



**DEPARTMENT OF THE ARMY**  
**PITTSBURGH DISTRICT, CORPS OF ENGINEERS**  
**FEDERAL BUILDING, 1000 LIBERTY AVENUE**  
**PITTSBURGH, PENNSYLVANIA 15222**

ORPED-PR

21 December 1972

SUBJECT: Root Creek, Bolivar, New York

THRU: Division Engineer, Ohio River  
ATTN: ORDPD-F

TO: HQDA (DAEN-CWE)  
Washington, D. C. 20314

1. Authority. This reconnaissance report has been prepared to determine the feasibility of developing a small flood protection project on Root Creek in Bolivar, New York under the authority provided by Section 205 of the 1948 Flood Control Act, as amended. Authorization and Advice of allotment for the report are contained in 2d Indorsement, 1 February 1972, DAEN-CWE-I, to the Pittsburgh District letter of 20 December 1971, ORPED-PF, subject Flood Problem at Richburg and Bolivar, New York. An allotment of \$7,500 under appropriation 96X3122 Construction, General, was made available to the Pittsburgh District to accomplish this study. An additional allotment of \$3,500 was made available when it became apparent that certain studies completed prior to Tropical Storm Agnes were made invalid and restudies were required.

2. Prior Investigations. The Corps of Engineers has investigated water related problems on Root Creek in Bolivar, Allegany County, New York, on two previous occasions, as follows:

a. In response to a letter directed to the President and referred to this office for reply, a representative of this District visited Bolivar on 3 October 1961, to meet with local interests and to investigate possible flood related problems. The problems pertained to flood and soil erosion damage to properties adjacent to the creek. At that time, it was concluded that a project for flood control would be feasible from an engineering viewpoint; however, it was found that such a project would be infeasible from an economic standpoint since project benefits would not be commensurate with project costs.

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b. On 20 December 1971, a brief letter report, ORPED-PF, was submitted providing a description of the damage caused by the flooding of Root Creek in Bolivar and on an "Unnamed Run" in Richburg. The study was the result of a request by Commissioner Henry L. Diamond of the Department of Environmental Conservation of the State of New York. This request was the result of repetitive and serious flooding on both streams in recent years. The Richburg flooding problem was later dismissed, however, due to very minor flood damage. However, funds in the amount of \$7,500 were requested for Root Creek under Section 205 of the 1948 Flood Control Act, as amended, to develop the hydrologic and hydraulic characteristics of the stream; to establish an estimate of the average annual flood damage; to consider possible alternative methods for obtaining flood protection; and to determine the economic and engineering feasibility of any potential flood protection project.

3. Location of the Study Area. The problem area is located in the Village of Bolivar, Allegany County, New York, about 17 road miles east of Olean, New York. The exact location is shown on the Bolivar, New York, 7-1/2 minute quadrangle map of the U. S. Geological Survey, a portion of which is included as PLATE 1.

4. Description of the Study Area. The study area is situated within the boundaries of Bolivar, New York, an incorporated village with a population of about 1,400 (1970 census). The village is primarily a residential community with all the usual public utilities such as public water and sewage, gas and electricity. The stream, as shown on PLATE 1, runs through the southern end of town in a westward direction emptying into the Little Genesee Creek. Access to the study area is provided by State Routes 17 and 275.

5. The study has been limited to that reach of Root Creek which lies between the Route 17 Highway Bridge, east of the town of Bolivar, and the stream's mouth on the Little Genesee Creek (see PLATE 2). This is the area of concentrated damage due to flooding.

6. Root Creek is a headwater stream, primarily flowing in wet weather, which drains approximately nine square miles. The Creek flows westward from high ground through the village of Bolivar and then a small marshland before it empties into the Little Genesee Creek.

7. Stream and Basin Characteristics. The Root Creek basin above the Rt. 17 Highway Bridge, which is the upstream study limit, is sparsely populated and consists of much forest and some farmland. The stream is generally narrow with steep valley walls and has an extremely steep gradient, which in the study area averages about 11 feet per thousand.

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8. The stream cuts through very porous sand and gravel. Because of this material, much sediment is carried during periods of high flow and the results are a high degree of erosion in the upper reaches and large amounts of sediment deposition downstream. The channel banks for most of the study reach are unstable and constantly experience some degree of change.

9. The stream, in the Town of Bolivar, is approximately 16 feet wide, with a low right bank and a high left bank. This condition exists from just upstream of the Bolivar Central School Athletic Field to just above the Main Street Bridge; downstream from this point both banks are relatively low. Four bridges, photographs of which are contained in EXHIBITS A and B, cross Root Creek within the confines of the study, with three in the Town of Bolivar. The First Street and the Main Street bridges are in the center of the town, about 300 feet apart and the Davis Street Bridge is approximately 1,500 feet upstream of Main Street. The fourth structure is the Route 17 Highway Bridge just east of the town which has been selected as the upstream limit of the study area. Also existing along this section of the stream are short lengths of small dikes that were privately built and are for the most part eroded and of little value in preventing flooding. The depth of rock has not been determined for this report, but it appears that no rock excavation would be necessary for the purposes of a channel improvement.

10. Nature of Flood Problem. A flood problem exists in the area occupied by and immediately surrounding the Village of Bolivar which lies in that reach of Root Creek between the Route 17 Highway Bridge and the Creek's mouth. In this residential area, houses are susceptible to flooding, especially the flash type, due to intense rainfall and very high runoff. Flooding is the result of the existing channel's inability to contain most high flows and low bridge clearances which create back-water effects, causing higher than normal overbank flooding. The Root Creek watershed is typical of the many steep, small tributaries in the Allegheny River basin that are susceptible to high rates of runoff due to intense summer storms.

11. Flooding in the area of the Bolivar Central School Athletic Field is mainly attributable to the overflow of an unnamed run which flows through a 6-foot semicircular multiplate culvert under the field. This culvert fills up with gravel and sand, greatly impeding the flow of water through the culvert causing overbank flooding. This problem has been taken care of in the past by clearing the culvert periodically.

12. Pattern of Flooding. Due to the geography of the watershed, floods are of high intensity and short duration. The more numerous floods are of the basement variety associated with overbank flows. Property losses during such periods of flooding generally include damages to garages,

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streets, yards, walks, driveways, gardens and patios. In addition, the stream banks are affected by erosion and in some wider areas the stream centerline shifts. Floods beyond the annual frequency begin to cause first floor damage in several areas.

13. Records of Floods. There is no dependable record of major floods on Root Creek. However, newspaper accounts and interviews have established the following approximate record, in chronological order:

July 1942  
January 1959  
September 1967  
July 1970  
June 1972

14. Flood of June 1972. The findings of this reconnaissance study are based on the flood of June 1972. This flood resulted from extremely intense rainfall due to Tropical Storm Agnes. Because the stream is both swift and turbulent at high flows, it was not possible to obtain a firm determination of discharge by slope and area. However, a discharge value has been roughly estimated, based on the available effective cross-sectional area and on estimated critical velocity to have been 2,200 second-feet at its peak, or about 245 second-feet per square mile of drainage area.

15. Flood Damages. Damage from the June 1972 flood on Root Creek occurred to 111 residential buildings and 10 commercial buildings, totaling \$165,000 in primary damages. During the July 1970 flood, which is the only other event for which estimates could be obtained, 22 residential and 8 commercial buildings suffered a total of \$62,000 in primary damages. In both of these floods, as in all the floods on Root Creek, the stream banks were adversely affected by the high velocity. The outer stream banks were undercut causing slides and the material deposited in the creek channel. In addition, yards, gardens, retaining walls and dikes were affected. In the study area, average annual damages caused by frequent flooding are estimated at approximately \$36,000.

16. Solutions to the Problems. Three alternatives for flood control on Root Creek were investigated as follows:

a. Reservoirs. Topographically, the best site for an impoundment on Root Creek is located about 2.6 miles above the mouth. This site, however, would inundate an area where there are many small oil wells, some of which are still in operation, and would require considerable highway relocation work. Also, because of a steep stream gradient and relatively steep valley walls, a dam capable of impounding the amount of runoff necessary to alleviate flood damages downstream would require a high dam resulting in excessive costs. In view of the apparent project

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infeasibility due to extensive relocation and high dam construction costs, no further consideration was given to a reservoir solution.

b. Walls and Dikes. Walls to contain floods along Root Creek were given only cursory consideration since they would be far too costly in relation to flood protection benefits available. Dikes were also considered; however, because of their cost and the fact that rights-of-way needed for these dikes are not readily obtainable, they too would be too costly and were given no further consideration.

c. Channel Improvement. This method of providing flood protection for the area appears to be the most practicable and is economically feasible.

d. Flood Plain Management Services Program. As a means of reducing flood damages with no or minimal structural solutions, the Flood Plain Management Services Program offers technical assistance, information and guidance to individuals and local and state officials. It would be the responsibility of the local governments to prepare the necessary flood plain regulations, rezone the high damage areas and assist the owners and/or developers by providing information on special building and development techniques. This could also include educating the people in the application and use of proper flood proofing techniques.

17. Feasible Plan of Improvement. It is believed feasible to improve the channel of Root Creek in the reach of interest to contain a flood of 2,200 second-feet, the maximum flood of record with an estimated 100-year frequency of occurrence.

18. State of New York Department of Transportation Improvement. In planning the improvement of Root Creek, consideration was given to the proposed rebuilding of the Main Street Bridge by the State of New York Department of Transportation. Also included in their plans is the improvement of the Root Creek channel for a distance of approximately 300 feet upstream and 300 feet downstream of the bridge. The channel improvement will consist of a concrete lined, 30-foot channel bottom with 1 vertical on 1 horizontal side slopes extending to original ground elevation. A 4-foot concrete drop structure will be provided at the upstream end of the improvement. This improved channel would be capable of handling the maximum flood of record prior to Tropical Storm Agnes, which is the new maximum flood of record. However, the plans now may need a restudy with possible slight modifications. The State of New York Department of Transportation has expressed a desire to cooperate with the Pittsburgh District and wishes to be informed as to our findings.

19. Description of Plan of Improvement. In consideration of the area surrounding Root Creek, the most feasible plan of improvement would be as outlined below:

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a. The channel bottom would be excavated and seven gabion drop structures would be placed in critical areas along the improved reach. These drop structures would all be three feet in height and six of the seven would be 20 feet in width; however, the seventh drop structure would be 36 feet in width because it is in an area where the channel is 36 feet wide. The channel bottom would only be protected by mattress type gabions 12 feet upstream and 9 feet downstream of each drop structure to prevent scouring effects caused by the high velocities.

b. At the upstream end of the proposed improvement, a debris basin, approximately 75 feet wide and 250 feet long with a bottom slope of 0.4%, would be provided. The basin would capture a major portion of transported materials and would reduce maintenance costs by centralizing material removal. This area, station 65+75 to 63+25, was chosen because of easy access and available adjacent land.

c. In areas where the design water surface exceeds the proposed protected banks, small dikes are proposed to retain stream flow within its banks. These reaches are relatively short and the proposed dikes would be no higher than three feet.

d. A sheet pile wall exists on the right bank from station 50+93 to 49+68, near Bolivar Central School Athletic Field. This wall would be extended 100 feet downstream to station 48+68. Also, from station 36+64 to 35+64 there would be a concrete floodwall which would rise above the existing top of bank elevation about two feet.

e. In the area of Root Creek proposed for improvement, only one small sewer adjustment would be required. There are also several oil lines, running the entire reach of stream, which stem from old oil wells upstream of the study area. These lines are no longer in use and would be removed during construction.

f. A serious problem exists at the First Street Bridge because of its inadequate clearance which causes a backwater effect. Since this condition results in flooding in the area and since the bridge is not essential for providing access to the area, local officials are desirous that the bridge be considered as an abandoned facility. Accordingly, for the purposes of this report, the bridge will be considered as an abandoned facility and removed at Federal expense as part of the channel improvement project.

g. Slope protection for the entire length of the proposed project, station 63+30 to 18+28, would consist of mattress type gabions from the channel invert to the top of banks. (Excluded from this would be the State of New York Department of Transportation's improvement.)

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20. The use of gabions for slope protection and drop structures is considered to be the most economical method of protecting the banks of the stream from erosion and reducing stream flow velocities. In this area, stone of gradation size necessary to protect the stream banks against the velocities that do exist is very expensive. Also, concrete drop structures that would provide the same results as the proposed gabion drop structures would be 2- $\frac{1}{2}$  times as costly. Because of the design of gabion mattresses, a 9" thick mattress can provide the same protection as an 18" blanket of stone in maintaining slope stability against high velocities. Also, the quantity of stone needed to fill the gabions would be one-half of that needed for regular stone protection and its gradation size would be far less critical. These two factors, smaller quantity and less critical gradation size, cut the cost of slope protection by 35%. It is also possible, when investigated in more detailed studies, that some of the material excavated from the channel can be used to fill the gabions and would reduce the estimated cost of gabion slope protection substantially.

21. Environmental Impact. A preliminary analysis was made of the probable impact of the proposed project plan on the environment. The major beneficial impact of the proposed plan would be the reduction of flood damages to existing and future development in the area. The project would include the removal of the abandoned, exposed oil pipeline located within the channel in the reach to be improved. This would have a favorable effect on the aesthetics of the area. The use of gabions with natural colored plastic-coated wire mesh for the protection of the channel side slopes and for the drop structures within the channel would retain most of the natural environment of the area.

22. The stream is a wet weather stream and as such supports no fish or wildlife population. It is unlikely that the excavation of the improved channel would result in significant sediment transport since much of the construction would be done under dry conditions. Under wet weather conditions when high flows do occur, some additional sediment may be carried by the stream flow as a result of the disturbances of soil during project construction, but this would not constitute a significant adverse effect on the environment because of the non-existence of a major fish or wildlife population in the project area. During high flows, an increase may take place in the sediment load transported by Root Creek into Little Genesee Creek where a fish and wildlife population exists. However, the increment of increase is not expected to be significant in comparison to the load which exists under pre-project conditions and thus would not represent a significant detrimental effect on the environment.

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23. In addition to excavation, other project features often associated with potential detrimental environmental effects were evaluated. These include the debris basin, the disposal areas and possible borrow areas. The debris basin would be located at the upstream end of the project and would have no pronounced adverse visual effects, inasmuch as it would not be within easy viewing of the nearby residential areas. The disposal areas would be located near the downstream end of the project on the right bank. These areas would be sloped to drain and seeded, and consequently would have no detrimental effects on the area aesthetics nor introduce sediment to the stream. The suitability of the material excavated from the channel, for use as select fill for the construction of dikes, is not known at this time. If it is necessary to borrow the select fill material, the borrow areas would be restored as nearly to pre-excavation conditions as possible in order to avoid any adverse aesthetic effects.

24. The Carnegie Museum of Pittsburgh, Pennsylvania, has advised that based on a preliminary review of available data, it appears that the project area possesses no archeological salvage value.

25. In accordance with ER 1165-2-2, beautification features are included in the project plan. This would include the planting of trees and shrubs along the bank of certain reaches of the project to mitigate the loss of natural vegetation resulting from project clearing. The use of gabions as mentioned above, although part of the basic project plan for flood control purposes, would also serve a beautification function. Consideration was given to the landscape planting of the disposal areas and use of these areas for recreation development purposes in accordance with ER 1120-2-404. However, this possibility was dismissed because the disposal areas would be located near the downstream end of the project where access is not good. Also, the area is in close proximity to the sewage treatment plant and may be subject to occasional odor problems.

26. Cost Estimates. An approximate estimate of cost has been made to establish the feasibility of the plan outlined above. Estimate of costs as of October 1972 are shown in the following table:



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TABLE I  
FEDERAL CONSTRUCTION COSTS

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Amount</u>
Clearing	L.S.	---	---	\$ 3,000
Excavation	Cu.Yd.	30,000	2.25	67,500
Gabion Slope Protection	Cu.Yd.	5,500	36.00	198,000
Gabion Drop Structures	Each	7	2,100.00	14,700
Sheet Pile Walls	Sq.Ft.	2,000	7.00	14,000
Concrete Walls	Cu.Yd.	120	110.00	13,200
Dikes (rolled fill)	Cu.Yd.	300	3.50	1,000
Filter Cloth	Sq.Yd.	11,300	2.35	26,600
Bridge Removal	L.S.	---	---	500
Seeding	L.S.	---	---	2,500
Beautification	L.S.	---	---	<u>1,000</u>
Subtotal				\$342,000
Contingencies @ 25%				<u>86,000</u>
Subtotal				\$428,000
E&D and S&A				<u>95,000</u>
TOTAL, (rounded)				\$523,000

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TABLE II

NON-FEDERAL CONSTRUCTION COSTS

<u>Item</u>	<u>Amount</u>
Rights-of-Way	\$ 10,000
Sewer Adjustments	<u>3,000</u>
Subtotal	\$ 13,000
Contingencies @ 25%	<u>3,200</u>
Subtotal	\$ 16,200
Engineering, Legal Supervision	<u>2,300</u>
TOTAL (rounded)	\$ 18,500

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27. Average Annual Charges. The average annual Federal and non-Federal charges based on a 50-year project life with October 1972 values are summarized below:

Federal at 5- $\frac{1}{2}$ %

Interest (.055 x \$522,500)	\$ 28,737
Amortization (.00406 x \$522,500)	<u>2,121</u>
Total (rounded)	\$ 30,900

Non-Federal at 5- $\frac{1}{2}$ %

Interest (.055 x \$18,500)	\$ 1,018
Amortization (.00406 x \$18,500)	75
Maintenance	<u>2,000</u>
Total (rounded)	\$ 3,100

Total Average Annual Federal and Non-Federal Charges	\$ 34,000
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28. Economic Analysis. The average annual primary flood control benefits are estimated to be \$36,200 and the average annual Federal and non-Federal charges are estimated to be \$34,000. Accordingly, the economic ratio of average annual benefits to average annual charges, based on a 50-year project life and an interest rate of 5- $\frac{1}{2}$ %, is approximately 1.1 to 1.0. This benefit cost ratio does not reflect future development benefits which are also primary and which should, when considered, enhance the economic feasibility.

29. Assurance of Local Cooperation. The State of New York would be the local cooperating agency for any flood control improvements recommended for the study area. This assurance has been discussed with and approved by Mr. Eldred Rich, Chief of the Bureau of Water Management of the New York State Department of Environmental Conservation. A copy of the letter expressing this assurance is inclosed as EXHIBIT C.

30. Discussion. A flood problem exists along Root Creek in Bolivar which merits consideration of remedial action. A plan has been outlined above which could probably be effected within required economic limits. However, there are certain geological, hydraulic and structural problems as well as ecological impacts involved in the project development that require more detailed engineering and environmental analysis than is possible in a reconnaissance type investigation. The analysis could be made in a detailed project report which would establish the feasibility of a small project from engineering, economic and environmental

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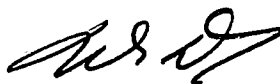
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standpoints. If a project would not be warranted after the more intensive investigation for the detailed project report, the study could be terminated.

31. Recommendation. It is recommended that funds in the amount of \$39,000 be allocated to the Pittsburgh District for preparation of a detailed project report covering the feasibility of a project on Root Creek in Bolivar, New York. A breakdown of this cost estimate is inclosed as EXHIBIT D.

6 Incl

1. PLATE 1
2. PLATE 2
3. EXHIBIT A
4. EXHIBIT B
5. EXHIBIT C
6. EXHIBIT D



N. G. DELBRIDGE  
Colonel, Corps of Engineers  
District Engineer

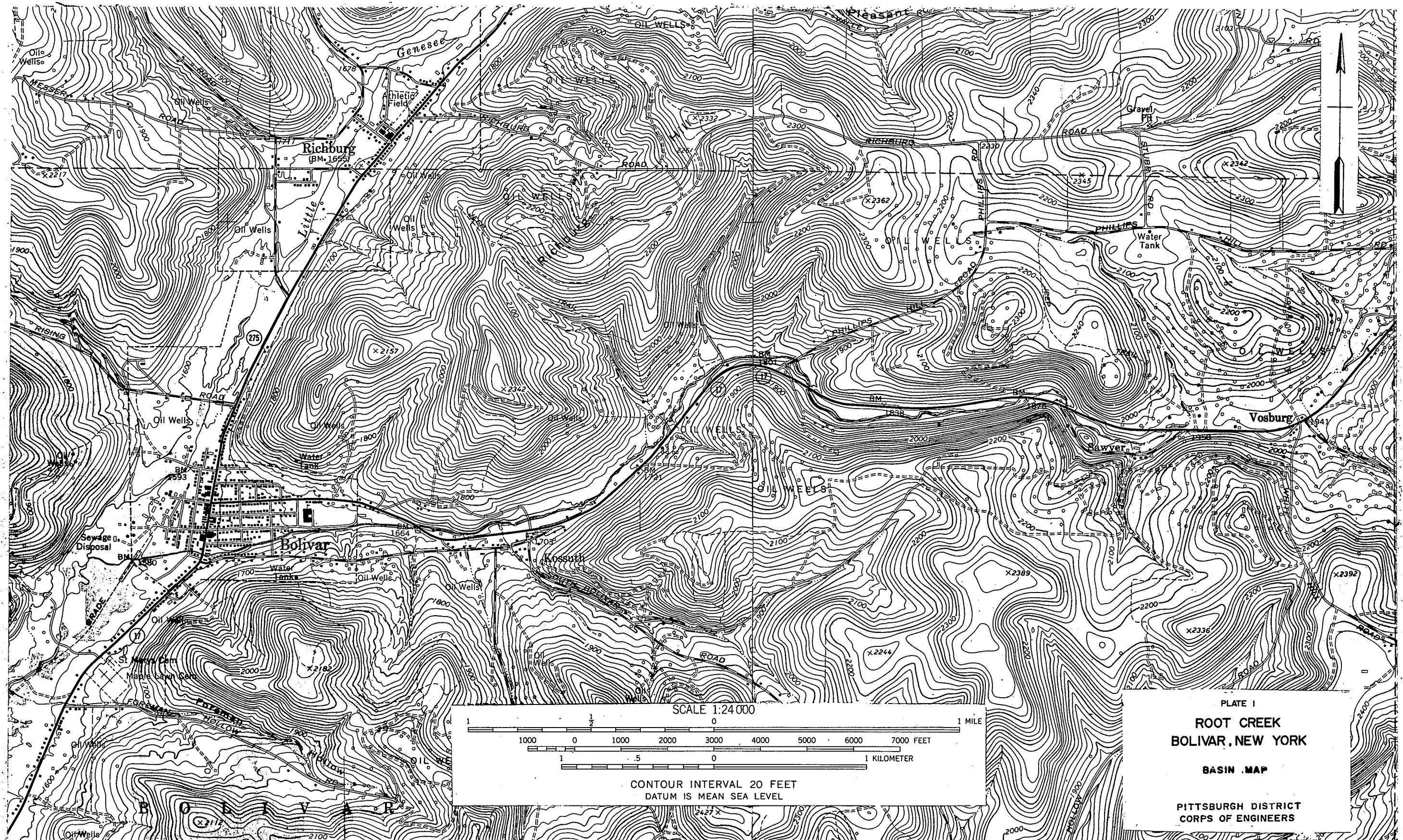
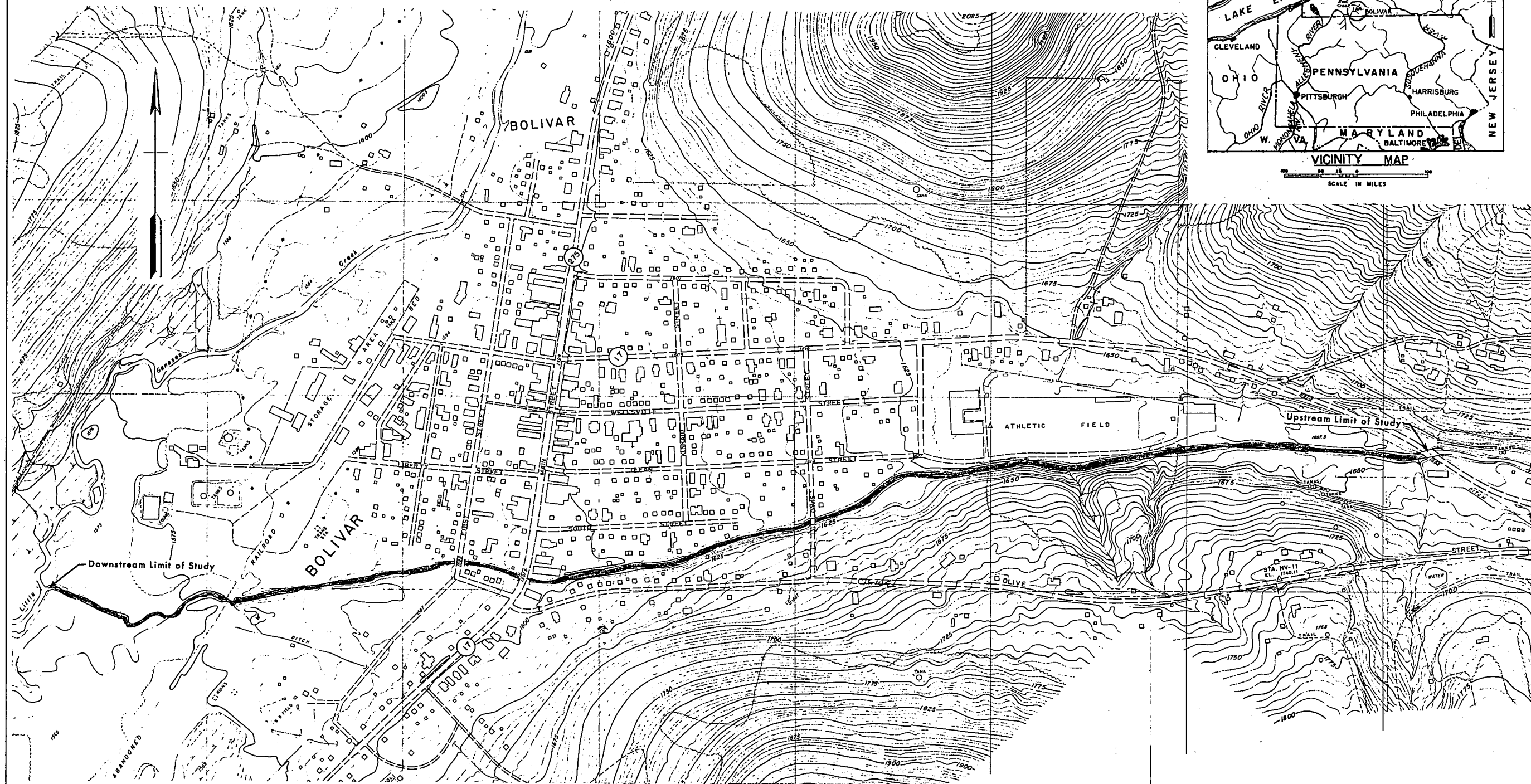


PLATE I  
ROOT CREEK  
BOLIVAR, NEW YORK  
BASIN MAP

PITTSBURGH DISTRICT  
CORPS OF ENGINEERS



**ROOT CREEK  
BOLIVAR, NEW YORK  
STUDY AREA AND VICINITY MAP**

200' 100' 0' 200' 400'

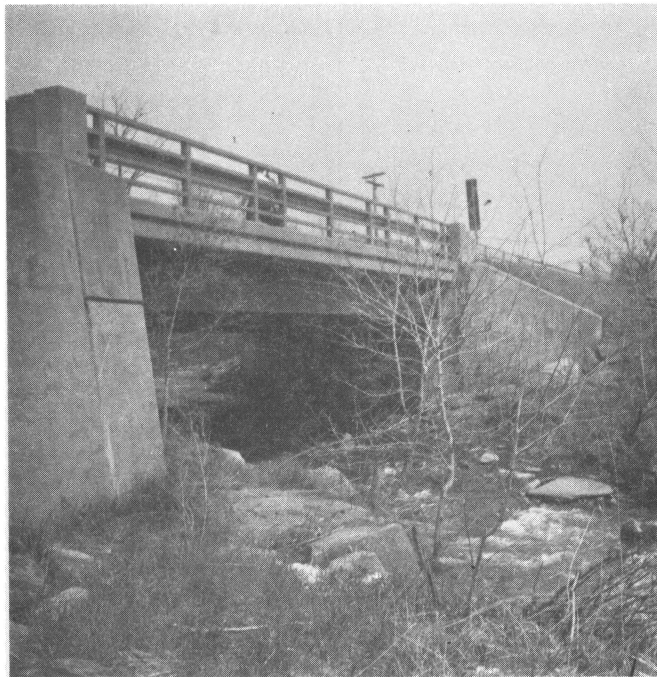
U.S. ARMY ENGINEER DISTRICT, PITTSBURGH, CORPS OF ENGINEERS  
OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA.

SUBMITTED: APPROVAL RECOMMENDED: APPROVED:

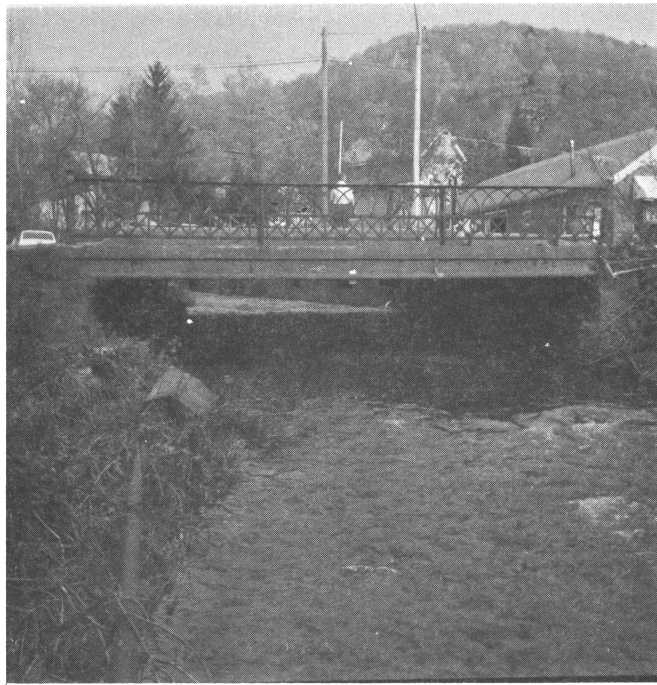
CHIEF, ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS,  
DISTRICT ENGINEER

PREPARED BY: *[Signature]*  
DRAWN BY:  
CHECKED BY:





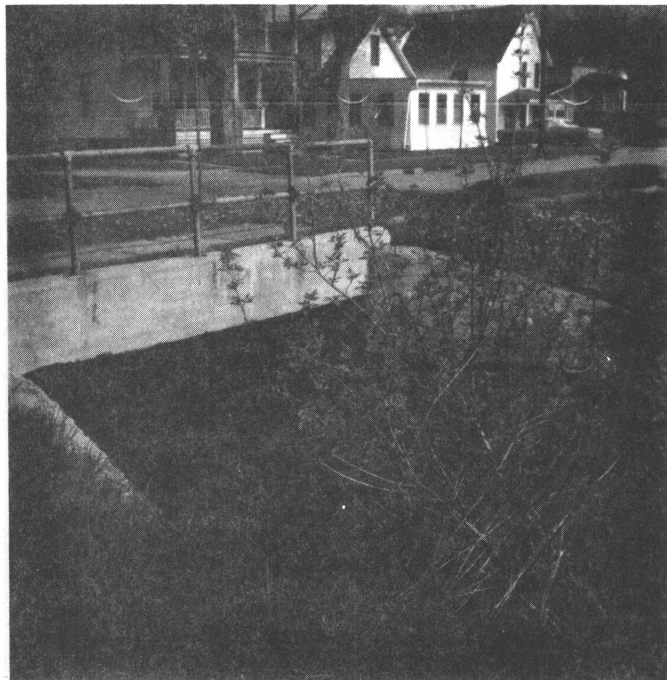
Route 17 Highway Bridge



Main Street Bridge

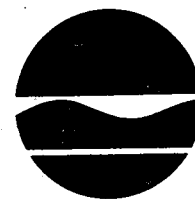


Davis Street Bridge



First Street Bridge





**New York State Department of Environmental Conservation**

Albany, N. Y. 12201

Henry L. Diamond,  
Commissioner

**DIVISION OF RESOURCE MANAGEMENT SERVICES  
BUREAU OF WATER MANAGEMENT**

December 14, 1972

Colonel Norman S. Delbridge, District Engineer  
Department of the Army  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

Dear Colonel Delbridge:

This is in reference to a telephone conversation on December 13th between Mr. George Haberman of your office, and Mr. Robert Knizek of my staff, regarding the interest of the State of New York, as official representative of local interests, in the plans of improvement for flood protection on Root Creek at Bolivar, N. Y.

The New York State Department of Environmental Conservation is interested in these improvements and is willing to comply with the items of local cooperation, subject to budgetary limitations and review of detailed plans, if the project becomes authorized and is engineeringly and environmentally sound and economically feasible.

Sincerely,

ELDRED RICH  
Chief, Bureau of Water Management

CWK:erb  
cc: Mayor James E. Dunn

EXHIBIT C

ROOT CREEK

BOLIVAR, NEW YORK

Cost Estimate for Detailed Project Report

(Oct 1972 Cost Level)

<u>Description</u>	<u>Cost</u>
Preliminary Planning and Public Contact	\$ 1,500
Public Meeting	1,500
Hydrology	2,500
Surveys	6,500
Materials on Foundations	1,500
Hydraulics	1,600
Design (Including Drafting)	6,000
Economics	1,500
Real Estate	700
Special Studies	700
Environmental Impact Studies	3,000
Preparation of the Report	4,000
S&A Overhead	<u>7,000</u>
	\$39,000