conflicting information is obtained which must be resolved prior to use in the report. The higher a flood, the more memorable it generally is, but often the higher flood occurred long ago and witnesses are scarce. In the present instance the August 24, 1933, flood was much more destructive than that of August 19, 1955, and consequently more generally remembered even though over 30 years have elapsed since its occurrence.

With the passage of time bank and channel conditions are often changed. New buildings and highways are constructed, encroachments and fills may limit the channel, streambeds scour or fill, new bridges may constrict the channel, or stream clearance may facilitate flow. Flat Rock Dam was rebuilt in 1904, which may raise some question about the 1869 and 1902 profiles in this vicinity. However, while many of the wooden-crib dams built on the Schuylkill River for use with the Schuylkill Canal were later replaced by dams of masonry construction,

the replacement dams were generally built at the same elevation to facilitate canal operations and maintain the established river level. For example, Fairmount Dam in Philadelphia was rebuilt in 1922, the new masonry dam being built at almost the same elevation as the old wooden-crib dam. In this report the gradual filling of the Schuylkill Canal in Conshohocken and the deposit and dredging of culm in the channel undoubtedly had an effect on flood elevations. In general, however, the flood elevations and profiles for the several floods showed a surprisingly high degree of conformity.

A further limitation in the accuracy is the relatively short period of adequate data for use in the flood-frequency relations. The user of this report should bear in mind the danger of large errors from extrapolating the flood-frequency curves beyond 100 years.

Finally, although the effect of the planned Blue Marsh flood-control project and other flood-control projects have been carefully studied, the actual effects may be more or less than expected. Even though projected flood-control projects may reduce the frequency of flooding, not all future flooding will necessarily be eliminated and flood planning will still be needed.

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Figure 1.--Schuylkill River and canal spilling over into Conshohocken upstream from Fayette Street Bridge on August 24, 1933. Canal passes under ramp in center, Schuylkill River is off photo to left. Photograph courtesy of John Wood Company.

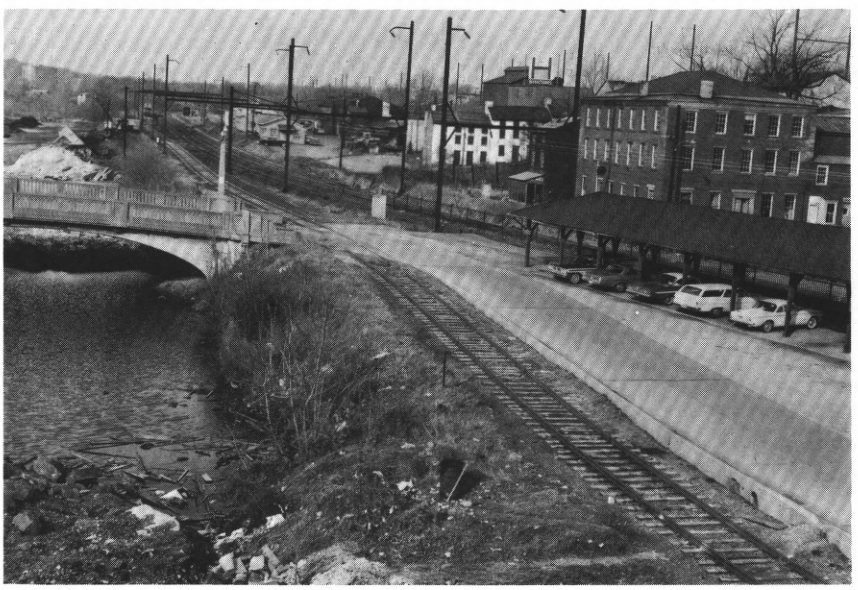

Figure 2.--Same site thirty-three years later. Schuylkill Canal has been filled except for stagnant pool in foreground.

Figure 3.--Reading Railway station at Conshohocken on August 24, 1933. Water has receded about eight inches from peak. Photograph courtesy of John Wood Company.

Figure 4.--Reading Railway station at Conshohocken thirty-three years later.

Figure 5.--Flooding downstream from Fayette Street Bridge in Conshohocken on August 24, 1933. Water has receded about eight inches from peak. John Wood Company plant on right. Photograph courtesy of John Wood Company.

Figure 6.--Same site thirty-three years later.

Figure 7.--Schuylkill River at Reading Railway station at Spring Mill on August 19, 1955. River has receded over two feet from peak. Photograph courtesy of Corps of Engineers, U.S. Army.

Figure 8.--Same site in 1966. Walker Company pumphouse is in background, Schuylkill River is down bank behind the pumphouse.

Figure 9.--Schuylkill River at Plymouth Dam on August 19, 1955. River is receding. Dam is still completely drowned out. Photograph courtesy of Corps of Engineers, U.S. Army.

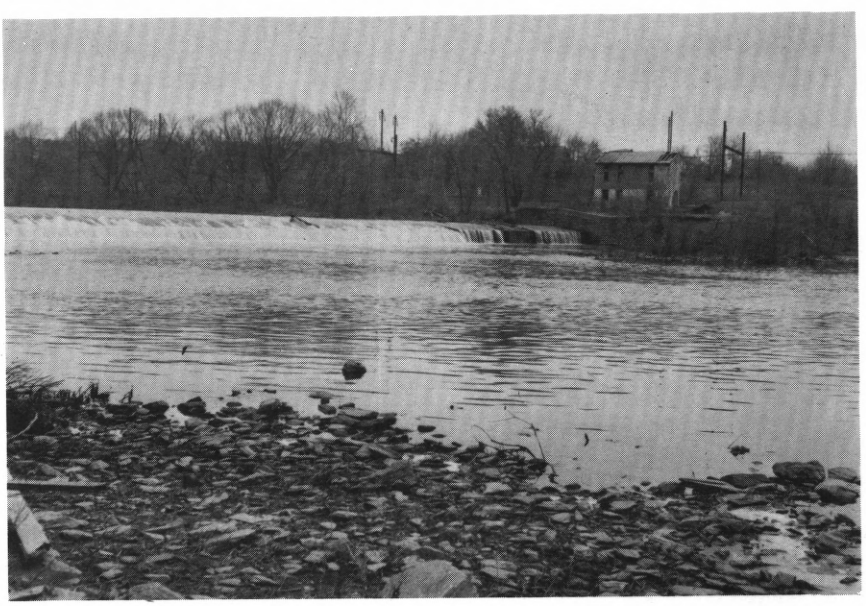

Figure 10.--Same site in 1966. Old dam tender's house is across river on left bank.

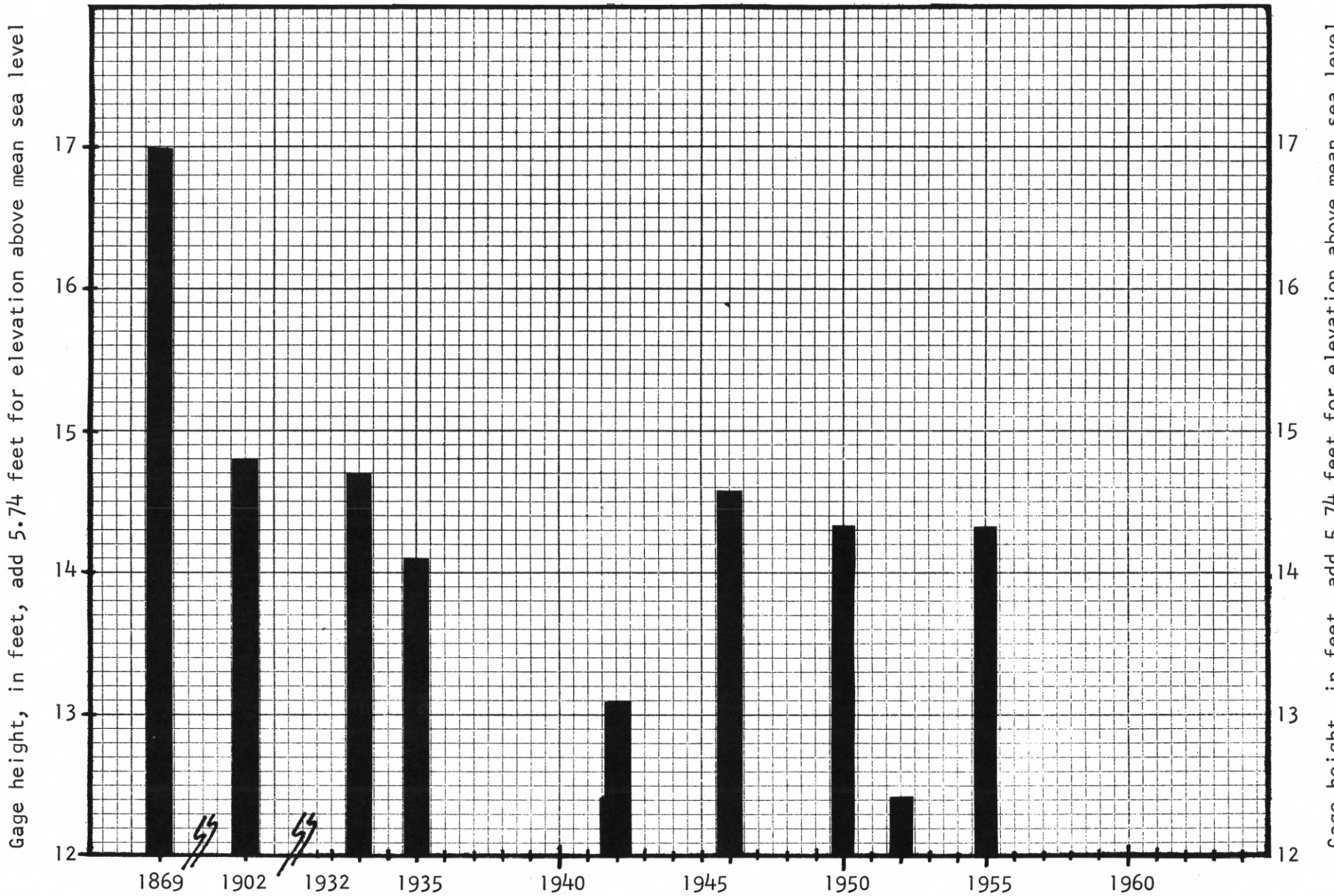

Figure 11.--Floods above 12.0-foot gage height, Schuylkill River at Philadelphia, Pa. 1932-64 and showing historical floods of 1869 and 1902.

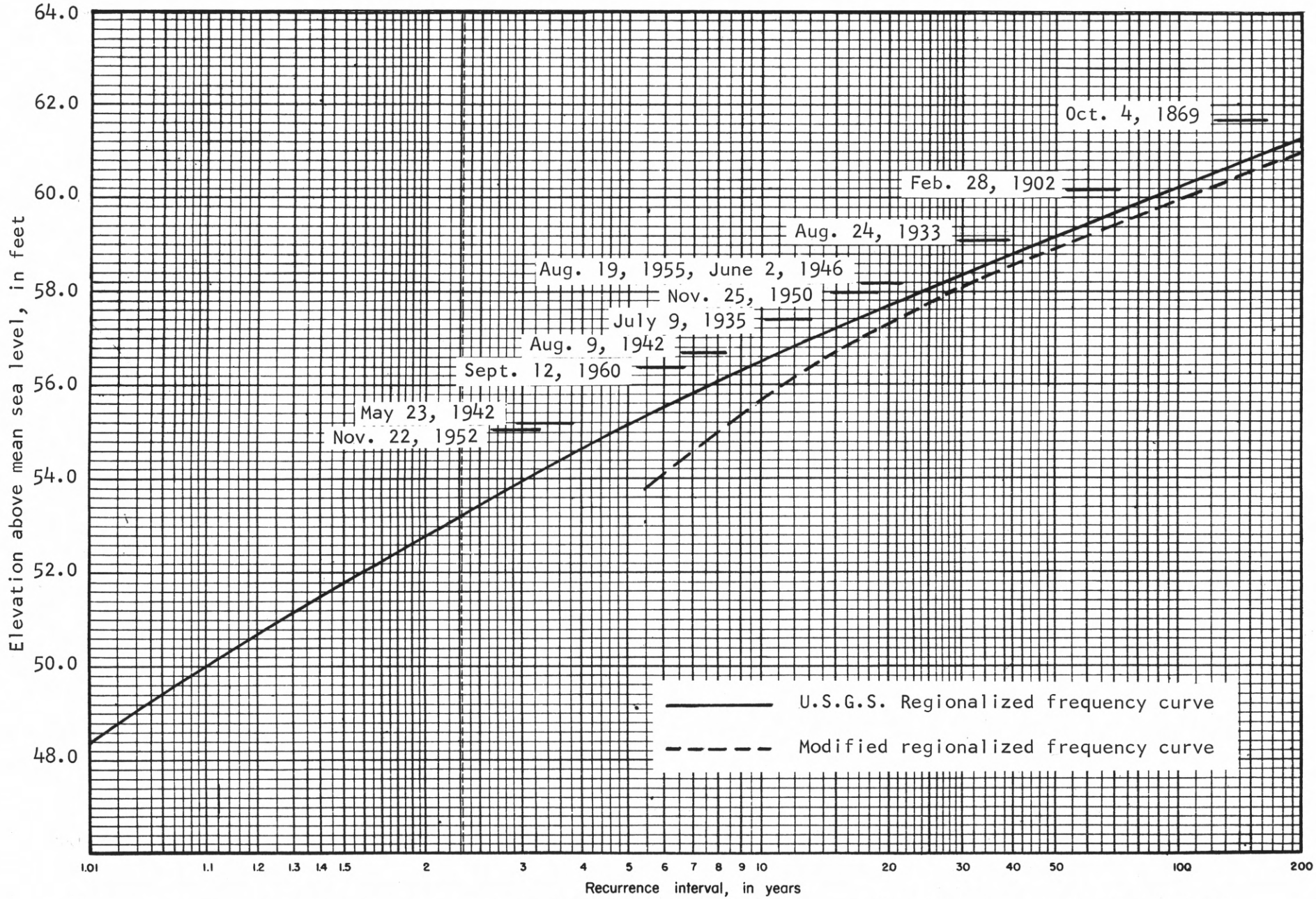

Figure 12.-- Frequency of floods on Schuylkill River at Conshohocken, and modified curve showing reduced flood elevations due to major flood-control structures planned for the Schuylkill River.

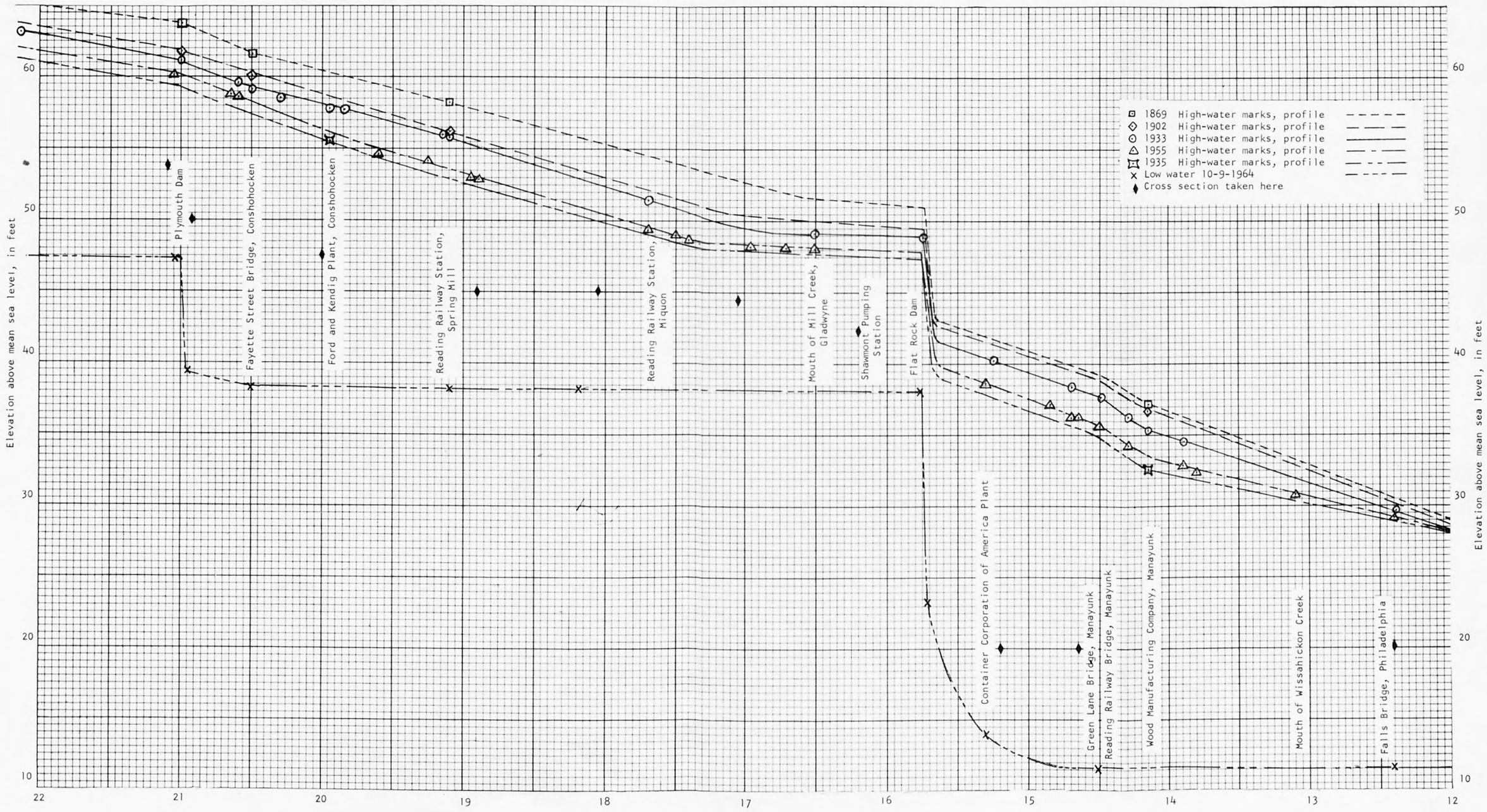

Figure 13.--Profiles of Schuylkill River

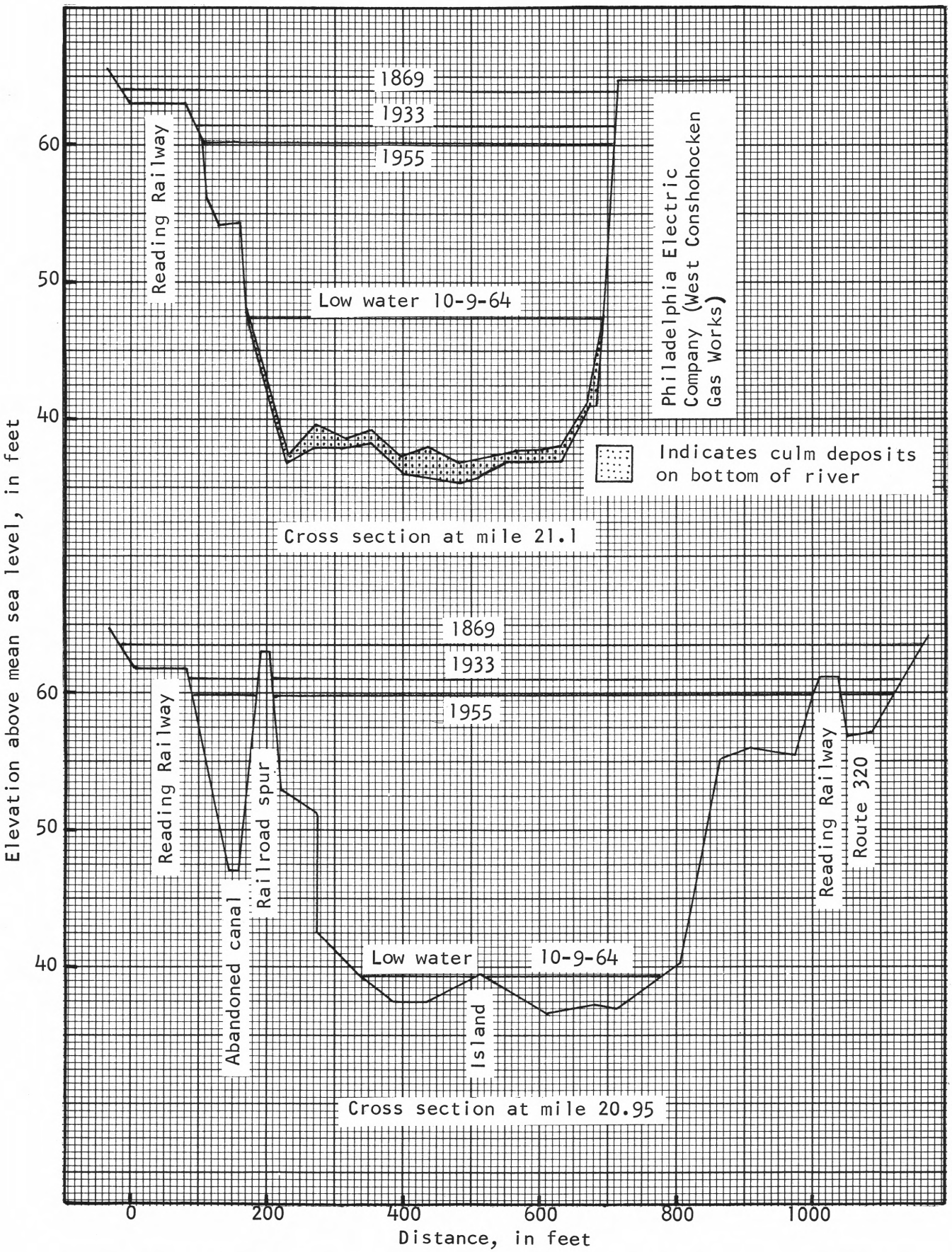

Figure 14.--Cross sections of Schuylkill River and flood plain at 21.1 and 20.95 miles upstream from mouth.

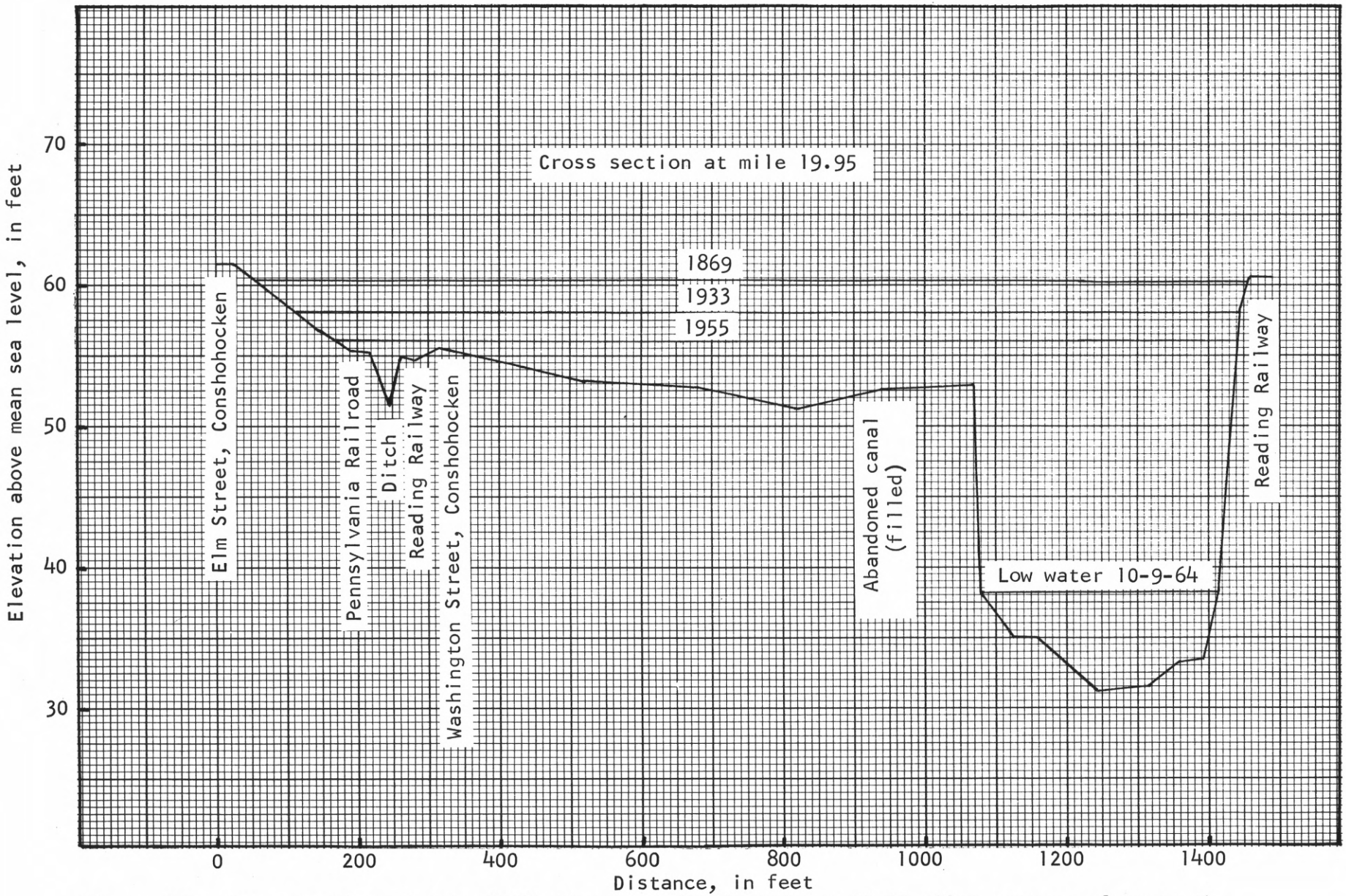

Figure 15.--Cross Section of Schuylkill River and flood plain at 19.95 miles upstream from mouth.

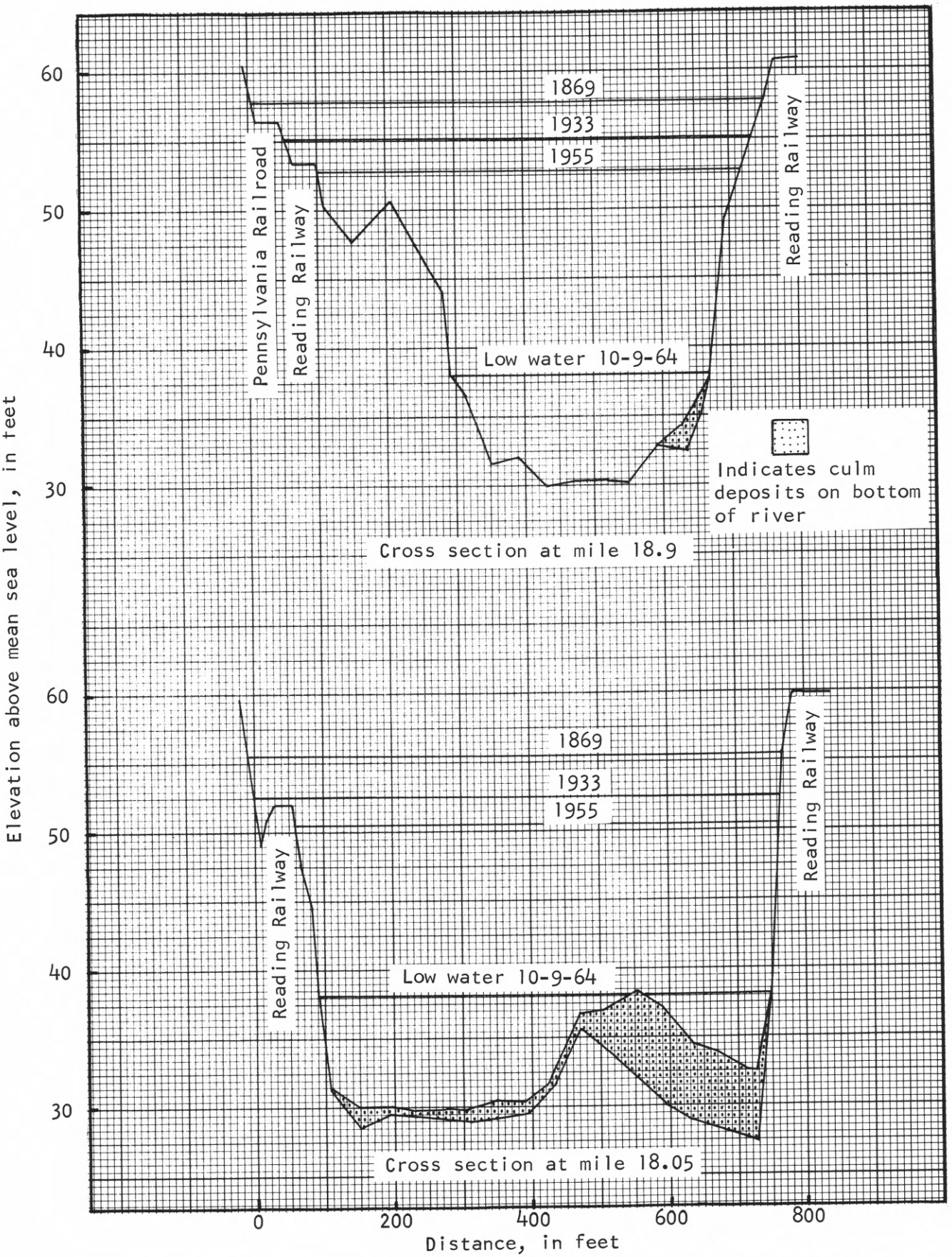

Figure 16.--Cross sections of Schuylkill River and flood plain at 18.9 and 18.05 miles upstream from mouth.

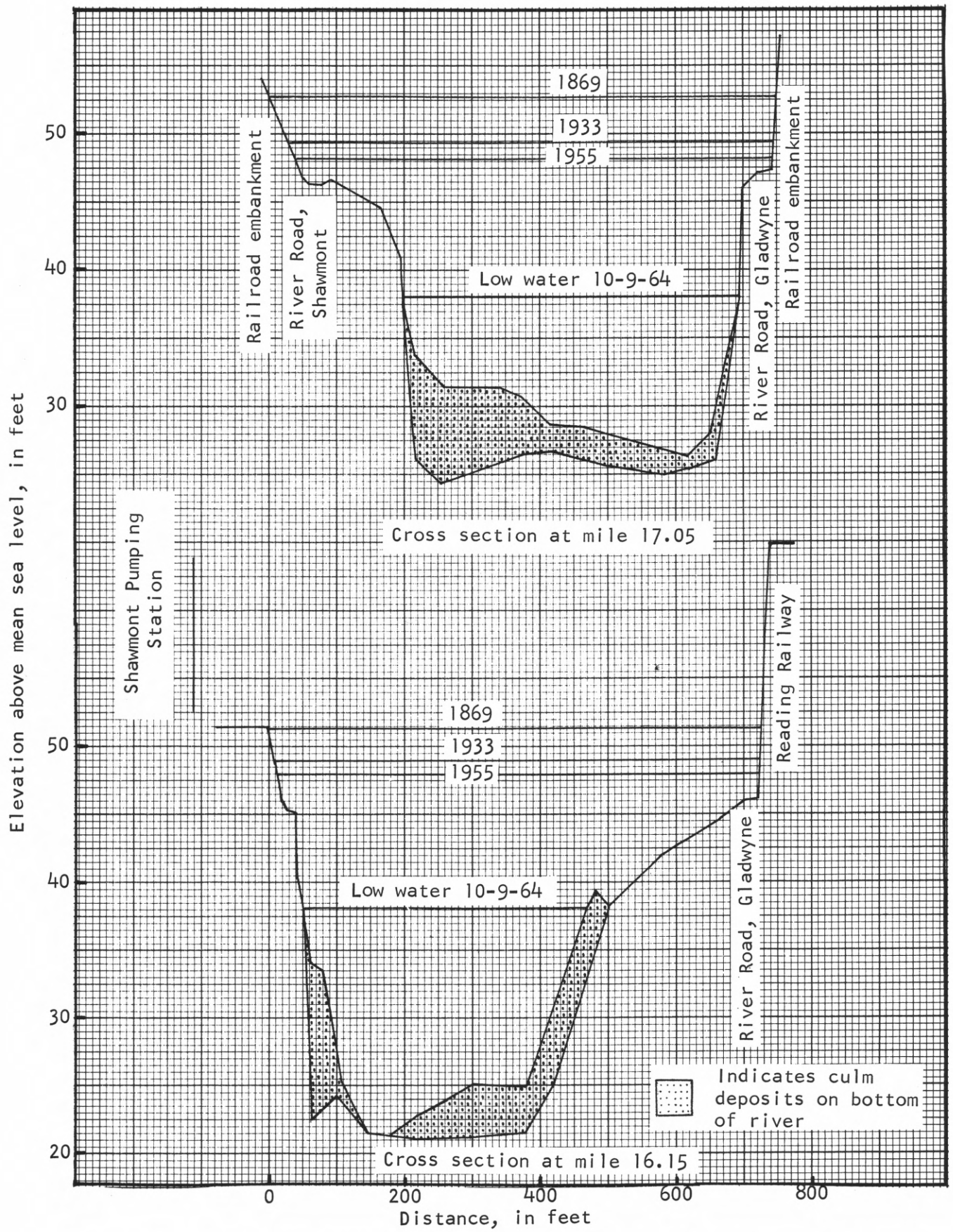

Figure 17.--Cross sections of Schuylkill River and flood plain at 17.05 and 16.15 miles upstream from mouth.

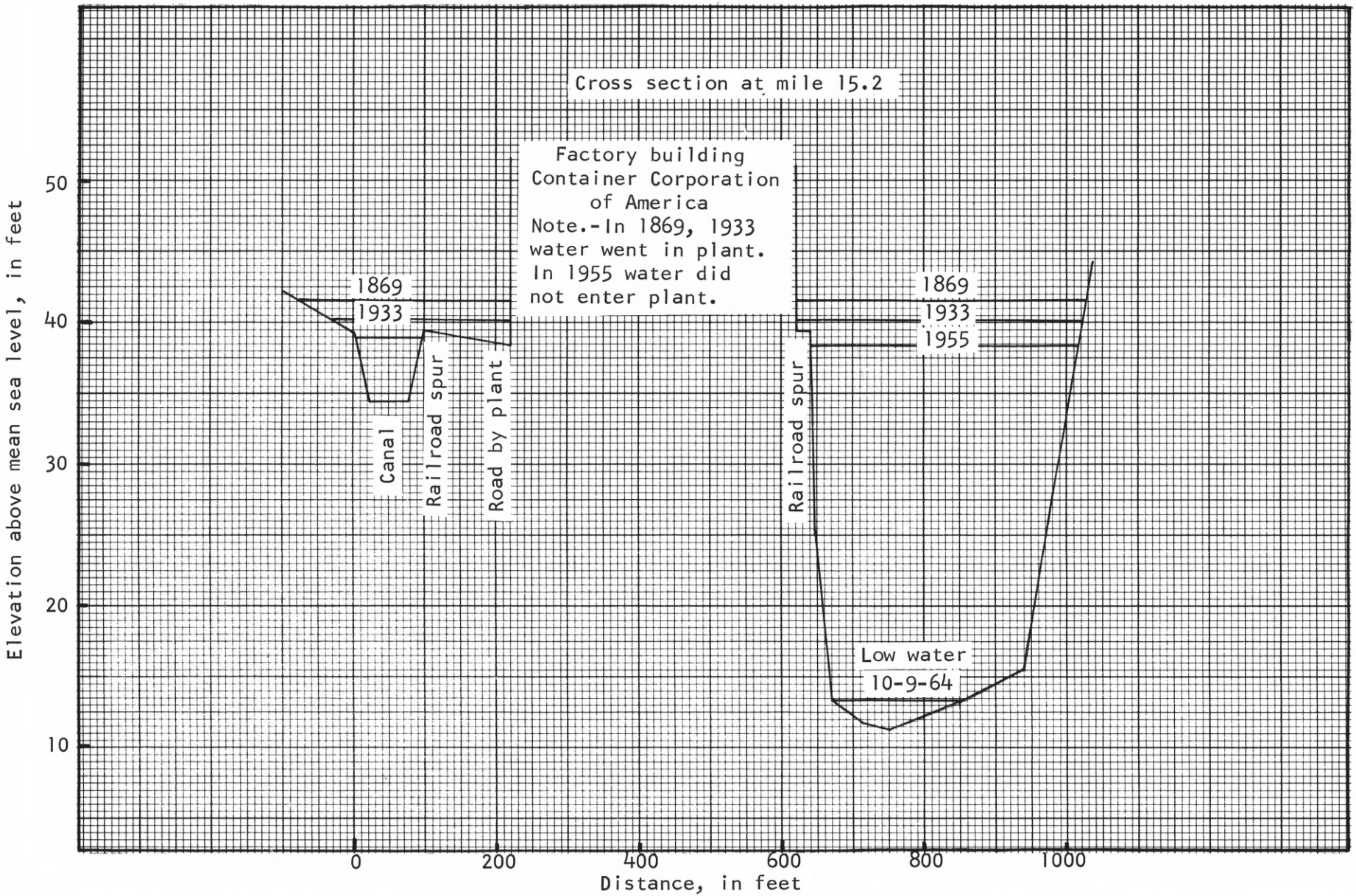

Figure 18.--Cross section of Schuylkill River and flood plain at 15.2 miles upstream from mouth.

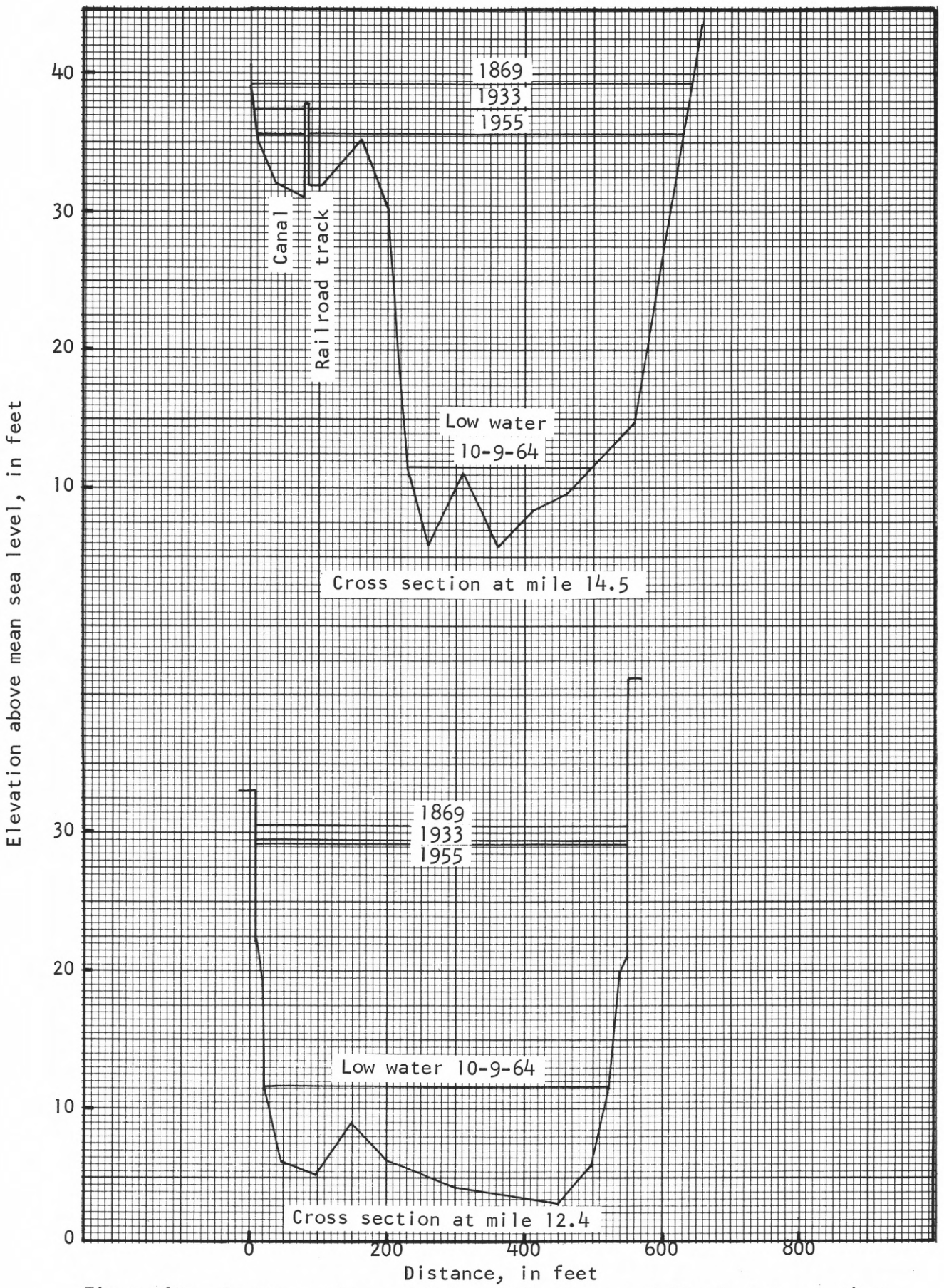

Figure 19.--Cross sections of Schuylkill River and flood plain at 14.5 and 12.4 miles upstream from mouth.

Table 1.--River miles upstream from mouth of Schuylkill River

Location	Miles upstream from mouth	Drainage area (sq mi)	Remarks
Schuylkill River:			
Reading, Pa.	76.5	880	Penn Street Bridge, USGS gage 1902-30
Pottstown, Pa.	54.3	1,147	Hanover Street Bridge, USGS gage 1928-64
Norristown, Pa.	24.5	-	Lockkeeper's house, right bank
Conshohocken, Pa.	21.0	-	Plymouth Dam
Conshohocken, Pa.	20.5	1,795	Fayette Street Bridge
Spring Mill, Pa.	19.2	-	Reading Railway Station
Miquon, Pa.	17.6	-	Reading Railway Station
Philadelphia, Pa.	15.9	-	Flat Rock Dam
Philadelphia, Pa.	14.5	-	Green Lane Bridge
Philadelphia, Pa.	13.0	-	Mouth of Wissahickon Creek
Philadelphia, Pa.	12.4	-	Falls Bridge
Philadelphia, Pa.	8.7	1,893	USGS gage at Fairmount Dam

Table 2.--Floods on Schuylkill River at Fayette Street Bridge in Conshohocken, Pa.
(1,795 sq mi drainage area)

	Discharge at Philadelphia	Discharge at Conshohocken*	Elevation above mean sea level at Conshohocken	Recurrence Interval
	(cfs)	(cfs)	(ft)	(yrs)
Oct. 4, 1869	135,000	129,000	61.7	>200
Feb. 28, 1902	98,000	93,900	60.2	100
Aug. 24, 1933	96,200	92,200	59.1	50
Aug. 19, 1955	90,100	86,300	a58.2	27
June 2, 1946	94,600	90,700	58.2	27
Nov. 25, 1950	89,800	86,100	58.0	24
July 9, 1935	82,000	78,600	a57.4	17
Aug. 9, 1942	71,500	68,500	56.7	11
Sept. 12, 1960	51,200	49,100	56.4	$9\frac{1}{2}$
May 23, 1942	61,400	58,800	55.2	5
Nov. 22, 1952	60,300	57,800	55.1	5

a - From profile.
* - Discharge at Conshohocken prorated from discharge at Philadelphia based on ratio of drainage areas raised to 0.8 power.

Table 3.--Flood-crest elevations on Schuylkill River

Miles above mouth	Location	Elevation above mean sea level, in feet						
		Oct. 4, 1869	Feb. 28, 1902	Aug. 24, 1933	July 9, 1935	June 2, 1946	Aug. 19, 1955	Low water Oct. 9, 1964
22.15	Ivy Rock, Alan Wood Steel Co. pumphouse, left bank.....			b63.2				
21.05	West Conshohocken, Philadelphia Electric Co. gas plant, right bank.						b60.2	
21.0	West Conshohocken, Plymouth Dam, right bank.....							47.3
21.0	Conshohocken, dam tender's house, Plymouth Dam, left bank.....	b63.8	b61.8	b61.2				
20.95	Conshohocken, below Plymouth Dam, low-water surface, right side.....							39.4
20.65	Conshohocken, old freight station, left bank.....						b58.9	
20.6	Conshohocken, ramp to Fayette Street Bridge, left bank.....						b58.6	
20.6	Conshohocken, house on Oak Street, left bank.....			b59.6				
20.5	Conshohocken, Fayette Street Bridge, marks on both banks.....	c61.7	c60.2	b59.1		b58.2		38.2

Table 3.--Flood-crest elevations on Schuylkill River--Continued

Miles above mouth	Location	Elevation above mean sea level, in feet						
		Oct. 4, 1869	Feb. 28, 1902	Aug. 24, 1933	July 9, 1935	June 2, 1946	Aug. 19, 1955	Low water Oct. 9, 1964
20.3	Conshohocken, John Wood Co. office, left bank			b58.5				
19.95	Conshohocken, Ford and Kendig Co. plant, left bank			b57.8	b55.7			
19.85	Conshohocken, C and D Batteries Co. plant, left bank			b57.8				
19.6	Conshohocken, Philadelphia Steel and Iron Corp. plant, left bank						b54.6	
19.25	Conshohocken, Quaker Chemical Corp. plant, left bank						b54.2	
19.15	Spring Mill, Pennsylvania Railroad Station, left bank			b56.0				
19.10	Spring Mill, Frankenfield's Mill, left bank	b58.3	b56.2	a55.9				38.2
18.95	Spring Mill, telephone pole, left bank						b53.0	
18.9	Spring Mill, small building, left bank						b52.9	

Table 3.--Flood-crest elevations on Schuylkill River--Continued

Miles above mouth	Location	Elevation above mean sea level, in feet						
		Oct. 4, 1869	Feb. 28, 1902	Aug. 24, 1933	July 9, 1935	June 2, 1946	Aug. 19, 1955	Low water Oct. 9, 1964
18.2	Miquon, point 0.6 mile upstream from station, left bank.....							38.2
17.7	Gladwyne, house on River Road, right bank.....			b51.4			b49.4	
17.5	Gladwyne, house on River Road, right bank.....						b48.9	
17.4	Gladwyne, house on River Road, right bank.....						b48.6	
16.95	Shawmont, house on River Road, left bank.....						b48.2	38.2
16.7	Shawmont, house on River Road, left bank.....						b48.1	
16.5	Gladwyne, house on River Road, right bank.....			b49.0			b48.0	
15.75	Manayunk, steps on Flat Rock Dam, left bank.....			b48.9				38.2
15.7	Manayunk, below Flat Rock Dam, left bank.....							23.2

Table 3.--Flood-crest elevations on Schuylkill River--Continued

Miles above mouth	Location	Elevation above mean sea level, in feet						
		Oct. 4, 1869	Feb. 28, 1902	Aug. 24, 1933	July 9, 1935	June 2, 1946	Aug. 19, 1955	Low water Oct. 9, 1964
15.3	Manayunk, staff gage on pump house of Container Corporation of America, left bank					b36.9	b38.6	13.8
15.25	Manayunk, Pioneer Trucking Office at Container Corporation of America, left bank			b40.2				
14.85	Manayunk, Namico Co. plant, left bank						b37.1	
14.7	Manayunk, Mt. Vernon Machine Shop, left bank			b38.4			b36.1	
14.65	Manayunk, Mrs. Paul's Frozen Fish plant, left bank						b36.3	
14.5	West Manayunk, Corps of Engineers plaque on right abutment of Green Lane Bridge, right bank			a37.6			a35.7	11.5
14.3	West Manayunk, Reading Railway bridge, right bank			b36.3				
14.3	Manayunk, Connerly Container Corporation plant, left bank						b34.3	

Table 3.--Flood-crest elevations on Schuylkill River--Continued

Miles above mouth	Location	Elevation above mean sea level, in feet						
		Oct. 4, 1869	Feb. 28, 1902	Aug. 24, 1933	July 9, 1935	June 2, 1946	Aug. 19, 1955	Low water Oct. 9, 1964
14.15	Manayunk, Wood Manufacturing Co., left bank	b37.1	b35.9	b35.2	b32.7			
13.9	Manayunk, Shurs Lane and Main Streets, left bank			b34.5			b32.8	
13.8	Manayunk, Littlewood and Sons Co., warehouse, left bank						b32.3	
13.1	Philadelphia, plaque in Philadelphia Canoe Club house, left bank						b30.6	
12.4	Philadelphia, Corps of Engineer plaque on downstream wingwall of Falls Bridge. Low-water surface at left end of bridge			a29.5			a29.2	11.5

a From information furnished by Corps of Engineers, U.S. Army.

b From information furnished by local residents or industrial firm.

c From Hosmer and Shade - 1915 Report.

Table 4.--Mean sea level reference points

All bench marks referenced to mean sea level, datum of 1929. For more exact information on location write to Map Information Office, U.S. Department of Commerce, Coast and Geodetic Survey, Washington, D.C. Monuments on Plymouth and Flat Rock Dams are Corps of Engineers bench marks, and exact information on their location can be obtained from the Corps of Engineers, U.S. Army.

Map designation	Reference mark description	Elevation above mean sea level, in feet
89	USC&GS B M F 1. At Reading Railway station, Wissahickon, Philadelphia County. Standard brass disc stamped "89.127 F 1 1929."	89.13
68	USC&GS B M G 1. 100 yards east of Reading Railway station at Shawmont, Philadelphia County. Standard brass disc stamped "67.841 G1 1929."	67.84
61	USC&GS B M X 277. About 0.35 miles northwest of Shawmont, Philadelphia County. Standard brass disc in steel pole for electric line, about 30 yards northwest of blacktop road crossing, and stamped X 277 1961."	61.50
58	USC&GS B M K 1. At Conshohocken, Montgomery County near Reading Railway station. A standard disc stamped "58.241 K1 1929." Set in concrete post	58.24
55	USC&GS B M Y 270. At Conshohocken, Montgomery County at railroad crossing at C and D Batteries Division of Electric Autolite Company. A standard brass disc stamped "Y 270 1961."	55.38

Table 4.--Mean sea level reference points--Continued

Map designation	Reference mark description	Elevation above mean sea level, in feet
55	US Army Engineer monument No. 12. A standard brass disc set in top of right abutment of Plymouth Dam.....	54.77
54	USC&GS B M L 277. 0.6 mile southeast on Pennsylvania Railroad from Spring Mill railroad station. Standard disc stamped "L 277 1961.".	54.08
53	USC&GS B M M 277. 0.6 mile northwest of railroad station at Miquon on Pennsylvania Railroad. Standard brass disc stamped "M 277 1961.".....	52.72
53	USC&GS B M J 1. At Reading Railway station in Spring Mill, Montgomery County. A standard brass disc stamped "52.638 J1 1929.".....	52.64
52	USC&GS B M H 1. At Miquon, Montgomery County, at east end of Reading Railway station platform. A standard brass disc stamped "52.411 H1 1929.".....	52.41
47	USC&GS B M Y 277. 0.9 mile northwest of railroad station at Shawmont, Philadelphia County. Set horizontally in a small bridge over a creek on River Road. Standard brass disc stamped "Y 277 1961.".....	47.30
44	US Army Engineer monument No. 9. A standard brass disc set in top of right abutment of Flat Rock Dam.....	44.03

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