



**US Army Corps  
of Engineers  
Pittsburgh District**

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# **Bolivar - Right Bank Root Creek**

**Bolivar, New York**

## **Periodic Inspection Report No. 1**

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Prepared By:

USACE Buffalo District  
Buffalo, New York

Prepared For:

USACE Pittsburgh District  
Pittsburgh, Pennsylvania

**Date of Inspection: June 12, 2017**

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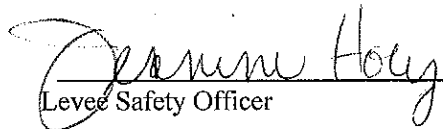
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**LEVEE SAFETY OFFICER APPROVAL MEMORANDUM  
2017 PERIODIC INSPECTION REPORT  
BOLIVAR, NEW YORK LOCAL PROTECTION PROJECT  
ROOT CREEK  
BOLIVAR, ALLEGANY COUNTY, NEW YORK  
FIRST PERIODIC INSPECTION REPORT  
12 JUNE 2017**

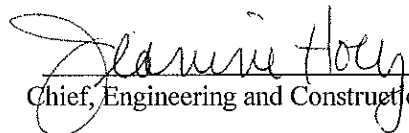
The District has completed a review of the Periodic Inspection Report for the Bolivar, New York Local Protection Project. Notice is hereby given that the Project does not meet the established policy, principals, and procedures as stated in the authorized Project agreement.

  
Levee Safety Officer

22 Sep 2017  
Date

**CERTIFICATION OF INTERNAL TECHNICAL REVIEW**

All concerns resulting from the internal technical review have been fully resolved.

  
Chief, Engineering and Construction Division

22 Sep 2017  
Date

## **Preface**

The purpose of the Bolivar Levee System Periodic Inspection is to identify deficiencies that pose hazards to human life or property. This assessment of the general condition of the levee system is based on available data and visual inspections. Detailed investigation and analysis involving hydrologic design, topographic mapping, subsurface investigations, testing and detailed computational evaluations is beyond the scope of this levee system inspection. The inspection is intended to identify the issues to facilitate such future studies and associated repairs as appropriate.

This levee system inspection is based on observations of field conditions and available data at the time of the inspection. The condition of any levee system depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It is incorrect to assume the present condition of the levee system will continue to represent the levee system condition in the future. Only through continued inspection, maintenance, repair, and rehabilitation can there be a reasonable chance that unsafe conditions can be avoided.

# Executive Summary

## Segment Name:

<b>Community</b>	Bolivar
<b>County</b>	Allegany
<b>State</b>	New York
<b>Stream</b>	Root Creek

**Inspection Date:** Periodic Inspection Number 1 was completed on June 12, 2017.

**Inspection Team:** David Mitchell, PE/PG (USACE); Daniel Bennett, PE (USACE); Josh Kennedy (USACE); Thomas Brown (USACE – escort); Ted Myers (NYSDEC); Larry Middaugh (NYSDEC); Joel Warner (NYSDEC); Kerrie O’Keefe (NYSDEC); Bob Mitchell (Village of Bolivar); James Barnes (Village of Bolivar).

## **Summary of Findings:**

### Design Criteria Review:

The design criteria review of the Detailed Project Report (USACE 1975) and the project design drawings dated 3 April 1979 indicate that the levee embankment geometry and features (e.g. crest width and use of gabion baskets) are not in accordance with current design criteria. Levee embankment stability or seepage analyses are not presented within the Detailed Project Report to evaluate against current criteria. It is unknown whether the levee segment crest is at design elevations and is within settlement criteria as no as-built drawings were available for the project and no recent comparison data set is available for the levee crest.

No channel lining analyses or riprap sizing evaluations were presented in the Detailed Project Report, consequently it is unknown if project channel lining would meet current design criteria for erosion protection. Interior drainage at the project includes the use of corrugated metal pipe (CMP). Based on long-term reliability issues with CMP for gravity drains, the minimum standard for these pipelines is reinforced concrete pipe (RCP).

No structural analyses for the project drop structures, associated concrete gravity wall (associated with drop structure located at Station 24+15), or bridge abutment structures were presented in the Detailed Project Report or available at the time of preparation of this report. It is unknown whether these features meet current structural design criteria.

### Inspection Results:

- **General Items:** An Operations & Maintenance Manual (O&M) has not been prepared for the project. A project specific Emergency Action Plan (EAP) has not been prepared for the project. The project Sponsor has nearby equipment and supplies available to perform flood fighting.
- **Levee Embankments:** The levee embankments were observed to be functional. Heavy vegetation and large trees were observed on the embankment and within 15 feet of the landside and waterside levee toe. Encroachments are present that impede inspection, flood fighting, and maintenance

actions. No settlement, slope stability or seepage issues were noted during the inspection. Sod cover was adequate with only minor areas in need of repair. Several animal burrows were present requiring repair.

- **Interior Drainage:** The interior drainage features were observed to be functional. The Sponsor provided video inspection documentation for two pipes located beneath/adjacent to a project levee embankment. Results indicate the culvert original to the project is in acceptable condition. Corrosion and a hole in the invert of a pipe installed after original project construction was identified.
- **Flood Damage Reduction Channel:** The flood damage reduction channel was observed to be functional, however, heavy vegetation including large trees was observed on both channel banks. Moderate shoaling at several locations was observed in and along the channel banks. Gabion channel lining was in adequate condition with only minor areas in need of repair however heavy vegetation was observed within the gabion lining throughout the project extent. The drop structures were observed to be in acceptable working condition. A modification to the project sedimentation basin and channel has been made as part of a bus garage complex at the upstream extent of the project. A request for formal USACE approval has not been received for this modification.

### **Recommendations:**

#### General:

- Prepare an O&M Manual and update the manual on a regular basis;
- Prepare a project specific Emergency Action Plan (EAP) and update contacts and procedures on a regular basis.

#### Levee Embankments:

- Remove vegetation from within the vegetation free zone;
- Maintain right of way and remove or request permit for encroachments along the alignment of the levee embankments;
- Repair bank caving at the identified location along the levee alignment;
- Continue to maintain sod cover and animal control program.

#### Interior Drainage:

- Continue to video inspect the culverts and discharge pipes every five years;
- Perform maintenance as the video inspection results indicate.

#### Flood Damage Reduction Channel:

- Remove unwanted vegetation from within the channel extent;
- Maintain right of way and remove/permit encroachments along the project channel extent;
- Remove unwanted vegetation from gabion channel lining and repair gabion lining per USACE Pittsburgh District guidelines;
- Remove shoals/debris from channel;
- Obtain formal USACE permit for bus garage encroachment/sediment basin alteration.

Based on the results of this Periodic Inspection and the condition of the project at the time of the inspection, the overall system rating for the Bolivar LFPP is MINIMALLY ACCEPTABLE. The primary factors for this rating include heavy unwanted vegetation on or adjacent to the levee and heavy unwanted vegetation within the flood damage reduction channel along its entire alignment. In the interest of transparency and public safety, USACE recommends the local sponsor make these overall ratings available to the city/county residents in or near the leveed area.

# 1. Inspection Team and Date of Inspection

## 1.1 Inspection Team

The levee inspection team included:

<u>Name</u>	<u>Discipline</u>	<u>Location</u>	<u>Phone</u>	<u>E-mail</u>
David Mitchell, PE/PG, (Team Lead)	Geotechnical/ Civil	Buffalo, NY	(716) 879-4115	david.j.mitchell@usace.army.mil
Daniel Bennett, PE	Hydraulics/ Hydrology	Buffalo, NY	(716) 879-4249	daniel.a.bennett@usace.army.mil
Joshua Kennedy, EIT	Geotechnical/ GIS	Buffalo, NY	(716) 879-4417	joshua.m.kennedy@usace.army.mil
Thomas Brown, PE (USACE – Escort, Project Rep)	Pittsburgh LSPM	Pittsburgh, PA	(412) 395-7459	thomas.m.brown@usace.army.mil

## 1.2 Date of Inspection

The inspection team began their work on June 12, 2017.

## 1.3 Weather During Inspection

The weather during the inspection was in the low to mid 80's with partial sun.

## 1.4 River Gage During Inspection

The stream gage closest to the project location is United States Geological Survey (USGS) Root Creek at Davis Street at Bolivar, NY (USGS Gaging Station 03010674). The river gage is located at Davis Street near the middle of the project at Latitude: 42°03'51.8" and Longitude: 78°09'46.6", with a gage datum of 1,605.79 (NAVD 88). The daily mean gage reading on the day of the inspection was obtained from the USGS gage, and that reading and the water surface elevation are presented below.

Date	Gage Height, feet (Mean)	Water Surface Elevation (NAVD 88)
12 June 2017	0.11	1,605.90

## **2. System Background Information**

### **2.1 System Name**

As recorded in the USACE National Levee Database (NLD), the name of the levee system is “Bolivar - Right Bank Root Creek”.

### **2.2 Project Type**

The Bolivar - Right Bank Root Creek local protection project, is an urban project that is authorized by the federal government and operated and maintained by the New York State Department of Environmental Conservation. The principal improvements consist mainly of providing protection along 4,750 feet of Root Creek by widening and deepening, slope protection, drop structures, a debris basin and one bridge invert and abutment protection.

### **2.3 Project Authority**

The project is authorized under Section 205 of the Flood Control Act of 1948 as amended.

### **2.4 Original Cost**

The 1986 Federal cost and allotments were \$1,591,436 with an estimated cost of \$36,000 for the non-Federal component.

### **2.5 Construction Completion Date**

Construction was completed in July 1982 and turned over to the State of New York on February 1984.

### **2.6 Public Sponsor**

The New York State Department of Environmental Conservation (NYSDEC) is the project sponsor. The sponsor contact information for the project is:

Mr. Ted Myers, PE  
NYSDEC – Buffalo  
270 Michigan Ave.  
Buffalo, NY 14203  
Telephone: 716-851-7088  
Email: [theodore.myers@dec.ny.gov](mailto:theodore.myers@dec.ny.gov)

### **2.7 Location**

The project is located on Root Creek in Bolivar, Allegany County, New York. Root Creek is a tributary to the Little Genesee Creek, having its mouth in Bolivar, New York. Root Creek is a headwater stream which drains approximately 9 square miles of area. The creek flows from high ground in the east, through the Village of Bolivar and then through a small marshland before it empties into the Little Genesee Creek.



## 2.8 Potential Consequences

The project provides reduction of flood damage risk to the Village of Bolivar, New York. Consequences of failure of the project may include property damage (primarily residential with some effects likely on commercial/institutional property), and the associated impacts on commerce, disruption of the local economy and services depending on the severity of the failure and the community's response.

## 2.9 Design Flood - Flow Rate and Elevation

The maximum flood of record occurred in June 1972, with peak flow of 2,000 c.f.s. The project is designed to provide flood risk reduction against a recurrence of the maximum flood of record, having a recurrence interval computed at once in 100 years.

Under normal stream flow conditions, Root Creek is a perennial stream that often experiences low flow that exists through most of the summer. This low flow condition consists of 1-3 inches of slow-moving water.

## 2.10 Record of Flood Events

The current active stream gage closest to the project location is USGS Root Creek at Davis Street at Bolivar, NY (USGS Gaging Station 03010674). The gage has been in service since October 2012. The two highest daily mean events since the gage became active are an elevation of 1,608.52 on January 11, 2014 and 1,607.42 on January 9, 2017. The maximum gage height for the period of record was 3.32 feet (1,609.11 feet) recorded on January 10, 2014 and appeared to be a result of ice jamming. Table 1 presents the historic known flood elevations at the Main Street Bridge prior to the completion of the project (USACE Detailed Project Report, 1975).

**Table 1. Historic Design Floods**

<b>Date</b>	<b>Elevation at Main St. Bridge (ft above msl)</b>
June 1972	1600.5
February 1959	1599.7
July 1970	1599.6
September 1967	1599.6

## 2.11 Investigations Prior to Construction

Bolivar is located on the maturely dissected Appalachian Plateau just south of the terminal moraine of the southern advancing Wisconsin ice sheet and within the small outwash valley of the Little Genesee Creek. The streambed of Root Creek (tributary to the Little Genesee Creek and flowing through Bolivar) consists of glacial, outwash which is at least fifty (50) feet thick and generally composed of local flat and slabby heterogeneous gravels with scarce bedding features. The bedrock floor and walls of the valley are composed of horizontally bedded upper Devonian shales and siltstones at the very top of which are some remnants of Mississippian shales and thin sandstones. There are no bedrock outcrops within the project limits. There were 14 test pits excavated in November of 1973 within the limits of the proposed improvements as shown

on design drawing 038pa.1-P1-10/1. The results classified the channel material, in general, as being composed of 60% gravels, 30% sands, and 10% silts and clays.

## **2.12 Remedial Measures and Major Modifications**

No remedial measures have been documented for this project. Modification documentation received from the sponsor for the project is limited. The most notable modification identified is the construction of a bus garage complex in the early 2000's for the Bolivar-Richburg School District at the upstream extent of the project that has significantly modified the original sediment basin and channel design. Correspondence/plans from the local sponsor regarding the modifications related to the bus garage were received by the Pittsburgh District, however, final USACE approval for this work has not been identified.

## **2.13 Most Current Inspection Report**

The most current project inspection was a routine inspection performed by USACE on October 15, 2015. As a result of the 2015 routine inspection, the project was rated Minimally Acceptable (M). The full routine inspection report is provided in Appendix F (Pre-Inspection Packet) of this report. The following is a summary of the deficiencies recorded from the 2015 Routine Inspection (USACE 10/21/2015):

- Significant brushy vegetation (minimal woody vegetation): could not inspect the flood side of levee (U).
- Old football equipment within permanent easement.
- Vegetation should be mowed/controlled on the banks in the sedimentation area (M).
- Small vegetation and small diameter tree through gabions (M).
- Old cast iron pipe with tree growing on top (M).
- Channel is not viewable due to vegetation (M).
- Large diameter tree (M).
- Pine trees are shown on the design drawings (near STA 33+00-32+00), but other vegetation makes access difficult (M).
- Small brush on both sides of Root Creek (M).
- Debris basin. Sediment should be removed in this area (M).
- Vegetated shoaling downstream of drop structure at STA 40+25 (M).
- Shoaling significantly reduces the channel capacity downstream of drop structure (U).
- Residential debris piles (M).
- 12 inch CMP drain pipe with flap gate (STA 41+50+/-). The flap is separated from the concrete and will no longer function properly (U).
- Sponsor should remove the vegetation from the gabion dike area (M).

Also noted during the 2015 routine inspection, at the upstream end of the project, a debris basin originally constructed by USACE was realigned by the local school district to accommodate a new bus garage. The debris basin was realigned and rock slope protection was installed upstream of the basin. At the time of the 2015 inspection, it appeared that the rock protection was installed along with a concrete wall to prevent undermining and destabilization of the rock. USACE requested as-built drawings of the realignment from the local sponsor.

There have been no prior periodic inspection for the project.

### 3. Pre Inspection Packet

#### 3.1 Features

The principal improvements consist mainly of providing protection along 4,750 feet of Root Creek by widening and deepening, slope protection, drop structures, a debris basin and one bridge invert and abutment protection. Feature details associated with the project, including features not covered in this inspection, such as bridge abutment details, can be seen in the project design drawings provided in Appendix A of the Pre-Inspection Packet and are indicated in Table 2 below.

**Table 2. Location and Features of the project**

STATION	COMPONENT
18+65 to 21+75	Levee (Right Bank)
22+80 to 24+20	Levee (Right Bank)
28+75 to 30+25	Levee (Right Bank)
33+40 to 36+30	Levee (Right Bank)
41+00 to 43+20	Gabion Levee
24+15	Drop Structure
27+37	Drop Structure
33+60	Drop Structure
40+25	Weir Drop Structure
45+25	Drop Structure
48+50	Drop Structure
62+30 to 66+30	Debris Basin
21+00	Access Ramp (Left Bank)
39+20	Access Ramp (Right Bank)

An Operation & Maintenance Manual (O&M Manual) has not been prepared for the project.

#### 3.2 Levee Embankments

As shown on the project drawings, five levee segments (referred to as dikes on the project design drawings) are present on the right bank. The levees are low height (crest height < ~4 feet. above grade). Further discussion of the levees based on the design drawings is provided within Section 4.2.3 under Design Criteria review.

#### 3.3 Interior Drainage

Interior drainage features for the project, according to Design Drawing No. 038 pa.1-P1-82/9, consist of the following storm drains discharging to the channel:

**Table 3. Outlet Pipe Structures**

PIPE OUTLET DATA								
STATION	DWG.	BANK	MARK	SIZE & TYPE	INVERT ELEVATION	FUNCTION	(14) ADJUSTMENT REQUIRED	
21+80±	82/2	LEFT	P-1	12" CMP	1587.9	STORM DRAIN	EXTEND 6 L.F.	GOV'T CONTRACTOR
21+80±	"	RIGHT	P-2	12" CMP	1588.8	STORM DRAIN	REMOVE 14 L.F.	" "
28+85±	82/3	LEFT	P-3	18" CMP	1599.0	STORM DRAIN	EXTEND 4 L.F.	" "
32+50±	"	LEFT	P-4	12" VCP	1613.0	STORM DRAIN	PROVIDE 38.5' STONE GUTTER	" "
39+20±	82/4	RIGHT	P-5	18" VCP	1608.5	STORM DRAIN	REMOVE 32 L.F.	" "
40+85±	"	LEFT	P-6	8" CIP	1618.0	STORM DRAIN	EXTEND 10 L.F. THRU NEW WINGWALL	" "
40+95±	"	RIGHT	P-7	12" VCP	1612.5	STORM DRAIN	REMOVE 18 L.F.	" "
41+20±	"	RIGHT	P-8	6" CIP	1610.0	STORM DRAIN	REMOVE 12 L.F.	" "
47+90±	82/5	RIGHT	P-9	18" CMP	1619.0	STORM DRAIN	REMOVE 24 L.F.	" "
41+30±	82/4	RIGHT	P-10	6" CIP	1610.0	STORM DRAIN	REMOVE 15 L.F. AND PROVIDE FLAPGATE	" "
32+21±	82/3	LEFT	P-11	4" VCP	—	DRAIN	EXTEND THROUGH FINISHED SLOPE	" "
41+70	82/4	RIGHT	P-12	12" CMP	1613.0±	STORM DRAIN	PROVIDE NEW 12" CMP DRAIN AND FLAPGATE	" "

\*EXACT LOCATION AND ELEVATION TO BE DETERMINED BY CONTRACTING OFFICER

With the exception of the 6 inch diameter cast-iron pipe (CIP) at Station 41+20, these outlets do not appear located beneath project levee segments. The outlet pipe at Station 41+20 crosses beneath the gabion levee section just upstream of Davis St. Additionally, the design drawings indicate the 6 inch CIP was to be replaced with a 12 inch corrugated metal pipe with a flap gate. Video inspection requirements for pipe outlets beneath levee sections applies for this outlet at Station 41+20.

### 3.4 Drop Structures

There are a total of six drop structures located within the channel improvement. The drop structure at Sta: 40+25 varies from the other five by being a weir type drop structure. The drop structure at Sta. 24+15 includes the addition of a new concrete wall on the left bank of the channel. Table 4, acquired from Design Drawing No. 038 pa.1-P1-82/13, presents the drop structures and stationing locations (see note at base of table regarding the sixth drop structure):

**Table 4. Drop Structures**

DROP STRUCTURE TABLE				
DROP STRUCTURE STATION	DROP	DOWNSTREAM LENGTH	LENGTH OF EACH SHEET PILE	NUMBER OF SHEET PILES
STA 24 + 15	2'	36'	6'	36 SHEETS
STA 33 + 60	3'	53'	9'	43 SHEETS
STA 40 + 25	SEE DETAILS OF WEIR TYPE			
STA 45 + 25	4'	50'	12'	45 SHEETS
STA 48 + 50	4'	68'	12'	41 SHEETS

Note: There is a sixth drop structure in the channel improvement section constructed by NYSDOT located at Station 27+37 according to Design Drawing No. 038 pa.1-P1-82/3.

### 3.5 Channels

According to the design drawings, the channel would be excavated from station 16+20 to 48+50. The channel bottom width would be 20 feet wide with side slopes varying between 1 vertical: 2 horizontal

(1V:2H) and 1V:1.75H with an invert grade of one-half of one percent. Gabions would provide the necessary slope protection as shown on the design drawings. The channel improvement included a reach between Station 24+20 to 28+57 to be constructed by the New York Department of Transportation in conjunction with the replacement of the Main Street Bridge. This would consist of a 30 ft., wide concrete-lined trapezoidal channel and a 4 ft. high drop structure. Five gabion and steel sheet piling drop structures would be provided to control the effective gradient and thereby reduce velocities and channel erosion without otherwise excessive excavation requirements. According to Design Drawing No. 038 pa.1-P1-82/6, at the upstream end of the project, a debris basin approximately 400 feet in length between Station 62+30 and 66+30 varying in width up to 75 feet with an invert grade of 0.4-percent would be provided to trap a major portion of debris and bed load which otherwise would increase channel maintenance downstream.

### **3.6 Access Ramps**

Two access ramps exist for the project, one on the left bank at Station 21+00 off of Leather St., and the other situated on the right bank at Station 39+20 off of Davis St.

## **4. Inspection Findings and Evaluations**

### **4.1 Results of Inspection**

Descriptions and photographs of observed deficiencies are documented in the Inspection Report found in Appendix B. Recommendations for repair are also included. Orthophoto maps displaying the locations of the deficiencies are included in Appendix A.

The Inspection Report in Appendix B is provided in a checklist format. Each feature of the levee, such as a levee embankment, floodwall, or pump station has several individual items or components that constitute a rated item (e.g., culverts, monolith joints, or pumps). Observations consisting of remarks, recommendations, and ratings are made on multiple components within a rated item of a levee system (e.g., multiple culverts, monolith joints, or pumps).

Potential ratings for each segment and items on each segment are Acceptable, Minimally Acceptable, Unacceptable, or Not Applicable. Some items, such as closure structures, do not allow a Minimally Acceptable rating. Rating guidelines discussing the potential ratings are provided for each rated item in Appendix B. From the multiple inspection observations, an overall rated item rating is made based on the condition of those rated item components in a segment of a system. The result is a USACE standard segment/system inspection report.

The following paragraphs summarize conditions of system features and highlight areas of concern. All major deficiencies are addressed. Please note that the Inspection Identification numbers referenced in the Inspection Report in Appendix B include the prefix “USACE\_CELRP\_BOLI\_2017\_p.” This prefix is not included when referencing Inspection Identification numbers in the body of this report.

#### **4.1.1 General Items for All Flood Damage Reduction Segments/Systems**

Based on visual observations, review and consideration of data provided for this system and this segment, and the individual rated items discussed below, the General Item feature does not appear to be in accordance with current USACE guidelines. Specific observations are discussed individually in the sections that follow.

#### **4.1.1.1 Project Operations and Maintenance Manual**

Criteria: The Levee Owner's Manual and the Operation and Maintenance Manual must be present.

The following observations of the O&M Manual were noted:

- No O&M manual exists for this project.

This item is rated Unacceptable.

#### **4.1.1.2 Emergency Supplies and Equipment**

Criteria: The Sponsor must maintain a stockpile of sandbags, shovels and other flood fighting supplies which will adequately supply all needs for the initial days of a flood fight.

- Sponsor has nearby equipment and materials to remove downed trees and make necessary repairs to the project.

This item is rated Acceptable.

#### **4.1.1.3 Flood Preparedness and Training**

Criteria: Sponsor has a solid understanding of and written plans for how to operate, maintain and staff the FCW during a flood including plans for short term situations such as a contingency plan for flood fighting while the LFPP is undergoing repairs or maintenance.

- Sponsor does not have a project specific Emergency Action Plan (EAP) which is kept at the project site and is reviewed by O&M staff.

This item is rated Minimally Acceptable.

### **4.1.2 Levee Embankments**

Based on visual observations, review and consideration of data provided for this system and this segment, and the individual rated items discussed below, the Levee Embankments Item feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

The levee embankments were generally observed to be functional. However, a number of rated items for the levee embankments were assigned ratings of Minimally Acceptable or Unacceptable. Specific items that need action are provided below by rated item.

#### **4.1.2.1 Unwanted Vegetation Growth**

Criteria: The vegetation-free zone is a three-dimensional corridor surrounding the levees and floodwalls. This zone applies to all vegetation except grass. The primary purpose of the vegetation-free zone is to provide a reliable corridor of access to and along levees and floodwalls by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood fighting. During flood-fighting operations, this space may be necessary for the construction of temporary flood-control structures. The secondary purpose is to provide distance between root systems and levees and floodwalls. Roots may provide a shortened pathway for seepage and piping that might ultimately threaten the stability of the levees and

floodwalls.

Little or no unwanted vegetation (trees, bush, or undesirable weeds), except for vegetation that is properly contained and/or situated on overbuilt sections, should be present in the area of the levee such that the mandatory three-foot root-free zone is preserved around the levee profile. A vegetation-free zone extending 15 feet from both the landside and riverside toes of the levee to the centerline of the tree should be maintained per the requirements of *ETL 1110-2-583: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (USACE 2014)*. Removal of trees and vegetation shall follow USACE Pittsburgh District guidelines.

The following observations were Unacceptable:

- Unwanted vegetation on waterside slope (obs. 0025);
- Large pine trees within 15 feet of levee landside toe (obs. 0027);
- Unwanted vegetation within 15 feet of levee landside toe (obs. 0041);
- Small tree in levee crest (obs. 0042);
- Unwanted heavy wooded vegetation on waterside slope (obs. 0044);
- Large pine tree at the start of the levee (obs. 0053);
- Unwanted heavy woody vegetation on both levee side slopes and crest. (obs. 0055);
- Large trees in levee crest and landside slope (obs. 0057);
- Unwanted heavy woody vegetation on both levee slopes and crest. Five (5) large pine trees within easement on landside toe (obs. 0058);
- Large box elder tree on levee landside slope (obs. 0065);
- Two (2) trees within 15 feet of levee toe and within permanent easement (obs. 0068);
- Unwanted heavy woody vegetation on levee waterside slope and crest (obs. 0072);
- Large tree on levee landside slope (obs. 0076);
- Unwanted large tree on levee landside toe within permanent easement (obs. 0078);
- Unwanted woody vegetation (obs. 0079).

The follow observation was Minimally Acceptable:

- Unwanted soft to woody vegetation on levee crest and waterside slope (obs. 0064).

This item is rated Unacceptable.

#### **4.1.2.2 Sod Cover**

Criteria: There should be good sod cover over the levee. Seeding and cover requirements shall follow USACE Pittsburgh District guidelines.

The sod cover on the system was generally complete and appeared well established with the exception of several observations receiving a rating of Minimally Acceptable as follows:

- Lack of sod cover (obs. 0031);
- Lack of sod cover on levee crest (obs. 0071);
- Damaged sod cover on levee landside slope (0074).

This item is rated Minimally Acceptable.

#### **4.1.2.3 Encroachments**

Criteria: No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions should be present within the easement area that may inhibit operations and maintenance or emergency operations, or that may negatively impact the integrity of the levee.

The following observations received a Minimally Acceptable rating:

- Construction debris, metal barrel, four wheeler, swing on levee crest and landside slope (obs. 0045);
- Fence (plastic) preventing access on right bank (obs. 0054);
- Fence blocking access along right bank (obs. 0067);
- Trailer within 15 feet of levee landside toe (obs. 0040);
- Lawn debris on levee crest (obs. 0066);
- Trailer and tires within permanent easement of levee landside toe (obs. 0070);
- 2 vehicles within 15 feet of levee landside toe and within the easement (obs. 0073);
- Tree debris on levee landside slope and at levee toe within the easement (obs. 0077);
- At the downstream limit of the project, there appears to be an approximate 215 foot section of levee on the right bank that was not part of the original project design (obs. 0090).

This item is rated Minimally Acceptable.

#### **4.1.2.4 Closure Structures**

Criteria: Closure structures should be in good repair, with all equipment and materials readily available at all times, components clearly marked, and installation instructions/procedures readily available. Trial erections have been accomplished in accordance with the O&M manual.



- There are no closure structures as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.2.5 Slope Stability**

Criteria: No slides, sloughs, tension cracking, slope depressions, or bulges should be present.

- Slope stability issues were not observed during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.2.6 Erosion/Bank Caving**

Criteria: No erosion or bank caving should be observed on the levee embankment that might endanger stability.

The following observation received a Minimally Acceptable rating for erosion:

- Bank caving/excavation was observed at the LS levee toe near 1<sup>st</sup> St. during the inspection (obs. 0075).

This item is rated Minimally Acceptable.

#### **4.1.2.7 Settlement**

Criteria: No depressions should be observed in the crown of the levee. Settlement may compromise protection from large floods and threaten the integrity of the levee.

- Settlement was not observed along the levee crest during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.2.8 Depressions/Rutting**

Criteria: There are scattered, shallow ruts, pot holes or other depressions on the levee that are unrelated to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.

- Depressions/rutting was not observed during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.2.9 Cracking**

Criteria: Only minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack may be present. No cracks that extend continuously through the levee crest may be present.

- No cracking of levee embankment was observed during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.2.10 Animal Control**

Criteria: Levee Sponsors should have an animal control program in place that includes the elimination of active burrowing and the filling of existing burrows.

The following observations received a Minimally Acceptable rating for animal control:

- Multiple animal burrows (obs. 0030);
- Animal burrow on landside slope (obs. 0080);
- Animal burrow levee landside slope (obs. 0083).

This item is rated Minimally Acceptable.

#### **4.1.2.11 Culverts/Discharge Pipes**

Criteria: Discharge pipes/culverts should have no breaks, holes, or cracks that would result in significant water leakage and should be essentially circular. All joints should be closed and the soil tight. Corrugated metal pipes should be in good condition with the asphalt or galvanizing completely in place. The condition of pipes must be verified using television camera videotaping or visual inspection methods every five years, and the report for every pipe made available for review.

- All discharge pipes/culverts present are discussed in section 4.1.3.9 Interior Drainage System.

This item is rated Not Applicable.

#### **4.1.2.12 Riprap Revetments and Bank Protection**

Criteria: No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank should be apparent. Riprap should be intact with no woody vegetation present.

- There are no riprap revetments for the levee embankment as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.2.13 Revetments other than Riprap**

Criteria: Existing revetment protection is properly maintained, undamaged, and clearly visible.

- There are no revetments for the levee embankment as part of the designed project for the Bolivar LFPP. However, the gabion dike section has a vertical gabion wall as the waterside protection, the condition of which is noted in observation 0026 as acceptable.

This item is rated Acceptable.

#### **4.1.2.14 Underseepage Relief Wells/Toe Drainage Systems**

Criteria: Nothing should be observed which would indicate that toe drainage systems and pressure relief wells would not function properly during the next flood. Documentation should be available for review to confirm that wells have been pump tested within the past five years. Maintenance records should be available to show regular cleaning has been performed.

- There are no underseepage relief wells or toe drainage systems for the levee embankment as part of the designed project for the Bolivar LFPP.

This item is rated Not Applicable.

#### **4.1.2.15 Seepage**

Criteria: No evidence or history of unrepaired seepage, saturated areas, or boils should be seen.

- No levee embankment seepage issues were observed during the inspection.

This item is assigned an Acceptable rating.

### **4.1.3 Interior Drainage System**

Based on visual observations, our review and consideration of data provided for this system and this segment, and the individual rated items discussed below, the Interior Drainage Item feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

The interior drainage system was generally observed to be functional. Rated items for the interior drainage system are discussed below along with specific items that require action.

#### **4.1.3.1 Vegetation and Obstructions**

Criteria: No obstructions, vegetation, debris, or sediment accumulation should be present within interior drainage channels or blocking the culverts, inlets, or discharge areas. Concrete joints and weep holes should be free of grass and weeds.

- No obstructions that would block the culverts, inlets, or discharge areas were observed during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.3.2 Encroachments**

Criteria: No trash, debris, structures, excavations or evidence of other unauthorized activities should be present in the easement area.

- Encroachments into the drainage easement were not observed during the inspection.

This item is assigned an Acceptable rating.

#### **4.1.3.3 Ponding Areas**

Criteria: No trash, debris, structures, or other obstructions should be present within the ponding areas. USACE guidelines specify that sediment deposits should not exceed 10% of capacity.

- There are no ponding areas as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.4 Fencing and Gates**

Criteria: Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts. Potentially dangerous features should be secured.

- There are no fences or gates for the interior drainage as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.5 Concrete Surfaces**

Criteria: Concrete surfaces should exhibit negligible spalling, scaling, or cracking. The presence of such surface deterioration and cracking may lead to additional damage during periods of freezing and thawing. Further surface deterioration and deep cracks may result in an unreliable structure.

- There are no concrete components of the interior drainage system that are part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.6 Tilting, Sliding, or Settlement of Concrete and Sheet Pile Structures**

Criteria: Concrete and sheet pile structures, such as gate wells, outfalls, intakes, or culverts, should exhibit no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structures.

- There are no concrete or sheet pile components of the interior drainage system that are part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.7 Foundations of Concrete Structures**

Criteria: No areas should display signs of active erosion, scouring, or bank caving that might endanger the stability of concrete structures, such as culverts, inlet and discharge structures, or gatewells.

- There are no concrete components of the interior drainage system that are part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.8 Monolith Joints**

Criteria: The joint material between monolith sections should be in good condition, exterior joint sealant should be intact with minimal cracking or desiccation present, and the joint filler material and/or waterstop should not be visible at any point.

- There are no monolith joints associated with the interior drainage system as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.9 Culverts/Discharge Pipes**

Criteria: Discharge pipes/culverts should have no breaks, holes, or cracks that would result in significant water leakage and should be essentially circular. All joints should be closed and the soil tight. Corrugated metal pipes should be in good condition with the asphalt or galvanizing completely in place. The condition of pipes should be verified using television camera videotaping or visual inspection methods every five years, and the report for every pipe made available for review by the inspector.

The sponsor provided video-inspection results and defect report for two culverts located on the right bank just upstream of Davis St.: 12 inch diameter CMP with flapgate at Station 41+20 (installed as part of the project), and a 10 inch diameter CMP installed after the original project construction which appears associated with Davis St. bridge work. The following observation was rated Acceptable:

- 12 inch diameter CMP at Station 41+20 – video inspection indicated no visible defects (obs. 0028).

The following observation was rated Minimally Acceptable:

- 10 inch diameter CMP just upstream of Davis St. – video inspection indicated moderate corrosion along pipe invert and a hole/invert loss at one location (obs. 0033). Additionally, no flap gate is present on this pipe.

This item is rated Minimally Acceptable.

#### **4.1.3.10 Sluice/Slide Gates**

Criteria: Sluice/slide gates should open and close freely and permit only minor leakage. The gate sill should be free of sediment and other obstructions. Gate operators should be in good working condition and be properly maintained.

- There are no sluice or side gates associated with the interior drainage system as part of the designed project for the Bolivar LFPP.

This item is assigned a Not Applicable rating.

#### **4.1.3.11 Flap Gates/Flap Valves/Pinch Valves**

Criteria: Gates and valves should open and close easily with minimal leakage and be exercised and lubricated as required. No corrosion damage should be observed.

The following observation was rated Acceptable:

- Flap gate at the 12 inch diameter CMP located at Sta. 41+20 along the right bank upstream of Davis St. was repaired and operated (obs. 0028).

This item is rated Acceptable.

#### **4.1.3.12 Trash Racks**

Criteria: Trash racks should be securely fastened in place and properly maintained.

- Trash racks are not part of the designed features for the LFPP.

This item is rated Not Applicable.

#### **4.1.3.13 Other Metallic Items**

Criteria: All metal parts not previously discussed should be protected from corrosion damage and should show no rust, damage, or deterioration that would cause a safety concern.

- The LFPP has no other metallic items.

This item is rated Not Applicable.

#### **4.1.3.14 Riprap Revetments of Inlet/Discharge Areas**

Criteria: Riprap revetment should show no signs of displacement or stone degradation, and no woody vegetation should be present.

- There is no riprap protecting the discharge feature of the interior drainage system.

This item was assigned a Not Applicable rating.

#### **4.1.3.15 Revetments other than Riprap**

Criteria: Existing revetment protection should be properly maintained, undamaged, and clearly visible. Any unwanted vegetation should be cleared or sprayed with an appropriate herbicide.

- There are no revetments protecting the discharge feature of the interior drainage system.

This item was assigned a Not Applicable rating.

#### **4.1.4 Flood Damage Reduction Channel**

Based on visual observations, review and consideration of data provided for this system and this segment, and the individual rated items discussed below, the Flood Damage Reduction Channel feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

The channel was generally observed to be functional. However, a number of rated items were assigned

ratings of Minimally Acceptable or Unacceptable. Specific items that need action are provided below by rated item.

#### **4.1.4.1 Vegetation and Obstructions**

Criteria: No obstructions, vegetation, debris, or sediment accumulation within the channel. Concrete channel joints and weep holes are free of grass and weeds.

The following observations were Unacceptable:

- Unwanted vegetation in channel along left bank toe (obs. 0008);
- Unwanted heavy woody vegetation on channel banks, view is looking upstream (obs. 0014).

The following observations were Minimally Acceptable:

- Looking downstream at unwanted vegetation on both banks (obs. 0013);
- Large fallen tree on left bank, possible snag starting (obs. 0043);
- Looking downstream from Main Street bridge at unwanted vegetation on both banks (obs. 0060),
- Unwanted vegetation in Leather Street access ramp (obs. 0089).

This item is rated Unacceptable.

#### **4.1.4.2 Shoaling (Sediment Deposition)**

Criteria: No shoaling or minor, non-vegetated shoaling is present.

The following observations were Minimally Acceptable:

- Shoal in channel downstream of the drop structure at Sta. 45+25 (obs. 0024).
- Shoal in channel (obs. 0002 and obs. 0036);
- Shoal in sediment basin at the upstream limit of the project (obs. 0004).

This item is rated Minimally Acceptable.

#### **4.1.4.3 Encroachments**

Criteria: No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the channel.

The following observations were Unacceptable:

- Sediment basin modified/relocated due to school bus garage (obs. 0001);

- Fence preventing access on right bank (obs.0050).

The following observations were Minimally Acceptable:

- Gate overhanging channel (obs. 0018);
- 6 inch PVC outfall on right bank (obs.0020);
- Concrete debris on right bank of channel (obs. 0048);
- Wood pellets debris. (No photo was taken) (obs. 0049);
- Stairs on right bank (obs. 0051);
- Lawn debris on channel slope (obs. 0052);
- Red foot bridge over channel. Determine if this defines the downstream project limit (obs.0082);
- Boat and debris on Leather Street access ramp (obs. 0088).

This item is rated Minimally Acceptable.

#### **4.1.4.4 Erosion**

Criteria: No head cutting or horizontal deviation observed.

- No head cutting or erosion was not observed during the inspection.

This item is rated Acceptable.

#### **4.1.4.5 Concrete Surfaces**

Criteria: Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.

The following observation was Minimally Acceptable:

- Cracking in concrete and corroded CMP on right bank in concrete trapezoidal channel NYSDOT portion of channel improvements (obs. 0061).

This item is rated Minimally Acceptable.

#### **4.1.4.6 Tilting, Sliding or Settlement of Concrete Structures**

Criteria: There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.

- No tilting, sliding, or settlement of drainage structures was observed during the inspection.



This item is assigned an Acceptable rating.

#### **4.1.4.7 Foundation of Concrete Structures**

Criteria: No active erosion, scouring, or bank caving that might endanger the structure's stability.

- No active erosion, scouring, or bank caving were observed during the inspection that might endanger the stability of any structures.

This item is rated Acceptable.

#### **4.1.4.8 Slab and Monolith Joints**

Criteria: The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.

- All joint material and monolith joints that were observed during this inspection were in good condition.

This item is rated Acceptable.

#### **4.1.4.9 Flap Gates/Flap Valves/Pinch Valves**

Criteria: Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.

- See Section 4.1.3.11 Flap gates/Flap Valve in Interior Drainage System of this report.

This item is assigned a Not Applicable rating.

#### **4.1.4.10 Riprap Revetments & Banks**

Criteria: No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.

The following observation was Minimally Acceptable:

- Unwanted woody vegetation in riprap along sediment basin banks (obs. 0003).

This item is rated Minimally Acceptable.

#### **4.1.4.11 Revetments other than Riprap**

Criteria: Existing revetment protection is properly maintained, undamaged, and clearly visible.

The following observations were Unacceptable:

- Unwanted woody vegetation in gabion channel slope protection on left bank (obs. 0009);

- Unwanted heavy woody vegetation in gabion channel slope protection on the right bank (obs.0010);
- Unwanted heavy large woody vegetation in gabion channel slope protection on the right bank (obs. 0011);
- Unwanted heavy woody vegetation in gabion channel slope protection on the left bank (obs. 0015);
- Heavy woody vegetation in gabion channel slope protection on both banks (obs. 0016);
- Unwanted heavy woody vegetation in gabion channel slope protection on both banks (obs. 0022);
- Unwanted heavy woody vegetation in gabion channel slope protection on both banks (obs. 0023);
- Damaged gabion in channel lining (obs. 0035);
- Unwanted heavy woody vegetation in gabion channel slope protection on both banks (obs. 0038, 0039, 0047, and 0056);
- Looking downstream at unwanted woody vegetation in gabion channel slope protection on both banks (obs. 0069);
- Looking upstream from red foot bridge at end of levee at unwanted heavy woody vegetation in gabion channel slope protection on both banks. (obs. 0081).

The following observations were Minimally Acceptable:

- Start of the right bank gabion channel slope protection (obs. 0006);
- Vegetation in gabion channel slope protection on right bank (obs. 0007);
- Unwanted vegetation in gabion channel slope protection on the left bank (obs. 0012);
- Unwanted woody vegetation in the gabion slope protection on both banks (obs. 0032).

This item is rated Unacceptable.

## **4.2 Design Criteria Review**

### **4.2.1 General Criteria and Survey Datum**

The objective of the design criteria review is to evaluate the system's original design criteria and compare it to current USACE design criteria. This section was developed from a review of available design documentation provided by the USACE Pittsburgh District and includes the Detailed Project Report (USACE 1975) and the project design drawings dated 3 April 1979. As-built drawings are not available for the project.

#### Survey Datum

Per the requirements of ER 1110-2-8160 (USACE, 2009), elevations should be referenced to the orthometric vertical reference datum within the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON). This datum is currently NAVD88. The design drawings have not been updated to reference NAVD88. In accordance with the requirements of the ER, the relationship between these datums should also be documented in the O&M Manual.

EC 1110-2-6065 (USACE, 2007) states that a minimum of one benchmark is required at each flood control structure site geodetically connected to the NAVD88 orthometric datum on the NSRS. Permanent benchmarks should be shown on the most recent contract plans with complete metadata descriptions. Benchmarks are shown on the project design drawings and the initial survey was made in 1973. The beginning horizontal control was based on scaled New York grid coordinates, traverses were run on third order accuracy. Elevations originated from USC&GS bench marks and refer to 1929 adjustment. Topography was obtained by plane table scale 1" = 30' and cross sections. Plane table sheets Nos. 999-1003. Additional field surveys were made in 1976 to locate and tie in the State of New York channel project at Main St. Bridge. Complete metadata descriptions and dual elevations based on NAVD88 are not provided.

#### **4.2.2 Hydraulics and Hydrology**

##### Level of Protection

The current FEMA Flood Plain Map for the village of Bolivar, Allegany County is 3600260001C, dated January 19, 1996. The project area indicates the Base Flood Elevation (1% annual chance event) ranges from Elevation 1636.7 feet (NGVD29) upstream to 1586.9 feet downstream (taken from Table 2 of FIS 360026, Village of Bolivar, New York Allegany County, dated: Revised January 19, 1996).

##### Interior Drainage

EM 1110-2-1413 (USACE January, 1987) states that the minimum system should be able to convey the local storm system design event under gravity conditions with no increase in interior flooding. A future condition analysis is also required and includes consideration of environmental and social factors as well as damage potential.

##### Channel

Channel lining: According to the Detailed Project Report, velocities for the improved project would average about 8.7 ft/sec. for the design flow except where influenced by the drop structures where they would be higher. The comparative value for the 1.3 year flow would be 5.8 ft/sec. Gabion mattresses at 9 inch thickness are designed as channel side slope lining. Current USACE design criteria suggests channels with velocity (7.0 fps) and/or shear exceeding permissible values will require paving or bank revetment. No channel lining analyses or riprap sizing evaluations were presented in the Detailed Project Report, consequently it is unknown if project channel lining would meet current design criteria for erosion protection.

12 inch diameter outlet culvert at 41+20 and 10 inch diameter culvert adjacent to Davis St. on upstream right bank: Video inspections indicate these pipes are corrugated metal. Based on historic reliability issues with corrugated metal pipe (CMP) for gravity drains, the minimum standard for these pipelines is reinforced concrete pipe (RCP).

The hydraulics and hydrology information available for review does not contain sufficient analyses to determine if all current USACE design criteria have been met.

### **4.2.3 Geotechnical**

The Detailed Project Report (USACE 1975) includes slope stability calculations for the channel side slopes. The left bank was analyzed at a number of locations including: Station: 29+00, 42+00, 47+00, 53+00, 55+00 and 59+00, where the height of the slopes ranged from 15 feet to 30 feet in height and the steepest at 30 to 55 degrees. This determined that a slope of 1 vertical on 1  $\frac{3}{4}$  horizontal was a safe economical choice at these locations. A stability analysis was performed at a critical section at Station 32+66 due to surcharge of a two story house. A factor of safety of 1.65 was determined at this location. From station 31+75 to 33+50 several structures are close to the top edge of the natural slope. To prevent sliding into the new channel a proposed wedge of soil was to be excavated and placed at a slope of 2 horizontal to 1 vertical against the natural embankment raising the factor of safety to 1.8. USACE design and construction guideline for embankment levee indicates minimum required factors of safety of 1.3 and 1.4 for end of construction and long term stability conditions, respectively.

#### Levee Embankment

No geotechnical analyses for the levee embankments were available at the time of preparation of this report, and no geotechnical analyses for the embankments are provided in the Detailed Project Report. Based on the project drawings, the levee crown width for the earthen levee sections is 5 feet wide, which is less than the minimum current design guideline of 10 feet width. Landside embankment side slopes are 2 horizontal to 1 vertical. While on the waterside embankment side slopes are sloped at 3 horizontal to 1 vertical, according to Design Drawing No. 038pa.1-P1-82/7. Both slopes meet current design criteria of 2 horizontal to 1 vertical or flatter for stability. The landside slopes are steeper than the 3 horizontal to 1 vertical for conventional mowing practices. The gabion levee section, according to Design Drawing No 038pa.1-P1-82/7, consists of 3-foot wide gabions with a 2 horizontal to 1 vertical landside slope and vertical waterside slope. The gabion levee embankment design does not appear to be consistent with current design criteria.

#### Slope Stability

Slope stability analyses for levee sections consisting of earthen embankments or gabion embankments were not known to have been performed. It is unknown as to whether the embankment slopes meet current stability criteria.

#### Seepage Control

Based on design drawings there is no indication of a horizontal drainage blanket, pervious toe drains, or relief wells installed as part of the levee design. Seepage analyses for levee sections consisting of earthen embankments or gabion embankments were not included in the known files associated with the project at the time of preparation of this report. No calculations were available for review to assess seepage potential and whether the levee structures meet current seepage design criteria.

#### Settlement

Settlement calculations were not known to have been performed. Based on past years of routine inspections there is no indication of significant settlement by the inspection teams. It is unknown as to whether the levee segment crest elevations have been maintained and within settlement criteria as no as-built drawings

or current survey data are available to evaluate in this context.

#### Levee Embankment Slope Protection

Based on the design drawings slope protection is not present on any portion of the levee alignment. However, there is a segment of levee referred to as the gabion dike which has a gabion basket wall as its waterside slope instead of a conventional sloped embankment. The gabion levee embankment design does not appear to be consistent with current design criteria.

#### **4.2.4 Structural**

No structural analyses for the project drop structures, associated concrete gravity wall (associated with drop structure located at Station 24+15), or bridge abutment structures were presented in the Detailed Project Report or available at the time of preparation of this report. It is unknown as to whether these features meet current structural design criteria.

### **4.3 Levee Safety Issues**

Heavy vegetation is present along the levee and channel alignment preventing the ability to access the system during a flood event. Fence encroachments are also present within the permanent easement preventing the ability to access the system during a flood event and to perform routine maintenance.

No recent hydraulics and hydrology review has been completed to verify the level of protection.

No O&M manual, EPP, or as-built drawings have been prepared for this project.

No formal USACE Pittsburgh District permit has been identified stating that the alteration of the sediment basin at the upstream end of the project was approved.

It is also important that any modifications to the levee system and encroachments on or across the levee be permitted by the Pittsburgh District USACE prior to construction. In addition, any decommissioning or abandoning of features should also be permitted by the Pittsburgh District USACE prior to any action taking place.

## **5. Conclusions and Recommendations**

A description of the identified deficiencies for each feature and item and recommendations for the Sponsor to consider on how to repair, mitigate, or improve these deficiencies are discussed in the appropriate report section.

Recommendations for each observation are included in Appendix B. This section is a highlight of recommendations for system features of particular concern.

The local Sponsor should consult USACE Pittsburgh District as to whether new hydrologic and hydraulic analyses of the Bolivar LFPP should be performed to determine the impact of land use changes as well as changes in stream hydrology and hydraulics since the project was originally constructed.

The local Sponsor should consult USACE Pittsburgh District as to whether analyses should be performed of the floodwall (drop structure at 24+15 and associated concrete gravity wall) and levee for stability to

determine factors of safety per the requirements of EM 1110-2-1902, EM 1110-2-1913, EM 1110-2-2100 and ER 1110-2-2502. Seepage analysis should also be considered based on the requirements of EM 1110-2-1901 as well as filter materials per the requirements of EM 1110-2-1901.

## **5.1 General Items**

### **5.1.1 Project Operations and Maintenance Manual**

An O&M Manual should be created for the project in coordination with the Pittsburgh District USACE. The developed O&M Manual should include but not limited to:

- Reference to the current survey datum (NAVD88);
- Documentation of all permitted conditions and other modifications to the system;
- Updated maintenance procedures that incorporate the latest USACE SOPs;
- Update to current conditions and contact information.

### **5.1.2 Flood Preparedness and Training**

There is no written emergency action plan for the project. The Sponsor should develop a written system-specific flood response plan addressing how to operate, maintain, and staff the FDR system during a flood and including a list of emergency contact information for appropriate personnel and other emergency response agencies.

## **5.2 Levee Embankments**

### **5.2.1 Unwanted Vegetation Growth**

The vegetation located within the vegetation-free zone should be cleared in order to provide a reliable corridor of access to and along levees and floodwalls by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood fighting. Trees larger than 4 inches in diameter should be completely removed including the root ball and the excavations backfilled with compacted soil. This work should follow USACE Pittsburgh District guidelines.

### **5.2.2 Sod Cover**

A good coverage of sod should be maintained over the levee. Areas where sod cover is missing or thin create an area of potential erosion. During the inspection, the sod cover was noted to be in generally acceptable condition, however, several minor areas of disturbed/missing sod were identified. These areas should be scarified, seeded, and covered with a bio-degradable geotextile or equivalent according to USACE Pittsburgh District procedures.

### **5.2.3 Encroachments**

Remove miscellaneous encroachments within the project easements identified in Section 4.1.2.3 (e.g. trailers, vehicles, lawn/tree debris, etc.).

Obtain authorization from USACE Pittsburgh District or remove fence encroachments preventing access along the levee alignment.

Formal acknowledgement of the project termination point needs to be determined with USACE Pittsburgh District input in order to validate an approximately 215 foot section of levee at the downstream extent of the channel on the right bank. This section of levee is not included on the design drawings.

#### **5.2.4 Erosion and Bank Caving**

Repair the levee toe area at Obs. 0075 (near 1st St.). The bank caving/excavation should be filled with compacted soil, seeded or sodded and protected in accordance with USACE Pittsburgh District guidelines.

#### **5.2.5 Animal Control**

Animal burrows should be filled per the guidelines contained in USACE *Backfill Procedures Animal Burrows In or Near Levees* dated 29 July 2008 and sod cover reestablished per USACE Pittsburgh District guidelines. The Sponsor should continue to monitor the levee for burrowing animal activity.

### **5.3 Interior Drainage System**

#### **5.3.1 Culverts and Discharge Pipes**

The culverts and discharge pipes should continue to be video inspected every five years in accordance with the requirements of USACE *Guidance for CCTV and Sonar Inspection Pipes Penetrating Levees* dated February 2013. The records of the inspection and corresponding action should be submitted to USACE Pittsburgh District for review and maintained for review during periodic inspections. Indicated repairs should be performed and USACE should be notified of any planned repairs or replacements.

The 10 inch diameter CMP located on the right bank just upstream of Davis St. not installed as part of the project should be evaluated by the sponsor as to the necessity of installation of a flap gate. Additionally this pipe exhibited defects/corrosion based on video-inspection and should be repaired as necessary to ensure continued functionality. Project modification documentation should be prepared and provided to USACE for review and approval.

### **5.4 Flood Damage Reduction Channel**

#### **5.4.1 Vegetation and Obstructions**

The vegetation located within the permanent easement should be cleared in order to provide a reliable corridor of access to and along the channel by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood fighting. Trees should be completely removed including the root ball and the hole backfilled with compacted soil. This work should follow USACE Pittsburgh District guidelines.

#### **5.4.2 Shoaling (sediment deposition)**

Shoals should be removed so that they do not become well established and stabilized by vegetation. Removal will prevent both channel flow from being diverted to channel walls and channel capacity being reduced. This work should follow USACE Pittsburgh District and State EPA guidelines.

### **5.4.3 Encroachments**

Unauthorized encroachments or inappropriate activities that inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the channel need to be removed. All encroachments listed in section 4.1.4.3 with a Minimally Acceptable or Unacceptable rating need to be reviewed by USACE Pittsburgh District to determine if a USACE permit is to be issued or if the encroachment is to be removed.

### **5.4.4 Concrete Surfaces**

Cracking of concrete surfaces for the NYSDOT trapezoidal channel portion of the channel system located at Main Street should be repaired in accordance with USACE Pittsburgh District guidelines.

### **5.4.5 Riprap Revetments and Banks**

Unwanted woody vegetation in the riprap along the sediment basin and within the permanent easement needs to be removed.

### **5.4.6 Revetments other than Riprap**

The extensive unwanted vegetation and dense brush and trees within the gabion channel slope protection and within the permanent easement needs to be removed. Repairs to the damaged gabion channel lining need to be made and should follow USACE Pittsburgh District guidelines.

## **5.5 Rating**

Based on the results of this Periodic Inspection and the condition of the project at the time of the inspection, the overall system rating for the Bolivar LFPP is MINIMALLY ACCEPTABLE. The primary factors for this rating include heavy unwanted vegetation on or adjacent to the levee and heavy unwanted vegetation within the flood damage reduction channel along its entire alignment. Refer to Appendix B of this report for a full list of M and U-rated items.

## **5.6 Certification**

At this time the Bolivar LFPP levee system has not met minimum certification criteria under 44 CFR Section 65.10 and the system is not accredited by FEMA.

## **5.7 Next Periodic Inspection**

The next periodic inspection is currently scheduled for FY2022.



# **Appendix A**

## **Figures, Drawings, and Maps**

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### Levee Inspection Map

**Bolivar, NY - Root Creek**

Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix: USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

Levee

**Observation Points**

- Acceptable
- Minimally Acceptable
- Unacceptable
- Not Applicable

**Observation Lines**

- Acceptable
- Minimally Acceptable
- Unacceptable
- Not Applicable

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Feet

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US Army Corps of Engineers

Allegany

New York

Pennsylvania

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### Levee Inspection Map

**Bolivar, NY - Root Creek**

Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix: USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

Levee

**Observation Points**

- Acceptable
- Minimally Acceptable
- Unacceptable
- Not Applicable

**Observation Lines**

- Acceptable
- Minimally Acceptable
- Unacceptable
- Not Applicable

0140280

Feet

N



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### Levee Inspection Map

**Bolivar, NY - Root Creek**





Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix:  
USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

 Levee


**Observation Points**

-  Acceptable
-  Minimally Acceptable
-  Unacceptable
-  Not Applicable

**Observation Lines**


-  Acceptable
-  Minimally Acceptable
-  Unacceptable
-  Not Applicable


0 140 280 Feet



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N





New York

Pennsylvania

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**Levee Inspection Map**

**Bolivar, NY - Root Creek**

Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix:  
USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

 Levee

- Observation Points**
-  Acceptable
  -  Minimally Acceptable
  -  Unacceptable
  -  Not Applicable

- Observation Lines**
-  Acceptable
  -  Minimally Acceptable
  -  Unacceptable
  -  Not Applicable

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**Levee Inspection Map**

**Bolivar, NY - Root Creek**





Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix:  
USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

 Levee

**Observation Points**

-  Acceptable
-  Minimally Acceptable
-  Unacceptable
-  Not Applicable

**Observation Lines**

-  Acceptable
-  Minimally Acceptable
-  Unacceptable
-  Not Applicable

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**Levee Inspection Map**

**Bolivar, NY - Root Creek**

Location: Bolivar, NY  
Year/cycle: 2017 p  
Inspection type: Periodic  
Inspected by: LRB Team  
Inspection date(s): 6/12/2017  
Observation ID prefix:  
USACE\_CELRP\_BOLI\_2017\_p  
Map created: 03 August 2017

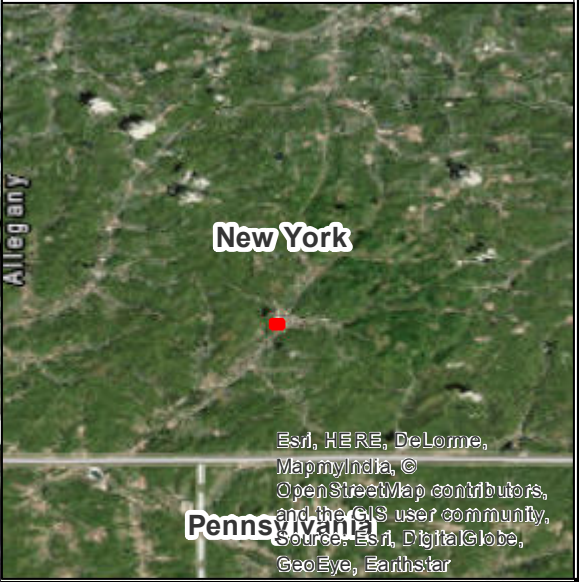
 Levee

- Observation Points**
-  Acceptable
  -  Minimally Acceptable
  -  Unacceptable
  -  Not Applicable
- Observation Lines**
-  Acceptable
  -  Minimally Acceptable
  -  Unacceptable
  -  Not Applicable

0 140 280 Feet



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**Appendix B**  
**Inspection Report and Photographs**

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## Flood Damage Reduction Segment / System Inspection Report

Name of Segment / System: Bolivar, NY - Root Creek

Public Sponsor(s): NYSDEC

Public Sponsor Representative: Ted Myers, PE

Sponsor Phone: 716-851-7088

Sponsor Email: theodore.myers@dec.ny.gov

Corps of Engineers Inspector: David Mitchell, P.G., P.E.

Inspection Start Date: 6/12/2017

Inspection End Date: 6/12/2017

Inspection Report Prepared By: LRB Team

Date Report Prepared: \_\_\_\_\_

Internal Technical Review (for Periodic Inspections) By: Pittsburgh District *for New*

Date of ITR: 8/29/17

Final Approved By: *Jessie Horig*

Date Approved: 9/22/17

Type of Inspection:

- ☐ Initial Eligibility Inspection  
☐ Continuing Eligibility Inspection (Routine)  
☒ Continuing Eligibility Inspection (Periodic)

Overall Segment / System Rating:

- ☐ Acceptable  
☒ Minimally Acceptable  
☐ Unacceptable

Contents of Report:

- ☒ Instructions  
☐ Initial Eligibility Inspection  
☒ General Items for All Flood Control Works  
☒ Levee Embankment  
☐ Concrete Floodwalls  
☐ Sheet Pile and Concrete I-walls  
☒ Interior Drainage System  
☐ Pump Stations  
☒ FDR System Channels

Note: In addition to the report contents indicated here, a plan view drawing of the system, with stationing, should be included with this report to reference locations of items rated less than acceptable. Photos of general system condition and any noted deficiencies should also be attached.

Note: This inspection rating represents the Corps evaluation of operations and maintenance of the flood damage reduction system and may be used in conjunction with other information for a levee certification determination for National Flood Insurance Program (NFIP) purposes if applicable. An Acceptable Corps inspection rating, alone, does not equate to a certifiable levee for the NFIP. It is recommended for levee systems currently accredited by the Federal Emergency Management Agency (FEMA) for NFIP purposes receiving a Corps Minimally Acceptable or Unacceptable rating, be evaluated by the levee owner to determine the potential impacts to the certification for FEMA.



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# **Flood Damage Reduction Segment / System Public Sponsor Pre-Inspection Form**

The following information is to be provided by the levee district sponsor prior to an inspection. This information will be used to help evaluate the organizational capability of the levee district to manage the levee segment / system maintenance program.

<b>1. Levee segment / system and district: (name of the segment / system and levee district)</b> Bolivar, NY - Root Creek for CELRP
<b>2. Reporting period: (month/day/year to month/day/year)</b> 10/15/2015-06/12/2017
<b>3. Summary of maintenance required by last inspection report:</b> Refer to PI Report
<b>4. Summary of maintenance performed this reporting period:</b> Refer to PI Report
<b>5. Summary of maintenance planned next reporting period:</b>
<b>6. Summary of changes to segment / system since last inspection:</b>
<b>7. Problems/ issues requiring the assistance of the US Army Corps of Engineers:</b>



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**Flood Damage Reduction Segment / System  
Inspection Report  
Bolivar, NY - Root Creek (BOLI)**

**Pre-Inspection Form  
Page 1 of 2**

# Public Sponsor Pre-Inspection Report

The following information is to be provided by the levee district sponsor prior to an inspection

8. Levee district organization: (elected or appointed levee district officials and key employees)

Name	Position	Mailing Address	Phone Number	Email Address
Ted Myers, PE	NYSDEC Engineer	270 Michigan Ave. Buffalo, NY 14203	716-851-7088	theodore.myers@dec.ny.gov



# General Instructions for the Inspection of Flood Damage Reduction Segments / Systems

## A. Purpose of USACE Inspections:

The primary purpose of these inspections is to prevent loss of life and catastrophic damages; preserve the value of Federal investments, and to encourage non-Federal sponsors to bear responsibility for their own protection. Inspections should assure that Flood Damage Reduction structures and facilities are continually maintained and operated as necessary to obtain the maximum benefits. Inspections are also conducted to determine eligibility for Rehabilitation Assistance under authority of PL 84-99 for Federal and non-Federal systems. (ER 1130-2-530, ER 500-1-1)

## B. Types of Inspections:

The Corps conducts several types of inspections of Flood Damage Reduction systems, as outlined below:

Initial Eligibility Inspections	Continuing Eligibility Inspections	
	Routine Inspections	Periodic Inspections
IEIs are conducted to determine whether a non-Federally constructed Flood Damage Reduction system meets the minimum criteria and standards set forth by the Corps for initial inclusion into the Rehabilitation and Inspection Program.	RIs are intended to verify proper maintenance, owner preparedness, and component operation.	PIs are intended to verify proper maintenance and component operation and to evaluate operational adequacy, structural stability, and safety of the system. Periodic Inspections evaluate the system's original design criteria vs. current design criteria to determine potential performance impacts, evaluate the current conditions, and compare the design loads and design analysis used against current design standards. This is to be done to identify components and features for the sponsor that need to be monitored more closely over time or corrected as needed. (Periodic Inspections are used as the basis of risk assessments.)

## C. Inspection Boundaries:

Inspections should be conducted so as to rate each Flood Damage Reduction "Segment" of the system. The overall system rating will be the lowest segment rating in the system.

Project	System	Segment
A flood damage reduction project is made up of one or more flood damage reduction systems which were under the same authorization.	A flood damage reduction system is made up of one or more flood damage reduction segments which collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.	A flood damage reduction segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A flood damage reduction segment can be made up of one or more features (levee, floodwall, pump stations, etc).

## D. Land Use Definitions:

The following three definitions are intended for use in determining minimum required inspection intervals and initial requirements for inclusion into the Rehabilitation and Inspection Program. Inspections should be considered for all systems that would result in significant environmental or economic impact upon failure regardless of specific land use.

Agricultural	Rural	Urban
Protected population in the range of zero to 5 households per square mile protected.	Protected population in the range of 6 to 20 households per square mile protected.	Greater than 20 households per square mile; major industrial areas with significant infrastructure investment. Some protected urban areas have no permanent population but may be industrial areas with high value infrastructure with no overnight population.

**E. Use of the Inspection Report Template:**

The report template is intended for use in all Army Corps of Engineers inspections of levee and floodwall systems and flood damage reduction channels. The section of the template labeled "Initial Eligibility" only needs to be completed during Initial Eligibility Inspections of Non-Federally constructed Flood Damage Reduction Systems. The section labeled "General Items" needs to be completed with every inspection, along with all other sections that correspond to features in the system. The section labeled "Public Sponsor Pre-Inspection Report" is intended for completion before the inspection, if possible.

**F. Individual Item / Component Ratings:**

Assessment of individual components rated during the inspection should be based on the criteria provided in the inspection report template, though inspectors may incorporate additional items into the report based on the characteristics of the system. The assessment of individual components should be based on the following definitions.

Acceptable Item	Minimally Acceptable Item	Unacceptable Item
The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.	The inspected item has one or more minor deficiencies that need to be corrected. The minor deficiency or deficiencies will not seriously impair the functioning of the item as intended during the next flood event.	The inspected item has one or more serious deficiencies that need to be corrected. The serious deficiency or deficiencies will seriously impair the functioning of the item as intended during the next flood event.

**G. Overall Segment / System Ratings:**

Determination of the overall system rating is based on the definitions below. Note that an Unacceptable System Rating may be either based on an engineering determination that concluded that noted deficiencies would prevent the system from functioning as intended during the next flood event, or based on the sponsor's demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner.

Acceptable System	Minimally Acceptable System	Unacceptable System
All items or components are rated as Acceptable.	One or more items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the segment / system from performing as intended during the next flood event.	One or more items are rated as Unacceptable and would prevent the segment / system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

**H. Eligibility for PL84-99 Rehabilitation Assistance:**

Inspected systems that are not operated and maintained by the Federal government may be Active in the Corps' Rehabilitation and Inspection Program (RIP) and eligible for rehabilitation assistance from the Corps as defined below:

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
The system is active in the RIP and eligible for PL84-99 rehabilitation assistance.	The system is Active in the RIP during the time that it takes to make needed corrections. Active systems are eligible for rehabilitation assistance. However, if the sponsor does not present USACE with proof that serious deficiencies (which had previously resulted in a minimally acceptable system rating) were corrected within the established timeframe, then the system will become Inactive in the RIP.	The system is Inactive in the RIP, and the status will remain Inactive until the sponsor presents USACE with proof that all items rated Unacceptable have been corrected. Inactive systems are ineligible for rehabilitation assistance.

**I. Reporting:**

After the inspection, the Corps is responsible for assembling an inspection report (or a summary report if it was a Periodic Inspection) including the following information:

- a. All sections of the report template used during the inspection, including the cover and pre-inspection materials. (Supplemental data collected, and any sections of the template that weren't used during the inspection do not need to be included with the report.)
- b. Photos of the general system condition and noted deficiencies.
- c. A plan view drawing of the system, with stationing, to reference locations of items rated less than acceptable.
- d. The relative importance of the identified maintenance issues should be specified in the transmittal letter.
- e. If the Overall System Rating is Minimally Acceptable, the report needs to establish a timeframe for correction of serious deficiencies noted (not to exceed two years) and indicate that if these items are not corrected within the required timeframe, the system will be rated as Unacceptable and made Inactive in the Rehabilitation Inspection Program.

**J. Notification:**

Reports are to be disseminated as follows within 30 days of the inspection date.

<b>If the Overall System Rating is Acceptable</b>	<b>If the Overall System Rating is Minimally Acceptable</b>	<b>If the Overall System Rating is Unacceptable</b>
Reports need to be provided to the local sponsor and the county emergency management agency.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, and to the FEMA region.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, FEMA region, and to the Congressional delegation within 30 days of the inspection.



## General Items for All Flood Damage Reduction Segments / Systems

For use during all inspections of all Flood Damage Reduction Segments / Systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Operations and Maintenance Manuals	<b>U</b>	<b>A</b>	Levee Owner's Manual, O&M Manuals, and/or manufacturer's operating instructions are present.	BOLI_2017_p_0085: Station_1 NA: No O&M manual exists for this project.: Coordinate preparation of an O&M Manual with USACE. (U)
		<b>M</b>	Sponsor manuals are lost or missing or out of date; however, sponsor will obtain manuals prior to next scheduled inspection.	
		<b>U</b>	Sponsor has not obtained lost or missing manuals identified during previous inspection.	
2. Emergency Supplies and Equipment (A or M only)	<b>A</b>	<b>A</b>	The sponsor maintains a stockpile of sandbags, shovels, and other flood fight supplies which will adequately supply all needs for the initial days of a flood fight. Sponsor determines required quantity of supplies after consulting with inspector.	BOLI_2017_p_0086: Station_1 NA: Sponsor has nearby equipment and materials to remove downed trees and make necessary repairs.: NA (A)
		<b>M</b>	The sponsor does not maintain an adequate supply of flood fighting materials as part of their preparedness activities.	
3. Flood Preparedness and Training (A or M only)	<b>M</b>	<b>A</b>	Sponsor has a written system-specific flood response plan and a solid understanding of how to operate, maintain, and staff the FDR system during a flood. Sponsor maintains a list of emergency contact information for appropriate personnel and other emergency response agencies.	BOLI_2017_p_0087: Station_1 NA: Sponsor does not have a project specific Emergency Action Plan which is kept at the project site and is reviewed by O&M staff.: A project specific plan should be developed. (M)
		<b>M</b>	The sponsor maintains a good working knowledge of flood response activities, but documentation of system-specific emergency procedures and emergency contact personnel is insufficient or out of date.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction



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Flood Damage Reduction Segment / System  
Inspection Report  
Bolivar, NY - Root Creek (BOLI)

General Items for All Flood Damage Reduction  
Segments / Systems  
Page 1 of 1

# Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Unwanted Vegetation Growth <sup>1</sup>	<b>U</b>	<b>A</b>	The levee has little or no unwanted vegetation (trees, bush, or undesirable weeds), except for vegetation that is properly contained and/or situated on overbuilt sections, such that the mandatory 3-foot root-free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation-free zone extends 15 feet from both the landside and riverside toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits. Reference EM 1110-2-301 or Corps policy for regional vegetation variance.	BOLI_2017_p_0025: Station_1 NA: Unwanted vegetation on WS slope.: Remove unwanted vegetation. (U) BOLI_2017_p_0027: Station_1 NA: Large pine trees within 15 feet of levee LS toe.: Remove trees within the easement. (U) BOLI_2017_p_0041: Station_1 NA: Unwanted vegetation within 15 feet of levee LS toe.: Remove unwanted vegetation. (U)
		<b>M</b>	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee.	BOLI_2017_p_0042: Station_1 NA: Small tree in levee crest.: Remove tree. (U) BOLI_2017_p_0044: Station_1 NA: Station_2 NA: Unwanted heavy wooded vegetation on WS slope.: Remove unwanted vegetation. (U)
		<b>U</b>	Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above and must be removed to reestablish or ascertain levee integrity.	BOLI_2017_p_0053: Station_1 NA: Large pine tree at the start of the levee.: Remove tree. (U) BOLI_2017_p_0055: Station_1 NA: Station_2 NA: Unwanted heavy woody vegetation on both levee side slopes and crest.: Remove unwanted vegetation. (U) BOLI_2017_p_0057: Station_1 NA: Large trees in levee crest and LS slope.: Remove trees. (U) BOLI_2017_p_0058: Station_1 NA: Station_2 NA: Unwanted heavy woody vegetation on both levee slopes and crest. 5 large pine trees within easement on LS toe.: Remove unwanted vegetation. (U) BOLI_2017_p_0064: Station_1 NA: Station_2 NA: Unwanted soft to woody vegetation on levee crest and WS slope.: Remove unwanted vegetation. (M) BOLI_2017_p_0065: Station_1 NA: Large box elder tree on levee LS slope.: Remove tree. (U) BOLI_2017_p_0068: Station_1 NA: 2 trees within 15 feet of levee toe and within permanent easement.: Remove trees. (U) BOLI_2017_p_0072: Station_1 NA: Station_2 NA: Unwanted heavy woody vegetation on levee WS slope and crest.: Remove unwanted vegetation. (U) BOLI_2017_p_0076: Station_1 NA: Large tree on levee LS slope.: Remove tree. (U) BOLI_2017_p_0078: Station_1 NA: Unwanted large tree on levee LS toe within permanent easement.: Remove tree. (U) BOLI_2017_p_0079: Station_1 NA: Station_2 NA: Unwanted woody vegetation LS slope.: Remove unwanted vegetation. (U)

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction



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Flood Damage Reduction Segment / System  
Inspection Report  
Bolivar, NY - Root Creek (BOLI)

Levee Embankments  
Page 1 of 23

# Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
2. Sod Cover	<b>M</b>	<b>A</b>	There is good coverage of sod over the levee.	BOLI_2017_p_0031: Station_1 NA: Lack of sod cover.: Reestablish sod cover. (M) BOLI_2017_p_0071: Station_1 NA: Lack of sod cover on levee crest.: Reestablish sod cover. (M) BOLI_2017_p_0074: Station_1 NA: Damaged sod cover on levee LS slope.: Reestablish sod cover. (M)
		<b>M</b>	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
		<b>U</b>	Over 50% of the sod cover is missing or damaged over a significant portion or portions of the levee embankment.	
		<b>N/A</b>	Surface protection is provided by other means.	
3. Encroachments	<b>M</b>	<b>A</b>	No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the levee.	BOLI_2017_p_0040: Station_1 NA: Trailer within 15 feet of levee LS toe.: Remove trailer. (M) BOLI_2017_p_0045: Station_1 NA: Construction debris, metal barrel, four wheeler, swing on levee crest and LS slope.: Remove all materials from levee to outside the easement. (M) BOLI_2017_p_0054: Station_1 NA: Fence (plastic) preventing access on right bank.: Remove fence from within the easement or provide gate access through the fence. (M) BOLI_2017_p_0066: Station_1 NA: Lawn debris on levee crest.: Remove lawn debris. (M) BOLI_2017_p_0067: Station_1 NA: Fence blocking access along right bank.: Remove fence from within the easement or provide gate access through the fence. (M) BOLI_2017_p_0070: Station_1 NA: Trailer and tires within permanent easement of levee LS toe.: Remove trailer and tires. (M) BOLI_2017_p_0073: Station_1 NA: 2 vehicles within 15 feet of levee LS toe and within the easement.: Remove vehicles. (M) BOLI_2017_p_0077: Station_1 NA: Tree debris on levee LS slope and at levee toe within the easement.: Remove the debris. (M) BOLI_2017_p_0090: Station_1 NA: According to the design drawings there is an approximate 215 foot section of levee that was not part of the project.: Submit project modification information/as-built documentation to USACE. (M)
		<b>M</b>	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		<b>U</b>	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	
4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag	<b>NA</b>	<b>A</b>	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions/ procedures readily available. Trial erections have been accomplished in accordance with the O&M Manual.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
Closures) (A or U only)		<b>U</b>	Any of the following issues is cause for this rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instructions/ procedures are not readily available. Trial erections have not been accomplished in accordance with the O&M Manual.	
		<b>N/A</b>	There are no closure structures along this component of the FDR segment / system.	
5. Slope Stability	<b>A</b>	<b>A</b>	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
		<b>M</b>	Minor slope stability problems that do not pose an immediate threat to the levee embankment.	
		<b>U</b>	Major slope stability problems (ex. deep seated sliding) identified that must be repaired to reestablish the integrity of the levee embankment.	
6. Erosion/ Bank Caving	<b>M</b>	<b>A</b>	No erosion or bank caving is observed on the landward or riverward sides of the levee that might endanger its stability.	BOLI_2017_p_0075: Station_1 NA: Bank caving/excavation at LS levee toe.: Reestablish levee emabankment to the original project dimensions. (M)
		<b>M</b>	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b>	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Settlement <sup>2</sup>	<b>A</b>	<b>A</b>	No observed depressions in crown. Records exist and indicate no unexplained historical changes.	
		<b>M</b>	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive.	
		<b>U</b>	Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	
8. Depressions/ Rutting	<b>A</b>	<b>A</b>	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are unrelated to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
		<b>M</b>	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	
		<b>U</b>	There are depressions greater than 6 inches deep that will pond water.	
9. Cracking	<b>A</b>	<b>A</b>	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack. No cracks extend continuously through the levee crest.	
		<b>M</b>	Longitudinal and/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		<b>U</b>	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through the entire levee width.	
10. Animal Control	<b>M</b>	<b>A</b>	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	BOLI_2017_p_0030: Station_1 NA: Multiple animal burrows.: Implement animal control program and fill holes. (M)
		<b>M</b>	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and they require immediate attention.	BOLI_2017_p_0080: Station_1 NA: Animal burrow on LS slope.: Implement animal control program and fill in hole. (M)
		<b>U</b>	Animal burrow control program is not effective or is nonexistent. Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	BOLI_2017_p_0083: Station_1 NA: Animal burrow levee LS slope.: Implement animal control program. (M)
11. Culverts/ Discharge Pipes <sup>3</sup> (This item includes both concrete and corrugated metal pipes.)	<b>NA</b>	<b>A</b>	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	See Interior Drainage System for discussion of pipes/culverts beneath the levee.
		<b>M</b>	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>U</b>	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		<b>N/A</b>	There are no discharge pipes/ culverts.	
12. Riprap Revetments &	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
Bank Protection		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
13. Revetments other than Riprap	<b>A</b>	<b>A</b>	Existing revetment protection is properly maintained, undamaged, and clearly visible.	BOLI_2017_p_0026: Station_1 NA: Condition of levee gabions.: NA (A)
		<b>M</b>	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	
14. Underseepage Relief Wells/ Toe Drainage Systems	<b>NA</b>	<b>A</b>	Toe drainage systems and pressure relief wells necessary for maintaining FDR segment / system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning. Wells have been pumped tested within the past 5 years and documentation is provided.	
		<b>M</b>	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular cleaning and pump testing.	
		<b>U</b>	Toe drainage systems or pressure relief wells necessary for maintaining FDR segment / system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.	
		<b>N/A</b>	There are no relief wells/ toe drainage systems along this component of the FDR segment / system.	
15. Seepage	<b>A</b>	<b>A</b>	No evidence or history of unrepaired seepage, saturated areas, or boils.	
		<b>M</b>	Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport.	
		<b>U</b>	Evidence or history of active seepage, extensive saturated areas, or boils.	

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<sup>1</sup> If there is significant growth on the levee that inhibits the inspection of animal burrows or other items, the inspection should be ended until this item is corrected.

<sup>2</sup> Detailed survey elevations are normally required during Periodic Inspections, and whenever there are obvious visual settlements.

<sup>3</sup> The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

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	<p><b>Inspect ID:</b> BOLI_2017_p_0025 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0025_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted vegetation on WS slope.; Action: Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0025 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0025_2.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted vegetation on WS slope.; Action: Remove unwanted vegetation.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0027 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0027_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Large pine trees within 15 feet of levee LS toe.; Action: Remove trees within the easement.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0041 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0041_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted vegetation within 15 feet of levee LS toe.; Action: Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0042 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0042_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Small tree in levee crest.; Action: Remove tree.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0044 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0044_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted heavy wooded vegetation on WS slope.; Action: Remove unwanted vegetation.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0044 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0044_2.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted heavy wooded vegetation on WS slope.; Action: Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0053 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0053_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Large pine tree at the start of the levee.; Action: Remove tree.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0055 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0055_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted heavy woody vegetation on both levee side slopes and crest.; Action: Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0057 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0057_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Large trees in levee crest and LS slope.; Action: Remove trees.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0058 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0058_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted heavy woody vegetation on both levee slopes and crest. 5 large pine trees within easement on LS toe.; Action: Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0064 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0064_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Unwanted soft to woody vegetation on levee crest and WS slope.; Action: Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0065 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0065_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Large box elder tree on levee LS slope.; Action: Remove tree.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0068 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0068_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: 2 trees within 15 feet of levee toe and within permanent easement.; Action: Remove trees.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0072 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0072_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted heavy woody vegetation on levee WS slope and crest.; Action: Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0076 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0076_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Large tree on levee LS slope.; Action: Remove tree.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0078 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0078_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted large tree on levee LS toe within permanent easement.; Action: Remove tree.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0079 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0079_1.jpg <b>Rated Item:</b> 1. Unwanted Vegetation Growth <b>Caption:</b> Rating: Unacceptable; Remarks: Unwanted woody vegetation LS slope.; Action: Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0031 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0031_1.jpg <b>Rated Item:</b> 2. Sod Cover <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Lack of sod cover.; Action: Reestablish sod cover.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0071 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0071_1.jpg <b>Rated Item:</b> 2. Sod Cover <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Lack of sod cover on levee crest.; Action: Reestablish sod cover.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0074 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0074_1.jpg <b>Rated Item:</b> 2. Sod Cover <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Damaged sod cover on levee LS slope.; Action: Reestablish sod cover.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0040 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0040_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Trailer within 15 feet of levee LS toe.; Action: Remove trailer.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0045 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0045_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Construction debris, metal barrel, four wheeler, swing on levee crest and LS slope.; <b>Action:</b> Remove all materials from levee to outside the easement.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0054 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0054_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Fence (plastic) preventing access on right bank.; <b>Action:</b> Remove fence from within the easement or provide gate access through the fence.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0066 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0066_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Lawn debris on levee crest.; Action: Remove lawn debris.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0067 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0067_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Fence blocking access along right bank.; Action: Remove fence from within the easement or provide gate access through the fence.</p>





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**Inspect ID:** BOLI\_2017\_p\_0070 **Title:** USACE\_CELRP\_BOLI\_2017\_p\_0070\_1.jpg  
**Rated Item:** 3. Encroachments **Caption:** Rating: Minimally Acceptable; Remarks: Trailer and tires within permanent easement of levee LS toe.; Action: Remove trailer and tires.



**Inspect ID:** BOLI\_2017\_p\_0073 **Title:** USACE\_CELRP\_BOLI\_2017\_p\_0073\_1.jpg  
**Rated Item:** 3. Encroachments **Caption:** Rating: Minimally Acceptable; Remarks: 2 vehicles within 15 feet of levee LS toe and within the easement.; Action: Remove vehicles.



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	<p><b>Inspect ID:</b> BOLI_2017_p_0077 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0077_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Tree debris on levee LS slope and at levee toe within the easement.; Action: Remove the debris.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0075 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0075_1.jpg <b>Rated Item:</b> 6. Erosion/ Bank Caving <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Bank caving/excavation at LS levee toe.; Action: Reestablish levee emabankment to the original project dimensions.</p>



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Levee Embankments  
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## Levee Embankments

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	<p><b>Inspect ID:</b> BOLI_2017_p_0030 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0030_1.jpg <b>Rated Item:</b> 10. Animal Control <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Multiple animal burrows.; Action: Implement animal control program and fill holes.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0080 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0080_1.jpg <b>Rated Item:</b> 10. Animal Control <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Animal burrow on LS slope.; Action: Implement animal control program and fill in hole.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0083 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0083_1.jpg <b>Rated Item:</b> 10. Animal Control <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Animal burrow levee LS slope.; Action: Implement animal control program.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0026 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0026_1.jpg <b>Rated Item:</b> 13. Revetments other than Riprap <b>Caption:</b> Rating: Acceptable; Remarks: Condition of levee gabions.; Action: NA</p>





# Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Vegetation and Obstructions	<b>A</b>	<b>A</b>	No obstructions, vegetation, debris, or sediment accumulation noted within interior drainage channels or blocking the culverts, inlets, or discharge areas. Concrete joints and weep holes are free of grass and weeds.	
		<b>M</b>	Obstructions, vegetation, debris, or sediment are minor and have not impaired channel flow capacity or blocked more than 10% of any culvert openings, but should be removed. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
		<b>U</b>	Obstructions, vegetation, debris, or sediment have impaired the channel flow capacity or blocked more than 10% of a culvert opening. Sediment and debris removal required to re-establish flow capacity.	
2. Encroachments	<b>A</b>	<b>A</b>	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the interior drainage system.	
		<b>M</b>	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		<b>U</b>	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of this component of the interior drainage system.	
3. Ponding Areas	<b>NA</b>	<b>A</b>	No trash, debris, structures, or other obstructions present within the ponding areas. Sediment deposits do not exceed 10% of capacity.	
		<b>M</b>	Trash, debris, excavations, structures, or other obstructions present, or inappropriate activities that will not inhibit operations and maintenance. Sediment deposits do not exceed 30% of capacity.	
		<b>U</b>	Trash, debris, excavations, structures, or other obstructions, or other encroachments or activities noted that will inhibit operations, maintenance, or emergency work. Sediment deposits exceeds 30% of capacity.	
		<b>N/A</b>	There are no ponding areas associated with the interior drainage system.	
4. Fencing and Gates <sup>1</sup>	<b>NA</b>	<b>A</b>	Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts.	
		<b>M</b>	Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.	
		<b>U</b>	Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.	
		<b>N/A</b>	There are no features noted that require safety fencing.	
5. Concrete Surfaces (Such as gate)	<b>NA</b>	<b>A</b>	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
wells, outfalls, intakes, or culverts)		<b>M</b>	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		<b>U</b>	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures <sup>2</sup> (Such as gate wells, outfalls, intakes, or culverts)	<b>NA</b>	<b>A</b>	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
		<b>M</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
		<b>U</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
7. Foundation of Concrete Structures <sup>3</sup> (Such as culverts, inlet and discharge structures, or gatewells.)	<b>NA</b>	<b>A</b>	No active erosion, scouring, or bank caving that might endanger the structure's stability.	
		<b>M</b>	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. The rate of erosion is such that the structure is expected to remain stable until the next inspection.	
		<b>U</b>	Erosion or bank caving observed that may lead to structural instabilities before the next inspection.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
8. Monolith Joints	<b>NA</b>	<b>A</b>	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		<b>M</b>	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	

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		<b>U</b>	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		<b>N/A</b>	There are no monolith joints in the interior drainage system.	
9. Culverts/ Discharge Pipes <sup>4</sup>	<b>M</b>	<b>A</b>	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	BOLI_2017_p_0033: Station_1 NA: 10" diameter CMP just upstream of Davis St. – video inspection indicated moderate corrosion along pipe invert and a hole/invert loss at one location.: Repair pipe at location identified. (M)
		<b>M</b>	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>U</b>	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		<b>N/A</b>	There are no discharge pipes/ culverts.	
10. Sluice / Slide Gates <sup>5</sup>	<b>NA</b>	<b>A</b>	Gates open and close freely to a tight seal or minor leakage. Gate operators are in good working condition and are properly maintained. Sill is free of sediment and other obstructions. Gates and lifters have been maintained and are free of corrosion. Documentation provided during the inspection.	
		<b>M</b>	Gates and/or operators have been damaged or have minor corrosion, and open and close with resistance or binding. Leakage quantity is controllable, but maintenance is required. Sill is free of sediment and other obstructions.	
		<b>U</b>	Gates do not open or close and/or operators do not function. Gate, stem, lifter and/or guides may be damaged or have major corrosion.	
		<b>N/A</b>	There are no sluice/ slide gates.	

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11. Flap Gates/ Flap Valves/ Pinch Valves <sup>1</sup>	<b>A</b>	<b>A</b>	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	BOLI_2017_p_0028: Station_1 NA: 12" diameter CMP at Station 41+20 video inspection indicated no visible defects.: NA (A)
		<b>M</b>	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
		<b>U</b>	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
		<b>N/A</b>	There are no flap gates.	
12. Trash Racks (non-mechanical)	<b>NA</b>	<b>A</b>	Trash racks are fastened in place and properly maintained.	
		<b>M</b>	Trash racks are in place but are unfastened or have bent bars that allow debris to enter into the pipe or pump station, bars are corroded to the point that up to 10% of the sectional area may be lost. Repair or replacement is required.	
		<b>U</b>	Trash racks are missing or damaged to the extent that they are no longer functional and must be replaced. (For example, more than 10% of the sectional area may be lost.)	
		<b>N/A</b>	There are no trash racks, or they are covered in the pump stations section of the report.	
13. Other Metallic Items	<b>NA</b>	<b>A</b>	All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
		<b>M</b>	Corrosion seen on metallic parts appears to be maintainable.	
		<b>U</b>	Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
		<b>N/A</b>	There are no other significant metallic items.	
14. Riprap Revetments of Inlet/ Discharge Areas	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
15. Revetments other than Riprap	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	

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		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	

<sup>1</sup> Proper operation of this item must be demonstrated during the inspection.

<sup>2</sup> The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

<sup>3</sup> Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

<sup>4</sup> The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

<sup>5</sup> Proper operation of the gates (full open and closed) must be demonstrated during the inspection if no documentation is available. Be aware of both manual and electrical operators.

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	<p><b>Inspect ID:</b> BOLI_2017_p_0033 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0033_1.jpg <b>Rated Item:</b> 9. Culverts/ Discharge Pipes <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> 10" diameter CMP just upstream of Davis St. – video inspection indicated moderate corrosion along pipe invert and a hole/invert loss at one location. ; <b>Action:</b> Repair pipe at location identified.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0028 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0028_1.jpg <b>Rated Item:</b> 11. Flap Gates/ Flap Valves/ Pinch Valves <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> 12" diameter CMP at Station 41+20 video inspection indicated no visible defects. ; <b>Action:</b> NA</p>



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# Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Vegetation and Obstructions	<b>U</b>	<b>A</b>	No obstructions, vegetation, debris, or sediment accumulation within the channel. Concrete channel joints and weep holes are free of grass and weeds.	BOLI_2017_p_0005: Station_1 NA: Channel section that is not included in the channel remediation of the design drawings.: NA (M) BOLI_2017_p_0008: Station_1 NA: Unwanted vegetation in channel along left bank toe.: Remove unwanted vegetation. (U) BOLI_2017_p_0013: Station_1 NA: Looking downstream unwanted vegetation on both banks.: Remove unwanted vegetation. (M) BOLI_2017_p_0014: Station_1 NA: Unwanted heavy woody vegetation on channel banks looking upstream.: Remove unwanted vegetation. (U) BOLI_2017_p_0043: Station_1 NA: Large fallen tree on left bank possible snag starting.: Remove fallen tree. (M) BOLI_2017_p_0060: Station_1 NA: Looking downstream from Main Street bridge unwanted vegetation on both banks.: Remove unwanted vegetation. (M) BOLI_2017_p_0089: Station_1 NA: Unwanted vegetation in Leather Street access ramp.: Remove unwanted vegetation. (M)
		<b>M</b>	Obstructions (including log jams), vegetation, debris, or sediment are minor and have not impaired channel flow capacity, but should be removed. Sediment shoals have not developed to the extent that they can support vegetation other than non-aquatic grasses. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
		<b>U</b>	Obstructions (including log jams), vegetation, debris or sediment have impaired the channel flow capacity. Sediment shoals are well established and support woody and/or brushy vegetation. Sediment and debris removal required to re-establish flow capacity.	
2. Shoaling <sup>1</sup> (sediment deposition)	<b>M</b>	<b>A</b>	No shoaling or minor, non-vegetated shoaling is present.	BOLI_2017_p_0002: Station_1 NA: Shoal in channel.: Remove shoal. (M) BOLI_2017_p_0004: Station_1 NA: Shoal in sediment basin.: Remove shoal. (M) BOLI_2017_p_0024: Station_1 NA: Shoal in channel downstream of the drop structure at Sta. 45+25.: Remove shoal. (M) BOLI_2017_p_0036: Station_1 NA: Shoal in channel.: Remove shoal. (M)
		<b>M</b>	More widespread vegetated and non-vegetated shoaling is present. Non-aquatic grasses are present on shoal. No trees or brush is present on shoal, and channel flow is not significantly reduced. Sediment and debris removal recommended.	
		<b>U</b>	Shoaling is well established, stabilized by saplings, brush, or other vegetation. Shoals are diverting flow to channel walls. Channel flow capacity is reduced and maintenance is required.	
3. Encroachments	<b>M</b>	<b>A</b>	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the channel.	BOLI_2017_p_0001: Station_1 NA: Sediment basin modified/relocated due to school bus garage.: Submit NYDEC modification permit to USACE for approval. (U) BOLI_2017_p_0018: Station_1 NA: Gate overhanging channel.: Remove or obtain USACE permit. (M) BOLI_2017_p_0020: Station_1 NA: 6 inch PVC outfall on right bank.: Remove or obtain USACE permit. (M) BOLI_2017_p_0037: Station_1 NA: Access ramp downstream of Davison St.: NA (A) BOLI_2017_p_0048: Station_1 NA: Concrete debris on right bank of channel.: Remove concrete debris. (M) BOLI_2017_p_0049: Station_1 NA: Wood pellets debris. (No photo was taken):. Remove debris. (M)
		<b>M</b>	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		<b>U</b>	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the channel.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
				BOLI_2017_p_0050: Station_1 NA: Fence preventing access on right bank.: Remove fence from within the easement or provide gate access through the fence. (U) BOLI_2017_p_0051: Station_1 NA: Stairs on right bank.: Remove stairs or obtain USACE permit. (M) BOLI_2017_p_0052: Station_1 NA: Lawn debris on channel slope.: Remove lawn debris. (M) BOLI_2017_p_0082: Station_1 NA: Red foot bridge over channel.: Determine if this defines downstream project limit. (M) BOLI_2017_p_0088: Station_1 NA: Boat and debris on Leather Street access ramp.: Remove boat and debris. (U) BOLI_2017_p_0091: Station_1 NA: USGS.: NA (A)
4. Erosion	<b>A</b>	<b>A</b>	No head cutting or horizontal deviation observed.	
		<b>M</b>	Head cutting and horizontal deviation evident, but is less than 1 foot from the designed grade or cross section.	
		<b>U</b>	Head cutting and horizontal deviation of more than 1 foot from the designed grade or cross section. Corrective actions required to stop or slow erosion.	
5. Concrete Surfaces	<b>M</b>	<b>A</b>	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	BOLI_2017_p_0061: Station_1 NA: Cracking in concrete and corroded CMP on right bank in concrete trapezoidal channel NYSDOT portion of channel improvements.: Repair cracking per USACE guidelines. (U) BOLI_2017_p_0063: Station_1 NA: Concrete wall along left bank.: NA (A)
		<b>M</b>	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		<b>U</b>	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
		<b>N/A</b>	There are no concrete items in the channel.	
6. Tilting, Sliding or Settlement of Concrete Structures <sup>2</sup>	<b>A</b>	<b>A</b>	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
		<b>M</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	

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		<b>U</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
		<b>N/A</b>	There are no concrete items in the channel.	
7. Foundation of Concrete Structures <sup>3</sup>	<b>A</b>	<b>A</b>	No active erosion, scouring, or bank caving that might endanger the structure's stability.	BOLI_2017_p_0017: Station_1 NA: Drop structure at 48+50.: NA (A) BOLI_2017_p_0019: Station_1 NA: Dragon's teeth at drop structure 48+50.: NA (A) BOLI_2017_p_0021: Station_1 NA: Drop structure at 45+25.: NA (A) BOLI_2017_p_0034: Station_1 NA: Drop Structure at 40+25 (Typ.): NA (A) BOLI_2017_p_0046: Station_1 NA: Drop structure at 33+60 (Typ.): NA (A) BOLI_2017_p_0059: Station_1 NA: Drop structure at 24+15 (Typ.): NA (A) BOLI_2017_p_0062: Station_1 NA: Drop structure at 27+32 built by NYS (Typ.): NA (A)
		<b>M</b>	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. For the purposes of inspection, the erosion or scour is not closer to the riverside face of the wall than twice the floodwall's underground base width if the wall is of L-wall or T-wall construction; or if the wall is of sheetpile or I-wall construction, the erosion is not closer than twice the wall's visible height. Additionally, rate of erosion is such that the wall is expected to remain stable until the next inspection.	
		<b>U</b>	Erosion or bank caving observed that is closer to the wall than the limits described above, or is outside these limits but may lead to structural instabilities before the next inspection. Additionally, if the floodwall is of I-wall or sheetpile construction, the foundation is unacceptable if any turf, soil or pavement material got washed away from the landside of the I-wall as the result of a previous overtopping event.	
		<b>N/A</b>	There are no concrete items in the channel.	
8. Slab and Monolith Joints	<b>A</b>	<b>A</b>	The joint material is in good condition. The exterior joint sealant is intact and cracking/desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		<b>M</b>	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	
		<b>U</b>	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		<b>N/A</b>	There are no concrete items in the channel.	
9. Flap Gates/ Flap Valves/	<b>NA</b>	<b>A</b>	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	See Section 11. Flapgates/Flap Valve in Interior Drainage Systems.

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
Pinch Valves <sup>4</sup>		<b>M</b>	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
		<b>U</b>	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
		<b>N/A</b>	There are no flap gates.	
10. Riprap Revetments & Banks	<b>M</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	BOLI_2017_p_0003: Station_1 NA: Unwanted woody vegetation in riprap along sediment basin banks.: Remove unwanted vegetation from riprap. (M)
		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
11. Revetments other than Riprap	<b>U</b>	<b>A</b>	Existing revetment protection is properly maintained, undamaged, and clearly visible.	BOLI_2017_p_0006: Station_1 NA: Start of the right bank gabion channel slope protection.: NA (M) BOLI_2017_p_0007: Station_1 NA: Vegetation in gabion channel slope protection on right bank.: Remove unwanted vegetation. (M) BOLI_2017_p_0009: Station_1 NA: Unwanted woody vegetation in gabion channel slope protection on left bank.: Remove unwanted vegetation. (U) BOLI_2017_p_0010: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on the right bank.: Remove unwanted vegetation. (U) BOLI_2017_p_0011: Station_1 NA: Unwanted heavy large woody vegetation in gabion channel slope protection on the right bank.: Remove unwanted vegetation. (M) BOLI_2017_p_0012: Station_1 NA: Unwanted vegetation in gabion channel slope protection on the left bank.: Remove unwanted vegetation. (M) BOLI_2017_p_0015: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on the left bank.: Remove unwanted vegetation. (U) BOLI_2017_p_0016: Station_1 NA: Heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U) BOLI_2017_p_0022: Station_1 NA: Unwanted heavy
		<b>M</b>	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
				<p>woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0023: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0032: Station_1 NA: Unwanted woody vegetation in the gabion slope protection on both banks.: Remove unwanted vegetation. (M)</p> <p>BOLI_2017_p_0035: Station_1 NA: Damaged gabion in channel lining.: Repair damaged gabion lining. (U)</p> <p>BOLI_2017_p_0038: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0039: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0047: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0056: Station_1 NA: Unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0069: Station_1 NA: Looking downstream at unwanted woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p> <p>BOLI_2017_p_0081: Station_1 NA: Looking upstream from red foot bridge at end of levee at unwanted heavy woody vegetation in gabion channel slope protection on both banks.: Remove unwanted vegetation. (U)</p>

<sup>1</sup> If weather and flow conditions allow, inspectors should walk in the channel and probe shoal areas in order to estimate extent of blockage of the cross-sectional area where shoaling is present.

<sup>2</sup> The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

<sup>3</sup> Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

<sup>4</sup> Proper operation of this item must be demonstrated during the inspection.

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	<p><b>Inspect ID:</b> BOLI_2017_p_0005 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0005_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Channel section that is not included in the channel remediation of the design drawings.; <b>Action:</b> NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0008 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0008_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted vegetation in channel along left bank toe.; <b>Action:</b> Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0013 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0013_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Looking downstream unwanted vegetation on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0014 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0014_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation on channel banks looking upstream.; <b>Action:</b> Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0043 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0043_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Large fallen tree on left bank possible snag starting.; <b>Action:</b> Remove fallen tree.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0060 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0060_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Looking downstream from Main Street bridge unwanted vegetation on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0089 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0089_1.jpg <b>Rated Item:</b> 1. Vegetation and Obstructions <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Unwanted vegetation in Leather Street access ramp. ; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0002 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0002_1.jpg <b>Rated Item:</b> 2. Shoaling (sediment deposition) <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Shoal in channel.; <b>Action:</b> Remove shoal.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0004 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0004_1.jpg <b>Rated Item:</b> 2. Shoaling (sediment deposition) <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Shoal in sediment basin.; <b>Action:</b> Remove shoal.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0024 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0024_1.jpg <b>Rated Item:</b> 2. Shoaling (sediment deposition) <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Shoal in channel downstream of the drop structure at Sta. 45+25.; <b>Action:</b> Remove shoal.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0036 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0036_1.jpg <b>Rated Item:</b> 2. Shoaling (sediment deposition) <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Shoal in channel.; <b>Action:</b> Remove shoal.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0001 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0001_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Sediment basin modified/relocated due to school bus garage.; <b>Action:</b> Submit NYDEC modification permit to USACE for approval.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0018 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0018_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Gate overhanging channel.; Action: Remove or obtain USACE permit.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0020 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0020_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: 6 inch PVC outfall on right bank.; Action: Remove or obtain USACE permit.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0037 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0037_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Acceptable; Remarks: Access ramp downstream of Davison St.; Action: NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0048 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0048_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Concrete debris on right bank of channel.; Action: Remove concrete debris.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0050 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0050_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Unacceptable; Remarks: Fence preventing access on right bank.; Action: Remove fence from within the easement or provide gate access through the fence.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0051 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0051_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Stairs on right bank.; Action: Remove stairs or obtain USACE permit.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0052 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0052_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Lawn debris on channel slope.; Action: Remove lawn debris.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0082 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0082_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Minimally Acceptable; Remarks: Red foot bridge over channel.; Action: Determine if this defines downstream project limit.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0088 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0088_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Unacceptable; Remarks: Boat and debris on Leather Street access ramp.; Action: Remove boat and debris.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0091 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0091_1.jpg <b>Rated Item:</b> 3. Encroachments <b>Caption:</b> Rating: Acceptable; Remarks: USGS.; Action: NA</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0061 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0061_1.jpg <b>Rated Item:</b> 5. Concrete Surfaces <b>Caption:</b> Rating: Unacceptable; Remarks: Cracking in concrete and corroded CMP on right bank in concrete trapezoidal channel NYSDOT portion of channel improvements.; Action: Repair cracking per USACE guidelines.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0063 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0063_1.jpg <b>Rated Item:</b> 5. Concrete Surfaces <b>Caption:</b> Rating: Acceptable; Remarks: Concrete wall along left bank.; Action: NA</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0017 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0017_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop structure at 48+50.; <b>Action:</b> NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0019 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0019_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Dragon's teeth at drop structure 48+50.; <b>Action:</b> NA</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0021 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0021_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop structure at 45+25.; Action: NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0034 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0034_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop Structure at 40+25 (Typ.); Action: NA</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0046 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0046_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop structure at 33+60 (Typ.); Action: NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0059 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0059_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop structure at 24+15 (Typ.); Action: NA</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0062 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0062_1.jpg <b>Rated Item:</b> 7. Foundation of Concrete Structures <b>Caption:</b> Rating: Acceptable; <b>Remarks:</b> Drop structure at 27+32 built by NYS (Typ.); <b>Action:</b> NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0003 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0003_1.jpg <b>Rated Item:</b> 10. Riprap Revetments &amp; Banks <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Unwanted woody vegetation in riprap along sediment basin banks.; <b>Action:</b> Remove unwanted vegetation from riprap.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0006 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0006_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Start of the right bank gabion channel slope protection.; <b>Action:</b> NA</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0007 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0007_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Vegetation in gabion channel slope protection on right bank.; <b>Action:</b> Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0009 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0009_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted woody vegetation in gabion channel slope protection on left bank.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0010 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0010_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on the right bank.; <b>Action:</b> Remove unwanted vegetation.</p>





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	<p><b>Inspect ID:</b> BOLI_2017_p_0011 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0011_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Unwanted heavy large woody vegetation in gabion channel slope protection on the right bank.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0012 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0012_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Unwanted vegetation in gabion channel slope protection on the left bank.; <b>Action:</b> Remove unwanted vegetation.</p>



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	<p><b>Inspect ID:</b> BOLI_2017_p_0015 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0015_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on the left bank.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0016 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0016_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>



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## Flood Damage Reduction Channels

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	<p><b>Inspect ID:</b> BOLI_2017_p_0022 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0022_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0023 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0023_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>



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## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> BOLI_2017_p_0032 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0032_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Minimally Acceptable; <b>Remarks:</b> Unwanted woody vegetation in the gabion slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0035 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0035_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Damaged gabion in channel lining.; <b>Action:</b> Repair damaged gabion lining.</p>



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## Flood Damage Reduction Channels

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	<p><b>Inspect ID:</b> BOLI_2017_p_0038 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0038_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0039 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0039_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>



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## Flood Damage Reduction Channels

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	<p><b>Inspect ID:</b> BOLI_2017_p_0047 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0047_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0056 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0056_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Unwanted heavy woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>



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## Flood Damage Reduction Channels

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	<p><b>Inspect ID:</b> BOLI_2017_p_0069 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0069_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Looking downstream at unwanted woody vegetation in gabion channel slope protection on both banks.; <b>Action:</b> Remove unwanted vegetation.</p>
	<p><b>Inspect ID:</b> BOLI_2017_p_0081 <b>Title:</b> USACE_CELRP_BOLI_2017_p_0081_1.jpg <b>Rated Item:</b> 11. Revetments other than Riprap <b>Caption:</b> Rating: Unacceptable; <b>Remarks:</b> Looking upstream from red foot bridge at end of levee at unwanted heavy woody vegetation in gabion channel slope protection on both banks. ; <b>Action:</b> Remove unwanted vegetation.</p>



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## **Appendix C**

### **References**



## References

US Army Corps of Engineers. 2016. Annual Inspection Letter, Bolivar Flood Control Project – 2015 Continuing Eligibility Inspection.

US Army Corps of Engineers. 2016. Annual Inspection Report, Bolivar Flood Control Project – 2015 Flood Damage Reduction Segment / System Inspection Report.

Pittsburg District U.S. Army Corps of Engineers. 1975. Root Creek Bolivar, New York Local Flood Protection Project Detailed Project Report.

Pittsburg District U.S. Army Corps of Engineers. 1979. Project Design Drawings, Bolivar Flood Protection Project Root Creek Bolivar New York.

The following USACE design guidance were used for the review:

- ER 1110-1-12, 21 July 2006, Quality Management.
- ER 1110-2-1405, Hydraulic Design for Local Flood Protection.
- ER1110-2-1156 Safety of Dams, Policy and Procedures.
- ER 1110-2-8157 Responsibility for Hydraulic Steel Structures.
- ER 1110-2-8160 Policies for Referencing Project Elevation Grades to Nationwide Vertical Datums.
- ER 1110-2-1806 Earthquake Design and Evaluation for Civil Works Projects.
- EC 110-2-6065 Engineering and Design – Comprehensive Evaluation of Project Datums.
- ETL 1110-2-584 Design of Hydraulic Steel Structures.
- ETL 1110-2-569 Engineering and Design, Design Guidance for Levee Underseepage.
- ETL 1110-2-571 Guidelines for Landscape Planting and Vegetation Management at Levees, Flood walls, Embankment Dams and Appurtenant Structures.
- Engineering Manual (EM) 1110-2-1418, Channel Stability Assessment for Flood Control Channels.
- EM 1110-2-1416 River Hydraulics.
- EM 1110-2-1913 Design and Construction of Levees.
- EM 1110-1-1904 Settlement Analysis.
- EM 1110-2-1901 Seepage Analysis and Control for Dams.

- EM 1110-2-1902 Slope Stability.
- EM 1110-2-1908 Instrumentation of Embankment Dams and Levees.
- EM 1110-2-1914 Design, Construction and Maintenance of Relief Wells.
- EM 1110-2-2100 Stability Analysis of Concrete Structures.
- EM 1110-2-2104 Strength Design for Reinforced Concrete Hydraulic Structures.
- EM 1110-2-2502 Retaining and Flood Walls.
- EM 1110-2-2902 Conduits, Culverts, and Pipes.
- EM 1110-2-2906 Design of Pile Foundations.
- EM 1110-2-6054 Inspection, Evaluation and Repair of Hydraulic Steel Structures.
- EM 1110-2-2002 Evaluation and Repair of Concrete Structures.
- EM 1110-2-3105 Mechanical and Electrical Design of Pumping Structures.
- EM 1110-2-3102 General Principles of Pumping Station Design and Layout.
- EM 1110-2-3104 Structural and Architectural Design of Pumping Stations.
- EM 1110-2-1601 Hydraulic Design of Flood Control Channels.
- EM 1110-2-1413 Hydrologic Analysis of Interior Areas.

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# **Appendix D**

## **Independent Technical Review**

Comment Report: All Comments

Project: NY LFPP Periodic Inspection Reports

Review: 2017 Bolivar LFPP Periodic Inspection DQC Review

Displaying 16 comments for the criteria specified in this report.

<b>Id</b>	<b>Discipline</b>	<b>DocType</b>	<b>Spec</b>	<b>Sheet</b>	<b>Detail</b>
7116409	Geotechnical	Periodic Inspections	n/a	n/a	n/a

Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 3.1 Features, Page 5, PDF Page 12

In Table 2 add one more drop structure at Station 27+37. In Table 2 revise the Gabion Wall Stations, it is from Station 36+23 to 37+07 as mentioned in Detailed Project Report Page 18 Paragraph 4.

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017

Revised Aug 21 2017.

**1-0 Evaluation Non-concurred**

The addition drop structure has been added into table 2. However, we did not revise the table to include the gabion wall at Station 36+23 to 37+07. We did locate in the field the designated levee at Station 41+00 to 43+20, which is consistent with the design drawings dated 03APR1979. From our inspection the design drawings best reflect what was found in the field. The 1979 design drawings were located in the as-built folder provided by LRP which does not indicate a wall from station 36+23 to 37+07 and it was not seen in the field unless it was obscured by heavy vegetation.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7116417	Geotechnical	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 4.1.2.1, Page 8, PDF Page 15

Suggest deleting last line of the first paragraph "Structural damage also result from wind-driven tree overturning."

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017

**1-0 Evaluation Concurred**

The sentence was removed.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7116426	Geotechnical	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 4.2.3 Geotechnical, Page 21, PDF Page 28

Suggest deleting "relative" from "A relative stability analysis" (5th Line)

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017

Revised Aug 21 2017.

**1-0 Evaluation Concurred**

the word relative was removed.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7116430	Geotechnical	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 4.2.3 Geotechnical, Page 21, PDF Page 28

Replace the last sentence with "USACE design and construction guideline for embankment levee indicates minimum required factors of safety Of 1.3 and 1.4 for end of construction and long term stability conditions, respectively."

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017



Revised Aug 21 2017.

**1-0 Evaluation Concurred**

This sentence was added.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7116436	Geotechnical	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 4.2.3 Geotechnical, Page 22, PDF Page 29

Under Levee Embankment, provide the Project Drawing No./ Plate No. which show water embankment side slope of 3H : 1V as mentioned.

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017

Revised Aug 21 2017.

**1-0 Evaluation Concurred**

The sentence now reads: While on the waterside embankment side slopes are sloped at 3 horizontal to 1 vertical, according to Design Drawing No. 038pa.1-P1-82/7

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7116444	Geotechnical	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

**Coordinating Discipline(s):** Geotechnical

Section 4.2.3 Geotechnical, Page 22, PDF Page 29

Under Levee Embankment, provide the Project Drawing No./ Plate No. which show 3-foot wide gabions with a 2H : 1 V side slope as mentioned.

Submitted By: [Deepak Neupane](#) (412-395-7349). Submitted On: Aug 21 2017

Revised Aug 21 2017.

**1-0 Evaluation Concurred**

The sentence now reads: The gabion levee section, according to Design Drawing No 038pa.1-P1-82/7, consists of 3-foot wide gabions with a 2 horizontal to 1 vertical landside slope and vertical waterside slope.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [Deepak Neupane](#) (412-395-7349) Submitted On: Sep 06 2017

Current Comment Status: **Comment Closed**

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7126856	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

([Document Reference: Page 1](#))

**Coordinating Discipline(s):** Hydraulics

Page 1, Section 1.4, River Gage During Inspection. Latitude listed for the USGS gage at Bolivar is 42 03 51.8 not 40 03 51.8 degrees.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

The latitude was change to 42 03 51.8.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126857	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

([Document Reference: Page 1](#))

**Coordinating Discipline(s):** Hydraulics

Page 1 , Section 1.4, River Gage During Inspection. The gage readings at the USGS gage website at Bolivar are listed as daily mean values not peaks. Is the 0.15 ft gage reading the daily mean value or the peak. Recommend to state if mean value.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

This sentence was added: The daily mean gage reading on the day of the inspection was obtained from the USGS gage, and that reading and the water surface elevation are presented below.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126858	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(**Document Reference: Page 3**)

**Coordinating Discipline(s):** Hydraulics

Page 3, Section 2.10, Record of Flood Events. The two highest recorded events do not match the peak values and are average values not maximum values. The USGS website for the Bolivar stream gage shows the maximum gage height for the period of record as 3.32 feet on January 10, 2014 which was also the result of an ice jam.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

This sentence was added to this section: The two highest daily mean events since the gage became active are an elevation of 1,608.52 on January 11, 2014 and 1,607.42 on January 9, 2017. The maximum gage height for the period of record was 3.32 feet (1,609.11 feet) recorded on January 10, 2014 and appeared to be a result of ice jamming.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126859	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(**Document Reference: Page 6**)

**Coordinating Discipline(s):** Hydraulics

Page 6, Table 3 Outlet Pipe Structures, where was this table retrieved from since it is not in the 1975 USACE DPR. Need to reference table.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017



**1-0 Evaluation Concurred**

Leading sentence is as follows: Interior drainage features for the project, according to Design Drawing No. 038 pa.1-P1-82/9, consist of the following storm drains discharging to the channel:

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126860	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(**Document Reference: Page 6**)

**Coordinating Discipline(s):** Hydraulics

Page 6, Section 3.4, Drop Structures, The 1975 DPR, PLATE 1 Appendix II and the LRP District LFPP maps and data sheets show six drop structures not five. Verify drop structures and reference table in report and where it was from.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

The paragraph has been updated to read as follows with a note below the table explaining the 6th drop structure: There are a total of six drop structures located within the improved portion of the channel. The drop structure at Sta: 45+25 varies from the other five by being a weir type drop structure. Drop structure at Sta. 24+15 includes the addition of a new concrete wall on the left bank of the channel. Table 4, acquired from Design Drawing No. 038 pa.1-P1-82/9, presents the drop structures and stationing locations (see note at base of table regarding the sixth drop structure):

Note: There is a sixth drop structure in the channel improvement section constructed by NYSDOT located at Station 27+37 according to Design Drawing No. 038 pa.1-P1-82/3.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Open Comment**

Table 4 is on Drawing No. 038 pa.1-P1-82/13 not 82/9. Weir Drop structure is at 40+25 not 45+25.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

**2-0 Evaluation Non-concurred**

We do concur that the table was referenced to the wrong design drawing sheet and that has been corrected. In regards to the drop structure stationing concerns, if you look at observation point 0035 in appendix B of the report you will see the photo of a weir drop structure downstream of the Davis Street Bridge. The drop structure according to

measurements taken off of Google Earth puts the drop structure approximately 30 feet downstream of the Davis Street Bridge, this measurements coincides with Design Drawing sheet 038pa.1-PI-82/4. With that said the Design Drawings put the drop structure at 40+25 not 45+25. If you look at observation point 0021 in Appendix B you will see the drop structure at 45+25 which is deemed a typical drop structure in the Design Drawings. This too is 500 feet upstream of the 40+25 drop structure on both the Design Drawings and Google Earth. Unless there is a set of as-built drawings or a current survey that supersedes these documents that LRB was not made aware of, it still appears that the Design Drawings from 1979 are the most accurate representation of the project alignment/stationing at this time.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 12 2017

**2-1 Backcheck Recommendation Open Comment**

Checked final report. Change to drawing 82/13 is good. According to Drawing 038pa.1-P1-82/9 in the upper left corner, the drawing shows the weir drop structure at STA (40+25). The report states "The drop structure at Sta: 45+25 varies from the other five by being a weir type drop structure." This needs changed to Sta. 40+25 in the final report.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 14 2017

**3-0 Evaluation Concurred**

This was changed.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 14 2017

**3-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 19 2017

Current Comment Status: **Comment Closed**

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7126861	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

([Document Reference: Page 6](#))

**Coordinating Discipline(s):** Hydraulics

Page 6, Section 3.5, Channels. The 1975 USACE DPR shows the channel improvement from Station 24+20 to 28+57 that was constructed by NYDT. Check stationing.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

The stationing was changed to Station 24+20 to 28+57.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Aug 31 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126862	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(**Document Reference: Page 7**)

**Coordinating Discipline(s):** Hydraulics

Page 7, Section 3.5, Channels. The debris basin is shown as 75 feet wide by 30 long in the 1975 USACE DPR. Provide reference for the 400 feet determined for the length for the debris basin.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation For Information Only**

According to Design Drawing No. 038 pa.1-P1-82/6, at the upstream end of the project, a debris basin approximately 400 feet in length between Station 62+30 and 66+30 varying in width up to 75 feet would be provided.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 01 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126863	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(**Document Reference: Page 15**)

**Coordinating Discipline(s):** Hydraulics

Page 15, Section 4.1.3.9, Culvert/Discharge Pipes. Should this be Unacceptable since there is no flap gate on the 10 inch pipe and water may flood the levee area as stated in the report.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Non-concurred**

An analysis to evaluate whether backflow into the levee can occur was not performed prior to inspection and is beyond the scope of work for this inspection. It is noted that this is a non project pipe added as part of the bridge rehab construction. The second sentence of the second bullet in 4.1.3.9 will be edited to read as follows "no flap gate is present on the pipe." Note in section 5.3.1 it is recommended that this pipe be evaluated to see if a flap gate is necessary.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 01 2017



**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126864	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(Document Reference: Page 21)

**Coordinating Discipline(s):** Hydraulics

Page 21, Section 4.2.2 Hydraulics and Hydrology, Level of Protection. Bolivar is in Allegany County and the FEMA Map is 3600260001C.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation Concurred**

The spelling error has been revised.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 01 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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7126865	Hydraulics	Periodic Inspections	n/a	n/a	n/a
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Comment Classification: **Unclassified\\For Official Use Only (U\\FOUO)**

(Document Reference: Page 21)

**Coordinating Discipline(s):** Hydraulics

Page 21, Section 4.2.2 Hydraulics and Hydrology, Level of Protection. The Base Flood Elevation is only listed as whole numbers and not decimals on the map. How were these decimal numbers determined.

Submitted By: [James Kosky](#) (412-395-7346). Submitted On: Aug 29 2017

**1-0 Evaluation For Information Only**

The information was taken from Table 2 of FIS 360026, Village of Bolivar, New York Allegany County, dated: Revised January 19, 1996. This note has been added to section 4.2.2.

Submitted By: [Joshua Kennedy](#) (716-879-4417) Submitted On: Sep 01 2017

**1-1 Backcheck Recommendation Close Comment**

Closed without comment.

Submitted By: [James Kosky](#) (412-395-7346) Submitted On: Sep 08 2017

Current Comment Status: **Comment Closed**

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UNCLASSIFIED\\FOR OFFICIAL USE ONLY  
Patent 11/892,984 [ProjNet](#) property of ERDC since 2004.

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# **Appendix E**

## **Design Drawings**

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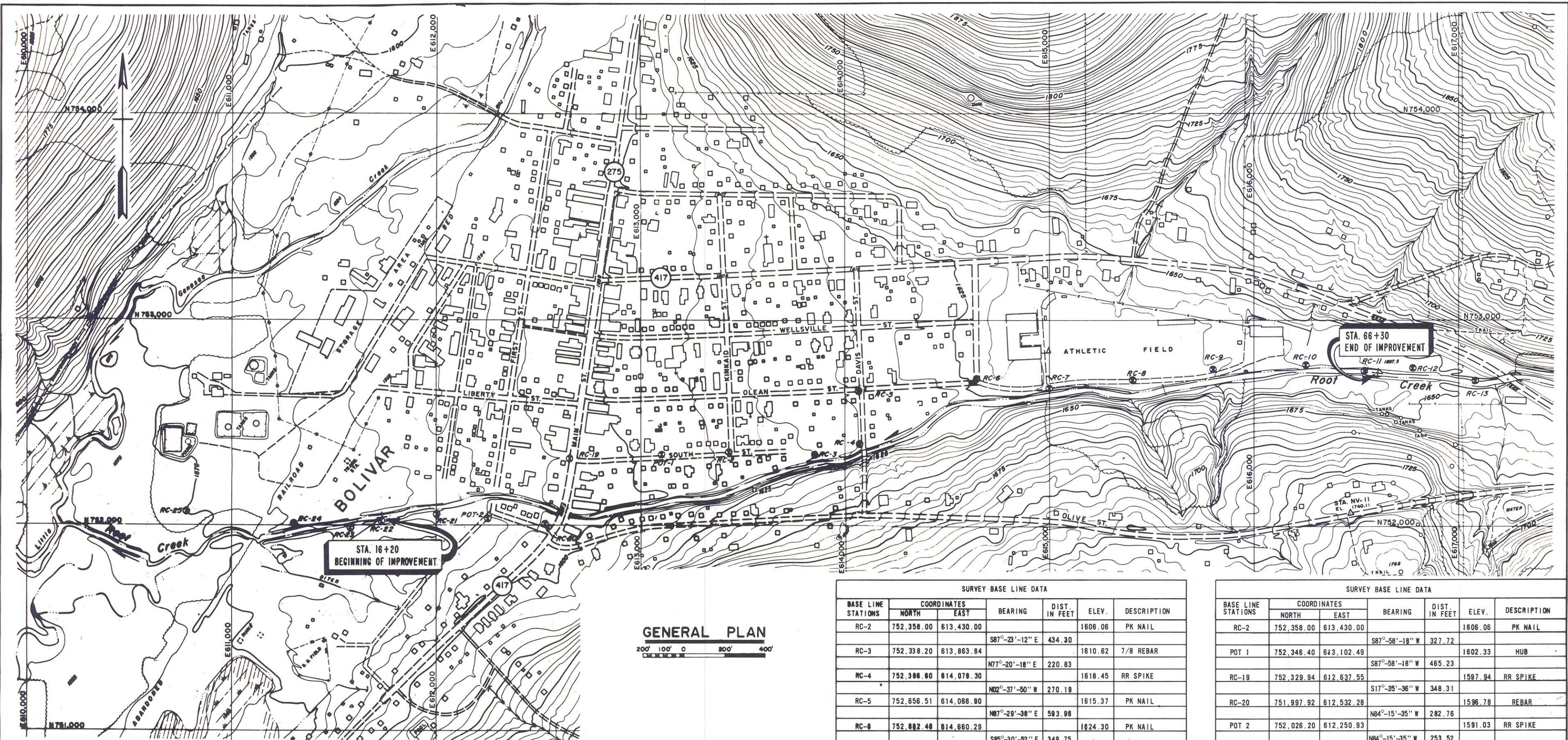
INDEX

TITLE	DRAWING NUMBER
GENERAL DRAWINGS	
INDEX	038pa.I-PI-0/1
LOCATION MAP, VICINITY MAP, GENERAL PLAN AND SURVEY BASELINE DATA	038pa.I-PI-3/1
FOUNDATION EXPLORATION AND TEST PITS	038pa.I-PI-10/1
HYDROGRAPHS AND STAGE DURATION CURVE	038pa.I-PI-14/1
CONSTRUCTION DRAWINGS	
LAYOUT PLAN AND SURVEY BASELINE DATA	038pa.I-PI-82/1
PLAN AND PROFILE-STA 16+20 TO STA 27+00.38	038pa.I-PI-82/2
PLAN AND PROFILE-STA 27+00.38 TO STA 37+20	038pa.I-PI-82/3
PLAN AND PROFILE-STA 37+20 TO STA 46+46.06	038pa.I-PI-82/4
PLAN AND PROFILE-STA 46+46.06 TO STA 56+48.96	038pa.I-PI-82/5
PLAN AND PROFILE-STA 56+48.96 TO STA 66+30	038pa.I-PI-82/6
SECTIONS	038pa.I-PI-82/7
SECTIONS	038pa.I-PI-82/8
MISCELLANEOUS STRUCTURES AND UTILITY LINE ADJUSTMENTS, PIPE OUTLET DATA, CONCRETE GRAVITY WALL AND MISCELLANEOUS DETAILS	038pa.I-PI-82/9
ACCESS RAMPS DETAILS	038pa.I-PI-82/10
DAVIS STREET BRIDGE ABUTMENT SUPPORT	038pa.I-PI-82/11
DAVIS STREET BRIDGE ABUTMENT SUPPORT, DETAILS	038pa.I-PI-82/12
DROP STRUCTURES DETAILS	038pa.I-PI-82/13
REFERENCE DRAWING	
GEOLOGIC STANDARD UNIFIED SOILS CLASSIFICATION	0-Z-24-1

NOTE: This is a half scale reproduction of the original drawing.

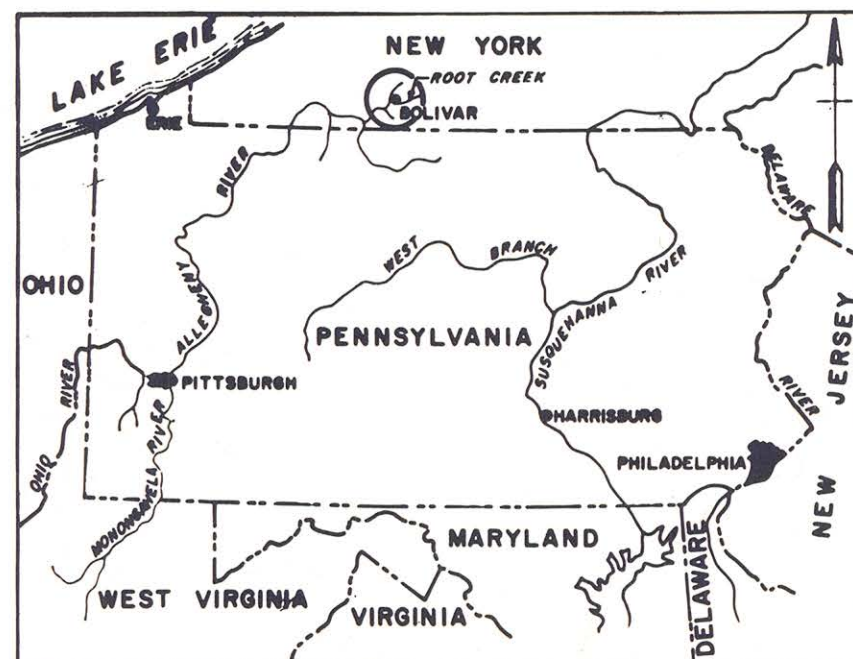
REVISION		DATE	DESCRIPTION	BY
GRAPHIC SCALE				
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA				
PREPARED BY: LEBDER	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK INDEX			
DRAWN BY: STASIOWSKI				
CHECKED BY: <i>[Signature]</i>				
SUBMITTED BY: <i>[Signature]</i>				
CHIEF DESIGN BRANCH APPROVAL RECOMMENDED <i>[Signature]</i>	APPROVED <i>[Signature]</i>		DATE 3 April 1977	
CHIEF ENGINEERING DIVISION APPROVED FOR	COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER		SCALE BSPC NO. 1	
DATE		DRAWING NUMBER 038pa.I-PI-0/1 SHEET OF		





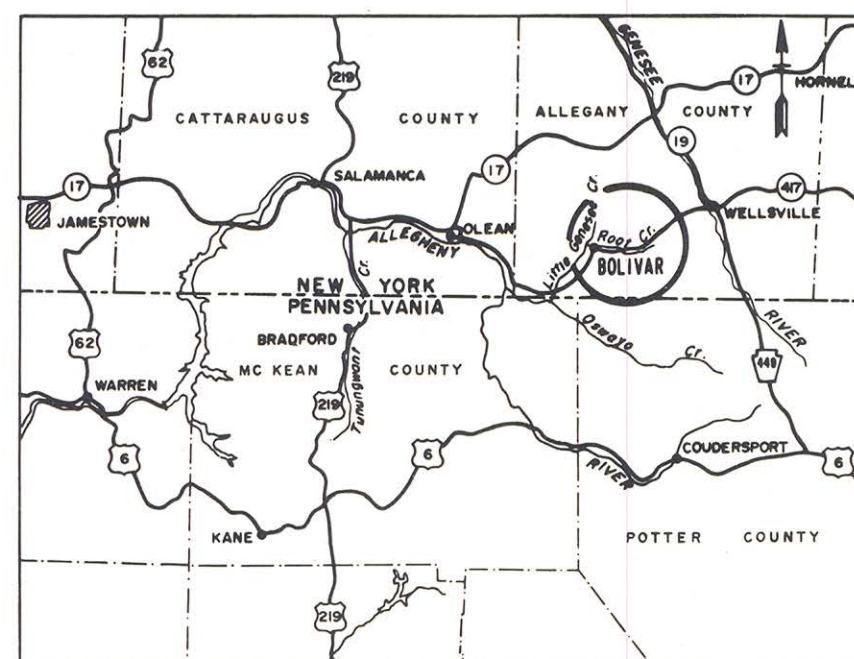
GENERAL PLAN

200' 100' 0' 100' 200'



LOCATION MAP

SCALE IN MILES



VICINITY MAP

SCALE IN MILES

SURVEY BASE LINE DATA						
BASE LINE STATIONS	COORDINATES		BEARING	DIST. IN FEET	ELEV.	DESCRIPTION
	NORTH	EAST				
RC-2	752,358.00	613,430.00	S87°-23'-12" E	434.30	1606.06	PK NAIL
RC-3	752,338.20	613,863.84	N77°-20'-18" E	220.83	1610.62	7/8 REBAR
RC-4	752,308.80	614,079.30	N02°-37'-50" W	270.19	1618.45	RR SPIKE
RC-5	752,656.51	614,066.90	N87°-28'-38" E	593.98	1615.37	PK NAIL
RC-6	752,802.48	614,860.29	S85°-30'-52" E	348.75	1624.30	PK NAIL
RC-7	752,655.13	615,008.97	N82°-40'-53" E	414.32	1628.50	7/8 REBAR
RC-8	752,707.91	615,419.91	N82°-20'-53" E	394.39	1632.45	7/8 REBAR
RC-9	752,780.42	615,810.79	S89°-38'-17" E	452.32	1635.11	7/8 REBAR
RC-10	752,757.57	618,283.09	S88°-21'-17" E	287.79	1646.29	7/8 REBAR
RC-11	752,749.30	616,550.76	N85°-42'-23" E	234.24	1650.39	7/8 REBAR
RC-12	752,786.84	618,784.34	S77°-21'-37" E	317.97	1654.40	7/8 REBAR
RC-13	752,897.26	617,094.60				

NOTES:

All Elevations to be checked in field.  
The Contractor shall be responsible for layout of the baseline from the control points and bench marks indicated. In the event these control points and bench marks cannot be located, the Contractor shall establish a new or re-establish the existing baseline.




NOTE: This is a half scale reproduction of the original drawing.



SURVEY BASE LINE DATA						
BASE LINE STATIONS	COORDINATES		BEARING	DIST. IN FEET	ELEV.	DESCRIPTION
	NORTH	EAST				
RC-2	752,358.00	613,430.00	S87°-23'-12" E	434.30	1606.06	PK NAIL
POT 1	752,346.40	613,102.49	S87°-58'-18" W	327.72	1602.33	HUB
RC-19	752,329.94	612,637.55	S87°-58'-18" W	465.23	1597.94	RR SPIKE
RC-20	751,997.92	612,532.28	S17°-35'-36" W	348.31	1596.78	REBAR
POT 2	752,026.20	612,250.93	N84°-15'-35" W	282.76	1591.03	RR SPIKE
RC-21	752,051.56	611,998.68	N84°-15'-35" W	253.52	1588.10	REBAR
RC-22	752,016.61	611,734.50	S82°-27'-52" W	286.48	1585.84	REBAR
RC-23	751,975.69	611,572.62	S75°-48'-50" W	188.98	1583.47	REBAR
RC-24	752,007.10	611,300.07	N83°-25'-34" W	274.35	1586.00	8" PLATE
RC-25	752,057.52	610,771.50	N84°-33'-05" W	530.97	1578.14	CW PIN

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
AS SHOWN			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH			
CORPS OF ENGINEERS			
OFFICE OF THE DISTRICT ENGINEER			
PITTSBURGH, PENNSYLVANIA			
PREPARED BY:	LEBOER	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK LOCATION MAP, VICINITY MAP GENERAL PLAN AND SURVEY BASELINE DATA	
DRAWN BY:	DUDICK		
CHECKED BY:			
SUBMITTED BY:			
APPROVED BY:			
CHIEF, DESIGN BRANCH		DATE:	3 April 1979
APPROVAL RECOMMENDED:		SCALE:	AS SHOWN
CHIEF ENGINEERING DIVISION		DRAWING NUMBER	038pa.I-PI-3/1
APPROVED FOR:		SHEET	OF





LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.050 E611.766		0		14 NOV 1973 Completed		TP-1		J. D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PI	WT	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description on)	CORE Drilled or Lost	BOX OF SAMPLE NO.	REMARKS
1585.0	0.0						BROWN SANDY GRAVEL (GP) (SAND BAR)			TOP OF HOLE
1584.5	0.5						BROWNISH GRAY ORGANIC SILTY SAND (OL) W/TRACE GRAVEL AND ROOTLETS		1	
1582.0	3.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		2	
1580.5	4.5						GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		3	
1579.7	5.3						LIGHT BROWN SILTY SANDY GRAVEL (GM)		4	
1579.6	5.4						GRAY SANDY GRAVEL (GP) W/TRACE OF SILT			NO sample taken
1576.0	9.0									BOTTOM OF HOLE

LOCATION N752.096 E612.844		DIRECTION OF HOLE FROM VERTICAL  0°		DATE HOLE Started 13 NOV 1973 Completed 13 NOV 1973		HOLE NO.  TP-2		SIZE AND TYPE OF BIT OR SAMPLER  J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PI	W*	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE NO.	REMARKS
1596.7	0.0						BROWNISH GRAY SANDY GRAVEL (GP) W/ TRACE OF SILT		1	TOP OF HOLE
1593.7	3.0						BROWNISH GRAY SILTY SANDY GRAVEL (GM)		2	
1586.7	10.0									

LOCATION N752.162 E613.391		DIRECTION OF HOLE FROM VERTICAL  0°		DATE HOLE Started 13 NOV 1973 Completed 13 NOV 1973		HOLE NO.  TP-3		SIZE AND TYPE OF BIT OR SAMPLER  J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PI	WT	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE NO.	REMARKS
1601.5	0.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		1	TOP OF HOLE
1598.5	3.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF CLAY		2	
1592.0	9.5									BOTTOM OF HOLE


LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE Started		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.274 E613.708		0°		14 NOV 1973 Completed		TP - 4		J. D. 310 BACKHOE		
14 NOV 1973										
ELEVATION	DEPTH	LL	PL	W'	Blows Per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE	REMARKS
1604.0	0.0						BROWNISH GRAY SANDY GRAVEL (GP)		1	TOP OF HOLE
1601.5	2.5						LIGHT BROWN SILTY CLAYEY SANDY GRAVEL (GC)		3	
1598.0	8.0									BOTTOM OF HOLE



LOCATION N752.319 E613.936		DIRECTION OF HOLE FROM VERTICAL  0°		DATE HOLE Started 14 NOV. 1973 Completed  14 NOV. 1973		HOLE NO.  TP-5		SIZE AND TYPE OF BIT OR SAMPLER  J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	WV	Blows Per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	Core Drilled or Lost	Box Filled or Sample	REMARKS
1608.2	0.0						GRAY GRAVELLY SAND (GP)		1	TOP OF HOLE
1604.2	4.0						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		2 AND 3	Samples taken at different depths
1598.2	10.0									BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.346 E614.101 AT LEFT ABUTMENT DAVIS ST. BRIDGE		0°		15 NOV 1973 Completed 15 NOV 1973		TP-6		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W	BLOWS Per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	Box of Sample	REMARKS
1609.4	0.0						GRAYISH BROWN SILTY SANDY GRAVEL (GP)		1	TOP OF HOLE
1607.9	1.5						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		2	CONC. FOOTER ADJACENT TO TEST PIT EL. 1610.4 TO EL. 1606.4
1605.4	4.0									BOTTOM OF HOLE



LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE Started		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.375 E614.098 AT RIGHT ABUTMENT DAVIS ST. BRIDGE		0°		14 NOV 1973 Completed 14 NOV 1973		TP-7		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W.	BLOWS Per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE	REMARKS
1609.4	0.0						GRAYISH BROWN SILTY SANDY GRAVEL (GM)		1	TOP OF HOLE
1608.4	3.0						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		2	CONC. FOOTER ADJACENT TO TEST PIT EL 1610.4 TO 1608.4
1604.4	5.0									BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE Started		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.477 E614.400		0°		15 NOV 1973 Completed 15 NOV 1973		TP-8		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W	Blows Per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE	REMARKS
-1615.9	0.0						TOPSOIL		1	TOP OF HOLE
-1614.4	1.5						GRAY SILTY SANDY GRAVEL (GP)		2	
-1613.4	2.5						GRAYISH BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		3	
-1611.4	4.0						GRAY SILTY SANDY GRAVEL (GM)		5	No Sample taken
-1611.4	4.5						GRAYISH BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		6	
-1609.9	6.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT			
-1604.9	11.0									BOTTOM OF HOLE



LOCATION N752.803 E614.830		DIRECTION 0°		DATE HOLE Started 15 NOV. 1973 Completed 15 NOV. 1973		HOLE NO. TP-9		SIZE AND TYPE OF BIT OR SAMPLER J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS ( Description )	CORE Drilled Lost	BOX OF SAMPLE	REMARKS
1618.9	0.0						BROWN SILTY SANDY GRAVEL (GP) W/TRACE OF CLAY		1 2 AND 3	TOP OF HOLE   Samples taken at different depths
1608.9	10.0									BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.691		0°		Started		TP-10		J.D. 310 BACKHOE		
E615.080				16 NOV. 1973						
AT S/S END OF RETAINING WALL				Completed						
				16 NOV. 1973						
ELEVATION	DEPTH	LL	PL	W	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE	REMARKS
1621.5	0.0						BROWN SILTY SANDY GRAVEL (GM)		1	TOP OF HOLE
1619.0	2.5						GRAYISH BROWN SILTY SANDY GRAVEL (GM)		3	BOTTOM OF STEEL PLATING EL. 1620.5
1617.0	4.5						W/TRACE OF CLAY			BOTTOM OF RAIL EL. 1617.2
										BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.641 E615.275		0°		15 NOV 1973 Completed 15 NOV 1973		TP-II		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W	BLOWS per FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled Lost	BOX OF SAMPLE	REMARKS
1624.6	0.0						BROWN SANDY GRAVEL (GW) W/TRACE OF SILT		1	TOP OF HOLE
1622.1	2.5						BROWN SILTY FINE SAND(SM) W/FEW GRAVELS		2	
1618.6	5.0						BROWN GRAVELLY SAND (SP) W/TRACE OF SILT		3	
1616.6	8.0						BROWN SANDY GRAVEL (GP)		4	
1614.1	10.5									BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE Started		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.690 E615.733		0°		16 NOV. 1973 Completed 16 NOV. 1973		TP-12		J. D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W%	Blows per Foot	LEGEND	CLASSIFICATION OF MATERIALS (Description)	Core Drilled or Lost	BOX OF SAMPLE	REMARKS
1629.2	0.0						BROWN SILTY SANDY GRAVEL (GM)		1	TOP OF HOLE
1626.2	3.0						GRAY SANDY SILTY CLAYEY GRAVEL (GC)		2	
1619.2	10.0									BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		DATE HOLE COMPLETED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER		
N752.735 E616.197		0°		16 NOV 1973		16 NOV 1973		TP-13		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W.	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE Drilled or Lost	BOX OF SAMPLE	REMARKS		
1633.0	0.0						BROWN SANDY GRAVEL (GP) W/ TRACE OF SILT			TOP OF HOLE		
										1 2 AND 3	Samples taken at different depths	
		N.P.	B.1									
1623.0	10.0									BOTTOM OF HOLE		

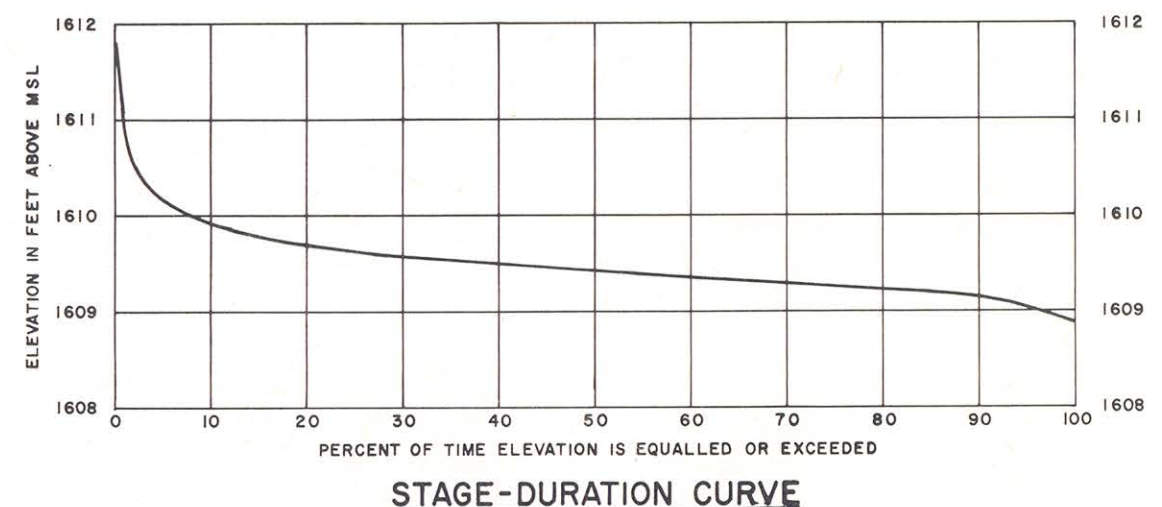
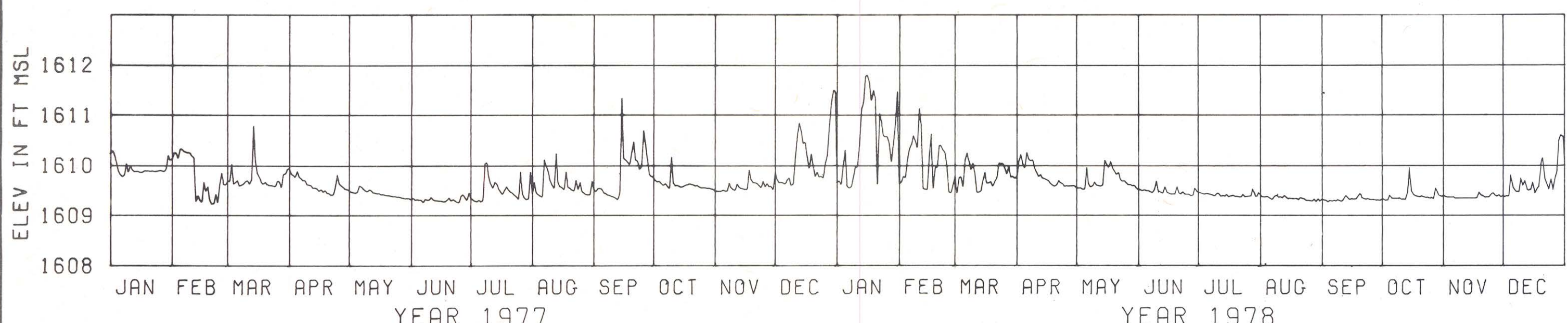
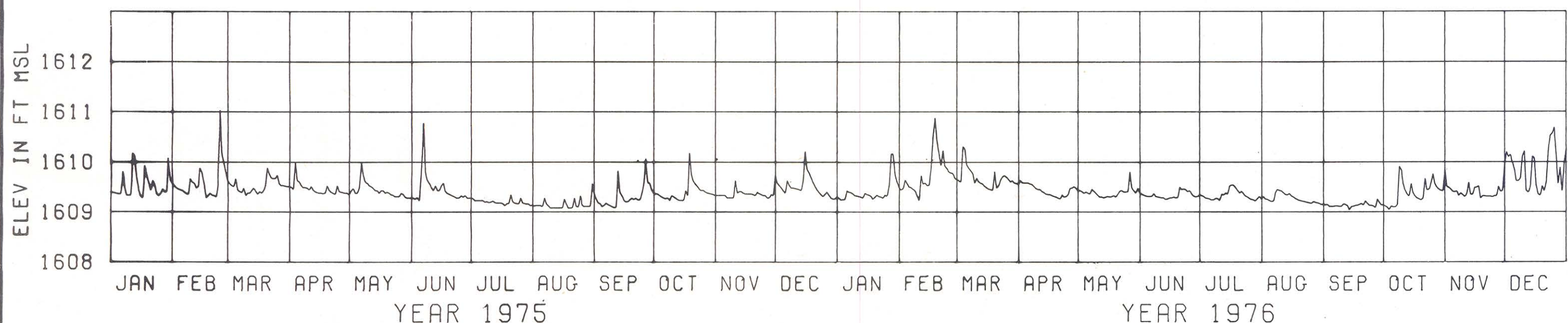
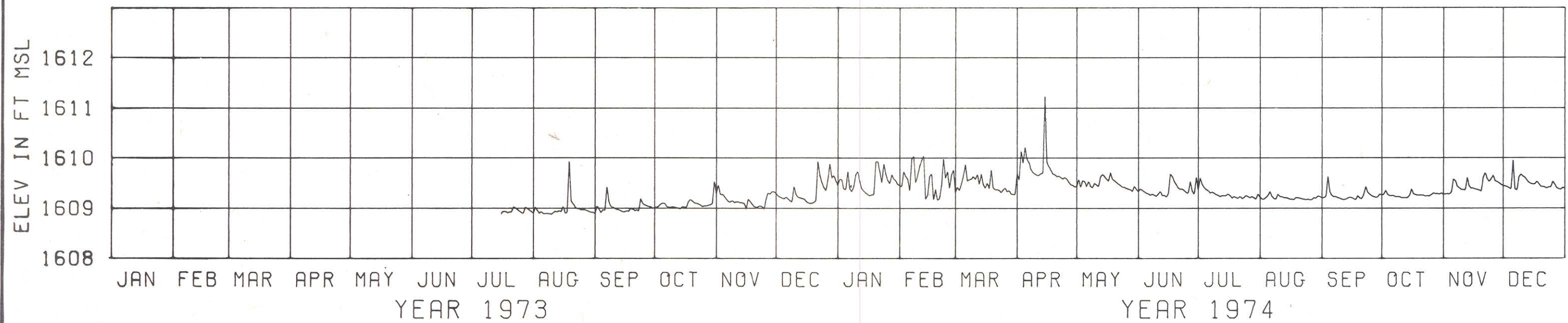
LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE Started		HOLE NO		SIZE AND TYPE OF BIT OR SAMPLER		
N752.739 E616.352		0°		16 NOV 1973 Completed 16 NOV 1973		TP-14		J.D. 310 BACKHOE		
ELEVATION	DEPTH	LL	PL	W	BLOWS per FOOT	LEGEND	CLASSIFICATION OF MATERIALS ( Description )	CORE Drilled Lost	BOX OF SAMPLE	REMARKS
1634.0	0.0						BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		1	TOP OF HOLE
1628.0	6.0									BOTTOM OF HOLE

NOTE: Water was encountered at the top of all holes except TP-8 where it was encountered at 2.0' depth.

NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: C.E.S.	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK FOUNDATION EXPLORATION TEST PITS HOLES TP-1 TO TP-14 INCLUSIVE		
DRAWN BY: M.B.	DATE: 3 April 1979		
CHECKED BY: J.S. Longman	APPROVED: Joseph J. Longman DISTRICT ENGINEER		
SUBMITTED BY: J.S. Longman	APPROVED: J.S. Longman DISTRICT ENGINEER		
APPROVAL RECOMMENDED: J.S. Longman	APPROVED: J.S. Longman DISTRICT ENGINEER		
APPROVED FOR:	SCALE: AS SHOWN DRAWING NUMBER: 038pa.1-P1-10/1 SHEET OF		



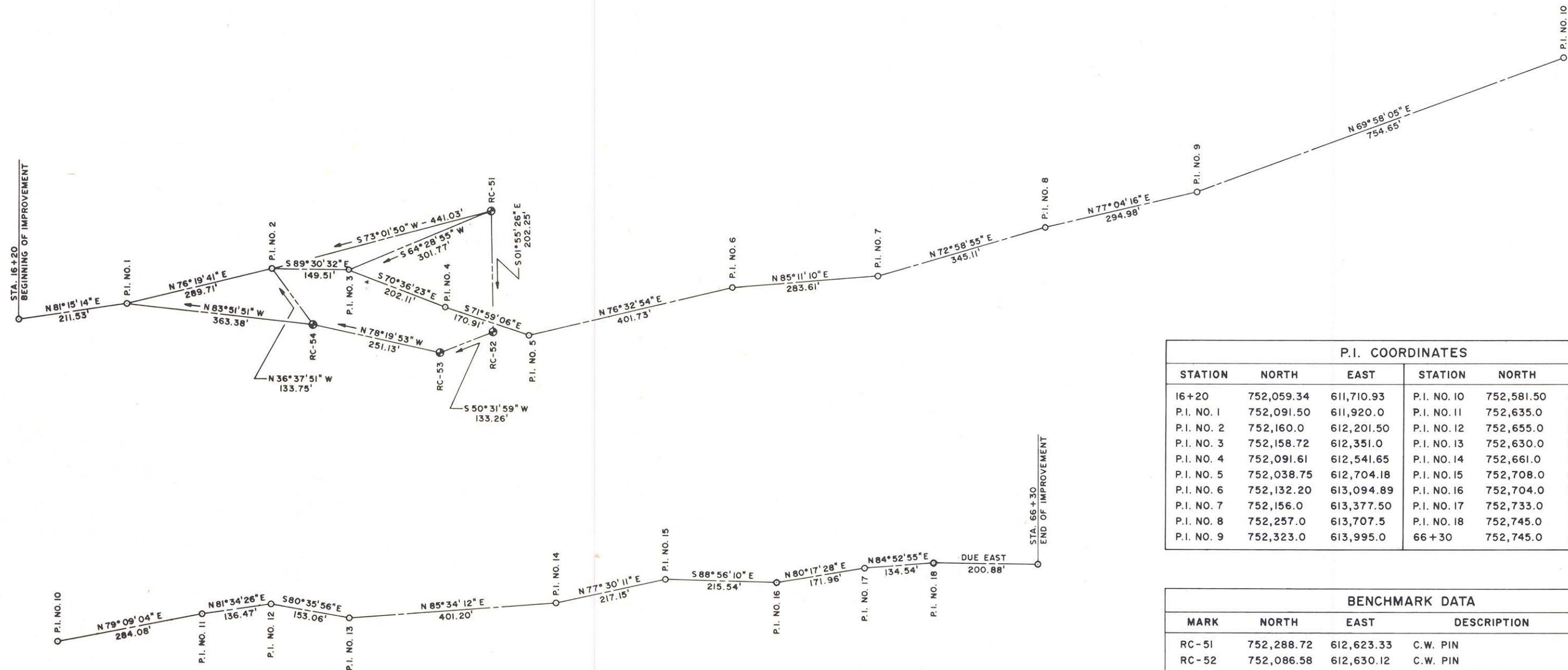


- NOTES:**
1. STAGE HYDROGRAPHS SHOWN ARE BASED ON ONCE-A-DAY READINGS OF THE U.S.C.E. WIRE WEIGHT GAGE ON ROOT CREEK IN BOLIVAR, N.Y. PEAK ELEVATIONS WERE USED IN LIEU OF THE REGULAR DAILY READINGS WHEN AVAILABLE.
  2. THE GAGE, WHICH IS LOCATED ON THE DAVIS STREET BRIDGE, HAS A DATUM OF 1603.73 FEET ABOVE MEAN SEA LEVEL.
  3. THE PERIOD OF RECORD FOR THE GAGE IS JULY 1973 TO DATE. DURING THIS PERIOD, READINGS WERE NOT TAKEN ON APPROXIMATELY 17 PERCENT OF THE DAYS. THE MISSING VALUES WERE ESTIMATED BASED ON PRECIPITATION RECORDS AND/OR THE U.S.G.S. GAGE ON OSWAYO CREEK AT SHINGLEHOUSE, PA.
  4. THE STAGE-DURATION CURVE FOR THE PERIOD OF RECORD IS BASED ON THE STAGE HYDROGRAPHS.

NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: SALESKY	<b>BOLIVAR FLOOD PROTECTION PROJECT</b> <b>ROOT CREEK</b> <b>BOLIVAR, NEW YORK</b> HYDROGRAPHS AND STAGE-DURATION CURVE		
DRAWN BY: STASIOWSKI			
CHECKED BY: WAS			
SUBMITTED BY: [Signature]			
APPROVAL RECOMMENDED: [Signature] CHIEF, ENGINEERING DIVISION	APPROVED: [Signature] COLONEL, CORPS OF ENGINEERS	DATE: <b>3 April 1979</b>	
SCALE: AS SHOWN		SPEC. NO. <b>038pa.1-PI-14/1</b>	
SHEET		OF	

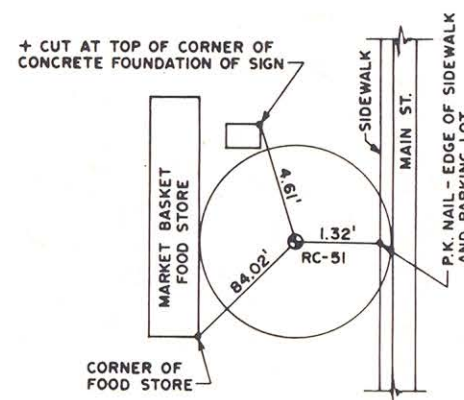




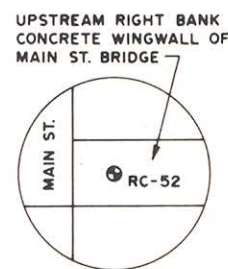
PLAN  
SCALE: 1" = 100'

P.I. COORDINATES					
STATION	NORTH	EAST	STATION	NORTH	EAST
16+20	752,059.34	611,710.93	P.I. NO. 10	752,581.50	614,704.0
P.I. NO. 1	752,091.50	611,920.0	P.I. NO. 11	752,635.0	614,983.0
P.I. NO. 2	752,160.0	612,201.50	P.I. NO. 12	752,655.0	615,118.0
P.I. NO. 3	752,158.72	612,351.0	P.I. NO. 13	752,630.0	615,269.0
P.I. NO. 4	752,091.61	612,541.65	P.I. NO. 14	752,661.0	615,669.0
P.I. NO. 5	752,038.75	612,704.18	P.I. NO. 15	752,708.0	615,881.0
P.I. NO. 6	752,132.20	613,094.89	P.I. NO. 16	752,704.0	616,096.50
P.I. NO. 7	752,156.0	613,377.50	P.I. NO. 17	752,733.0	616,266.0
P.I. NO. 8	752,257.0	613,707.5	P.I. NO. 18	752,745.0	616,400.0
P.I. NO. 9	752,323.0	613,995.0	66+30	752,745.0	616,600.88

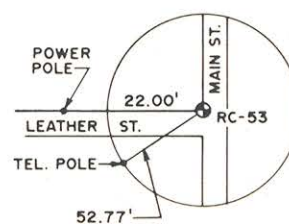
BENCHMARK DATA				
MARK	NORTH	EAST	DESCRIPTION	ELEV.
RC-51	752,288.72	612,623.33	C.W. PIN	1597.90
RC-52	752,086.58	612,630.12	C.W. PIN	1598.97
RC-53	752,001.88	612,527.24	+ CUT IN TOP OF CURB AT INT. OF MAIN & LEATHER STS.	1597.32
RC-54	752,052.67	612,281.30	5/8" RE-BAR	1592.10



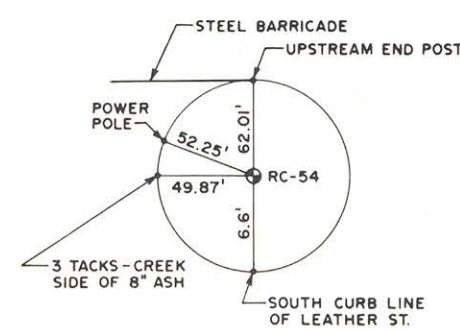
RC-51



RC-52



RC-53



RC-54

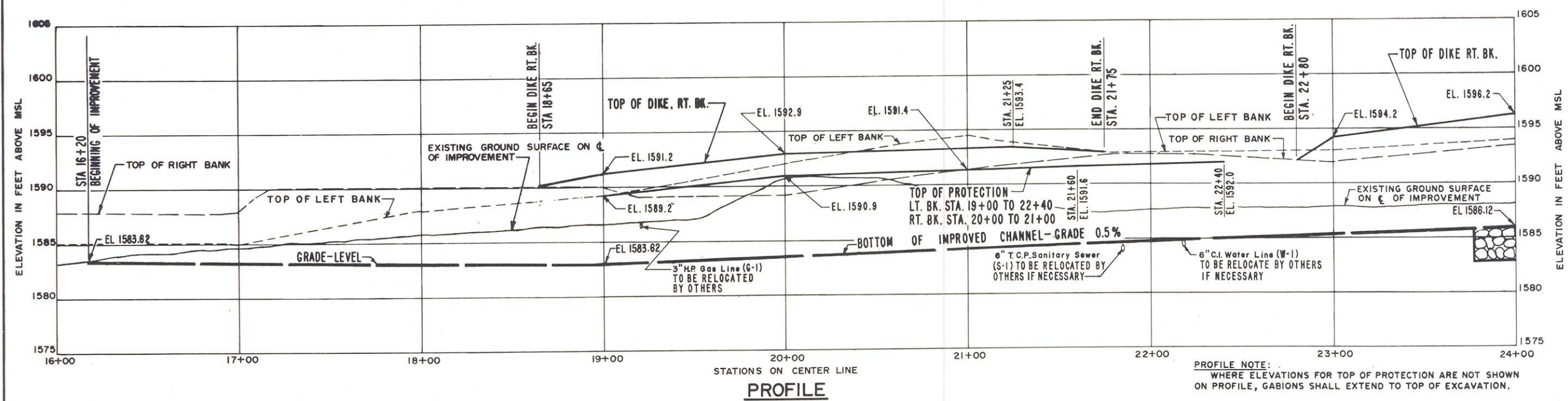
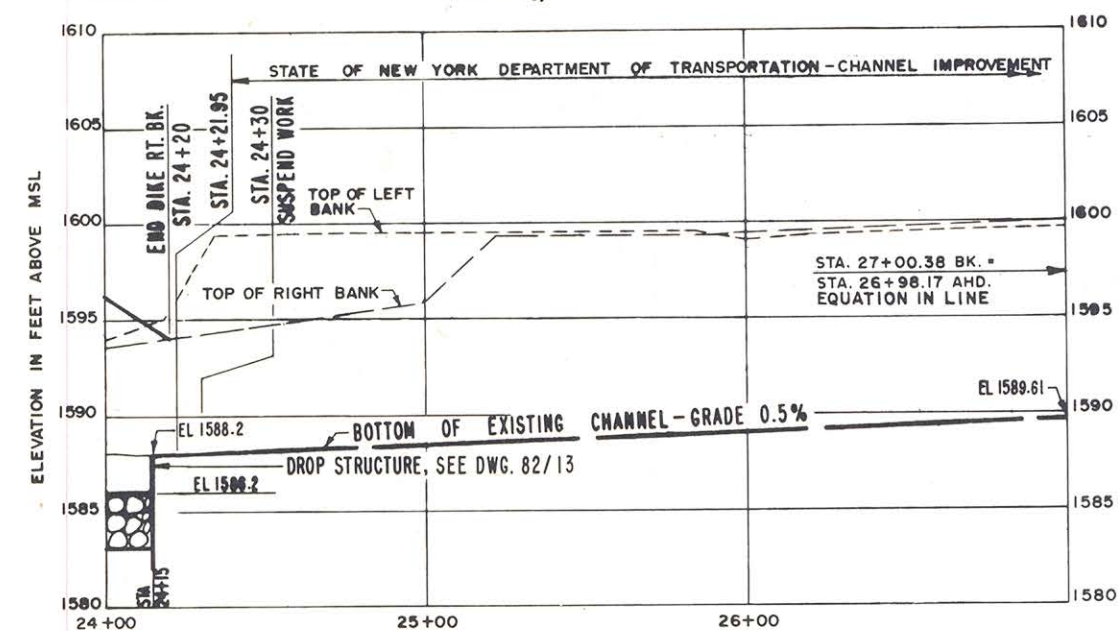
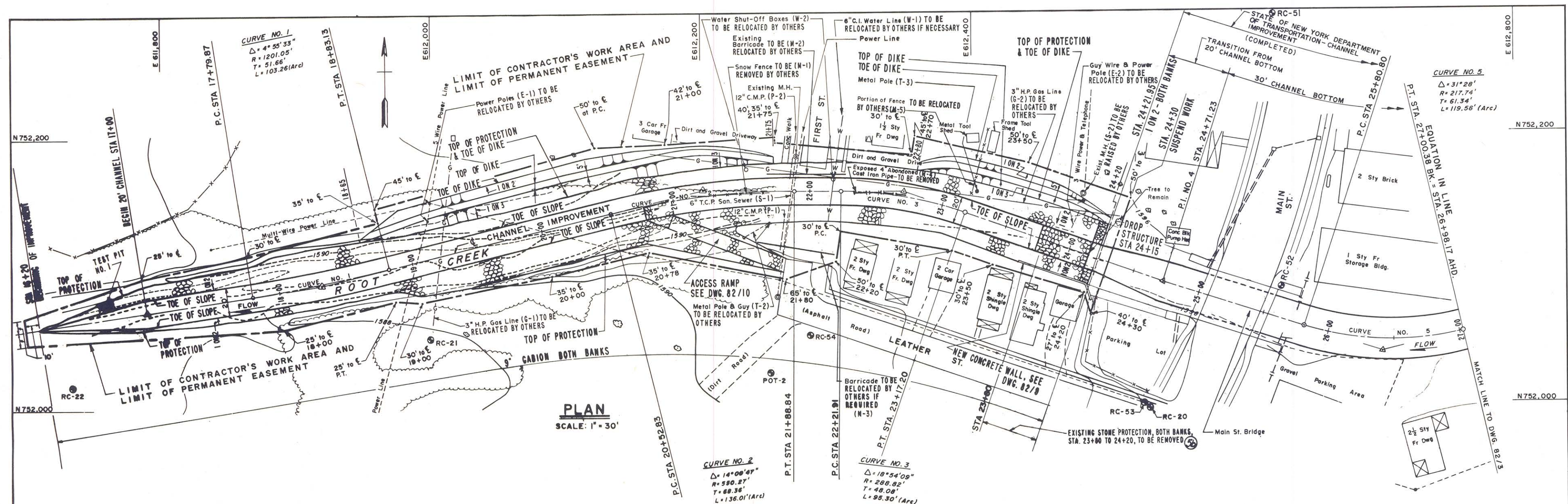
BENCHMARK LOCATIONS  
NOT TO SCALE

FOR CURVE DATA AND P.C. AND P.T. STATIONS, SEE PLAN SHEETS.

NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE 100' 50' 0 100' 200'			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: MAYERNIK	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK		
DRAWN BY: MANTHEY	LAYOUT PLAN AND SURVEY BASELINE DATA		
CHECKED BY: <i>[Signature]</i>	DATE: 2 April 1979		
SUBMITTED BY: <i>[Signature]</i>	APPROVED FOR: CHIEF, ENGINEERING DIVISION		
APPROVAL RECOMMENDED: <i>[Signature]</i>	CHIEF, CORPS OF ENGINEERS, DISTRICT ENGINEER		
SCALE: AS SHOWN		SPEC. NO.:	
DRAWING NUMBER 038pa.I-P1-82/1		SHEET OF	





**PROFILE NOTE:**  
WHERE ELEVATIONS FOR TOP OF PROTECTION ARE NOT SHOWN  
ON PROFILE, GABIONS SHALL EXTEND TO TOP OF EXCAVATION.

NOTE: This is a half scale reproduction of the original drawing.

### GENERAL NOTES

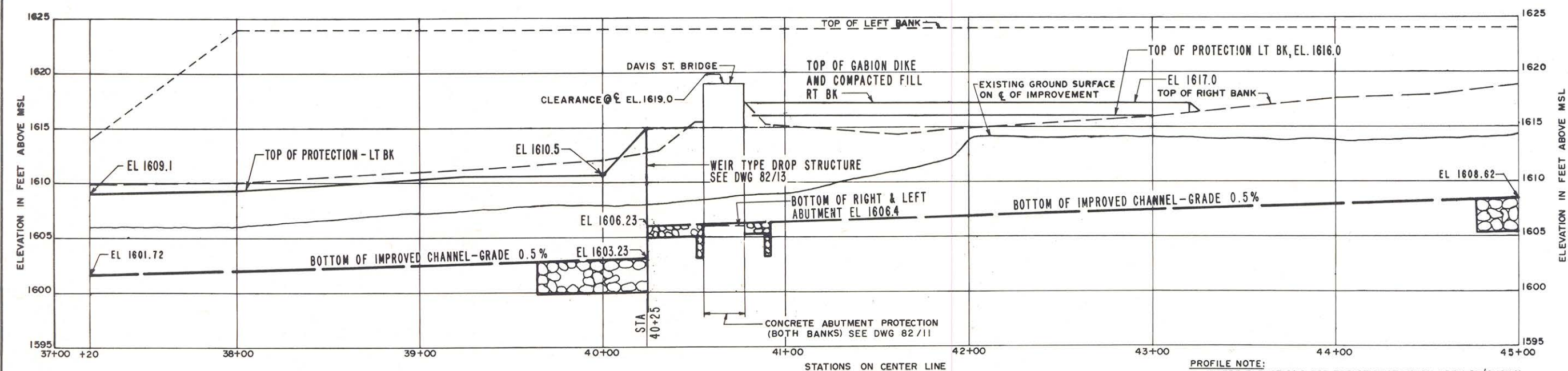
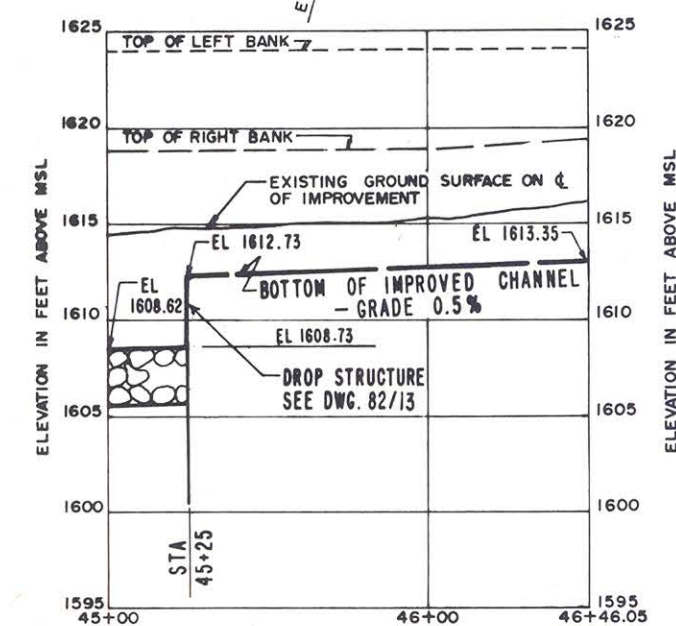
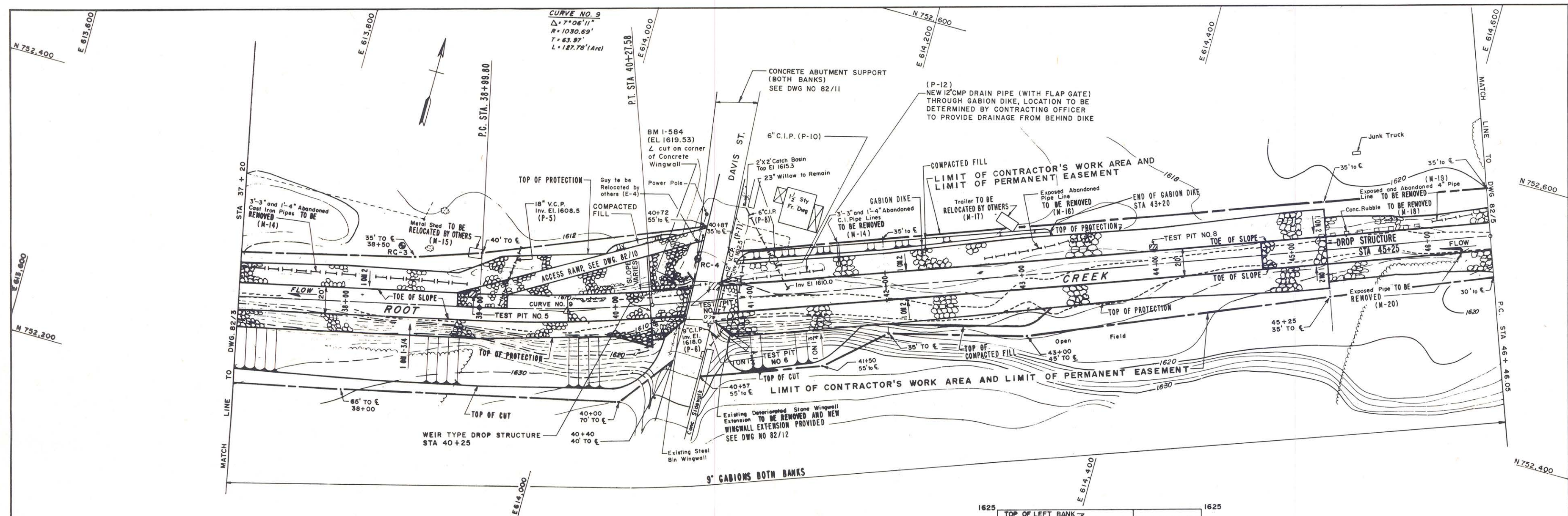
FOR TYPICAL SECTIONS OF CHANNEL, SEE DWGS. 82/7 AND 82/8  
FOR CHANNEL CENTERLINE DATA, SEE LAYOUT, DWG. 82/1  
FOR TABLES OF UTILITIES, PIPELINES, AND MISCELLANEOUS  
ITEMS REQUIRING ADJUSTMENT, SEE DWG. 82/9  
FOR DETAILS OF ACCESS RAMPS, SEE DWG. 82/10  
FOR DETAILS OF DROP STRUCTURES, SEE DWG. 82/13  
FOR LOGS OF TEST PITS, SEE DWG. 10/1  
FOR PROCEDURE FOR GROUTING OF 36" (2-18" layers) STONE FILLED  
GABIONS IMMEDIATELY DOWNSTREAM OF DROP STRUCTURES, SEE  
DWG. 82/10  
FOR PROCEDURE FOR GROUTING OF 12" STONE FILLED GABION BASKET  
IN CHANNEL INVERT FROM STA. 40+25 TO STA. 40+91, SEE DWG. 82/10

REVISION		DATE	DESCRIPTION		BY
<p style="text-align: center;"><b>GRAPHIC SCALE</b></p> <p style="text-align: center;">30'    15'    0    30'    60'</p> <p style="text-align: center;">1" = 30'</p>					
<p style="text-align: center;">U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA</p>					
PREPARED BY: LEBBER - MAYENIK			BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK		
DRAWN BY: LUSTER			PLAN AND PROFILE STA 16+20 TO STA 27+00.38		
CHECKED BY: <i>W. B. Collette</i>			DATE: <i>3 April 1979</i>		
SUBMITTED BY: <i>W. B. Collette</i>			APPROVED: <i>Frank P. [Signature]</i> COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER		
CHIEF, DESIGN BRANCH APPROVAL RECOMMENDED: <i>W. B. Collette</i> CHIEF, ENGINEERING DIVISION			SCALE: AS SHOWN    SPEC. NO.:		
APPROVED FOR:			DRAWING NUMBER 038pa.I-P1-82/2		
DATE:			SHEET OF		









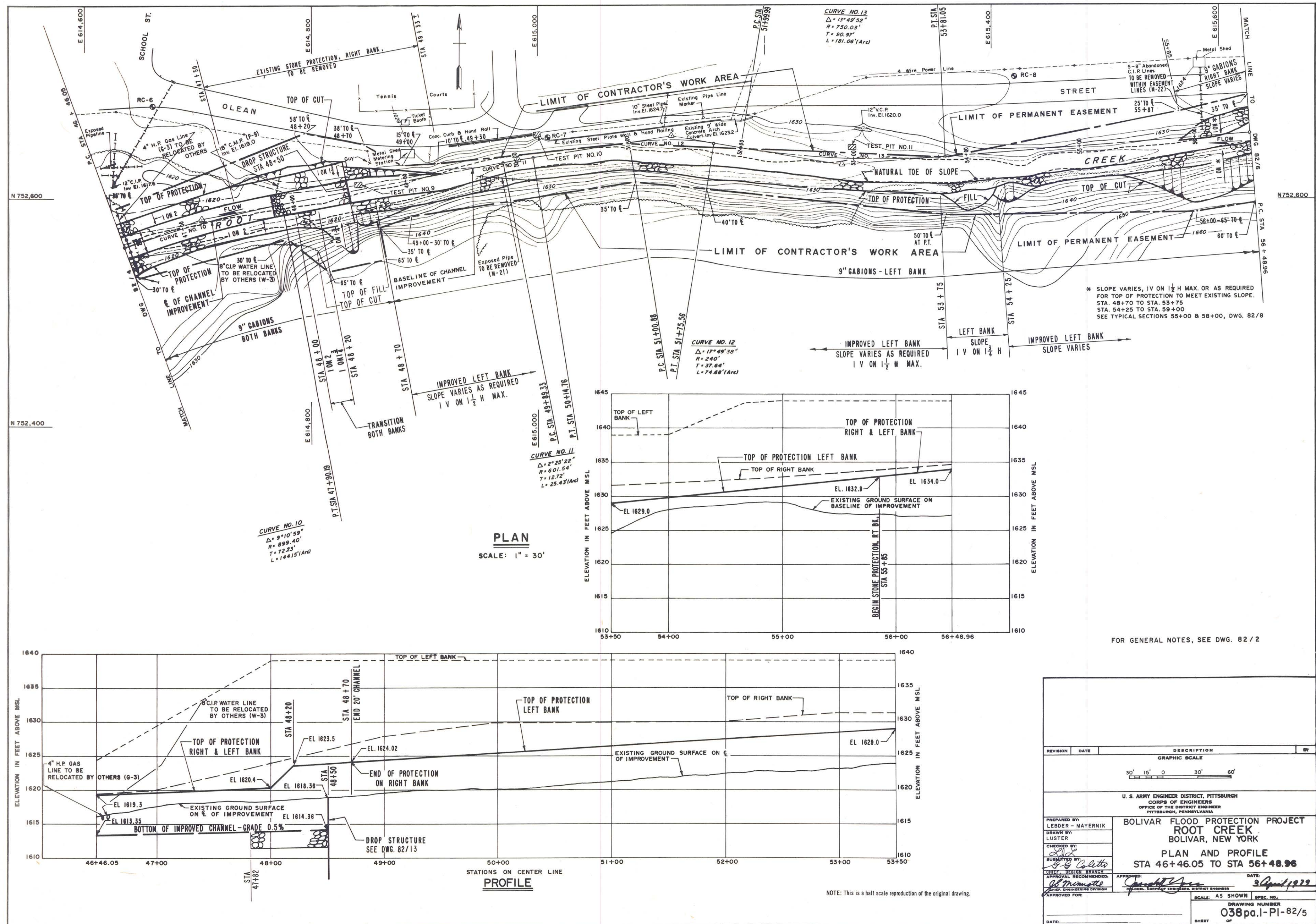
PROFILE NOTE:  
 WHERE ELEVATIONS FOR TOP OF PROTECTION ARE NOT SHOWN  
 ON PROFILE, GABIONS SHALL EXTEND TO TOP OF EXCAVATION.

NOTE: This is a half scale reproduction of the original drawing.

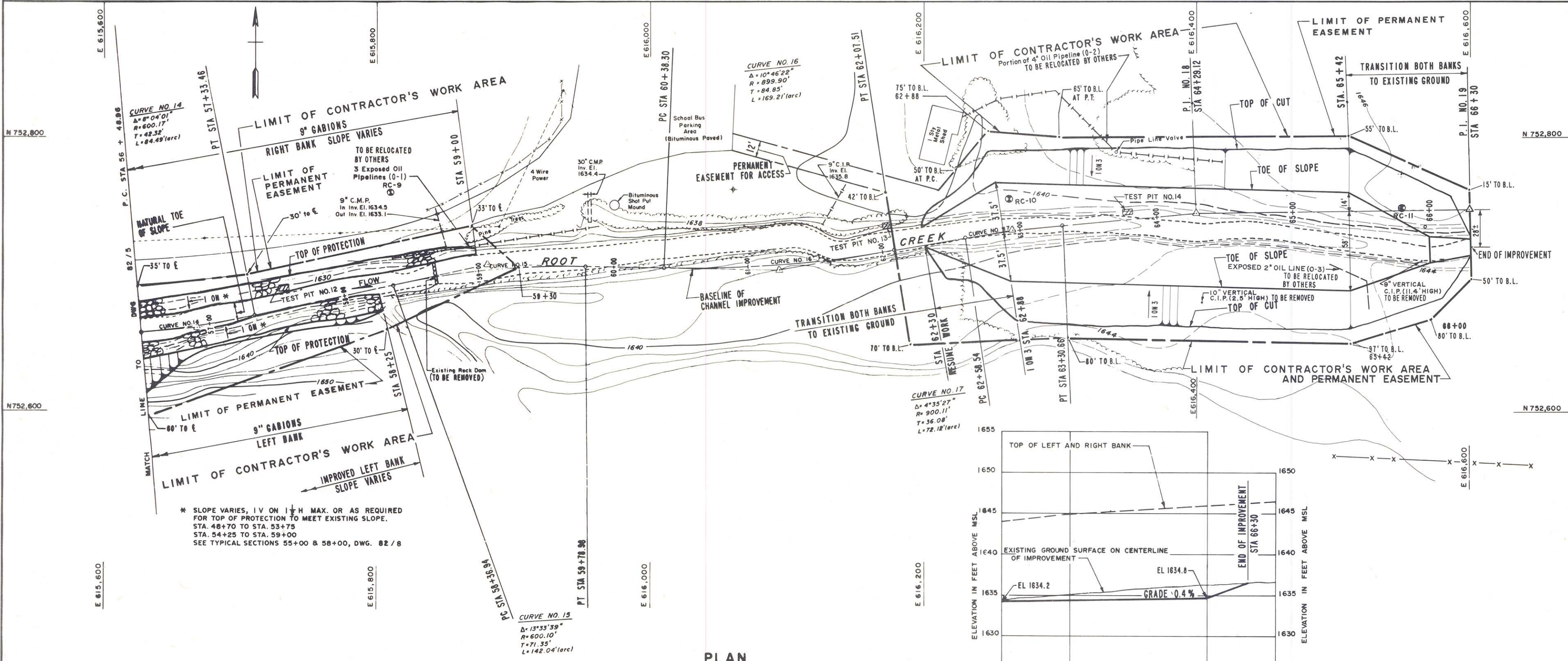
FOR GENERAL NOTES, SEE DWG. 82/2

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE 30' 15' 0 30' 60'			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
<b>BOLIVAR FLOOD PROTECTION PROJECT</b> <b>ROOT CREEK</b> <b>BOLIVAR, NEW YORK</b> <b>PLAN AND PROFILE</b> <b>STA 37+20 TO STA 46+46.05</b>			
PREPARED BY: LEBODER-MAYERNIK	DRAWING NUMBER <b>038pa.1-PI-82/4</b>		
DRAWN BY: LUSTER	SHEET OF		
CHECKED BY: [Signature]	DATE: <b>3 April 1979</b>		
SUBMITTED BY: [Signature]	APPROVED FOR:		
APPROVAL RECOMMENDED: [Signature]	APPROVED:		
CHIEF ENGINEERING DIVISION	SCALE: AS SHOWN		



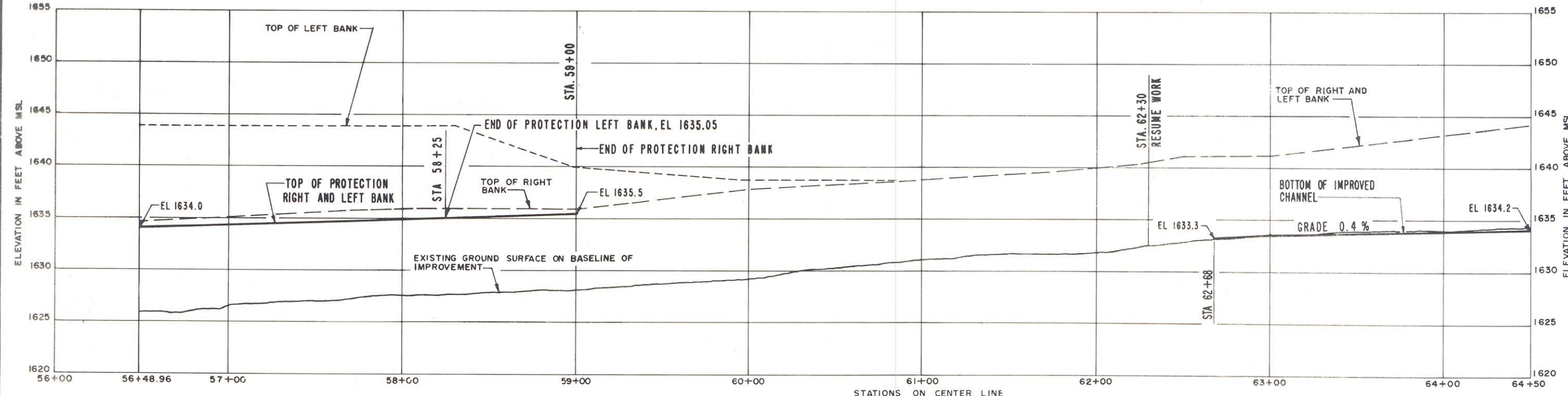
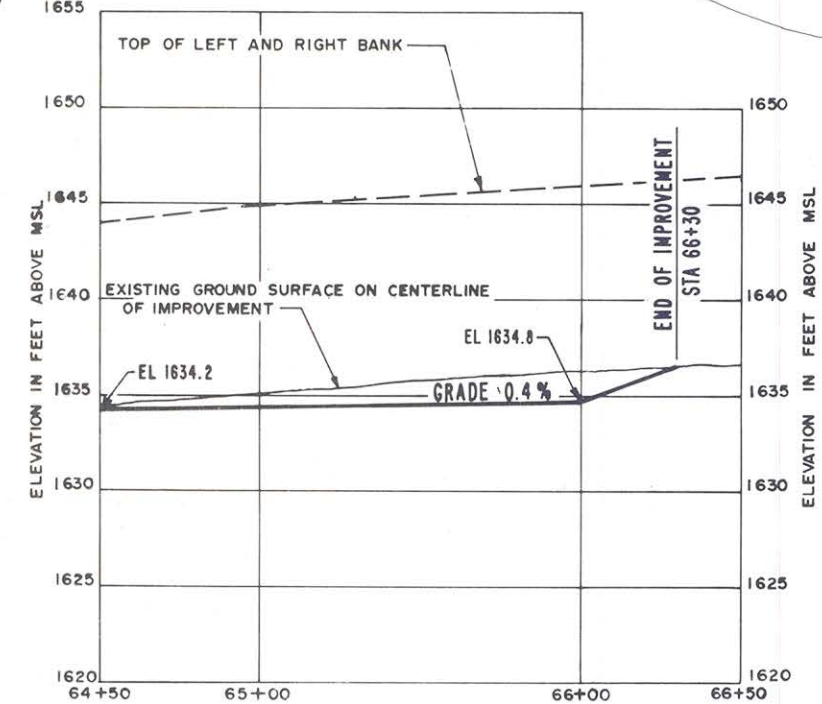






PLAN

SCALE: 1" = 30'



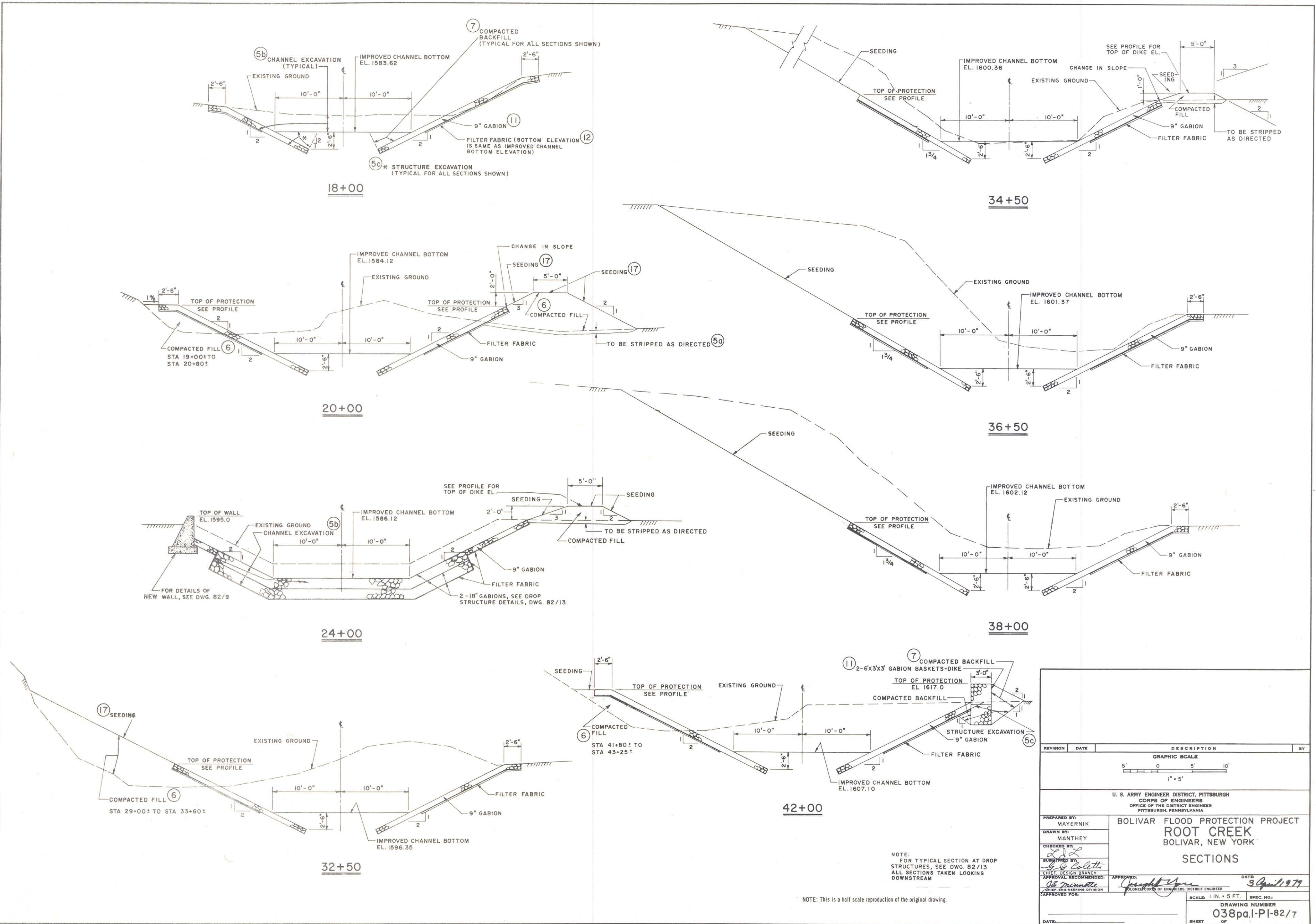
PROFILE

NOTE: This is a half scale reproduction of the original drawing.

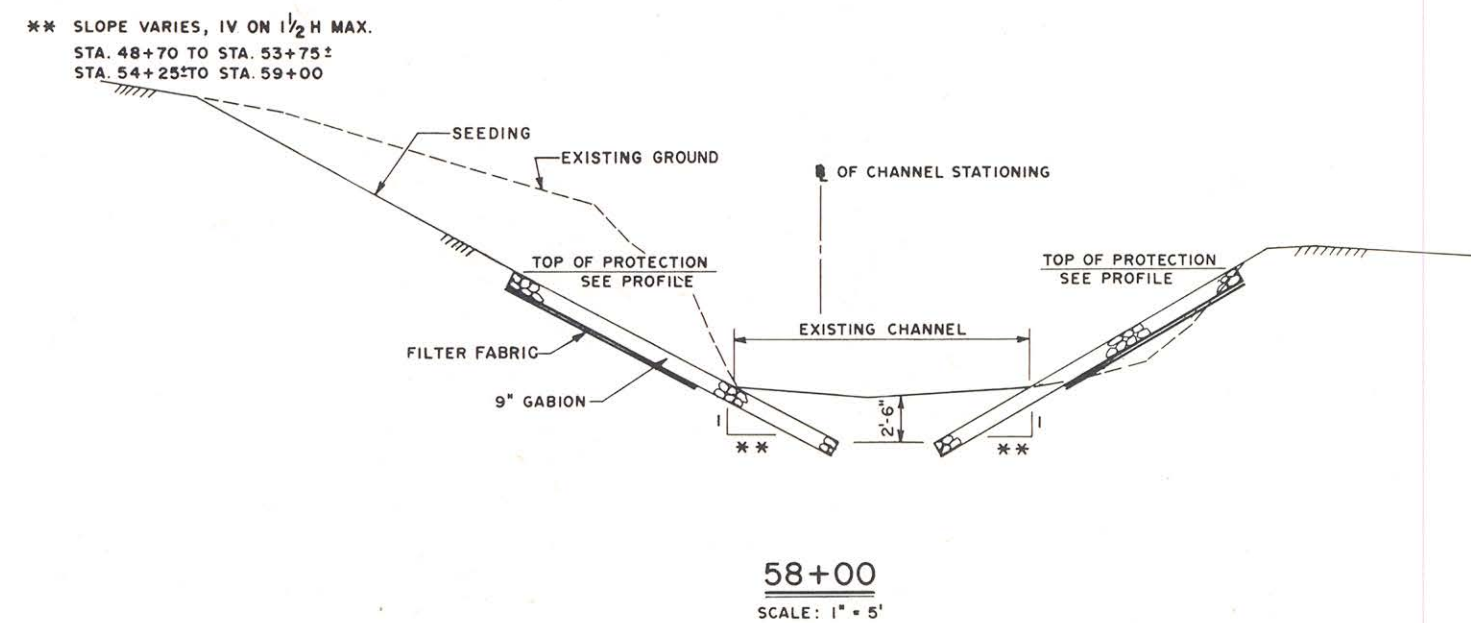
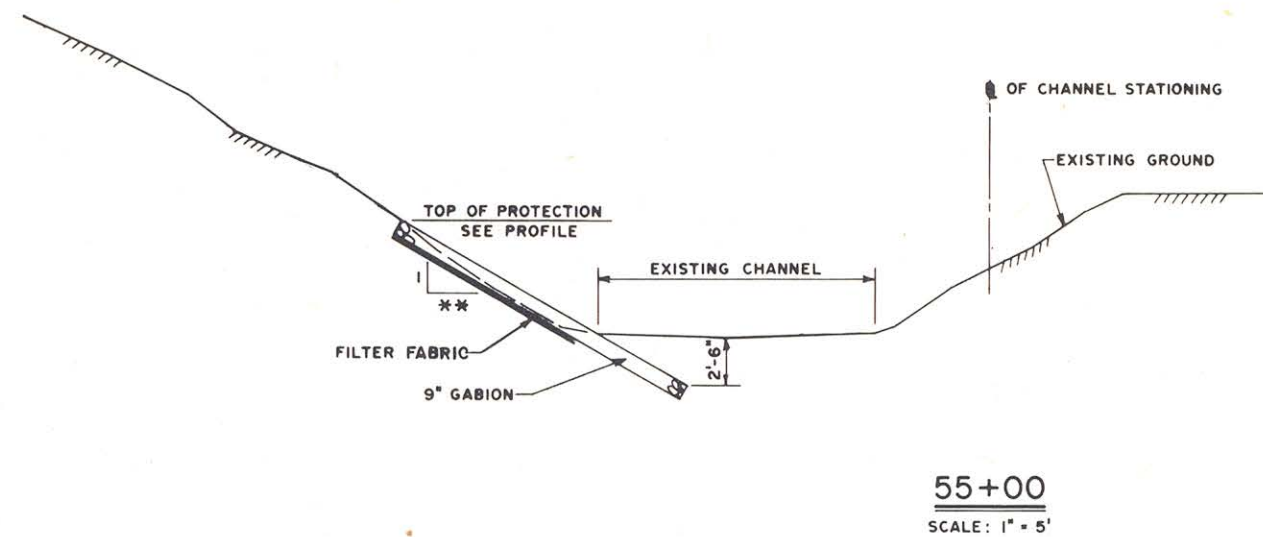
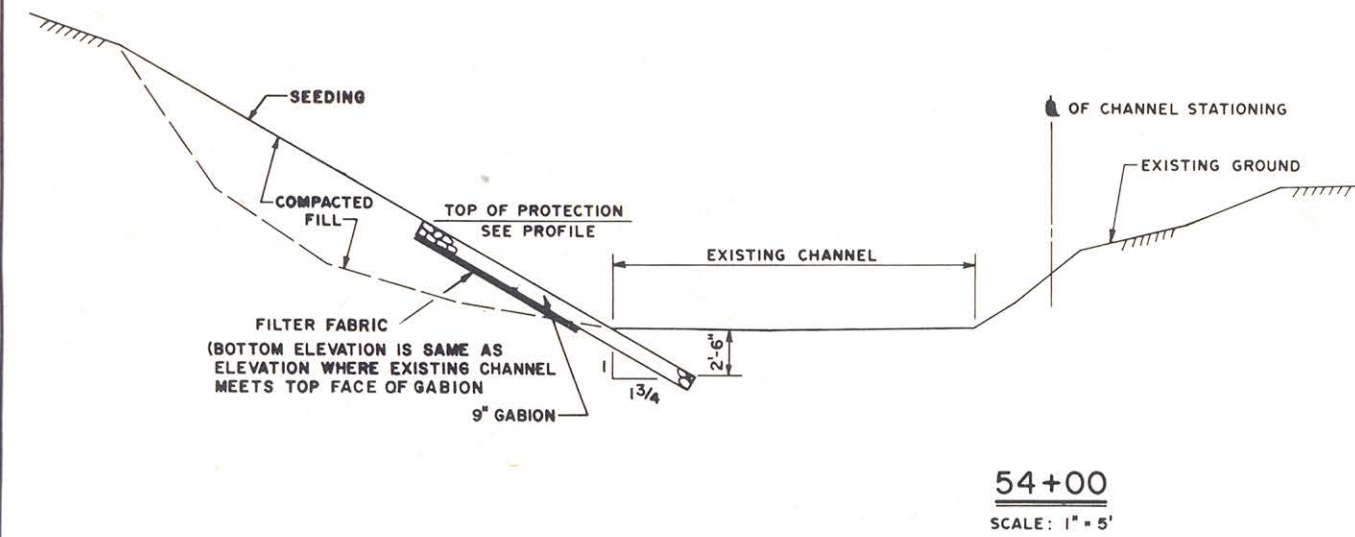
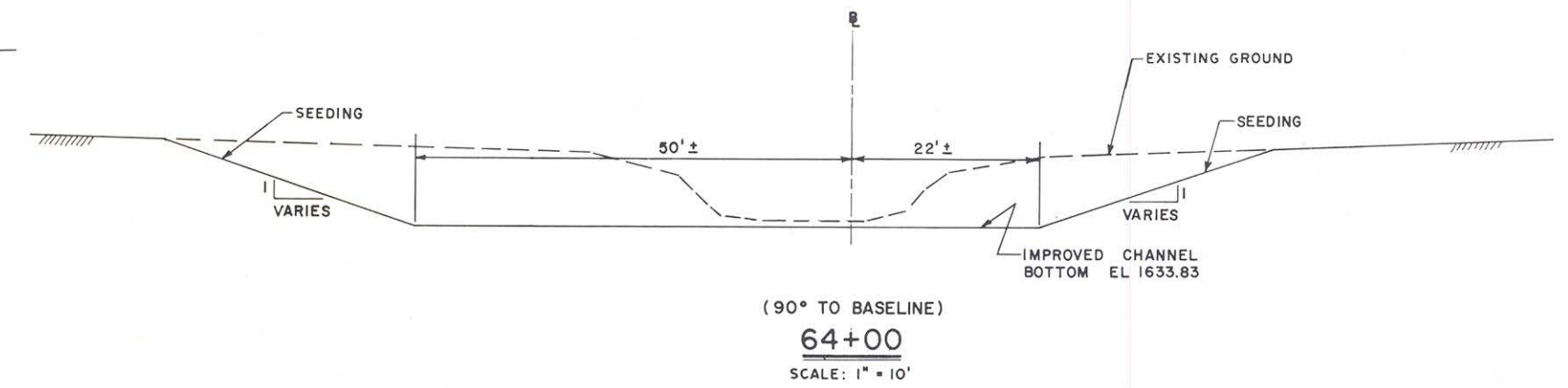
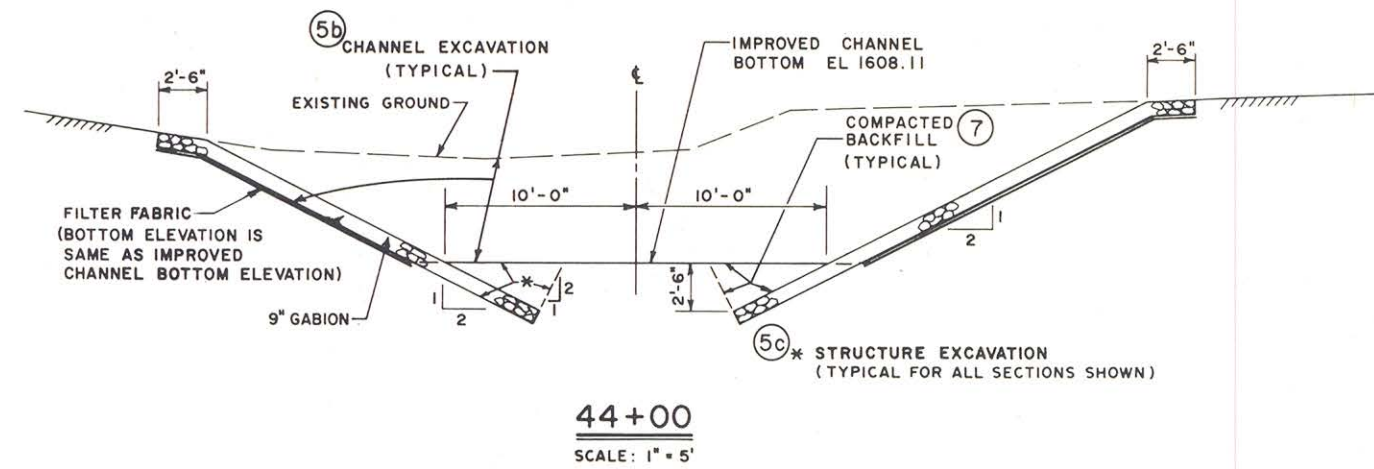
FOR GENERAL NOTES, SEE DWG. 82 / 2

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
30' 15' 0' 30' 60'			
1" = 30'			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK			
PLAN AND PROFILE STA 56+48.96 TO STA 66+30			
PREPARED BY: LEBBER - MAYERNIK	DATE: 3 April 1979		
DRAWN BY: LUSTER	APPROVED FOR: [Signature]		
CHECKED BY: [Signature]	APPROVED FOR: [Signature]		
SUBMITTED BY: [Signature]	APPROVED FOR: [Signature]		
CHIEF DESIGN BRANCH	APPROVED FOR: [Signature]		
APPROVAL RECOMMENDED:	APPROVED FOR: [Signature]		
APPROVED FOR:	APPROVED FOR: [Signature]		
SCALE AS SHOWN		SPEC. NO.	
DRAWING NUMBER		SHEET	
038pa.I-PI-82/6		OF	









NOTE: ALL SECTIONS TAKEN LOOKING DOWNSTREAM

NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: MAYERNIK	BOLIVAR FLOOD PROTECTION PROJECT		
DRAWN BY: WANTHEY	ROOT CREEK		
CHECKED BY: L. L. L.	BOLIVAR, NEW YORK		
SUBMITTED BY: J. G. Collette	SECTIONS		
APPROVAL RECOMMENDED: J. G. Collette	APPROVED: J. G. Collette	DATE: 3 April 1979	
CHIEF, ENGINEERING DIVISION	COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER	SCALE: AS SHOWN	SPEC. NO.:
DRAWING NUMBER 038pa.I-PI-82/8		SHEET OF	



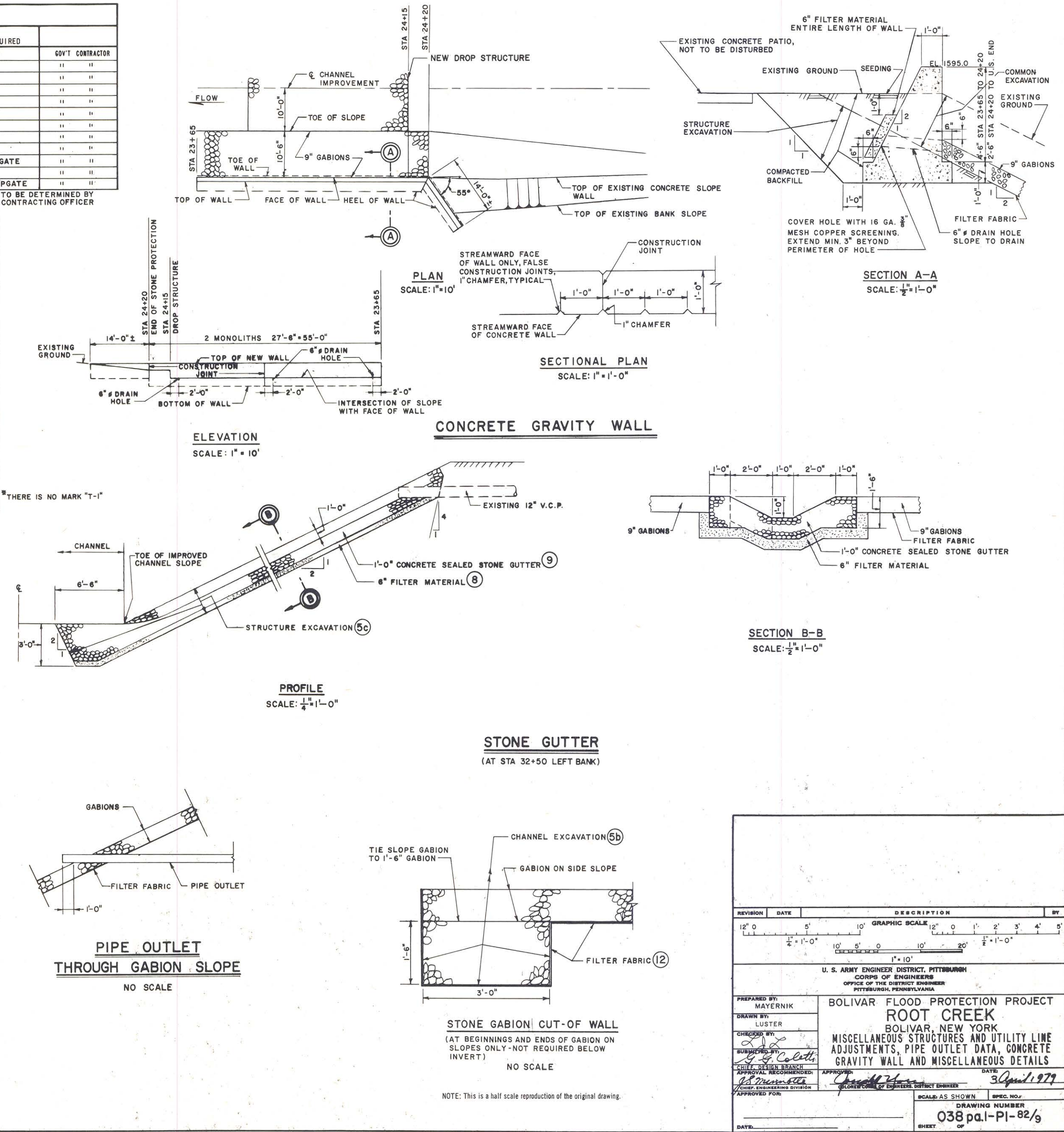
PIPE OUTLET DATA						
STATION	DWG.	BANK	MARK	SIZE & TYPE	INVERT ELEVATION	FUNCTION
21+80±	82/2	LEFT	P-1	12" CMP	1587.9	STORM DRAIN
21+80±	"	RIGHT	P-2	12" CMP	1588.8	STORM DRAIN
28+85±	82/3	LEFT	P-3	18" CMP	1599.0	STORM DRAIN
32+50±	"	LEFT	P-4	12" VCP	1613.0	STORM DRAIN
39+20±	82/4	RIGHT	P-5	18" VCP	1608.5	STORM DRAIN
40+85±	"	LEFT	P-6	8" CIP	1618.0	STORM DRAIN
40+85±	"	RIGHT	P-7	12" VCP	1612.5	STORM DRAIN
41+20±	"	RIGHT	P-8	8" CIP	1610.0	STORM DRAIN
47+80±	82/5	RIGHT	P-9	18" CMP	1619.0	STORM DRAIN
41+30±	82/4	RIGHT	P-10	8" CIP	1610.0	STORM DRAIN
48+21±	82/3	LEFT	P-11	4" VCP	-	DRAIN
41+70	82/4	RIGHT	P-12	12" CMP	1613.0±	STORM DRAIN

(14) ADJUSTMENT REQUIRED

\*EXACT LOCATION AND ELEVATION TO BE DETERMINED BY CONTRACTING OFFICER

UTILITY LINE ADJUSTMENTS						
DESCRIPTION	DWG.	STATION	BANK	MARK	ADJUSTMENT REQUIRED	ADJUSTING AGENCY
3" STEEL HIGH PRESSURE GAS LINE	82/2	19+20±	BOTH	G-1	PIPE TO BE LOWERED TO CLEAR CHANNEL INVERT AND SIDE SLOPES	COMPLETED
POWER POLES (2)	"	19+20±	RIGHT	E-1	RELOCATE POLES	COMPLETED
3" STEEL HIGH PRESSURE GAS LINE	"	21+50± to 23+90±	RIGHT	G-2	PIPE TO BE LOWERED TO CLEAR SIDE SLOPE	COMPLETED
METAL CABLE T.V. POLE AND GUY	"	21+70±	LEFT	T-2	RELOCATE POLE AND GUY	COMPLETED
8" T.C.P. SANITARY SEWER LINE	"	21+85±	BOTH	S-1	PIPE TO BE RELOCATED IF NECESSARY	RELOC. NOT REQ'D
6" CAST IRON WATER LINE	"	22+17±	BOTH	W-1	PIPE TO BE RELOCATED IF NECESSARY	RELOC. NOT REQ'D
METAL CABLE T.V. POLE	"	23+20±	RIGHT	T-3	RELOCATE POLE	COMPLETED
POWER POLE AND GUY	"	24+00±	RIGHT	E-2	RELOCATE POLE AND GUY	COMPLETED
MANHOLE	"	24+00±	RIGHT	S-2	RAISE MANHOLE TO NEW GRADE	LOCAL INTERESTS
POLE AND 2 GUYS	82/3	33+90±	RIGHT	E-3	RELOCATE 2 GUYS	COMPLETED
4" STEEL HIGH PRESSURE GAS LINE	82/5	48+50±	BOTH	G-3	PIPE TO BE LOWERED TO CLEAR CHANNEL INVERT AND SIDESLOPES	COMPLETED
3- EXPOSED OIL PIPE LINES	82/6	58+80±	RIGHT	O-1	REMOVAL	GOV'T. CONTRACTOR
4" OIL PIPELINE	"	64+00±	RIGHT	O-2	REMOVAL	GOV'T. CONTRACTOR
2" OIL PIPELINE	"	65+50±	LEFT	O-3	REMOVAL	GOV'T. CONTRACTOR
2 WATER SHUT-OFF BOXES	82/2	21+56± to 22+17±	RIGHT	W-2	RELOCATION	LOCAL INTERESTS
POWER POLE GUY WIRE	82/4	40+65±	RIGHT	E-4	RELOCATION	COMPLETED
8" CIP WATER LINE	82/5	46+56±	BOTH	W-3	RELOCATION	LOCAL INTERESTS

MISCELLANEOUS ITEMS REQUIRING ADJUSTMENT						
DESCRIPTION	DWG.	STATION	BANK	ADJUSTMENT REQUIRED	ADJUSTING AGENCY	MARK
SNOW FENCE	82/2	21+50±	RIGHT	REMOVAL	LOCAL INTERESTS	M-1
BARRICADE	"	22+00±	RIGHT	RELOCATION	"	M-2
BARRICADE	"	22+00±	LEFT	RELOCATION IF REQUIRED	"	M-3
4" ABANDONED CAST IRON PIPE	"	22+50±	RIGHT	REMOVAL	GOV'T. CONTRACTOR	M-4
BARBED WIRE FENCE	82/2	23+17±	RIGHT	RELOCATION	LOCAL INTERESTS	M-5
WIRE FENCE	82/3	28+57±	LEFT	RELOCATION	"	M-6
SWING SET	"	31+10±	RIGHT	RELOCATION	"	M-7
WIRE FENCE	"	31+50±	RIGHT	RELOCATION	"	M-8
FRAME SHED	"	32+80±	RIGHT	RELOCATION	"	M-9
PICKET FENCE	"	34+75±	RIGHT	RELOCATION	"	M-10
PICKET FENCE	"	34+75±	LEFT	RELOCATION	"	M-11
4" ABANDONED CAST IRON PIPE	"	35+20± to 37+20±	RIGHT	REMOVAL	GOV'T. CONTRACTOR	M-12
CONC. FOUNDATION	82/3	36+00±	RIGHT	REMOVAL	"	M-13
ABANDONED CAST IRON PIPES	82/4	37+40± to 41+80±	RIGHT	REMOVAL	"	M-14
METAL SHED	"	38+95±	RIGHT	RELOCATION	LOCAL INTERESTS	M-15
ABANDONED PIPELINE	"	43+00±	RIGHT	REMOVAL	GOV'T. CONTRACTOR	M-16
TRAILER	"	43+00±	RIGHT	RELOCATION	LOCAL INTERESTS	M-17
CONCRETE RUBBLE	"	45+30± to 46+00±	RIGHT	REMOVAL	GOV'T. CONTRACTOR	M-18
ABANDONED 4" PIPE	"	46+00±	RIGHT	REMOVAL	"	M-19
EXPOSED PIPE	82/4	48+30±	LEFT	REMOVAL	"	M-20
EXPOSED PIPE	82/5	48+90±	LEFT	REMOVAL	GOV'T. CONTRACTOR	M-21
5-8" ABANDONED CAST IRON PIPES	"	56+10±	RIGHT	REMOVAL	"	M-22



REVISION	DATE	DESCRIPTION	BY
1	3 April 1979	DESIGN BRANCH	...

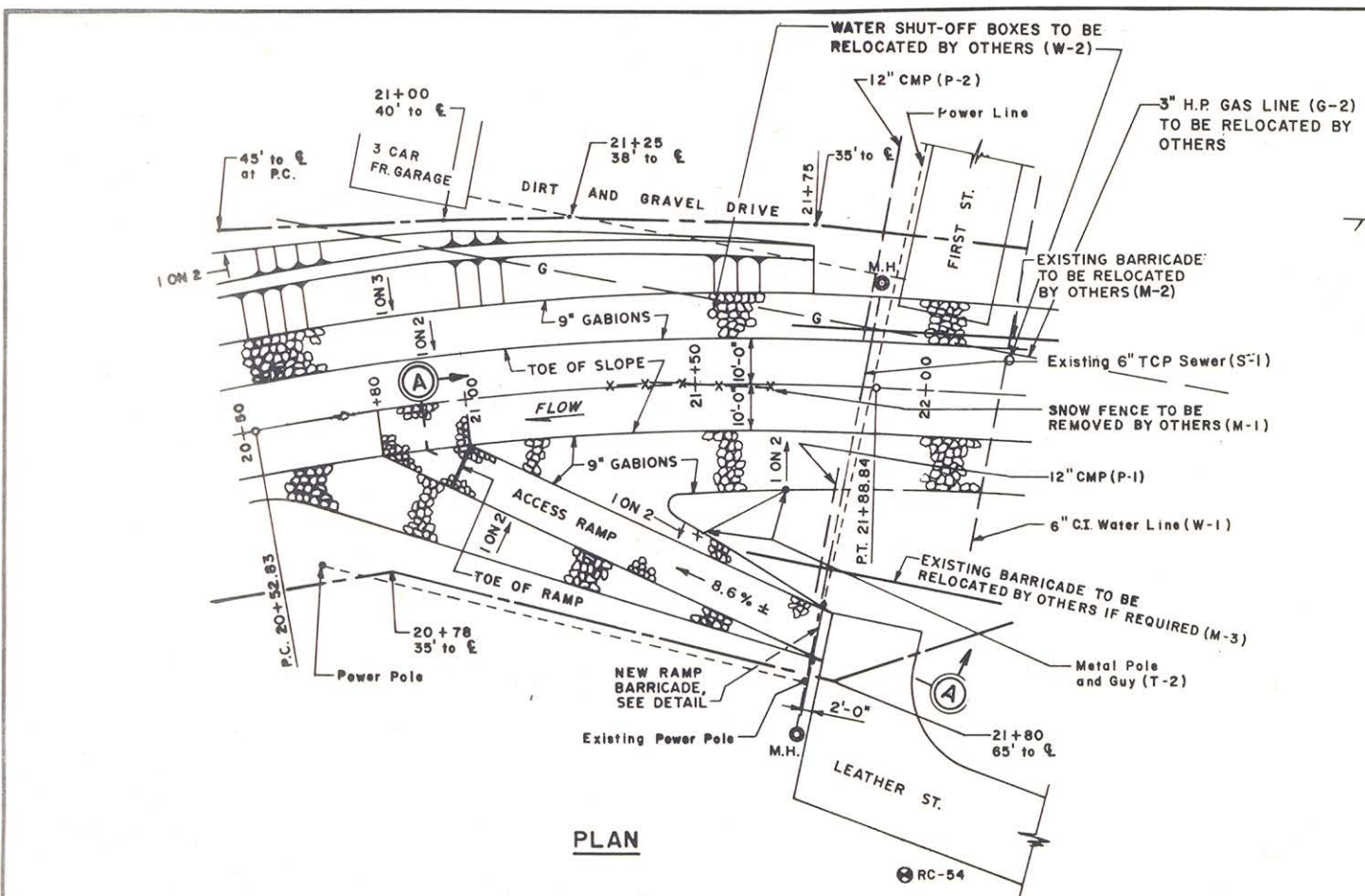
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH  
CORPS OF ENGINEERS  
OFFICE OF THE DISTRICT ENGINEER  
PITTSBURGH, PENNSYLVANIA

PREPARED BY: MAYERNIK  
DRAWN BY: LUSTER  
CHECKED BY: ...  
SUBMITTED BY: ...  
APPROVAL RECOMMENDED: ...  
APPROVED FOR: ...

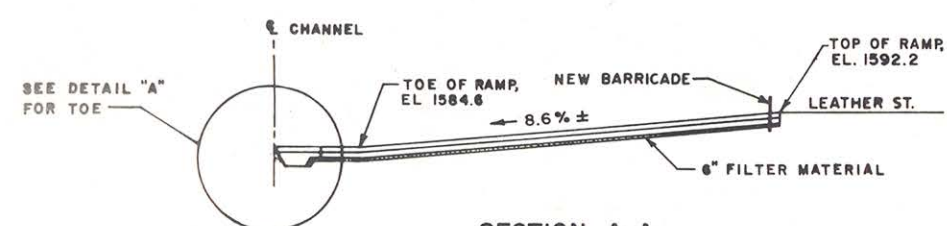
**BOLIVAR FLOOD PROTECTION PROJECT**  
**ROOT CREEK**  
BOLIVAR, NEW YORK  
MISCELLANEOUS STRUCTURES AND UTILITY LINE  
ADJUSTMENTS, PIPE OUTLET DATA, CONCRETE  
GRAVITY WALL AND MISCELLANEOUS DETAILS

DATE: 3 April 1979  
SHEET: 038 pa.1-PI-82/9

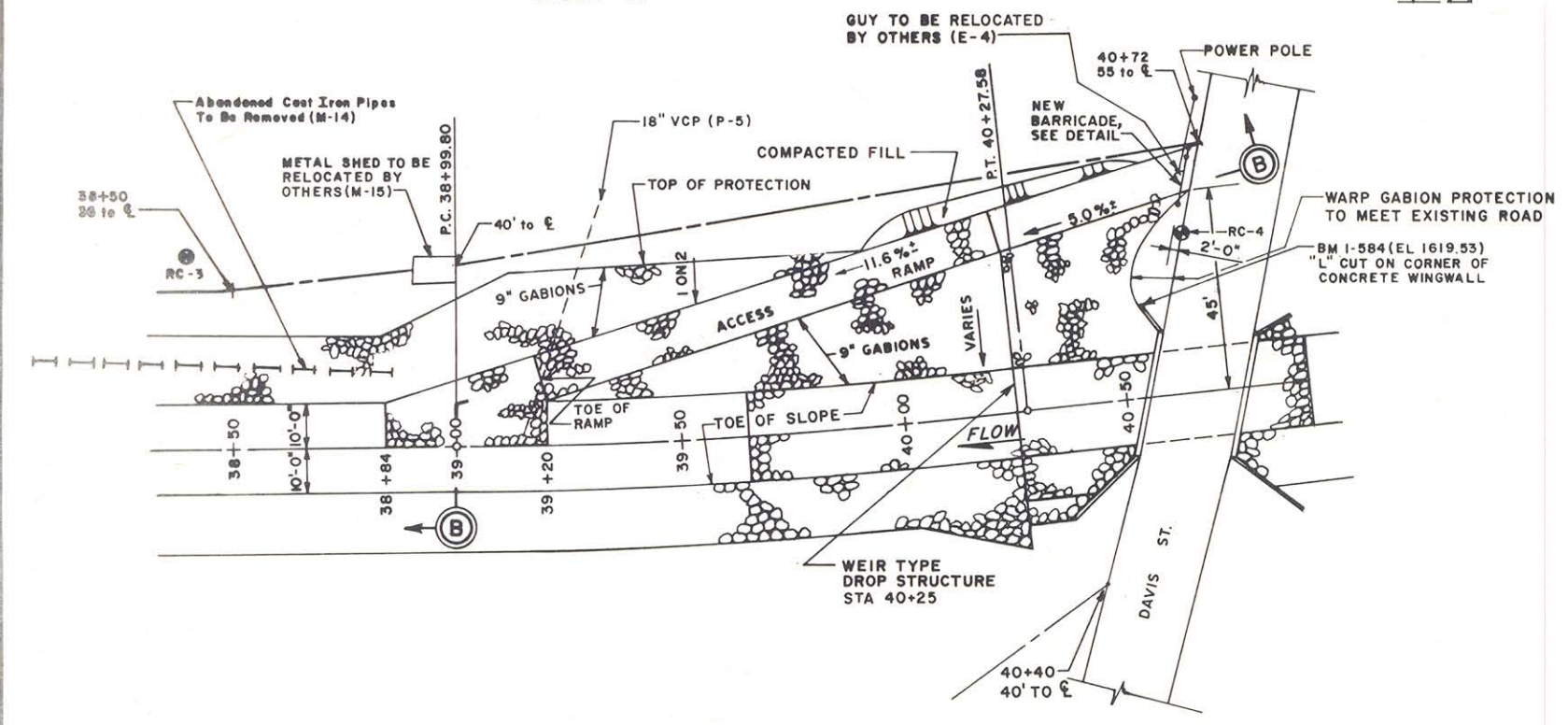




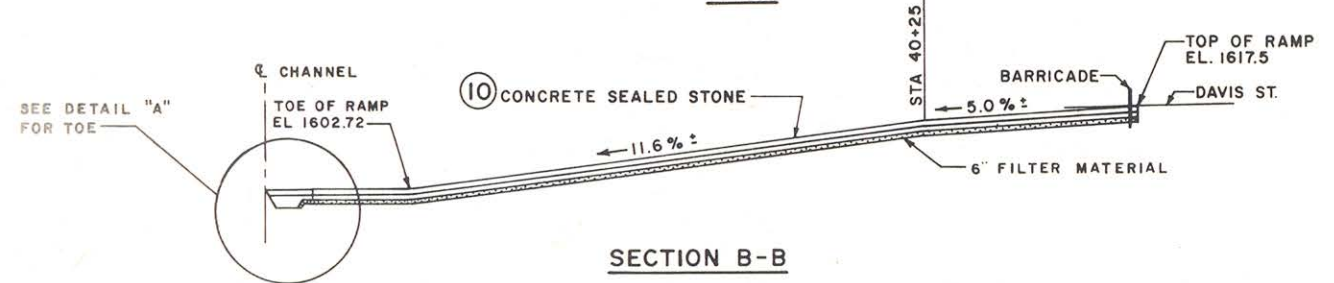
PLAN



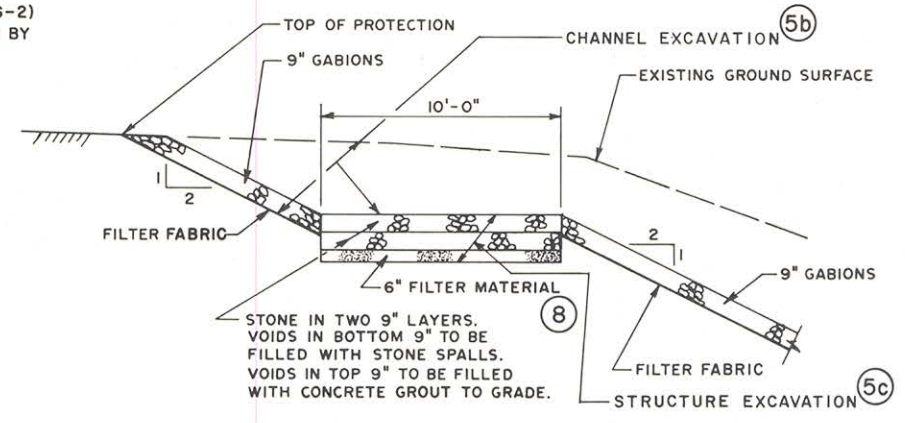
SECTION A-A  
ACCESS RAMP  
STA. 21+00  
SCALE: 1" = 20'



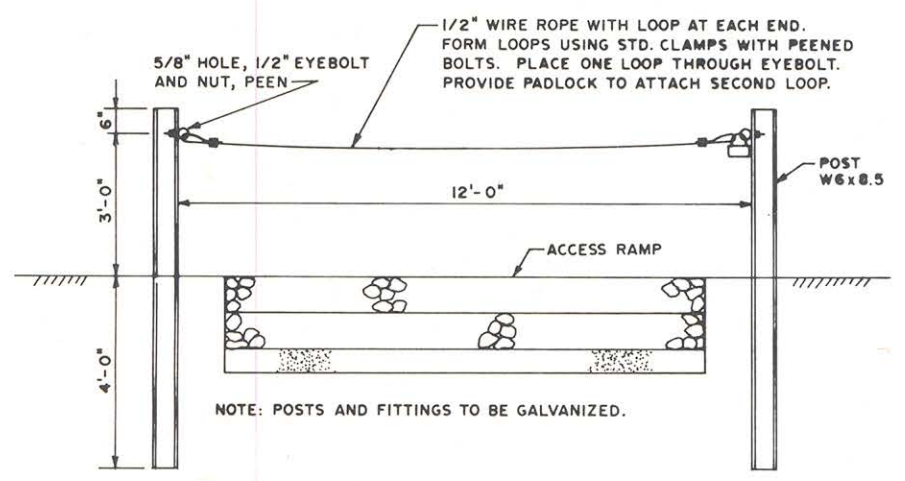
PLAN



SECTION B-B  
ACCESS RAMP  
STA. 39+20  
SCALE: 1" = 20'



ACCESS RAMP  
TYPICAL SECTION  
SCALE: 1/4" = 1'-0"



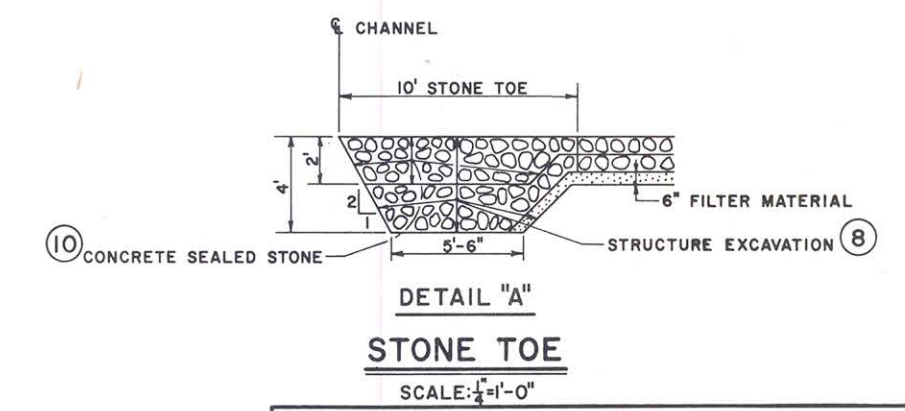
RAMP BARRICADE (15)  
SCALE: 1/2" = 1'-0"

PROCEDURE FOR GROUTING OF 36" (2-18" layers) STONE FILLED GABIONS IMMEDIATELY DOWNSTREAM OF DROP STRUCTURES.

1. Install bottom 18" stone filled gabion basket.
  2. Install top 18" gabion basket and tie down to bottom basket.
  3. Place 10"  $\pm$  layer of stones in top basket.
  4. Place 5"  $\pm$  layer of grout on top of 10" layer of stones.
  5. Prior to grout hardening, place final layer of gabion stones. Sufficient stone must be provided to displace the concrete grout and provide a uniform distribution of the top stone layer. The surface of the top stone layer must retain the roughness characteristics of the ungrouted stones.
  6. Place and tie down top of basket.
- NOTE: The thicknesses proposed in Steps 3 and 4 above may be slightly varied to provide the best arrangement satisfactory to the Contracting Officer.

PROCEDURE FOR GROUTING OF 12" STONE FILLED GABION BASKET IN CHANNEL INVERT FROM STA. 40+25 TO STA. 40+91.

1. Install 12 inch gabion basket in invert.
2. Place 4"  $\pm$  layer of stones in bottom of basket.
3. Place 5"  $\pm$  layer of concrete grout on top of bottom layer of stones.
4. Prior to grout hardening, place final layer of gabion stones. Sufficient stone must be provided to displace the concrete grout and provide a uniform distribution of the top stone layer. The surface of the top stone layer must retain the roughness characteristics of the ungrouted stones.
5. Place and tie down top of basket.

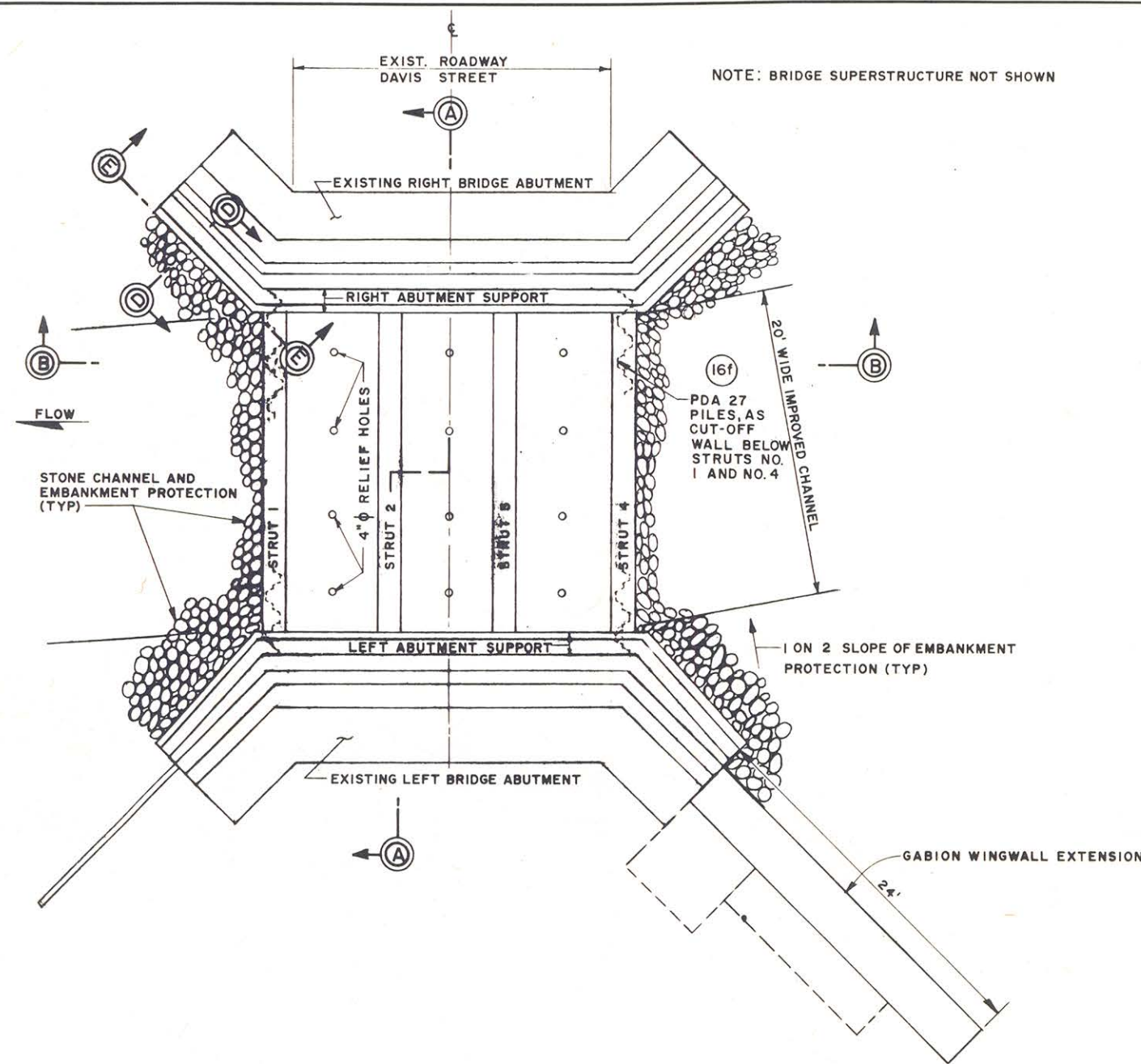


DETAIL 'A'  
STONE TOE  
SCALE: 1/2" = 1'-0"

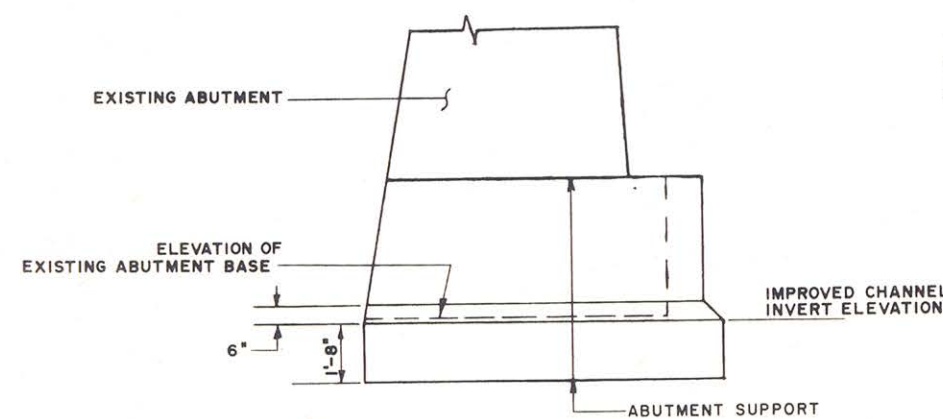
NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: MAYERNIK	BOLIVAR FLOOD PROTECTION PROJECT		
DRAWN BY: MANTHEY	ROOT CREEK		
CHECKED BY:	BOLIVAR, NEW YORK		
SUBMITTED BY:	ACCESS RAMPS & DETAILS		
CHIEF DESIGN BRANCH	APPROVED:	DATE:	
APPROVAL RECOMMENDED:		3 April 1979	
CHIEF ENGINEERING DIVISION	CORPORAL CORPS OF ENGINEERS DISTRICT ENGINEER		
APPROVED FOR:		SCALE: AS SHOWN	SPEC. NO.:
		DRAWING NUMBER	
		038 pa.1-P1-82/10	
		SHEET	OF

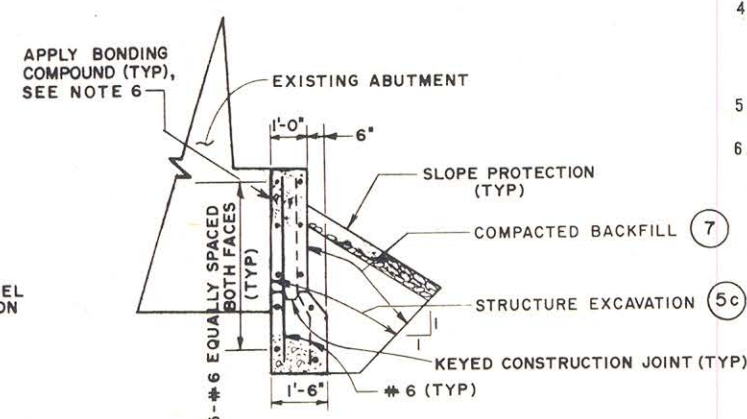




**PLAN**  
SCALE: 1" = 5'

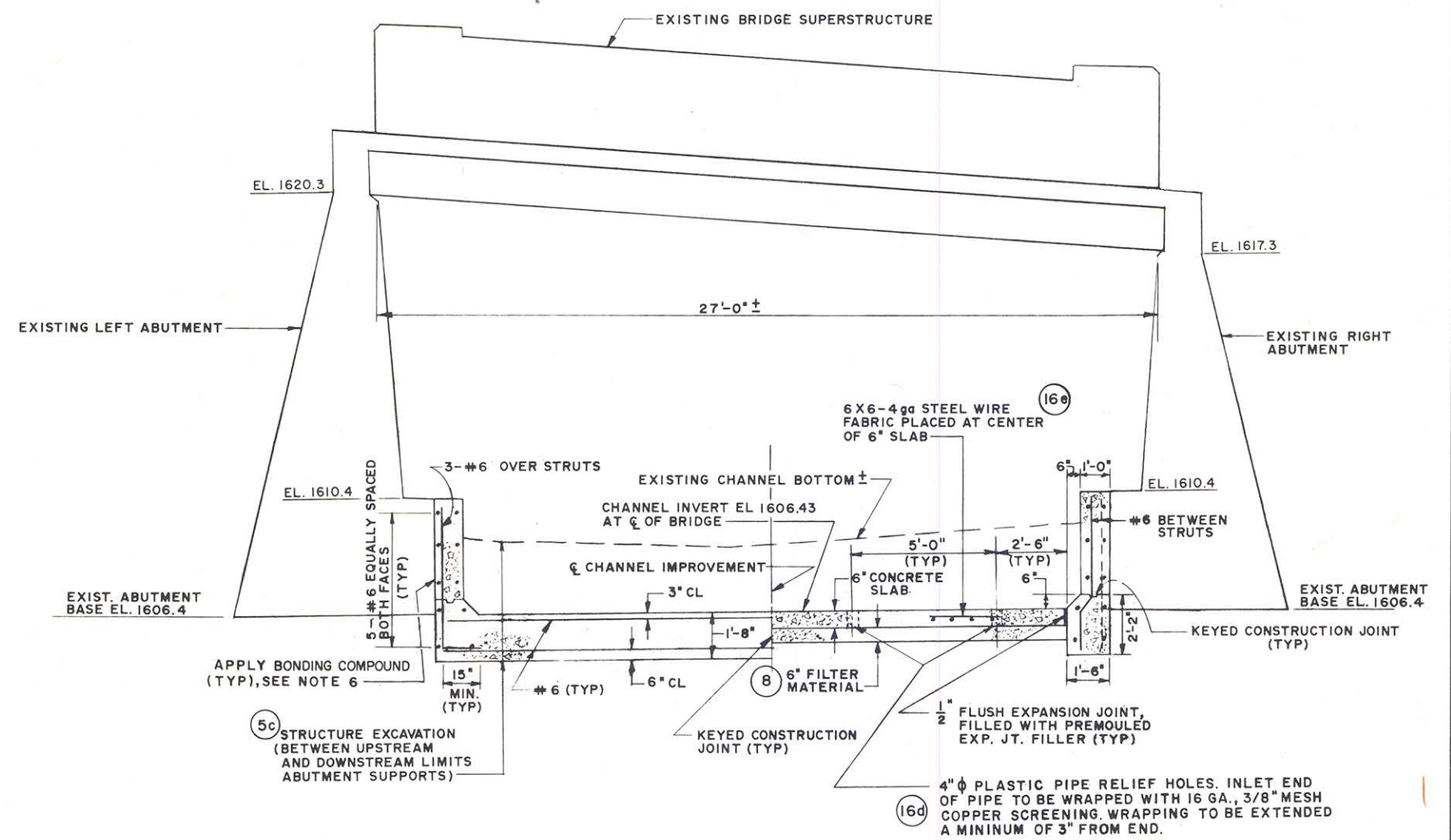


**E-E**



**D-D**

**SECTIONS**  
SCALE: 3/8" = 1'-0"



**SECTION A-A**  
SCALE: 3/8" = 1'-0"

**NOTES**

**ABUTMENT SUPPORT CONSTRUCTION PROCEDURE**

- THE CONTRACTOR SHALL FIRST CONSTRUCT THE TEMPORARY STRUT SUPPORT SYSTEM, AS SHOWN ON DWG. 82/12.
- THE TEMPORARY 48" Ø DIVERSION PIPE AND COMPACTED FILL DIKES SHALL BE PLACED ON THE LEFT SIDE OF CHANNEL AND STREAM FLOW DIVERTED THROUGH PIPE, AS SHOWN ON DWG. 82/12.
- EXCAVATION AND CONSTRUCTION ON THE RIGHT HALF OF THE CHANNEL SHALL PROCEED AS FOLLOWS:  
**PHASE I**, INCLUDING RIGHT HALF OF PERMANENT STRUTS #1 AND #2, ABUTMENT SUPPORT WALL, AND 6" SLAB BETWEEN STRUTS #1 AND #2, SHALL BE EXCAVATED AND CONSTRUCTED FIRST, AS SHOWN ON DWG. 82/12, SECTION B-B. **PHASE II**, INCLUDING RIGHT HALF OF PERMANENT STRUTS #3 AND #4 AND THE REMAINING ABUTMENT SUPPORT WALL AND 6" SLABS, SHALL FOLLOW ONLY AFTER PHASE I IS COMPLETELY CONSTRUCTED, FORMS ARE REMOVED, & ABUTMENT SUPPORT WALL IS BACKFILLED. ONLY THAT AREA NEEDED TO CONSTRUCT EACH PHASE SHALL BE EXCAVATED.
- AFTER COMPLETION OF PHASE II, THE TEMPORARY DIVERSION PIPE SHALL BE REMOVED FROM THE LEFT SIDE OF THE CHANNEL AND PLACED ON THE RIGHT SIDE OF THE CHANNEL AND THE WATER DIVERTED ACCORDINGLY. ADD WHATEVER FILL IS NEEDED TO RIGHT SIDE TO SUPPORT DIVERSION PIPE.
- EXCAVATE AND CONSTRUCT LEFT SIDE FOLLOWING SAME PROCEDURE AS FOR RIGHT SIDE.
- ALL EXCAVATION AND CONSTRUCTION SHALL BE DONE IN A DRY CONDITION. CONTRACTOR SHALL IMPLEMENT A DEWATERING SYSTEM, IF NECESSARY, TO MAINTAIN A DRY AREA.

**GENERAL NOTES**

- $f_c = 3000$  psi; REINFORCING TO BE GRADE 40.
- CONCRETE FINISH TO BE CLASS B FOR EXPOSED SURFACES AND CLASS D FOR UNEXPOSED SURFACES.
- ALL EXPOSED CORNERS AND CONSTRUCTION JOINTS TO HAVE 1" CHAMFER.
- LAP SLICES, UNLESS OTHERWISE SHOWN, SHALL BE AS FOLLOWS:  

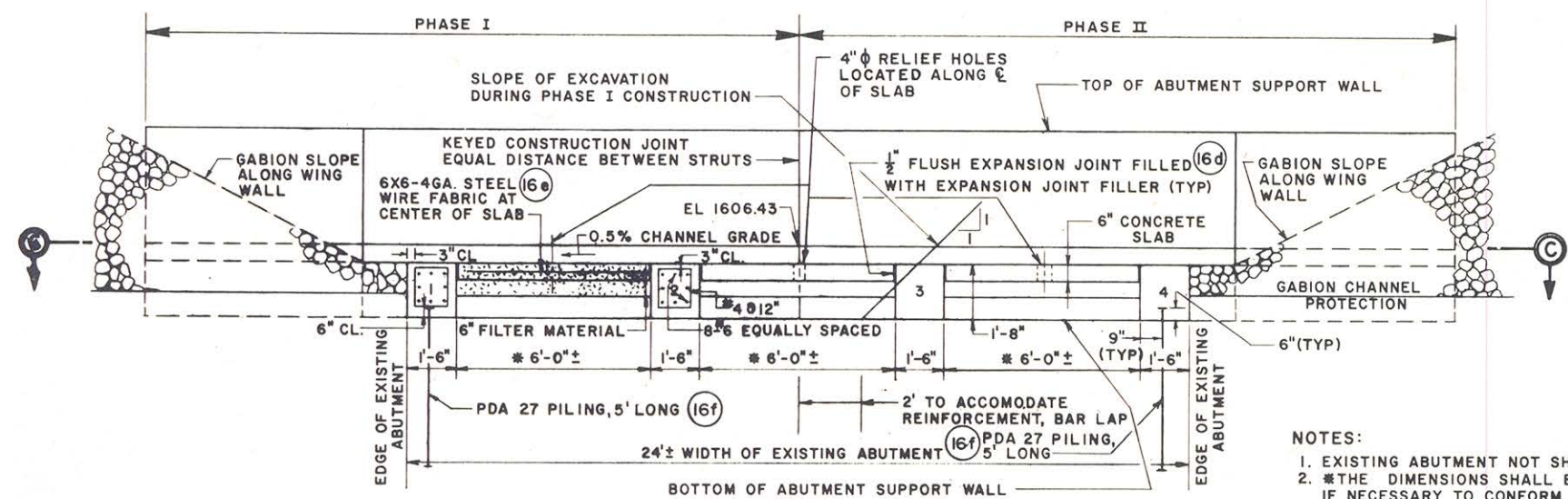
BAR SIZE	TOP BAR	OTHER BAR
#4	20"	13"
#6	31"	22"
- REINFORCING BAR BENDING SHALL CONFORM TO THE REQUIREMENTS OF THE CONCRETE REINFORCING STEEL INSTITUTE.
- ALL CONTACT AREAS BETWEEN NEW FRESH CONCRETE AND OLD HARDENED CONCRETE SHALL BE CLEANED BEFORE APPLYING A BONDING COMPOUND.

NOTE: WORK THIS DRAWING WITH DRAWING 82/12

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
<p>U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA</p>			
PREPARED BY: RAMBO	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK		
DRAWN BY: LUSTER	DAVIS STREET BRIDGE ABUTMENT SUPPORT		
CHECKED BY: <i>[Signature]</i>	DATE: 30 April 1979		
APPROVED BY: <i>[Signature]</i>	APPROVED FOR: SPECIAL AGENT IN CHARGE		
DATE:		SHEET OF	

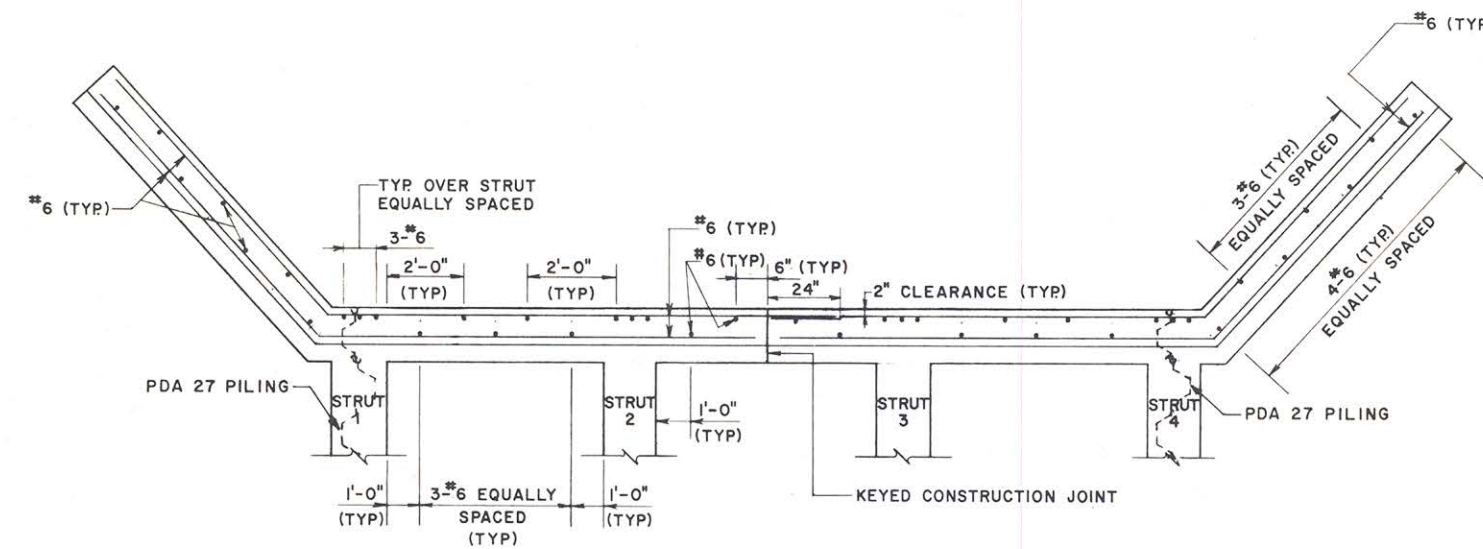
NOTE: This is a half scale reproduction of the original drawing.



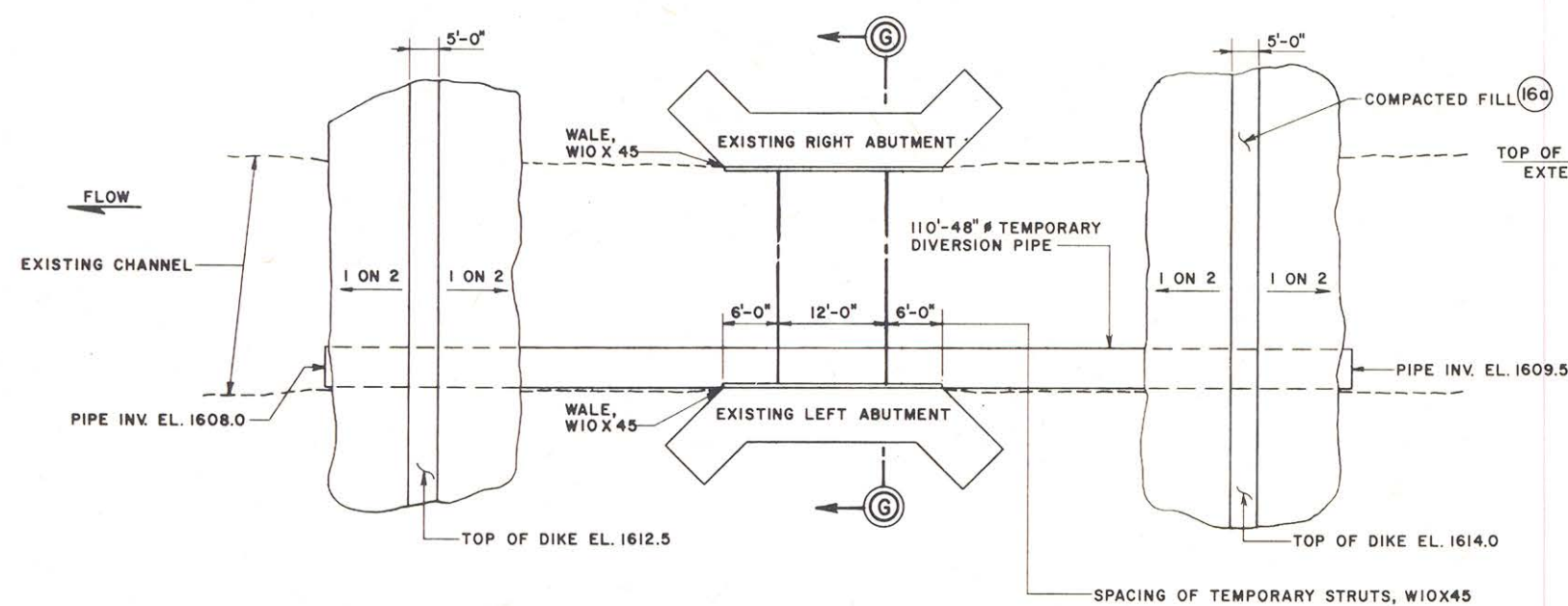


**SECTION B-B**  
SCALE:  $\frac{1}{8}'' = 1'-0''$

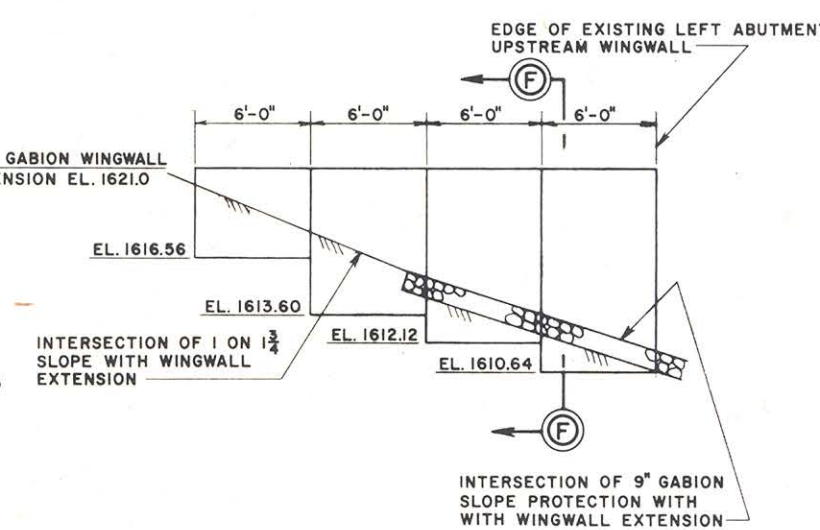
- NOTES:
1. EXISTING ABUTMENT NOT SHOWN.
  2. THE DIMENSIONS SHALL BE ADJUSTED IF NECESSARY TO CONFORM TO EXISTING CONDITIONS.
  3. STRUTS SHALL BE EQUALLY SPACED.



**SECTION C-C**  
SCALE:  $\frac{3}{8}'' = 1'-0''$

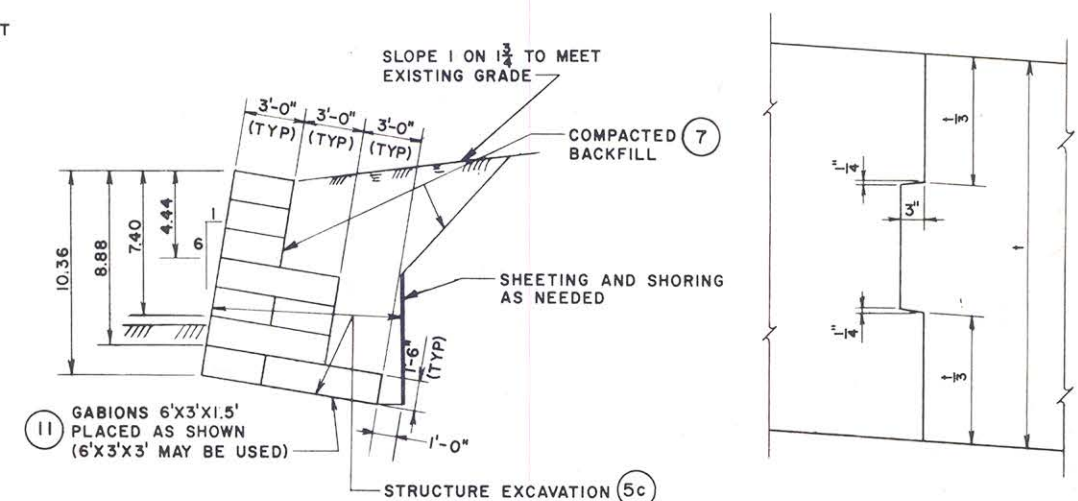


**PLAN**  
**TEMPORARY SUPPORT & DIVERSION PIPE**  
SCALE:  $1'' = 10'$



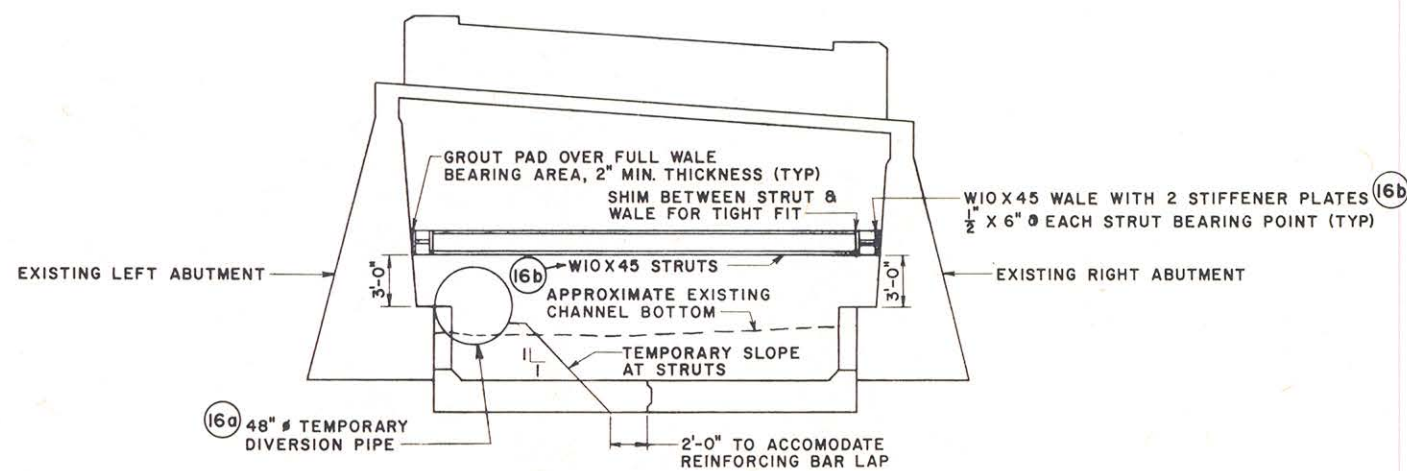
**GABION WINGWALL EXTENSION**  
SCALE:  $1'' = 5'-0''$

NOTE: GABION WINGWALL EXTENSION SHALL BE CONSTRUCTED AFTER CONSTRUCTION OF ABUTMENT SUPPORTS



**SECTION F-F**  
SCALE:  $1'' = 5'-0''$

**KEYED CONSTRUCTION JOINT DETAIL**  
NO SCALE



**SECTION G-G**  
**TEMPORARY SUPPORT & DIVERSION PIPE**  
SCALE:  $\frac{1}{8}'' = 1'-0''$

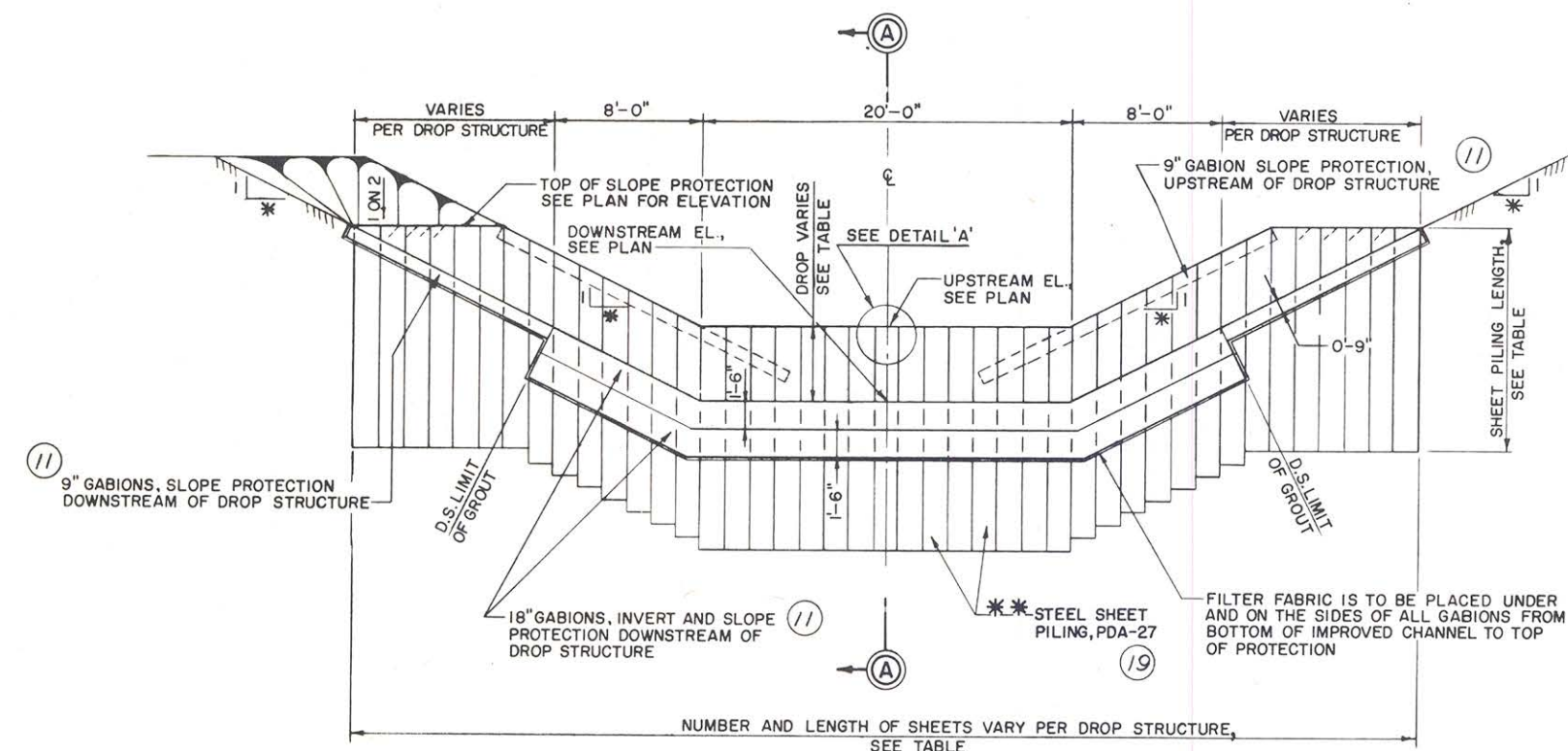
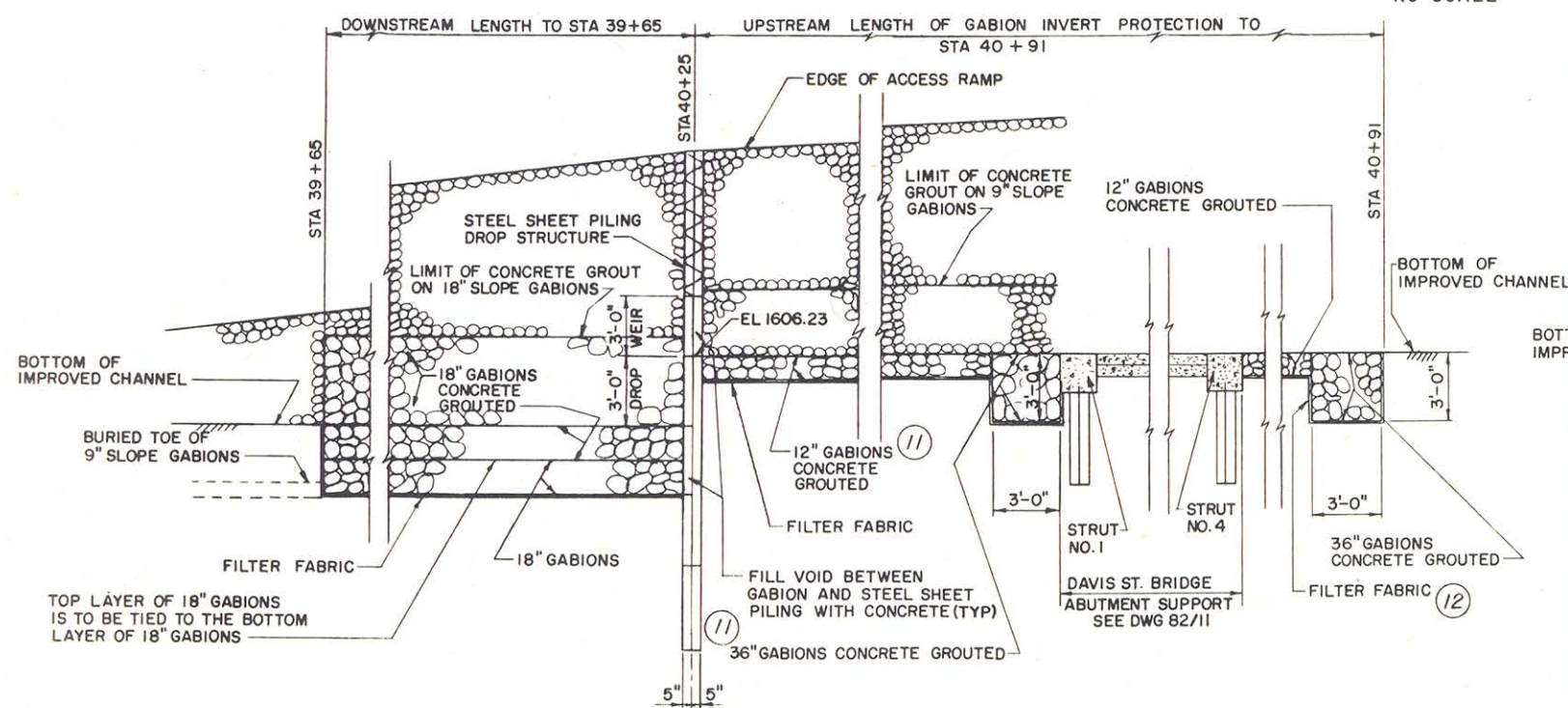
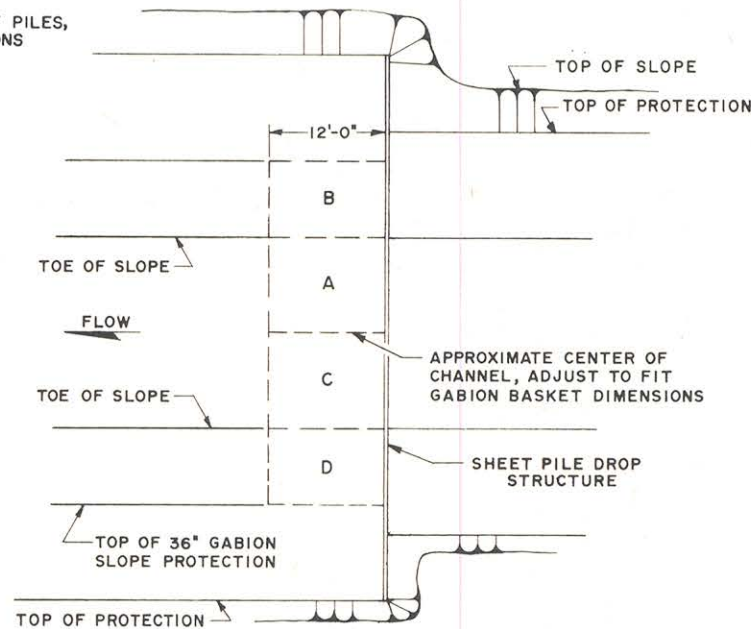
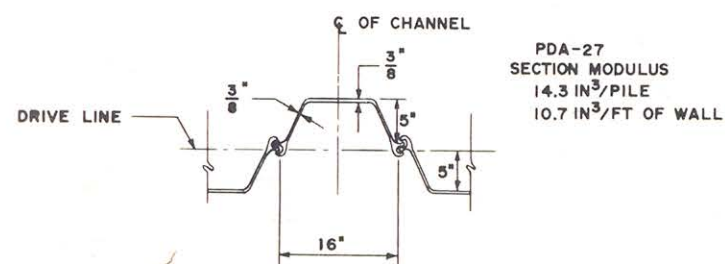
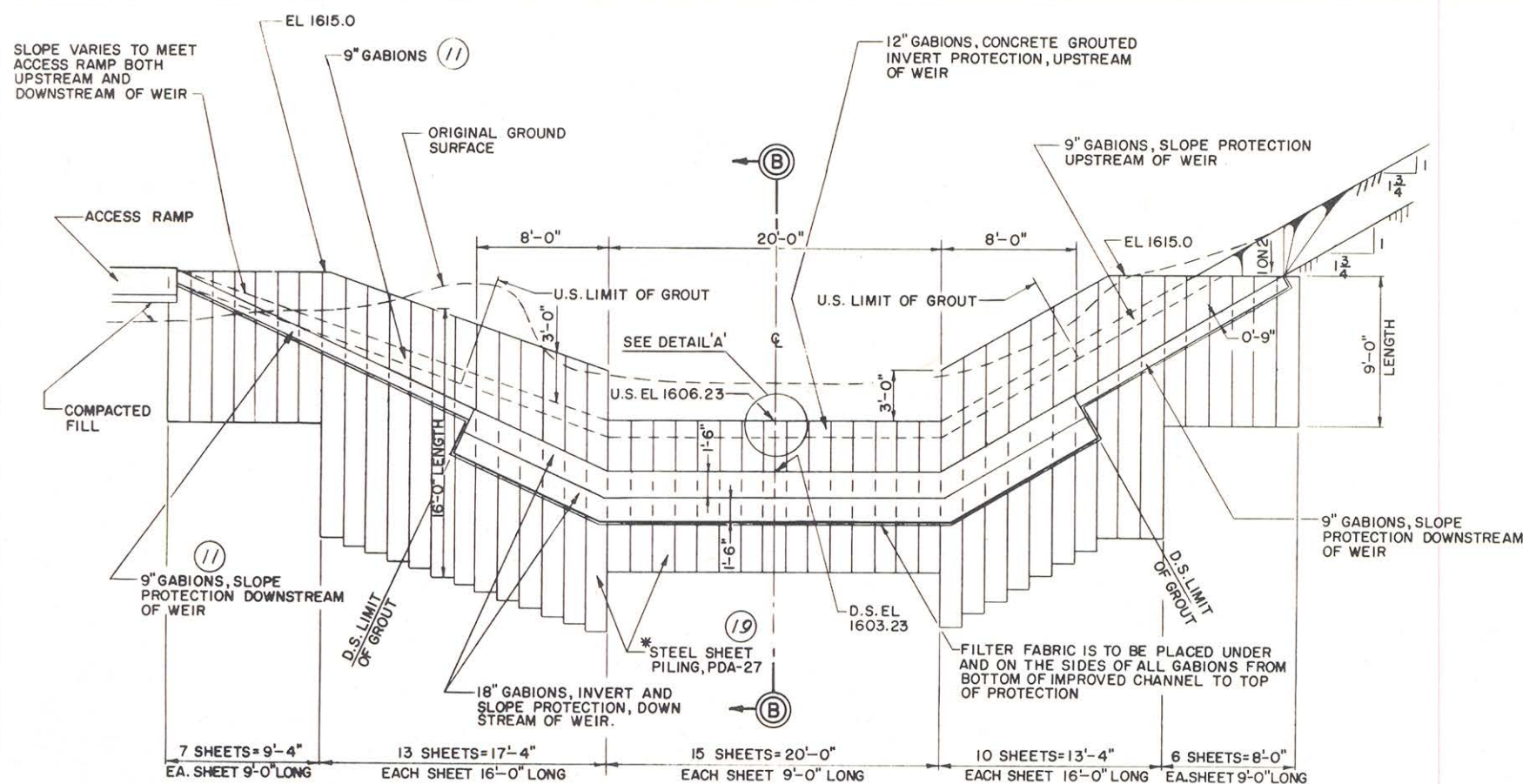
GENERAL NOTES: DIVERSION WORK WILL BE PAID FOR UNDER ITEM 16a. TEMPORARY SUPPORT SYSTEM WILL BE PAID FOR UNDER ITEM 16b.

NOTE: This is a half scale reproduction of the original drawing.

NOTE: WORK THIS DRAWING WITH DRAWING 82/11

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: RAMBO	BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR NEW YORK DAVIS STREET BRIDGE ABUTMENT SUPPORT DETAILS		
DRAWN BY: LUSTER			
CHECKED BY: [Signature]			
SUBMITTED BY: [Signature]			
APPROVAL RECOMMENDED: [Signature]	APPROVED: [Signature]	DATE: 3 April 1977	
SHEET		DRAWING NUMBER 038pa.1-P1-82/12	



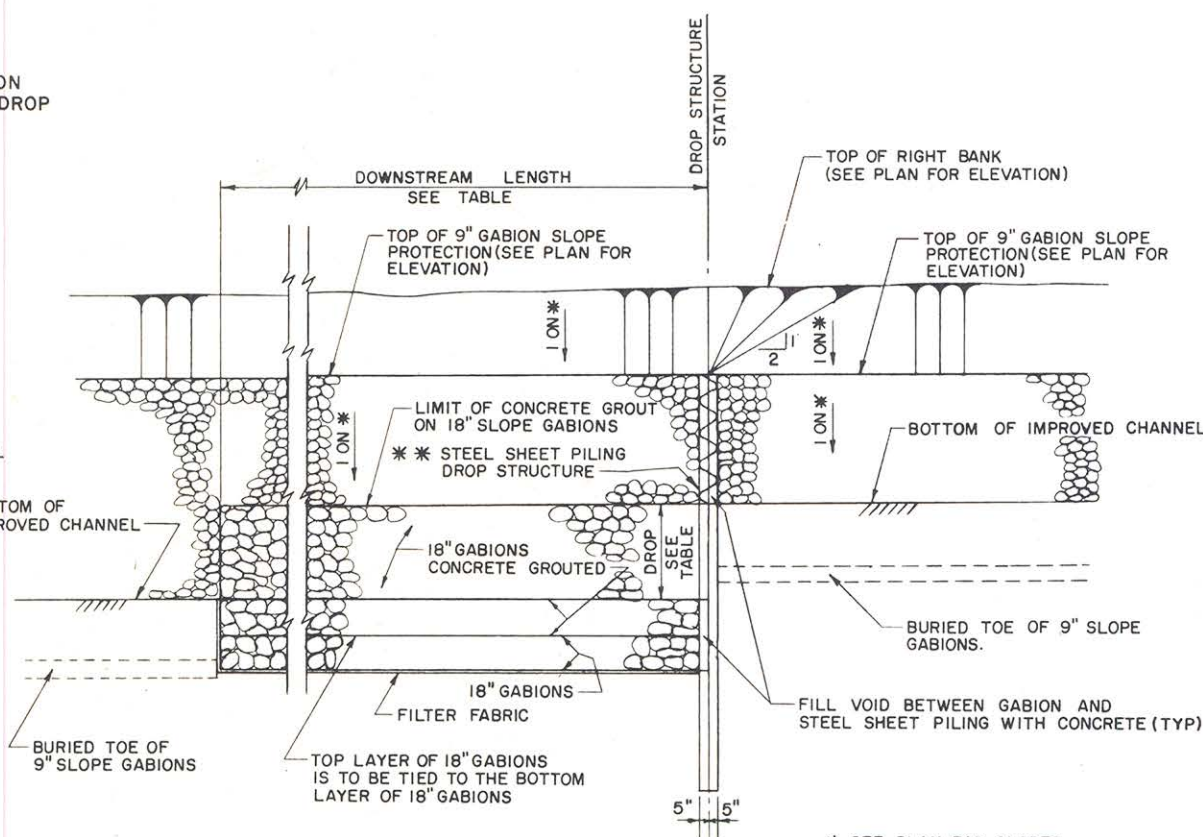


- # PROCEDURES FOR INSTALLING SHEET PILE DROP STRUCTURES AND 36" GABIONS IN CHANNEL BOTTOM AT DROP STRUCTURES

1. Install all sheet piling at drop structure. Prior to installation of piling, channel excavation for a distance of 12 feet downstream from the drop structure will not be permitted deeper than the elevation of the improved channel bottom upstream of the structure.
2. Excavation for the 36" (2'-18") gabions (downstream of drop structure) below the improved channel bottom & sides shall be in the sequence A, B, C, and D as shown in Detail B.
3. All segments must be protected to prevent erosion below the improved channel sides and bottom prior to the installation of the 36" gabion protection.
4. Each segment (ie A, B, etc) must be completed entirely including excavation, placement of gabions and grouting before beginning work on next segment.

TYPICAL SECTION  
DROP STRUCTURE

DROP STRUCTURE TABLE				
DROP STRUCTURE STATION	DROP	DOWNSTREAM LENGTH	LENGTH OF EACH SHEET PILE	NUMBER OF SHEET PILES
STA 24 + 15	2'	38'	6'	36 SHEETS
STA 33 + 60	3'	53'	9'	43 SHEETS
STA 40 + 25		SEE DETAILS OF WEIR TYPE		
STA 45 + 25	4'	50'	12'	45 SHEETS
STA 48 + 50	4'	68'	12'	41 SHEETS



\* SEE PLAN FOR SLOPES  
\* \* SEE TABLE FOR LENGTH AND  
NUMBER OF SHEETS

NOTE: This is a half scale reproduction of the original drawing.

REVISION	DATE	DESCRIPTION	BY
<p align="center"><b>GRAPHIC SCALE</b></p> <p>5' 4' 3' 2' 1' 0'      5'      10'</p> <p>1" = 5'</p> <p>12" 0'      5'      1'-0"</p> <p>4</p>			
<p align="center">U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA</p>			
PREPARED BY: CES  DRAWN BY: FAIRLEY  CHECKED BY: <i>[Signature]</i>  SUBMITTED BY: <i>G. B. Callett</i>	<p align="center"><b>BOLIVAR FLOOD PROTECTION PROJECT</b> <b>ROOT CREEK</b> <b>BOLIVAR, NEW YORK</b></p> <p align="center"><b>DROP STRUCTURES DETAILS</b></p>		
CHIEF DESIGN BRANCH APPROVAL RECOMMENDED: <i>[Signature]</i> CHIEF, ENGINEERING DIVISION APPROVED FOR:	APPROVED: <i>[Signature]</i> COLONEL CORPS OF ENGINEERS, DISTRICT ENGINEER  DATE: <i>9 April 1979</i>		
DATE: _____	SCALE: AS SHOWN      SPEC. NO.: DRAWING NUMBER <b>038pa.1-PI-82/13</b> SHEET <i>26</i>		



REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
<p>U.S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA</p>			
PREPARED BY: _____  DRAWN BY: _____ M. Bowden CHECKED BY: _____ M. Farnold SUBMITTED BY: _____ M. Farnold CITY ENGINEER & MAIL RD		<p><b>GEOLOGIC STANDARD UNIFIED SOILS CLASSIFICATION</b></p> <p>EM-1110-I-1806 PLATE I</p>	
APPROVAL RECOMMENDED: <i>C. B. Bennett</i> DISTRICT ENGINEERING DIVISION		APPROVED: <i>M. Farnold</i> COLONEL CORPS OF ENGINEERS DISTRICT ENGINEER DATE: 12 MARCH 74	
APPROVED FOR: _____  DATE: _____		SCALE: _____ SPEC. NO. _____ DRAWING NUMBER 0-Z 24-1 SHEET 1 OF 1	



**Appendix F**  
**Design Memorandum**



ROOT CREEK

BOLIVAR, NEW YORK

LOCAL FLOOD PROTECTION PROJECT

DETAILED PROJECT REPORT

ROOT CREEK, BOLIVAR, NEW YORK  
LOCAL FLOOD PROTECTION PROJECT  
DETAILED PROJECT REPORT

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F	Letter from Environmental Protection Agency (EPA)
G	Letter from National Park Service, U.S. Department of the Interior
H	Letter from New York State Parks and Recreation
I	Letter from New York State Department of Environmental Conservation

## PERTINENT DATA FOR RECOMMENDED PLAN

### 1. DESCRIPTION OF IMPROVEMENT

a. Location of project - Root Creek is a tributary to the Little Genesee Creek, having its mouth in Bolivar, New York. The study area extends from the mouth of Root Creek upstream for a distance of approximately 7,350 feet to the Route 17 Highway bridge.

b. Type of project - The project proposed herein would consist of an improvement of the Root Creek channel, including moderate widening, deepening and slope protection.

c. Purpose - The purpose of the project would be to alleviate flooding conditions in and about Bolivar, New York, thereby providing monetary and other tangible and intangible benefits, including the contribution to the general welfare of the people employed in and living in the Bolivar area.

d. Hydrologic data -

Drainage area	9.1 sq. mi.
Flow of maximum flood of record, June 1972	2,000 c.f.s.
Elevation of maximum flood of record	Elev 1606.4 m.s.l.
at damage reference point	
Design discharge (100 year)	2,000 c.f.s.
Existing stream channel slope	0.011 ft./ft.

e. Environmental Impacts - During project construction there would be a temporary increase in suspended solids and turbidity, however, the relative coarseness of the streambed material, frequent low flows in the creek and temporary erosion and sedimentation control measures would reduce, somewhat the adverse effects. Removal of bank vegetation in the project area could raise water temperatures, thereby reducing oxygen levels slightly, however, to the extent possible bank vegetation will be replaced. Flood damages in the project area would be reduced. There will be a loss of wildlife population inhabiting the reach of the stream involved, however, considering the natural character and high level of habitat diversity occurring in the basin, this loss would be negligible. A reduction in the benthic population would result from the construction work. Establishment of a new benthic community in Root Creek is anticipated to occur in the future, subsequent to the construction work, which differs in character from the present one. Construction of the proposed channel improvement would not significantly influence future population trends, existing recreation facilities and/or hunting and fishing opportunities in the area. Land use and development patterns are not expected to be significantly changed.



(cont)

f. Features of recommended local protection project -

Length 4,750 feet

Bottom widths:

Station	
16+20 to 19+00	Natural channel width
19+00 to 24+20	20 feet
24+20 to 27+37 (NYDOT Improvement)	30 feet
27+87 to 48+70	20 feet
48+70 to 63+00	Natural channel
63+00 to 66+00 (Debris Basin)	75 feet

Bottom Grades (between drop structures):

Station 16+20 to 19+00	level
" 19+00 to 24+20	0.5%
" 24+20 to 27+37 (NYDOT Improvement)	0.5%
" 27+37 to 33+60	0.5%
" 33+60 to 42+00	0.5%
" 42+00 to 45+25	0.5%
" 45+25 to 48+50	0.5%
" 48+50 to 63+00	Natural invert
" 63+00 to 66+00 (Debris Basin)	0.4%

Side Slopes:

Side slopes would vary from 1 vertical on 2 horizontal to 1 vertical on 1.75 horizontal as shown on PLATES 3 through 7.

Backfill and Disposal Area Treatment:

Seeding would be provided on disposal fills and on exposed cut side slopes. Gabion slope protection would be provided on all slopes to or greater than the design discharge elevation.

Bridge and Culvert Adjustments:

One bridge, the Davis Street bridge, would need underpinning and the wingwalls would be revamped.

Non-Federal cooperation:

The local cooperating agency's participation in the construction phase of the project would include the provision of lands, easements and rights-of-way. The participating non-Federal agency would also be required to maintain the improvement after construction.

(cont)

2. COST ESTIMATES - RECOMMENDED PLAN

a. Federal first cost:

(1) Channel improvement, including contingencies	\$429,000
(2) Engineering and design and supervision and administration	<u>130,000</u>
(3) Total Federal first cost, rounded	\$559,000

b. Non-Federal first cost

(1) Land, including contingencies	\$ 21,700
(2) Legal, engineering and supervision	<u>2,178</u>
(3) Total non-Federal first cost, rounded	\$ 24,000

3. ECONOMIC EVALUATION

a. First costs -

Federal	\$559,000
Non-Federal	<u>24,000</u>
Total Federal and non-Federal first costs	\$583,000

b. Annual charges (5-7/8% interest rate, 50-year project life) -

Federal

Interest (.05875 x \$559,000)	\$ 32,841
Amortization (.00359 x \$559,000)	<u>2,007</u>
Total	\$ 34,848

Non-Federal

Interest (.05875 x \$24,000)	\$ 1,400
Amortization (.00359 x \$24,000)	86
Maintenance	<u>5,000</u>
Total	\$ 6,486

Total Average Annual Federal and  
Non-Federal Charges

\$ 41,300

(cont)

c. Annual benefits -

Primary flood control benefits \$ 48,000

d. Economic ratio - 1.2

4. LOCAL COOPERATING AGENCY

The State of New York Department of Environmental Conservation



ROOT CREEK  
BOLIVAR, NEW YORK  
DETAILED PROJECT REPORT

SECTION I - INTRODUCTION

1. AUTHORIZATION

a. Congressional authority - A small flood control project on Root Creek in Bolivar, New York is considered under the authority of Section 205 of the Flood Control Act of 1948, as amended, which states as follows:

"The Secretary of the Army is hereby authorized to allot from any appropriation heretofore or hereafter made for flood control, not to exceed \$25,000,000 for any one fiscal year, for the construction of small projects for flood control and related purposes not specifically authorized by Congress, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when in the opinion of the Chief of Engineers such work is advisable: Provided, that not more than \$2,000,000 shall be allotted under this section for a project at any single locality and the amount allotted shall be sufficient to complete Federal participation in the project; Provided further, that the provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936, as amended, shall apply; And provided further, that the work shall be complete in itself and not commit the United States to any additional improvement to insure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports."

b. Authority for detailed project report - Preparation of this detailed project report and authority to proceed with funding is contained in a teletype 312009Z and a letter to the Division Engineer, Ohio River, DAEN-CWP-C, dated 1 November 1973, subject: Root Creek, Bolivar, New York.

2. PURPOSE AND EXTENT OF STUDY

a. Purpose - The study was undertaken to consider in detail the extent of the flooding problem in Bolivar and the methods of resolution available to reduce the identified problem at the least cost to the community, the State, the Federal Government and the area.

b. Extent of study

(1) Topographic surveys - Valley cross-sections were obtained throughout the 7,300-foot reach. These sections were supplemented by aerial topographic maps provided by the State of New York Department of Transportation, photographs and plane table surveys.

(2) Hydrologic and hydraulic studies - Hydrologic studies have been developed for the project area and are included in Appendix I, Hydrology, which is attached to this report. High water marks for the July 1970 and June 1972 floods were obtained by field survey. Hydraulic studies were then performed to establish the high water profile for the July 1972 flood, which is the maximum flood of record having a recurrence interval computed at once in 100 years. The hydraulic design for the proposed improvement alternatives was then completed.

(3) Geologic investigations - Bolivar is located on the maturely dissected Appalachian Plateau just south of the terminal moraine of the southern advancing Wisconsin ice sheet, and within the small outwash valley of the Little Genesee Creek. The streambed of Root Creek (tributary to the Little Genesee Creek and flowing through Bolivar) consists of glacial outwash which is at least fifty (50) feet thick and generally composed of 60% cobbles and gravels, 30% sands, and 10% silts and clays. Most of this material consists of local flat and slabby heterogeneous gravels with scarce bedding features. The bedrock floor and walls of the valley are composed of horizontally bedded upper Devonian shales and siltstones at the very top of which are some remnants of Mississippian shales and thin sandstones. There are bedrock outcrops within the study limits. The soil composition of the slopes is similar to that in the stream bed except that the silt and clay content (at the expense of the cobble and gravel fraction) is probably 5% to 10% higher. Using this information, a slope design of 1 vertical on 1-3/4 horizontal (30 degrees) was considered adequate where 1 vertical on 2 horizontal slopes (26.5 degrees) were not possible. The reaches where these 1 on 1-3/4 cuts are proposed are on the left bank between stations 29+00 and 42+00. (See PLATES 4 and 5.)

(4) Flood damage study - The flood damage study for the Root Creek, Bolivar, New York area was made in July 1972 and was based on the June 1972 flood. Values and degree of development have been revised to the July 1974 level.

(5) Environmental impact study - A complete environmental analysis was completed and incorporated into the development of alternatives and the preparation of this report.

(6) Recreation - Although the possibilities of providing recreational activities as part of the proposed project in Bolivar were investigated, it was evident that the potential for such was very limited.

### 3. PRIOR INVESTIGATIONS

The Corps of Engineers has investigated water related problems on Root Creek in Bolivar, Allegany County, New York, on one previous occasion as follows:

In response to a letter directed to the President and referred for reply to the Pittsburgh District, a representative of the 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.

## SECTION II - GENERAL DESCRIPTION

### 4. LOCATION AND DESCRIPTION OF PROJECT AREA

a. Location of 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.

b. Description of the study area - The study area is situated within the boundaries of Bolivar, which is an incorporated village with a 1970 population of about 1,400. The village is primarily a residential community with all the usual public utilities such as water and sewage, gas and electricity. The stream, as shown on PLATE A, 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. 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 PLATES 1 and 2). This is the area of concentrated damage due to flooding. Root Creek is a headwater stream which drains approximately 9 square miles of area. The Creek flows from high ground in the east, through the Village of Bolivar and then through a small marshland before it empties into the Little Genesee Creek.

c. Basin characteristics - The Root Creek basin above the Route 17 Highway bridge, is sparsely populated and consists of much forest and some farmland. The basin relief ranges from elevation 2440 m.s.l., on the southeastern perimeter of the basin to about elevation 1570 m.s.l., at the lower limit of the study area. Generally, the valley of Root Creek is narrow and the surrounding hillsides are steep producing a rapid concentration of runoff in the valley floor. Inadequate hydraulic capacity of the natural channels and several man-made obstructions tend to impede flow and cause Root Creek to overflow its banks.

d. Stream characteristics - The stream bed of Root Creek in the study reach has an average slope of about 11 feet per thousand feet. The widths of the existing channel range from 12 to 35 feet and the existing bank slopes range from nearly vertical to 1 vertical on 3 horizontal.



e. Bridges - There are four bridges crossing Root Creek in the study area. Physical features of these structures are tabulated in TABLE 1. See PLATES 1 and 2 for bridge locations.

TABLE 1  
BRIDGES IN STUDY AREA

<u>Bridge</u>	<u>Stream</u>	<u>Sta.</u>	<u>Horizontal Clearance (ft)</u>	<u>Vertical Clearance(ft)</u>	<u>Existing Approx. Waterway Opening (ft<sup>2</sup>)</u>
First Street	Root Creek	22+90	16.0	3.2	51
Main Street	Root Creek	26+10	24.0	3.3	79
Davis Street	Root Creek	41+30	23.0	10.1	232
Rt. 17 Highway	Root Creek	73+75	42.5	10.1	429

## 5. ECONOMIC DEVELOPMENT

a. Community development - Bolivar is primarily a residential community, although there are situated within the village, a number of commercial outlets, several light industrial firms, a central school and several churches. Private dwellings are generally in a fair to good condition. At one time the area was very prosperous due to the oil industry; however, as the oil production declined, the local economy did likewise. Currently, many of the community's residents are retired and many of those who do work, travel to nearby Olean or Wellsville. Wellsville is the economic center of Allegany County and along with the Village of Alfred provides a major contribution toward the county's mean income of \$10,022 per year. The mean income in Bolivar, however, is about \$7,800 per year. In the past 30 years the population of Bolivar and the economy has not significantly changed. It is felt that these trends will continue unless new methods of oil recovery are devised which would then promote a possible significant growth in the area.

b. Industry - There are two industries that appear to act as an economic base for the community. The Expert Cutlery Company employs approximately 15 people and the Allegany Forge Company employs approximately 10 people. Producers Gathering Company and Dempsey Pipe and Supply are involved in removing, reclaiming and selling the pipe formerly used as oil well casing are the other two minor industries in Bolivar.

c. Fish and wildlife-associated recreational activities - Recreational activities such as fishing and hunting are present in the Bolivar area. Hunting is good and vigorously pursued in the Root Creek and adjacent basins. Fishing in the area is also good, but not in Root Creek. The fish population of Root Creek consists of a variety of small minnows and darters which are not in the category of a game fish. The major sport fishing in the area is confined to Little Genesee Creek where the trout population is significant due mainly to annual stocking.

## 6. FLOODING

a. 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 from 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 backwater effects, which adds to the 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.

b. 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-damaging variety associated with overbank flows. Property losses during such periods generally include damages to garages, streets, yards, walks, driveways, gardens and patios. In addition, the stream banks are affected by erosion and in some wide areas with low banks the stream centerline shifts. Floods with a less than annual frequency begin to cause first floor damage in several areas. A stage-damage curve is inclosed as Exhibit A.

c. Flooding from Little Genesee Creek - Although the Little Genesee Creek overtops its banks near Bolivar, very little, if any flood damages are incurred. The lands that are flooded are now lying and little used.

d. Record 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

e. Flood of June 1972, design flood - The findings of this 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 calculated, based on the available effective cross-section area and on an estimated critical velocity of 2,000 second-feet at its peak, or about 220 second-feet per square mile of drainage area. This flood has been estimated to have a frequency of recurrence interval of once in 100 years.

f. Stage-discharge-frequency relations - A stage-discharge relation was developed for Root Creek at the damage reference point at Bolivar which is

600 feet upstream of the existing Main Street Bridge. Since discharge records were not available, the curve was established from backwater computations. A stage-frequency relationship was developed for the damage reference point by means of a regional analysis of basins with characteristics similar to those of the Root Creek basin. The stage-discharge and stage-frequency curves are inclosed in APPENDIX I - HYDROLOGY, which presents more detailed information on stream flow characteristics.

### SECTION III - PROBLEMS INVESTIGATED

#### 7. FLOOD DAMAGES

Damage from the June 1972 flood on Root Creek occurred to 111 residential buildings, 10 commercial buildings and other structures and facilities totaling \$181,300 in primary damages as noted in TABLE 2. During the July 1970 flood, which is the only other event for which estimates could be obtained, 72 residential and 8 commercial buildings, in addition to other facilities suffered a total of approximately \$68,000 in primary damages as listed in TABLE 3.

TABLE 2  
DAMAGES - JUNE 1972 FLOOD  
(Oct 1973 Values)

Type	No.	Yards and Foundations	Basements	1st Floor	Est. Value	Est. Damage
Residential	111	30	50	31	\$ 820,000	\$ 92,400
Commercial	10	--	5	5	268,000	44,300
Industrial(Lt.)	3	--	--	3	97,000	12,400
Schools	1	--	1	--	953,000	7,200
Churches	1	--	1	--	25,000	4,300
Municipal	5	2	1	2	184,000	19,600
Utilities	2	1	--	1	1,500	1,100
TOTAL	133	33	58	42	\$2,348,500	\$ 181,300

TABLE 3  
DAMAGES - JULY 1970 FLOOD  
(Oct 1973 Values)

Type	No.	Yards and Foundations	Basements	1st Floor	Est. Value	Est. Damage
Residential	72	28	36	8	\$ 495,500	\$ 40,400
Commercial	8	--	5	3	170,000	13,300
Industrial (lt)	2	--	--	2	27,000	4,400
Schools	1	--	1	--	950,000	3,300
Municipal	3	2	1	--	130,000	5,900
Utilities	1	--	--	1	1,500	700
TOTAL	87	30	43	14	\$1,774,000	\$ 68,000



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, with the displaced material being 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 \$53,400 (July 1974 values).

#### 8. IMPROVEMENTS BY OTHER AGENCIES

The State of New York Department of Transportation is presently entering the final design stages of a proposed Bolivar highway improvement project which is scheduled for construction in calendar year 1974. The project consists of a considerable amount of roadway rebuilding, replacement of the Main Street bridge and an improvement of a section of channel on Root Creek. The roadway rebuilding will eliminate a present flow restriction caused by an inadequate bridge clearance and the channel improvement will improve conditions to the extent that the design flow will be carried under the bridge unrestricted. The channel improvement will consist of a widening and deepening of the present channel, generally along its existing alignment, starting approximately 300 feet upstream from the existing bridge and extending 100 feet downstream (see PLATE 1). The new channel is to be lined with a six-inch layer of concrete. At the upstream end of this improvement, there will also be a four-foot concrete drop structure.

An addition to the proposed N.Y.D.O.T. channel improvement will be the removal of the First Street bridge which presents a serious hydraulic problem due to its very limited clearance. The New York Department of Transportation has recommended to the Town and Village of Bolivar that the bridge be abandoned so that it can be removed. The local officials have given their consent since the bridge is on a side street which is not a major traffic artery.

Continued coordination between the New York Department of Transportation and the Corps has yielded two plans that when completed, will be compatible with each other.

#### 9. IMPROVEMENTS DESIRED

The U. S. Army Engineer District, Pittsburgh, has maintained contact with officials of the State of New York Department of Environmental Conservation, the County of Allegany and the Village and Town of Bolivar. The State of New York will act as the local cooperating agency should a project for flood protection in Bolivar be approved. Both the State of New York and the people of Bolivar desire flood protection by any practicable means as expressed by both with favorable comments at the 4 March 1974 Public Meeting in Bolivar.

## SECTION IV - PLAN FORMULATION

### 10. NON-STRUCTURAL ALTERNATIVES

a. Criteria for minimum degree of non-structural protection - As an outgrowth of Presidential Order 11296, a design flood used in the Flood Plain Management Services Program and identified as the Intermediate Regional Flood (IRF) is generally recognized and accepted by Federal and non-Federal interests as being the reasonable minimum elevation of expected flooding to be used in community and regional planning activities. A hydrologic regional analysis has established that the crest elevation of this 100-year frequency flood would be equal to the June 1972 flood throughout the reach of Root Creek under study.

b. Available non-structural alternatives -

(1) Temporary evacuation after taking advantage of flood forecasting service - A most basic measure which can be taken to protect life and movable property is temporary evacuation. In order for this method to be effective, it would be necessary for local officials to completely familiarize themselves with the flood warning system operated by the Environmental Science Service Administration in Pittsburgh, Pennsylvania. A consideration of particular importance in implementing an evacuation program is the possibility of occurrence of a major storm centered directly over the study area. It is estimated that the warning time for a general storm over the basin would be about four hours; but for a summer thunderstorm, it is believed that at a maximum, only one hour's warning could be given. Therefore, although a temporary evacuation plan could avoid injury and worse, and prevent damage to certain movable property items, it would not completely eliminate the major damages caused by a significant flood. Moreover, with the extremely short warning time associated with a thunderstorm and the problem of information dissemination, it is doubtful if most movable property could be successfully displaced or all persons notified of the impending hazardous condition.

(2) Floodproofing - Floodproofing could be employed by those interests affected by flooding. This would be accomplished to the extent that all openings below the IRF elevations are sealed and made watertight, either permanently or temporarily during floods.

(3) Flood insurance - Flood insurance is a means for providing monetary recovery from flood damages. Reimbursement for such damage is generally available at subsidized rates, under the National Flood Insurance Program, for one to four family residential units and small businesses. Under this program a community must make application for this insurance and if they qualify, the residents are to obtain insurance. Bolivar does not as yet qualify and therefore cannot participate in the Federal Flood Insurance Program.

(4) Flood plain management (zoning) - Several Flood Plain management practices can be employed to avoid increasing potential flood hazards. The use of open space for recreation and conservation areas may offer the most productive land use with the least potential flood hazard. To be effective, flood plain zoning must be initiated before development occurs on the flood plain, and any development which might occur thereafter should be elevated to a level above the IRF level.

c. Discussion of non-structural alternatives as they apply to the current project -

(1) Temporary evacuation would only be an applicable and effective means of protection if the bulk of the damages sustained during a flood were to occur to objects which can be moved quickly and efficiently out of the danger zone. This method of protection is considered inadequate in this case, since much of the damage occurs to immovable structures and also, since the warning time for a serious storm occurring directly over the basin is estimated at only four hours. This method, however, would save lives and prevent some of the damage caused to movable items.

(2) Floodproofing would involve structural treatment of most of the homes, churches and commercial buildings in the flood zone. The treatment would consist of individual floodproofing of the involved buildings or the construction of separate dikes or walls to provide for their protection. Not all of the damageable structures, however, could be individually floodproofed economically because of their foundation and structural conditions. An estimate of cost for floodproofing, based on those structures for which floodproofing was determined economically feasible, was made. The estimated amount is \$592,000 which results in an average annual cost of \$36,900. The associate average annual benefits associated with the floodproofing plan is \$27,200 which when compared to the annual cost yields a B/C ratio of about 0.7. The residual damages which are estimated to still occur annually, with the floodproofing plan, are about \$23,000. This plan would also leave certain unprotectable structures, such as roads and public utilities, still vulnerable to damage. Other benefits usually provided by a flood protection works, such as the elimination of losses resulting from the interruption of commerce, production and traffic, and the danger of loss of human life, would also be foregone.

(3) Flood insurance is not a rational alternative to flood protection. Rather, flood insurance should be one of the final resorts, when it is found that no structural solution exists or that a flood protection project is infeasible. With a flood insurance program at Bolivar, all damages would, of course, still occur. Premiums would necessarily be paid by individuals who would wish to protect their damageable property. One major benefit to be derived from such a plan would be partial monetary compensation for direct damages. Flood insurance also could be a viable intermediate solution in the event a structural solution is feasible and is to be constructed in the future.



(4) Since the flood plain at Bolivar is already in an advanced stage of development, flood plain management techniques such as zoning would not provide a suitable means of damage prevention. Future development is expected to occur; however, it is considered that such development will consist mainly of improvements to existing structures and other damageable properties.

d. Conclusion - Non-structural approaches to the Bolivar flooding problem can be of significant benefit to the community. However, while some damage could be averted, substantial damage and inconvenience would still be experienced.

## 11. ALTERNATIVE STRUCTURAL PLANS CONSIDERED

a. General - The structural plans considered for the alleviation of flood conditions in Bolivar were (1) channel improvements; (2) a channel, dike and wall combination; and (3) a reservoir.

### b. Discussion of plans -

(1) A channel improvement was considered first as a possible means of providing a degree of flood protection, recognizing the limited flood control benefits available. A channel plan providing a reasonable degree of protection while still being economically justified was developed.

(2) Although reviewed as an alternate means of providing protection, a combination plan employing a minor channel improvement, dikes and walls was eliminated as being unacceptable due to high initial construction costs, high maintenance costs and the high costs of pump stations necessary to relieve internal drainage problems. In addition, walls and dikes would prove to be more detrimental to the local environment than other available means of protection in that the social impact of having to relocate several families would be very significant.

(3) Topographically, the best site, of several investigated, for an impoundment on Root Creek is located about 1.6 miles above the stream's 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 1.2 miles of costly highway relocation. Also, because of a steep stream gradient and relatively steep valley walls, a project capable of impounding the runoff necessary to significantly reduce flood damages downstream, would require a high dam at a substantial cost.

Although there are benefits, besides flood control, to be derived from a reservoir project, high construction and relocation costs and other impacts precluded such an alternative from further consideration.

(4) In summary, a channel improvement project, as illustrated in Table 4, is the only feasible structural alternative and would cause the

least overall environmental degradation. The social acceptability of a channel improvement project is greater than that of a channel, wall and dike combination, and much greater than that of a reservoir.

TABLE 4  
STRUCTURAL ALTERNATIVE DATA

<u>Type</u>	<u>Overall Environmental Effects</u>	<u>Social Acceptability</u>	<u>Average Annual</u>		<u>B/C Ratio</u>
			<u>Charges</u>	<u>Benefits</u>	
Improvement	minimal	good	\$41,300	\$48,000	1.2
Channel, wall and dike combination	moderate	fair	59,000	48,000	less than 1.0
Reservoir (Flood control only)	high	questionable	300,000 (minimum)	53,000	Far less than 1.0

## 12. COMPARISON OF FLOODPROOFING TO A CHANNEL IMPROVEMENT

The following table (TABLE 5) compares the economics of a floodproofing plan to those of a channel improvement plan. It should be remembered that the floodproofing plan is based on several assumptions which were presented in Paragraph 10-C(2).

TABLE 5  
COMPARISON OF A FLOODPROOFING PLAN  
TO A CHANNEL IMPROVEMENT PLAN

<u>Type of Plan</u>	<u>Structures Protected</u>	<u>Total Cost</u>	<u>Annual Cost</u>	<u>Annual Damages</u>	<u>Annual Benefits</u>	<u>Net Benefits</u>	<u>B/C Ratio</u>
Floodproofing	68	\$592,000	\$36,900	\$50,400	\$27,200	-\$9,700	0.7
Channel Improvement	133	\$583,000	\$41,300	\$50,400	\$48,000	\$6,700	1.2

Based on this economic analysis, the information in Paragraph 10-C(2) and the information presented in TABLE 7, a channel improvement plan appears to be a more viable solution to the flooding problem in Bolivar.

## 13. VARIOUS CHANNEL IMPROVEMENT SCHEMES

Eight channel improvement schemes were investigated to determine either the most economic plan or the most desirable plan of improvement. TABLE 6

gives the specifics of each investigated plan. Each plan incorporated the replacement of the Main Street Bridge and its associated channel work by NYDOT and an upstream debris basin.

TABLE 6  
CHANNEL IMPROVEMENT SCHEMES

<u>Degree of Protection</u>	<u>Length (station to station)</u>	<u>Average Annual Charges</u>	<u>Annual Benefits</u>	<u>Net Benefits</u>
25 <u>1/</u>	16+20 to 59+00	\$29,200	\$42,000	\$12,800
25	16+20 to 48+50	24,600	42,000	17,400
50 <u>1/</u>	16+20 to 59+00	34,100	44,300	10,200
50	16+20 to 48+50	29,900	44,300	14,400
75 <u>1/</u>	16+20 to 59+00	37,800	45,100	7,300
75	16+20 to 48+50	33,500	45,100	11,600
100 <u>1/</u>	16+20 to 59+00	41,300	48,000	6,700
100	16+20 to 48+50	36,300	48,000	11,700

1/ EQ type plan as described in paragraph 14.

a. National Economic Development (NED) Plan - As shown on Plate 10, the 25 year scheme maximizes net benefits. This would be the NED plan, however, the selected plan is the 100 year EQ plan. The reasoning behind the selection of this plan is that it provides a totally acceptable form and degree of protection while still being economically feasible. It also provides protection from the maximum flood of record which has been calculated to have a 100 year frequency of recurrence. Maximization, in this instance, would not provide a satisfactory degree of protection.

Table 7, on pages 13 thru 17, inclusive, spells out the specifics of the alternative's, both structural and non-structural, effect with respect to various factors in more detail. Only the selected structural alternative was evaluated since all the channel schemes would essentially produce the same effects.

#### SECTION V - PLAN OF IMPROVEMENT

##### 14. SCOPE OF PROPOSED PLAN

a. General - In consideration of the area surrounding Root Creek, the proposed plan of improvement would consist of the features described in the following subparagraphs.



TABLE 7  
ASSESSMENT OF ALTERNATIVES  
ROOT CREEK  
BOLIVAR, NEW YORK

FACTORS	STRUCTURAL				NON-STRUCTURAL			
	RECOMMENDED PLAN (RP)	FLOODWALLS & DIKES	RESERVOIR	TEMPORARY EVACUATION	FLOOD- PROOFING	FLOOD PLAIN ZONING	FLOOD INS.	NO ACTION
<u>ECONOMIC INPUTS</u>								
a. Initial const. cost	\$559,000	\$750,000	\$4,000,000	Nominal installation cost less than RP	Tot. cost less than RP, more expensive to individual prop. owners. Est. cost - \$592,000	No initial costs	Less than RP to community premiums expensive to individual prop. owners	NONE
b. Annual charges	\$ 41,300	\$ 59,000	\$ 300,000	Nominal	\$24,400	NONE	Same as above	NONE
c. Regional impact	1.3 miles of stream bank	Same as RP except more relocations required	Greater and more varied than RP	NONE	NONE	NONE	NONE	NONE
d. Tax base impact	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
e. Property values	\$ 21,700	Slightly more than RP	Much greater than RP	NONE	NONE	NONE	NONE	NONE
f. Public facilities	Limited utility relocation	More than RP	1.2 mi. of road & extensive utility relocation	NONE	NONE	NONE	NONE	NONE
g. Public service	Minor traffic disruption during construction	Same as RP	Greater than RP	NONE	NONE	NONE	NONE	NONE
h. Business & Industrial Activity	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
i. Employment/Labor force	Temporary increase in construction jobs	Same as RP	Greater than RP	NONE	NONE	NONE	NONE	NONE
j. Displacement of farms	NONE	NONE	Greater than RP	NONE	NONE	NONE	NONE	NONE

TABLE 7 (Cont'd)

FACTORS	STRUCTURAL				NON-STRUCTURAL			
	RECOMMENDED PLAN (RP)	FLOODWALLS & DIKES	RESERVOIR	TEMPORARY EVACUATION	FLOOD- PROOFING	FLOOD PLAIN ZONING	FLOOD INS.	NO ACTION
<u>ECONOMIC OUTPUTS</u>								
a. Annual benefits	\$48,000	\$48,000	\$ 53,000	Possible minor reduction in flood damages	Flood damage reduction less than RP. \$27,200 in benefits.	None-cont'd. damage to existing development	Distribution of flood losses	NONE
b. Annual net benefits	\$ 6,700	-\$11,000	-\$250,000	Nominal	-\$9,700	NONE	NONE	NONE
c. Benefit-cost ratio	1.2	Less than 1.0	Far less than 1.0	Not determined	0.7	Not determined	Not determined	N/A
d. Property values	Substantial reduction of average annual flood damages plus possible increase in real estate activities			NONE	Less than RP	NONE	NONE	Restrained
e. Regional impacts	See "Property Values" (above) plus temporary employment opportunities			NONE	Less than RP	Less than RP	NONE	NONE
f. Public facilities	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
g. Public services	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
h. Business and Industrial Activity	Potential for increased activity would be permanently established			NONE	NONE	NONE	NONE	Restrained
i. Employment/Labor force	The labor force would remain basically the same; however, potential for increased employment opportunity would be established			NONE	Less than RP	NONE	NONE	NONE
<u>PHYSICAL INPUTS</u>								
a. Land requirements	4 acres	More than RP	Considerably more than RP	NONE	NONE	None-use would be restricted	NONE	NONE
b. Improvements	NONE	More than RP	Considerably more than RP	NONE	Approx. 68 units in 100-yr. flood plain area	NONE	NONE	NONE

TABLE 7 (Cont'd)

FACTORS		STRUCTURAL			NON-STRUCTURAL			
	RECOMMENDED PLAN (RP)	FLOODWALLS & DIKES	RESERVOIR	TEMPORARY EVACUATION	FLOOD-PROOFING	FLOOD PLAIN ZONING	FLOOD INS.	NO ACTION
<u>PHYSICAL OUTPUTS</u>								
a.	Reduction in flood stage	2.3 feet (100-Year Flood)	Same as RP	Greater than RP	NONE	NONE	NONE	NONE
b.	Improvements protected	133 units	133 units	Greater than RP	NONE	68	NONE	NONE
<u>SOCIOLOGICAL IMPACTS</u>								
a.	Persons displaced	NONE	Several families	Slight	NONE	NONE	NONE	NONE
b.	Transportation patterns	Minor temporary disruption during const.	Same as RP	Greater than RP	NONE	NONE	NONE	NONE
c.	Acoustics	Slight	Same as RP	Less than RP because of location	NONE	Slight	NONE	NONE
d.	Community Cohesion	Possible improvement	Less improvement than RP; project more intrusive	Same as RP	NONE	NONE	NONE	NONE
e.	Community growth	Possible improvement	Same as RP	Greater than RP	NONE	NONE	Zoning may restrict growth	NONE
<u>ENVIRONMENTAL INPUTS</u>								
a.	Aesthetics	Loss of existing stream conditions. Debris basin and stream cleanup.	Similar to RP	Loss of natural stream and lands having good but not unique scenic qualities. No debris cleanup in Bolivar.	NONE	NONE	NONE	NONE
b.	Recreation	NONE	NONE	NONE	NONE	NONE	NONE	NONE
c.	Ecological	Loss of 1.3 mi. of stream bank vege. & slight alt. of aquatic eco-sys. on Root Creek and Little Genesee Creek	Same as RP plus part of adj. flood plain for dikes	Loss of free-flowing stream & aquatic eco-sys. it supports	NONE	NONE	NONE	NONE



TABLE 7 (Cont'd)

FACTORS		STRUCTURAL			NON-STRUCTURAL			
	RECOMMENDED PLAN (RP)	FLOODWALLS & DIKES	RESERVOIR	TEMPORARY EVACUATION	FLOOD- PROOFING	FLOOD PLAIN ZONING	FLOOD INS.	NO ACTION
<u>ENV. INPUTS (Cont'd)</u>								
d. Archeological	NONE (potential)	More potential than RP	More potential than RP	NONE	NONE	NONE	NONE	NONE
e. Man-made resources	NONE	More than RP	Considerably more than RP	NONE	Approx. 68 units in 100-yr. flood plain area	NONE	NONE	NONE
f. Natural resources	Use local stone aggregate	Similar to RP	Inundation of oil wells	NONE	NONE	NONE	NONE	NONE
g. Historical	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
h. Air pollution	Temp. rise during construction	Same as RP	Greater than RP	NONE	Less than RP	NONE	NONE	NONE
i. Water pollution	Slight increase in turbidity during constr.	Same as RP	Greater than RP	NONE	NONE	NONE	NONE	NONE
j. Water quality	Possible slight increase in water temps.	Same as RP	NONE	NONE	NONE	NONE	NONE	NONE
<u>ENVIRONMENTAL OUTPUTS</u>								
a. Aesthetics	Existing vegeta- tion removed by const. will be selectively re- growing trees and shrubs. Improve- ment from debris basin and stream cleanup.	Same as RP	Proj. removed from Bolivar; minimal land- scaping near dam. No im- provement from debris cleanup.	Continuation of present stream conditions				
b. Recreation	NONE	NONE	Potential recreation opportunities	NONE	NONE	NONE	NONE	NONE
c. Ecological	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
d. Health and sanitation	Post-flooding health hazards reduced	Same as RP	Same as RP	Continuation of post-flooding health hazards				

TABLE 7 (Cont'd)

FACTORS	STRUCTURAL			NON-STRUCTURAL				
	RECOMMENDED PLAN (RP)	FLOODWALLS & DIKES	RESERVOIR	TEMPORARY EVACUATION	FLOOD- PROOFING	FLOOD PLAIN ZONING	FLOOD INS.	NO ACTION
<u>ENV. OUTPUTS (Cont'd)</u>								
e. Man-made resources	NONE	NONE	NONE	Developments would remain susceptible to flooding				
f. Natural resources	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
g. Air pollution	No change	No change	No change	No change	No change	No change	No change	No change
h. Water pollution	No change	No change	No change	No change	No change	No change	No change	No change

TABLE 7A

## SUMMARY COMPARISON OF ALTERNATIVE PLANS

	1	2
	Recommended Plan (100 yr. Protection)	Channel Improvement (100 yr. Protection)
A. PLAN DESCRIPTION	Approx. 3,200 feet of excavated channel with gabion protected side slopes; 1,100 feet of gabion protection on natural banks near high school; an upstream debris basin; and 5 gabion drop structures.	Approx. 3,200 ft. of excavated channel with gabion protected side slopes; an upstream debris basin; and 5 gabion drop structures. (Same as 1 without bank protection near high school.)
B. SIGNIFICANT IMPACTS		
1. Economic	An estimated \$48,000 reduction in average annual flood damages; possible increase in real estate value and activities; and an increase in temporary employment.	Estimated annual damage reduction is the same as 1. The difference is that future O & M costs will be slightly higher due to continued erosion of banks near high school. Other aspects would also be the same as 1.
2. Social	Minor temporary disruption of traffic patterns during construction; slight rise in noise levels; possible improvement in community cohesion and community growth; and a reduction of personal concerns associated with the threat of floods and flood damages.	The same as 1 except community would not be in agreement with leaving the banks near the high school unprotected.
3. Environmental	Loss of existing stream conditions; loss of 1.3 miles of existing stream bank vegetation; slight alteration of aquatic eco-system on Root Creek and Little Genesee Creek; slight increase in stream turbidity; and a possible slight increase in water temperature. Preservation of existing stream bank and vegetation near high school.	Essentially the same as 1 except stream banks near high school with its present vegetation, would not be protected from future erosion.



TABLE 7A (Cont'd)

## SUMMARY OF COMPARISON OF ALTERNATIVE PLANS

## C. PLAN EVALUATION

## 1. Contribution to Planning Objective of Flood Control

## a. Adverse

5% of estimated average annual damages would still occur

Same as 1

## b. Beneficial

95% reduction in estimated average annual flood damages

Same flood reduction as 1. Slightly higher future O & M costs. (See 2-B1)

## 2. Relationship to Four (4) National Accounts

## a. National Economic Development (N.E.D.)

The benefit is the prevention of an estimated \$48,000 in average annual flood damages to Bolivar. The adverse contribution is an estimated annual economic cost of \$41,300.

The benefit is the same as 1. The adverse contribution is an estimated annual economic cost of \$36,300.

## b. Environmental Quality (E.Q.)

Essentially the same as B.3.

Essentially the same as B.3.

## c. Social Well Being (S.W.B.)

Essentially the same as B.2.

Essentially the same as B.2.

## d. Regional Development (R.D.)

Regional development may increase slightly in the form of improvements to existing structures and also as stated in B.1.

Same as 1

TABLE 7A (Con't)

SUMMARY COMPARISON OF ALTERNATIVE PLANS

1	2
Recommended Plan (100 yr. Protection)	Channel Improvement (100 yr. Protection)
<p>This plan is totally acceptable to the State of New York and the residents and officials of the Village of Bolivar. It provides protection from a recurrence of a 100 year frequency flood. It is complete in the overall objective of providing the best protection for Bolivar. The B/C ratio is 1.2. The economic stability of the area should increase slightly.</p> <p>The Federal Government (Corps) will be responsible for awarding a construction contract and funding the actual construction of the project. The local sponsor, in this case the State of New York, would be responsible for the acquisition of all necessary lands, easements and rights-of-way. The State would also be required to perform all, if any, utility relocations before project construction. After construction, the State would be responsible for maintaining the project to insure its proper functioning capability. The estimated annual maintenance cost is \$5,000.</p>	<p>This plan is not as acceptable as Plan 1 in that it would not prevent the continuing erosion of the left bank near the high school. It does, however, provide the same degree of protection as Plan 1. The B/C ratio is 1.3. The economic stability of the area should increase slightly.</p> <p>The responsibilities associated with this plan would be the same as 1. The amount of land to be acquired would be slightly less and the annual maintenance cost would be slightly higher, \$6,000.</p>

3. Plan Response to Associated Evaluation Criteria

D. IMPLEMENTATION RESPONSIBILITY

TABLE 7B

## SYSTEM OF ACCOUNTS

	1		2		Coding <u>1/</u>  Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
	Recommended Plan (100 yr. Protection)		Channel Improvement (100 yr. Protection)		
	<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	
1. National Economic Development (NED)					
a. Beneficial Impacts					
(1) Value of increased outputs of goods and services	Estimated \$48,000 reduction in average annual flood damages		Same as 1		1-6-7-9
(2) Value of output resulting from external economies	-0-	-0-	-0-	-0-	
(3) Value of output from under-or un- employed resources (labor)*	Slight increase in temp- orary employment oppor- tunities with a resulting potential for increased permanent employment opportunity.	Minimal effect	Same as 1	Minimal effect	1-6-8-9
Total N.E.D. Benefits	\$48,000	\$48,000	\$48,000	\$48,000	



TABLE 7B (Cont'd)

## SYSTEM OF ACCOUNTS

	1 Recommended Plan (100 yr. Protection)		2 Channel Improvement (100 yr. Protection)		Coding <u>1</u> /  Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
	Location of Impacts Within the immediate planning area	Within the rest of the nation	Location of Impacts Within the immediate planning area	Within the rest of the nation	
b. Adverse Impacts					
(4) Project costs	Estimated average annual cost of \$41,300 which includes an estimated annual main- tenance cost of \$5,000.		Estimated average annual cost of \$36,300 which includes an estimated annual main- tenance cost of \$6,000.		1-6-7-9
(5) Loss resulting from external dis-economies	-0-	-0-	-0-	-0-	
Total N.E.D. Costs	\$ 6,500 <u>2</u> /	\$ 34,800	\$ 7,000 <u>2</u> /	\$ 29,300	
Net N.E.D. Benefits	\$41,500	\$-34,800	\$41,000	\$-29,300	
2. Environmental Quality (E.Q.)					
a. E.Q. - Beneficial					
(1) Stream bank erosion control	4,300 feet	-0-	3,200 feet	-0-	1-6-8-9

TABLE 7B (Cont'd)

## SYSTEM OF ACCOUNTS

1		2		Coding 1/  Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
Recommended Plan (100 yr. Protection)		Channel Improvement (100 yr. Protection)		
<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	
95% reduction in estimated average annual flood damages		Same as 1		1-6-7-9
Significantly reduced	-0-	Reduction slightly less than 1.	-0-	1-6-7-9
Select, suitable fast growing trees and shrubs would be planted where existing vegetation would be removed due to project construction.	-0-	Same as 1 only over a shorter project reach.	-0-	1-6-7-9
Slight sediment load increase during con- struction & maintenance	-0-	Slightly less than 1.	-0-	1-6-7-9
No probable damage	-0-	Same as 1	-0-	1-5-8-9
Slightly altered	-0-	Slightly less than 1.	-0-	1-6-8-9
Possible slight increase in water temperature	-0-	Same as 1	-0-	1-5-8-9
Noise, dust and traffic during construction	-0-	Same as 1	-0-	1-6-8-9

TABLE 7B (Cont'd)

## SYSTEM OF ACCOUNTS

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- c. E.Q. - Destroyed
- (10) Stream Bank vegetation (existing)
- (11) Sport fishing
3. Social Well-Being (S.W.B.)
- a. Beneficial Impacts
- (1) Enhancement of health and community well being\*
- (2) Educational, cultural and recreational opportunities

1 Recommended Plan (100 yr. Protection)		2 Channel Improvement (100 yr. Protection)		Coding 1/ Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
Location of Impacts Within the immediate planning area	Within the rest of the nation	Location of Impacts Within the immediate planning area	Within the rest of the nation	
Removed in project	-0-	Same as 1	-0-	1-6-8-9
Future possibility of such prevented by drop- structures	-0-	Same as 1	-0-	1-6-8-9
Community atmosphere improved due to reduced threat of floods and associated damages. Also the communities cohesion should be improved.	-0-	Same as 1	-0-	1-6-8-9
Reduced erosion at high school.	-0-	No direct change	-0-	1-6-8-9



TABLE 7B (Cont'd)

## SYSTEM OF ACCOUNTS

	1 Recommended Plan (100 yr. Protection)		2 Channel Improvement (100 yr. Protection)		Coding 1/  Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
	Location of Impacts Within the immediate planning area	Within the rest of the nation	Location of Impacts Within the immediate planning area	Within the rest of the nation	
b. Adverse Impacts					
(3) Displacement of people*	-0-	-0-	-0-	-0-	
(4) Public facilities and service, edu- cational facilities	Slight traffic dis- ruption during con- struction	-0-	Same as 1	-0-	1-6-8-9
4. Regional Development (R.D.)					
a. Beneficial Impacts					
(1) Value of increased income	Not significant	-0-	Same as 1	-0-	1-6-8-9
(2) Quantity of in- creased employment	10-20 temporary all types	-0-	Same as 1	-0-	1-6-8-9
(3) Desirable popula- tion distribution	No change	-0-	Same as 1	-0-	1-6-8-9
(4) Increase stability of economic growth*	Possible improvement	-0-	Same as 1	-0-	2-5-8-9

TABLE 7B (Cont'd)

## SYSTEM OF ACCOUNTS

1 Recommended Plan (100 yr. Protection)		2 Channel Improvement (100 yr. Protection)		Coding 1/  Timing Uncertainty Exclusivity Actuality ..... Shown in sequential coding 0-0-0-0
<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	<u>Location of Impacts</u> Within the immediate planning area	Within the rest of the nation	
b. Adverse Impacts				
(5) Value of Income lost	No change -0-	Same as 1 -0-	-0-	
(6) Quantity of jobs lost	-0- -0-	-0- -0-	-0-	
(7) Undesirable growth	-0- -0-	-0- -0-	-0-	

1/1

1/

Timing

1. Impact is expected to occur prior to or during implementation of the plan.
2. Impact is expected within 15 years following plan implementation.
3. Impact is expected in a longer time frame (15 or more years following implementation.)

Uncertainty

4. The uncertainty associated with the impact is 50% or more.
5. The uncertainty is between 10% and 50%
6. The uncertainty is less than 10%.

Exclusivity

7. Overlapping entry; fully monetized in NED account.
8. Overlapping entry; not fully monetized in NED account.

Actuality

9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

2/

The State of New York, Department of Environmental Conservation is the local sponsor so most of this cost will be the State's responsibility.

\* Items specifically required in Section 122 (R & H and FCA 1970) and ER 1105-2-105, dated 15 December 1972.

(1) The channel invert and side slopes would be cleared and excavated from station 16+20 to 48+50. The channel would be 20 feet wide having a 0.5% grade.

(2) The side slopes, which vary from 1 vertical on 2 horizontal to 1 vertical on 1.75 horizontal, as shown on PLATES 3 through 7, would be protected with stone filled gabion mattresses from station 19+00 to 48+70. The protection would be to the design water surface elevation and to a thickness as deemed necessary due to the velocities in each area. In investigating the possibility of reducing the elevation of the side slope protection, it was found that the savings associated with protecting to only the 10-year flood elevation was minimal. The gabion would have a green poly-vinyl coating to retard corrosion, abrasion and add a pleasing appearance to the stark stone protection. The gabions when placed on the slopes will be toed into the channel bottom to a depth of about three (3) feet. In investigating this method versus a completely lined bottom, several items were considered. The first item would be the cost, however even though the cost of the completely lined bottom was greater, it would not affect the feasibility of the project. The next item was the fact that equipment that would be used for project maintenance could not operate on the gabion protected channel bottom because it could damage the gabion mesh. Thirdly, a natural channel bottom would be more in line with a recommendation from the Bureau of Sport Fisheries and Wildlife that a low-flow channel be constructed along the shaded side of the creek in order to prevent an unusual increase in water temperature. This letter is shown as EXHIBIT C. Although construction of such a channel is not possible in the type of streambed material that exists in this area, a low-flow channel will develop naturally. Also, significant increases in the water temperature of Root Creek will not occur since the proposed project will not significantly decrease the amount of shade normally provided to the creek.

(3) At various points throughout the improvement, there will be gabion drop structures as proposed; one 2-foot, two 3-foot and two 4-foot drop structures all 20 feet wide. The drop structures would have gabions on the invert and side slopes for a specific length upstream and downstream to prevent scour. The locations of the drop structures and the limits of the special protection are shown on PLATES 3 through 7 and a cross-section is shown on PLATE 8.

(4) Between stations 36+23 and 37+07 a gabion gravity wall would be constructed. The wall would rise from the channel invert to the existing ground level. The channel bottom in this area would be slightly widened to recover some of the hydraulic area lost in the construction of the wall. (See PLATES 4 and 8.)

(5) There are also four (4) areas within the project reach where small rolled earth fill dikes would be needed to contain the



design water discharge. The dikes would be no higher than four (4) feet above the existing ground level and would be 1.5 feet above the design water surface elevation. These areas are located on PLATES 2 and 3.

(6) At the upstream end of the study area in a flat area upstream of the Bolivar Central School bus garage, a debris basin would be provided. The debris basin would have a bottom width of 75 feet and a length of 300 feet. The invert slope would be 0.4% and the side slope 1 vertical on 3 horizontal. The basin would capture a major portion of transported materials and would reduce maintenance costs in the improved channel by centralizing material removal. This area, between station 63+00 to 66+00, was chosen because of easy access and available adjacent land.

(7) Temporary erosion and sediment control measures will be utilized by the contractor during construction of the project. The exact type will be spelled out in the plans and specifications prior to construction. These problems and others and the measures to take in controlling them are spelled out in The Guide Specifications of Environmental Protection, CE 1300, June 1973.

(8) The Davis Street bridge wing walls will be revamped and its existing abutments underpinned. The channel invert under the bridge will be protected with gabions to further protect the abutments from unmining caused by erosion.

(9) Disposal areas for the excavated material are shown on Plates 1 and 2. The material excavated for the debris basin will be placed on either side of the basin. The remaining two areas, on the left bank upstream of the Davis Street Bridge and the area behind the left bank just downstream of the First Street Bridge, will accommodate the remaining material.

(10) In order to reduce the possible increase in the water temperature of Root Creek, fast growing shade trees will be planted in areas where they are needed. Consideration was also given to the possibility of excavating a low-flow channel for the same purpose. However, due to the composition of the existing streambed material, such a channel would fill in with sediment in a very short period of time. A low-flow channel will, however, develop naturally. This will be due, again, to the type of material in the channel. Lining the channel invert with gabions in the form of a shallow "v" would create a permanent low-flow channel, but then the channel could not be economically maintained. To maintain the channel economically, machinery must be used; if gabions lined the invert, machinery would not be permitted on them. Therefore, it is more desirable and economical to have a natural channel invert and let a natural low-flow channel develop.

## 15. ENVIRONMENTAL QUALITY PLAN

In order to make the proposed project more complete, concur with the desires of local interests and prevent unnecessary erosion, that in the

past has caused many trees to fall, the left bank from station 48+70 to 58+25 and the right bank from station 56+00 to station 59+00 of the natural channel will be protected with gabions. The slopes will be cleared and the slope of 1 vertical on 1.75 horizontal will be used. The gabion slope protection will be placed to the 15-year flood elevation, this additional work will be added to the above 100-year plan and thus create the EQ plan. The results of implementing this plan would be a moderate decrease in future O & M costs. Also included in this EQ plan will be the planting of trees, both to replace those that will have to be removed during construction and enhance the natural values of the area. The excavated areas above the gabion slope protection and the disposal areas will also be seeded after the construction is completed.

#### 16. ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

a. Water quality - During project construction, there would be a temporary increase in suspended solids and turbidity resulting from excavation in the stream channel. This condition would be most evident during the single construction season (April to October) necessary to construct the proposed project and would continue to a lesser degree until adequate vegetative cover is established on exposed soils. The relative coarseness of the stream bed material, frequent low flows in the creek and temporary erosion and sediment control measures would reduce, somewhat, the adverse effects of increased turbidity and suspended solids. A portion of the suspended solids generated by the project would be deposited in the Little Genesee Creek near the mouth of Root Creek, resulting in a temporary disruption to aquatic organisms and fishlife.

The stabilization of the stream banks in the project area, upon completion of the proposed modification, would reduce erosion in the project limits and benefit the community of Bolivar.

The removal of some bank vegetation in the project area could raise water temperatures, thereby reducing oxygen levels slightly. However, bank vegetation will be replaced to the extent possible. Also, the stream velocities are such that the water will be subjected to increased exposure to the sun for only a short period of time. Therefore, this reduction in dissolved oxygen is anticipated to be negligible.

b. Flooding - The proposed project would reduce flood damages in the project area with a negligible increase in downstream water levels during periods of high flow.

c. Vegetation - A number of larger trees would have to be removed for construction. Of these, several are located on the bank and would eventually, be lost anyway by further erosion. When the project is complete, those remaining will be safe from this action. In addition, fill areas will be reseeded and where consonant with the functioning of the project, bank vegetation will be replaced.

d. Wildlife - During construction of the proposed channel modification, existing wildlife populations would move away from the area as a result of habitat destruction, increased noise levels, etc. The proposed reduction in streambank vegetation will restrict the ability of the area to support the terrestrial wildlife populations presently associated with this riparian habitat. Project construction would therefore result in a loss of wildlife populations inhabiting the reach of the stream involved. Considering the natural character and high level of habitat diversity occurring in the basin, this loss would be negligible.

Effects upon the aquatic ecosystems of both Root Creek and Little Genesee Creek would be disruptive. Modification of approximately 3,000 feet of stream channel will eliminate the existing diverse benthic habitat and community in Root Creek. A reduction in the benthic population, which serves as a food source for the larger aquatic wildlife, would result in a decline in the fish population in Root Creek. Existing fish population in Root Creek can be expected to emigrate into Little Genesee Creek as their food source declines. This relocation would somewhat disrupt the established ecosystem of Little Genesee Creek through increased competition for space and nourishment. The severity of this problem would depend upon the number of fish migrating into Little Genesee Creek from Root Creek. This is not expected to present a serious problem because of the periodic low-flow conditions. Establishment of a new benthic community in Root Creek is anticipated to occur in the future, differing in character from the present one.

e. Socio-Economics

(1) Land use and development - Erosion activity has resulted in direct loss of acreage. With the proposed control this loss in this manner would be minimized. Stabilization, in addition to the cleaning up of existing debris in the channel, could make those vacant areas adjoining Root Creek desirable and more valuable home sites as there will be less subjection to inundation. A flood plain management program could be adopted by local interests to support and enhance the effectiveness of the proposed construction project so that even greater protection and aesthetic quality would be maintained. The township presently has a comprehensive plan which should preclude unwise land use. It is not anticipated that the proposed project would significantly alter the land use and development patterns because more important factors, such as the local economy, outweigh it.

(2) Natural resources - Implementation of the proposed project would involve utilization of local stone-fill material for the gabion structures. This material would be obtained from a quarry located in Portville, Cattaraugus County, approximately 15 miles from the proposed project. No other natural resources would be affected by the proposed project.



(3) Population - As in the past, the population is directly related to the oil fields. The proposed project would not significantly influence future trends. There would be no displacement or disruption of inhabitants as a result of the project.

(4) Recreation - Construction of the proposed channel modification would not affect existing recreational facilities in the area.

(5) Hunting and fishing - Hunting and fishing opportunities in the area would not be affected directly or to any great extent by the proposed project.

(6) Aesthetics - The aftermath of any flooding activity invariably includes debris, mud and other similar type aesthetic intrusions, if only on a temporary basis. With flood control, those situations would be substantially reduced. Local policing could reduce the amount of debris thrown into and resting in the creek. This would significantly improve aesthetic quality.

Bank stabilization and the reduction of flooding activity, in conjunction with landscaping, including slope-seeding, could improve visual appeal. However, replacement of a natural channel with a man-made one would generally reduce the aesthetic quality of the stream.

(7) Archeological and historical resources - Although it appears that the proposed project will have no impact on these resources, information from the New York State Parks and Recreation Division of Historic Preservation disclosed that there may be sites of archeologist value in the area. As a result, a timely inventory will be made of the possible sites so that any required salvage can be performed prior to construction of the project. It is anticipated that the site inventory will be performed for the Corps by a recognized archeologist. The actual salvage, if required, will be the responsibility of the National Park Service.

(8) Future maintenance - Future maintenance has been estimated at \$5,000 annually. This will consist of sediment removal from the debris basin and below each drop structure should it need it. Unusually large deposits in the channel will also have to be removed. Also, the control of woody vegetation growth amidst the gabion slope protection would also require control.

## SECTION VI - ECONOMIC ANALYSIS

### 17. COST ESTIMATES

a. Federal first costs - An estimate of Federal first costs has been developed to establish the feasibility of the plan outlined above. Estimate of costs as of July 1974 are shown in the following table.

TABLE 8  
FEDERAL FIRST COSTS

Item	Units	Quantity	Unit Cost	Amount	Total
Clearing	Acres	5	\$ 300.00	\$ 1,500	
Excavation (Common)	Cu.Yds.	36,500	3.25	118,600	
9" Gabion Slope Protection	Cu.Yds.	3,100	40.00	124,000	
Placed Fill Over Slope Bottoms	Cu.Yds.	5,000	1.50	7,500	
Filter Cloth (Slopes)	Sq.Yds.	10,000	2.25	22,500	
Gabion Drop Structures:					
2-Foot Drop Structure (1):					
12" Slope and Invert Protection	Cu.Yds.	90	40.00	3,600	
36" Invert and Slope Protection	Cu.Yds.	108	40.00	4,320	
Filter Cloth (Invert)	Sq.Yds.	110	2.25	248	
Gabion Block Drop	Cu.Yds.	27	40.00	1,080	
Structural Excavation	Cu.Yds.	35	6.00	210	
Concrete Grout	Sq.Yds.	120	4.00	480	
Backfill	Cu.Yds.	9	22.00	198	
3-Foot Drop Structures (2):					
12" Slope and Invert Protection	Cu.Yds.	90	40.00	3,600	
36" Invert and Slope Protection	Cu.Yds.	378	40.00	15,120	
Filter Cloth (Invert)	Sq.Yds.	300	2.25	675	
Gabion Block Drop	Cu.Yds.	65	40.00	2,600	
Structural Excavation	Cu.Yds.	75	6.00	450	

TABLE 8 (Cont'd)

Item	Units	Quantity	Unit Cost	Amount	Total
Concrete Grout	Sq.Yds.	460	4.00	1,840	
Backfill	Cu.Yds.	18	22.00	396	
4-Foot Drop Structures (2):					
12" Slope and Invert Protection	Cu.Yds.	90	40.00	3,600	
36" Invert and Slope Protection	Cu.Yds.	475	40.00	19,000	
Filter Cloth (Invert)	Sq.Yds.	350	2.25	790	
Gabion Block Drop	Cu.Yds.	80	40.00	3,200	
Structural Excavation	Cu.Yds.	90	6.00	540	
Concrete Grout	Sq.Yds.	460	4.00	1,840	
Backfill	Cu.Yds.	20	22.00	440	
Gabion Gravity Wall:					
Gabions	Cu.Yds.	104	40.00	4,160	
Structural Excavation	Cu.Yds.	185	6.00	1,110	
Crushed Stone	Cu.Yds.	30	10.50	315	
Granular Backfill	Cu.Yds.	30	10.50	315	
12" Gabion Invert Protection (Upstream End of Debris Basin)	Cu.Yds.	50	40.00	2,000	
Filter Cloth	Sq.Yds.	150	2.25	338	
Davis Street Bridge:					
Underpinning of Abutments, Wing Wall, revamping and Invert Protection	L.S.	---	---	20,000	



TABLE 8 (Cont'd)

Item	Units	Quantity	Unit Cost	Amount	Total
Rolled Earth Fill (Dikes)	Cu.Yds.	600	4.00	2,400	
Seeding	Acres	4	250.00	1,000	
Beautification	L.S.	---	---	<u>3,000</u>	
		Subtotal		\$372,965	
		Subtotal (rounded)			\$373,000
Contingencies @ 15%					<u>56,000</u>
		Subtotal (rounded)			\$429,000
Engineering and Design @ 20%					85,800
Supervision and Administration					<u>44,200</u>
Total, Federal First Costs (rounded)					\$559,000

b. Non-Federal first cost - An estimate of non-Federal first cost for the proposed plan of improvement is contained in the following table. Estimates of costs are based on July 1974 price levels.

TABLE 9  
NON-FEDERAL FIRST COSTS

Item	Amount	Total
Rights-of-Way		
Permanent Easements	\$ 10,500	
Temporary Easements	500	
Severance	<u>5,420</u>	
Subtotal	\$ 16,420	
Acquisition Cost (brokerage) @ 15%	<u>2,460</u>	
Subtotal		\$ 18,880
Contingencies @ 15%		<u>2,820</u>
Total Land (rounded)		\$ 21,700
Legal, Engineering and Supervision at 10%		<u>2,170</u>
Total, Non-Federal First Costs (rounded)		\$ 24,000

## 18. ANNUAL CHARGES

a. Average annual charges - The average annual Federal and non-Federal charges based on a 50-year project life with July 1974 values are summarized in the following table.

TABLE 10  
AVERAGE ANNUAL CHARGES

Item	Amount
<u>Federal at 5-7/8%</u>	
Interest (.05875 x \$559,000)	\$ 32,841
Amortization (.00359 x \$559,000)	<u>2,007</u>
Total	\$ 34,848
<u>Non-Federal at 5-7/8%</u>	
Interest (.05875 x \$24,000)	\$ 1,400
Amortization (.00359 x \$24,000)	86
Maintenance	<u>5,000</u>
Total	\$ 6,486
Total Average Annual Federal and Non-Federal Charges (rounded)	\$ 41,300

## 19. ESTIMATES OF BENEFITS

a. Summary of average annual primary flood control damages and benefits (July 1974 values)

Natural Flood Damages	\$ 53,400
Natural Flood Damages (After N.Y.D.O.T. improvement)	50,300
Damages after Corps' improvement	<u>2,300*</u>
Benefits	\$ 48,000

b. Other attributable benefits - In investigating the benefits of a project, there are benefits in addition to primary flood control benefits that can be attributed to a project. These additional benefits are normal future development benefits and redevelopment benefits.

\*These residual damages are those which occur above the 100 year level of protection, on an annual basis.

(1) Normal future development benefits - Based on a 3-1/4% growth rate and average annual damages to the contents of residential dwellings in the amount of \$16,716, approximately \$12,600 in average annual normal future development benefits can be obtained. This estimate is based on a present worth factor of 12.08261 (3-1/4% annual growth rate for 50 years) and a partial payment factor for 50 years of 0.062340, both at a 5-7/8% interest rate.

$$\$16,716 \times 12.08261 = \$201,973 \times 0.062340 = \underline{\$12,591}$$

(2) Redevelopment benefits - Although the project area is not classified as an Economic Development Administration area, much of the surrounding area, within a 50-mile radius of Bolivar, is classified as such. Therefore, it may be assumed that a portion of the skilled, semi-skilled and unskilled labor needed in the construction of the proposed project would come from these areas. However, for the purposes of this report, the possibility of redevelopment benefits will only be recognized and not determined since their impact would be minimal.

(3) These other benefits are recognized but will not be used to justify the proposed project. Only primary flood control benefits will be used.

## 20. MAINTENANCE

a. Responsibility - The State of New York, the local cooperating agency, would be responsible for the continued effectiveness of the improvement by performing proper and systematic maintenance of the improved channel and associated structures.

b. Maintenance required - Local interests would be required to maintain the geometric shape and grade of the improved Root Creek channel by keeping it free of debris, sediment deposits, undesirable vegetation and other materials which would tend to decrease its efficiency. The debris basin is properly maintained with a periodic cleaning out. Periodic repair of the gabion slope protection and drop structures may also be required.

c. Annual maintenance cost - The average annual cost of maintaining the proposed improvement is estimated at \$5,000. This estimate is based on a percentage of the cost for structures in the proposed improvement plus the estimated cost of cleaning out the debris basin annually.

d. Sediment disposal - Sediment removed from the debris basin and the channel will be used as land fill in the low areas behind the left bank downstream of the end of the proposed improvement.



## 21. BENEFIT-COST ANALYSIS

The following table summarizes the proposed project's cost compared to its attributable benefits:

TABLE 11  
BENEFIT-COST ANALYSIS  
(Average Annual)

Average Annual Project Benefits		Average Annual Project Cost	B/C Ratio
A. Primary flood control only	\$48,000	\$41,300	1.2
B. Primary flood control and normal future development	\$60,600	\$41,300	1.5
C. Primary flood control and normal future development and redevelopment	slightly higher than B	\$41,300	slightly higher than B

## SECTION VII LOCAL COOPERATION AND COORDINATION

### 22. LOCAL COOPERATION

a. Local cooperation required - Local cooperation as specified in Section 3 of the Flood Control Act of 22 June 1936, as amended, would basically apply. The State of New York, the local cooperating body, would be required prior to the commencement of construction to:

(1) Provide without cost to the United States all lands, easements, and rights-of-way including suitable borrow and spoil disposal areas as determined by the Chief of Engineers as necessary to the construction of the project, at a presently estimated cost of \$24,000.

(2) Adjust utilities as necessary without cost to the United States;

(3) Hold and save the United States free from damages due to the construction work and maintenance of the project excepting, however, damages due to the fault or negligence of the United States or its contractors.

(4) Prescribe and enforce regulations to prevent obstruction or encroachment on channels and interior ponding areas which would reduce their flood carrying capacity or hinder maintenance and operation, and control development in the project area to prevent an undue increase in the flood damage potential;

(5) Maintain the project works after completion in accordance with regulations prescribed by the Secretary of the Army;

(6) At least annually, notify interests affected that the improvement will not provide complete protection from floods greater than the design conditions; and

(7) Comply with Section 221 of P.L. 91-611.

b. A letter, dated 11 February 1975, from the New York State Department of Environmental Resources expressing the State of New York's desire to comply with the items of local cooperation is inclosed as Exhibit B.

## 23. COORDINATION WITH OTHER AGENCIES

The plan to provide flood protection for Bolivar, New York has been outlined and referred to various Federal and non-Federal agencies for comment. Copies of correspondence from the following agencies have been received to date and are included in this report as EXHIBITS C through I, inclusive.

Bureau of Sport Fisheries and Wildlife  
United States Department of the Interior

Department of Housing and Urban Development

Soil Conservation Service  
United States Department of Agriculture

United States Environmental Protection Agency

New York State Department of Environmental Conservation

National Park Service  
United States Department of the Interior

New York State Office of Parks and Recreation

SECTION VIII  
RESULTS OF INVESTIGATION

24. STATEMENT OF FINDINGS

I have reviewed and evaluated in light of the overall public interest, the documents concerning the proposed action, as well as the stated views of interested agencies and the concerned public, relative to the various practicable alternatives for providing flood protection in the Root Creek Basin of Allegany County and with particular regard to the Village of Bolivar. Public and interagency coordination and communication have been maintained throughout the study, with several agencies participating in the evaluation of problems and alternative solutions.

The possible consequences of constructing the proposed project, as well as each of the alternatives, have been studied for environmental, social and economic effects, both regional and national, as well as engineering feasibility. Other factors bearing on my review have included the fulfillment of public need, particularly with regard to the alleviation of flood damages.

In the evaluations of viable alternative solutions and, ultimately, the selected plan, the following were considered pertinent:

a. Environmental Considerations - Of primary concern was the evolution of a plan that would best provide the level of flood protection desired by the affected local residents and maintain or enhance the physical environmental setting of the study area. Specifically, these considerations included modification of the existing stream channel; the effects on existing plant and animal life, both aquatic and terrestrial; aesthetic quality during construction and after project completion; water quality; local air quality and noise levels during project construction; and the effect on historical and archaeological values.

The most significant adverse environmental effect that could result from project construction would involve a possible increase in the present water temperatures of Root Creek. This possible increase in water temperatures could have an effect on the brown trout population of Little Genesee Creek to which Root Creek is a tributary. However, I have concluded, based on the information currently available to me, that this effect would be minimal.

b. Social Well-being Considerations - The proposed project will cause changes in the local social environment. Reducing the threat of flooding in the project area will lessen anxiety, promote better health, improve general living conditions, promote orderly community development and help generally to improve the standard of living. Negative social effects will be confined to the period of construction and include temporary traffic congestion and increased noise, dust and exhaust emissions from the construction equipment.



c. Engineering Considerations - Alternative solutions to the flooding problem of Root Creek through the Village of Bolivar involved consideration of a range of structural and non-structural measures. Included were an upstream reservoir; flood walls; increasing the existing channel capacity by widening, deepening or a combination of both; flood plain management; flood warning systems; flood insurance; flood proofing; relocation; and no-action of any kind. The no-action alternative would not provide any degree of relief from the currently experienced flood damages and would therefore be unresponsive to the needs and desires of the local people. The non-structural alternatives, while offering a small measure of benefit, involve unacceptably high costs to the community. Such measures should be viewed as a supplement to the proposed plan for structural protection.

General design studies for the structural measures relating to the Root Creek flooding problem were accomplished with a view toward the development of a plan of protection capable of providing the greatest return per dollar invested while meeting the desires of the people directly involved. After examination of all structural alternatives, the only possibilities that offered economic feasibility related to modification of the channel to provide various degrees of protection. The choice of the level of protection was that which would contain the flood of record which has an estimated 100-year frequency.

d. Economic Considerations - Construction of the proposed project would produce changes in the economy of the Bolivar area. The frequency of overbank flooding, and thus flood damages, within the project area will be reduced, resulting in economic savings to local residents. The project would require the conversion of approximately 4 acres of land from private to public ownership, thus removing that land from local tax rolls. However, these lands are essentially confined to the channel area and any loss could be offset by increased property values because of reduced flood hazard.

I find that the action proposed is based on a thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are found to be involved, they cannot be avoided by following reasonable alternative courses of action which would achieve the Congressionally-specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of national policy; that the recommended actions are consonant with national policy, statutes, and administrative directives; and that on balance the total public interest should best be served by the implementation of the recommended plan.

## 25. DISCUSSION

a. General - This detailed project report is concerned with the physical, hydrologic, hydraulic, environmental and economic features of Root

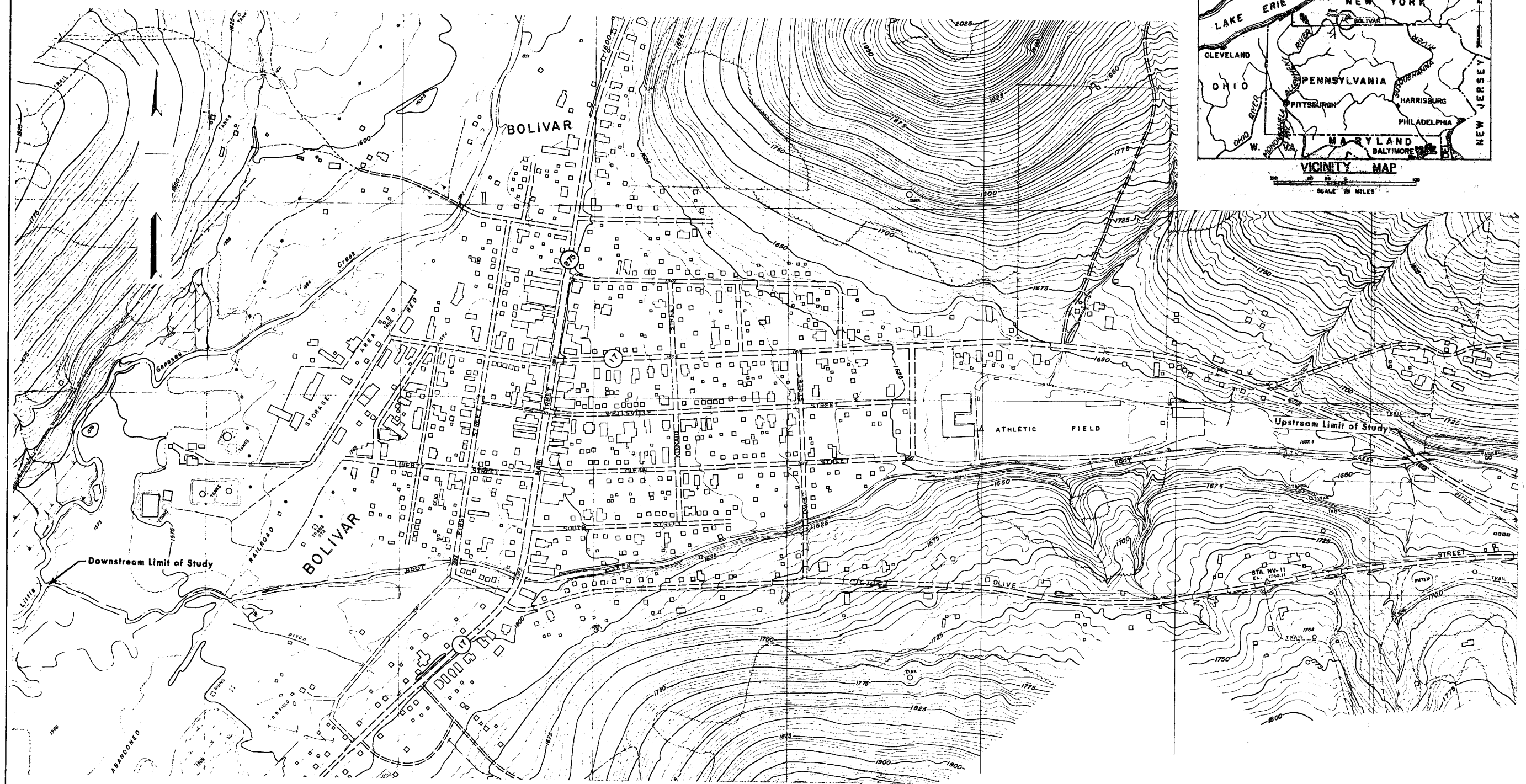
Creek in Bolivar. Considered in the report are the flood problem, the history and evaluation of flood damages, alternative methods of flood protection, the environmental setting with and without a project, cost estimates for the recommended plan and the economic justification and prospective benefits of providing flood protection.

b. Summary - Flood protection by channel improvement was found to be the only practicable solution to the problems in Bolivar. The plan herein proposed would substantially reduce primary damages from floods up to the maximum known flood. The proposed project would provide protection against the 100-year flood such as resulted from Tropical Storm "Agnes" in June of 1972. The Federal cost of the project is estimated to be \$559,000. Obligations of the local cooperating agency are evaluated at \$24,000. The development of a flood control project according to the recommended plan herein presented is feasible and economically justified. The current economic ratio is 1.2 considering primary flood control benefits only.

## 26. RECOMMENDATION

It is recommended that a channel improvement project for flood protection on Root Creek in Bolivar, New York, as developed in this report, be selected by the Chief of Engineers for implementation under the authority of Seciton 205 of the Flood Control Act of 1948, as amended, and further, that this detailed project report be approved as a basis for preparation of contract plans and specifications.

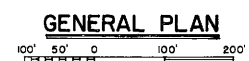
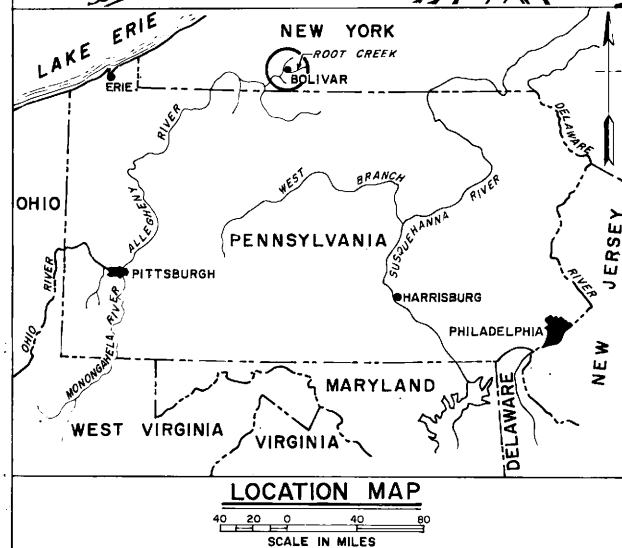
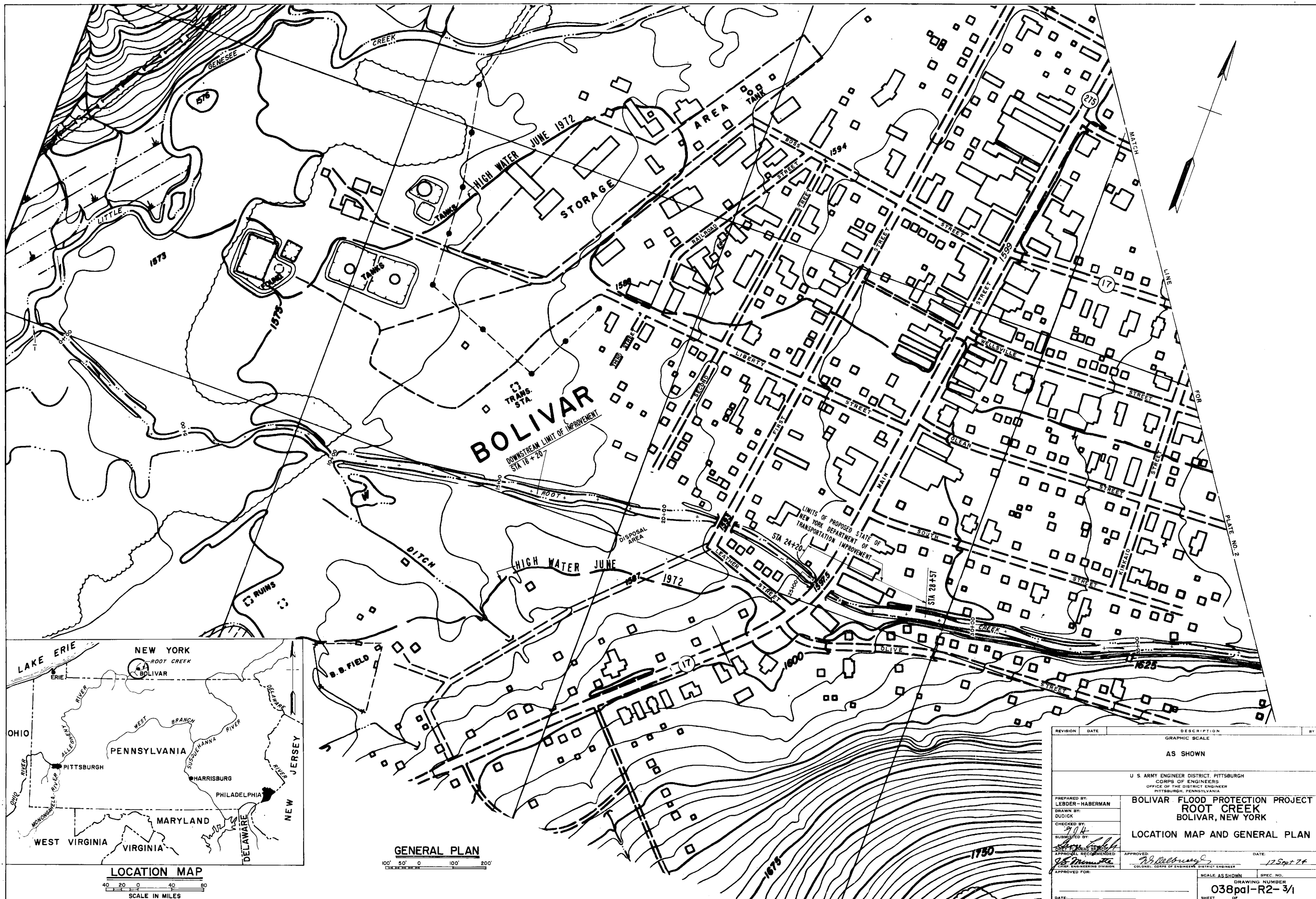
MAX R. JANAIRO, JR.  
Colonel, Corps of Engineers  
District Engineer



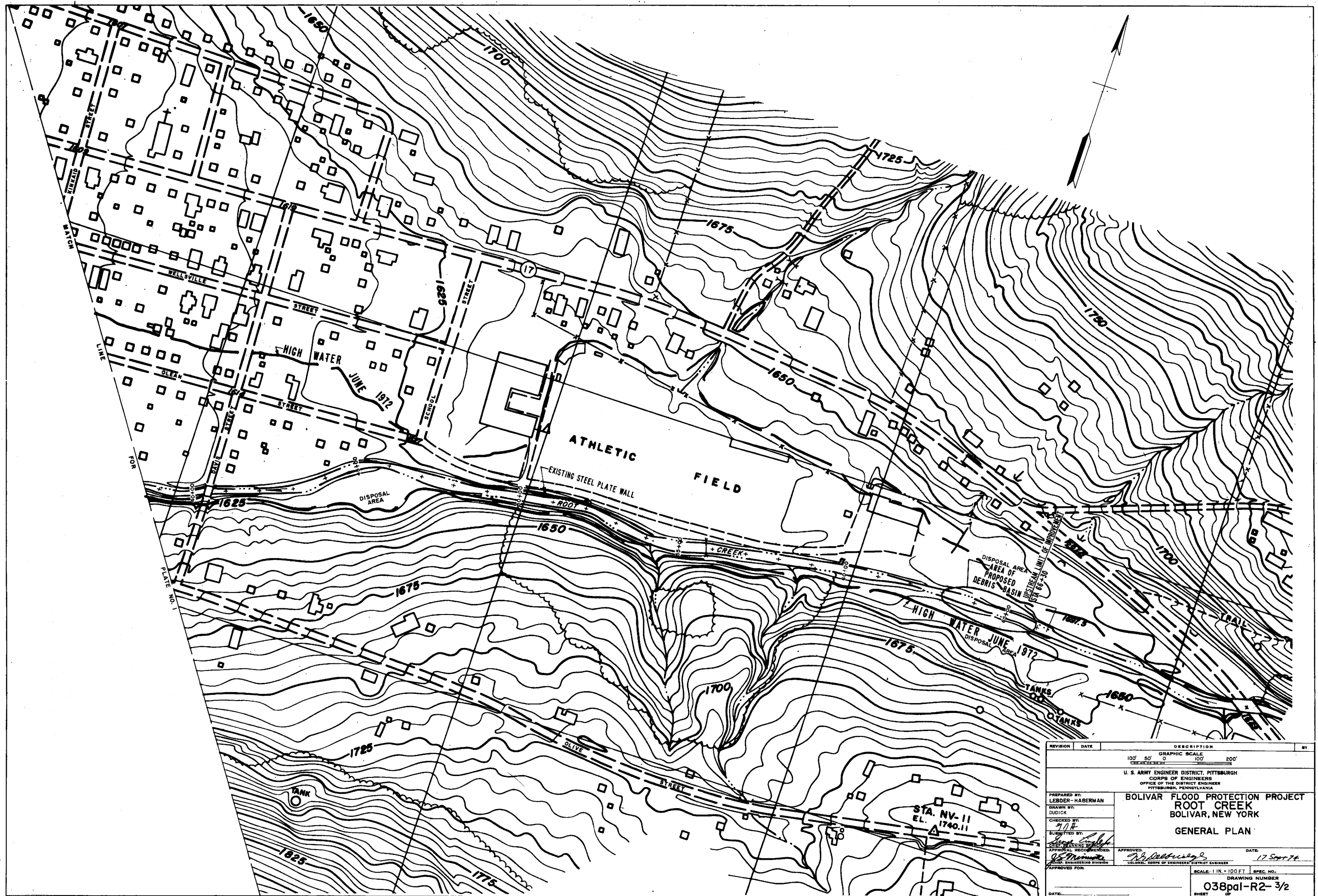
ROOT CREEK  
BOLIVAR, NEW YORK  
STUDY AREA AND VICINITY MAP

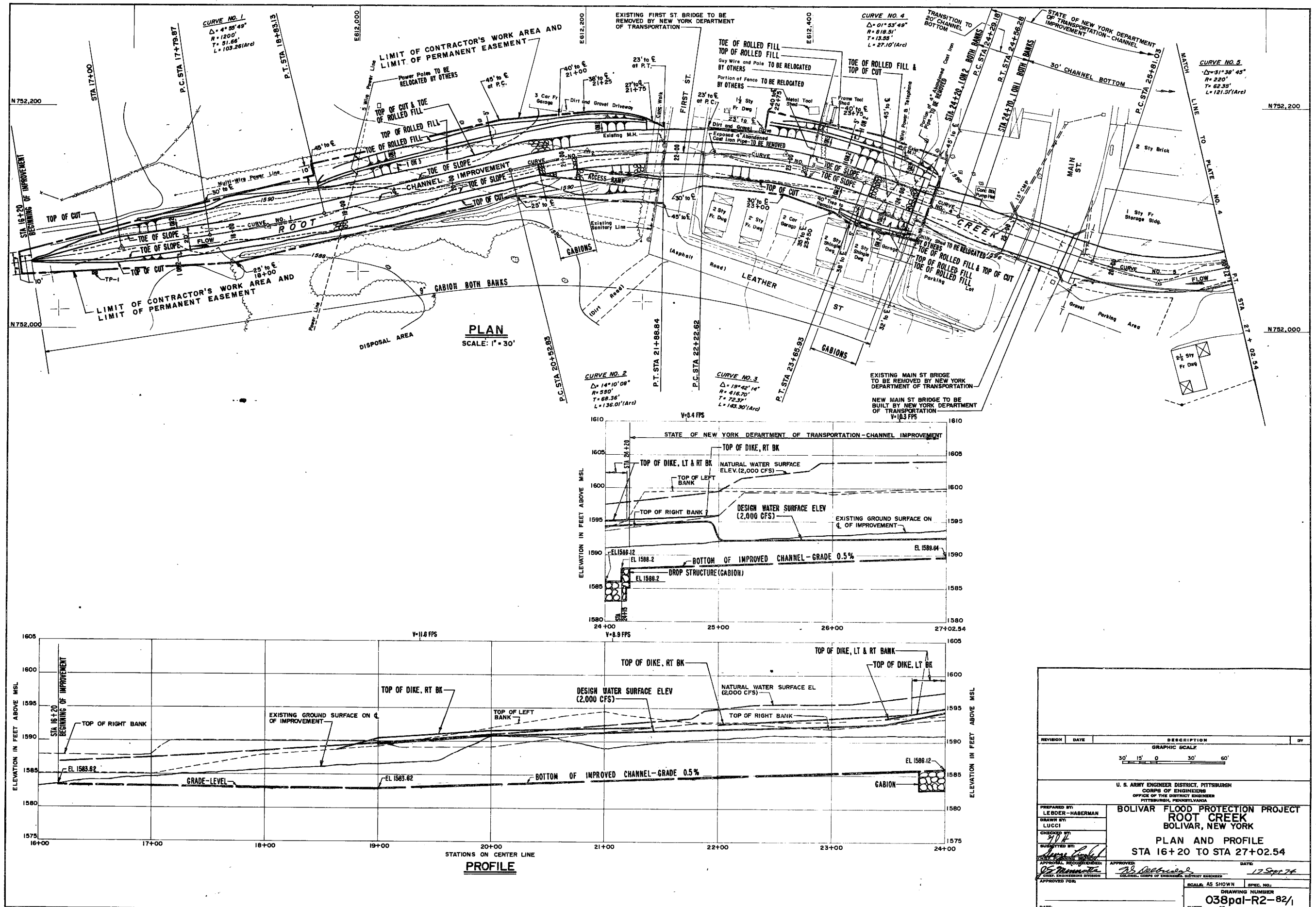
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OFFICE OF THE DISTRICT ENGINEER, PITTSBURGH, PA.  
SUBMITTED: APPROVAL RECOMMENDED: APPROVED:  
CHIEF, ENGINEERING DIVISION COLONEL, CORPS OF ENGINEERS,  
DISTRICT ENGINEER  
PREPARED BY: 11/16  
DRAWN BY:  
CHECKED BY:





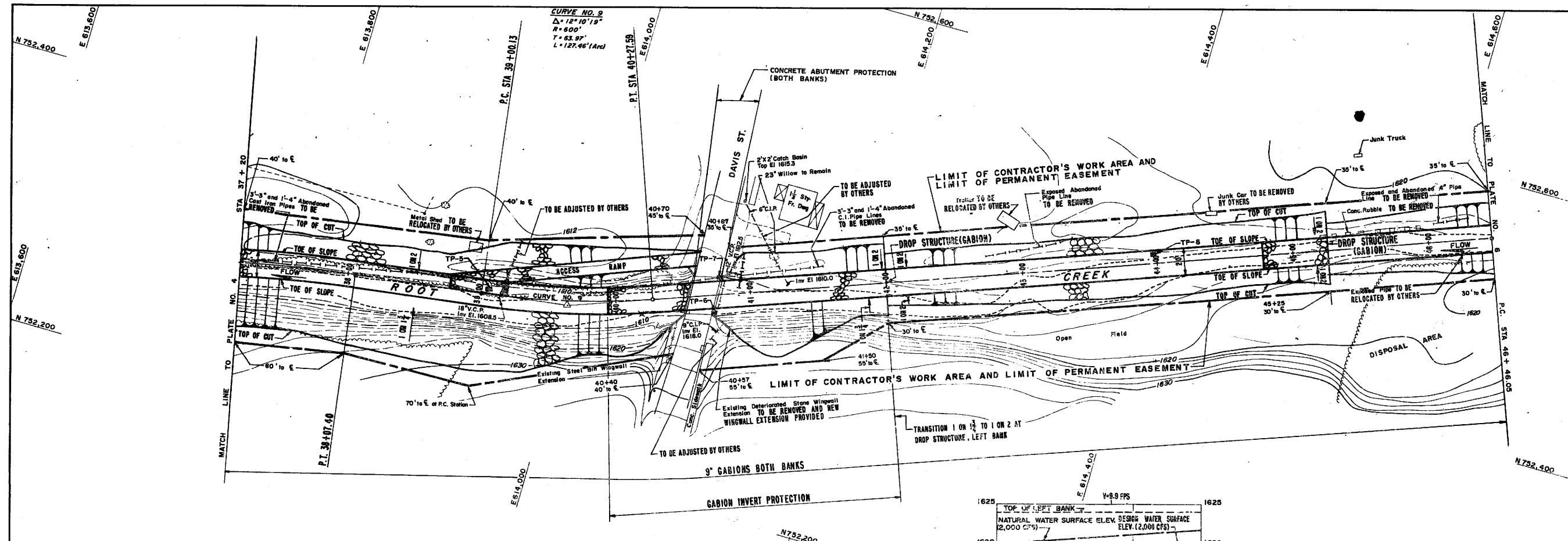
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BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK			
LOCATION MAP AND GENERAL PLAN			
PREPARED BY: LEBBER-HABERMAN	DATE: 17 Sept 72		
DRAWN BY: QUICK	APPROVED: [Signature] COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER		
CHECKED BY: [Signature]	APPROVED FOR:		
SUBMITTED BY: [Signature]	SCALE: AS SHOWN		
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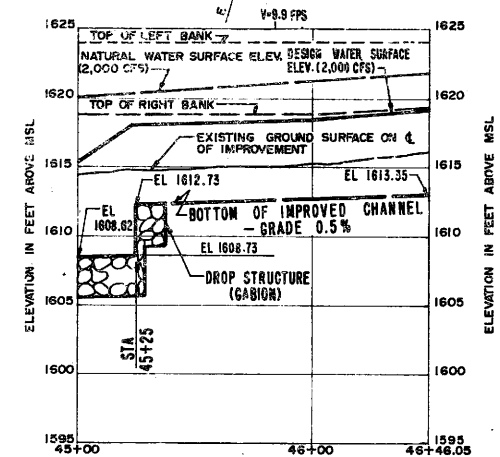


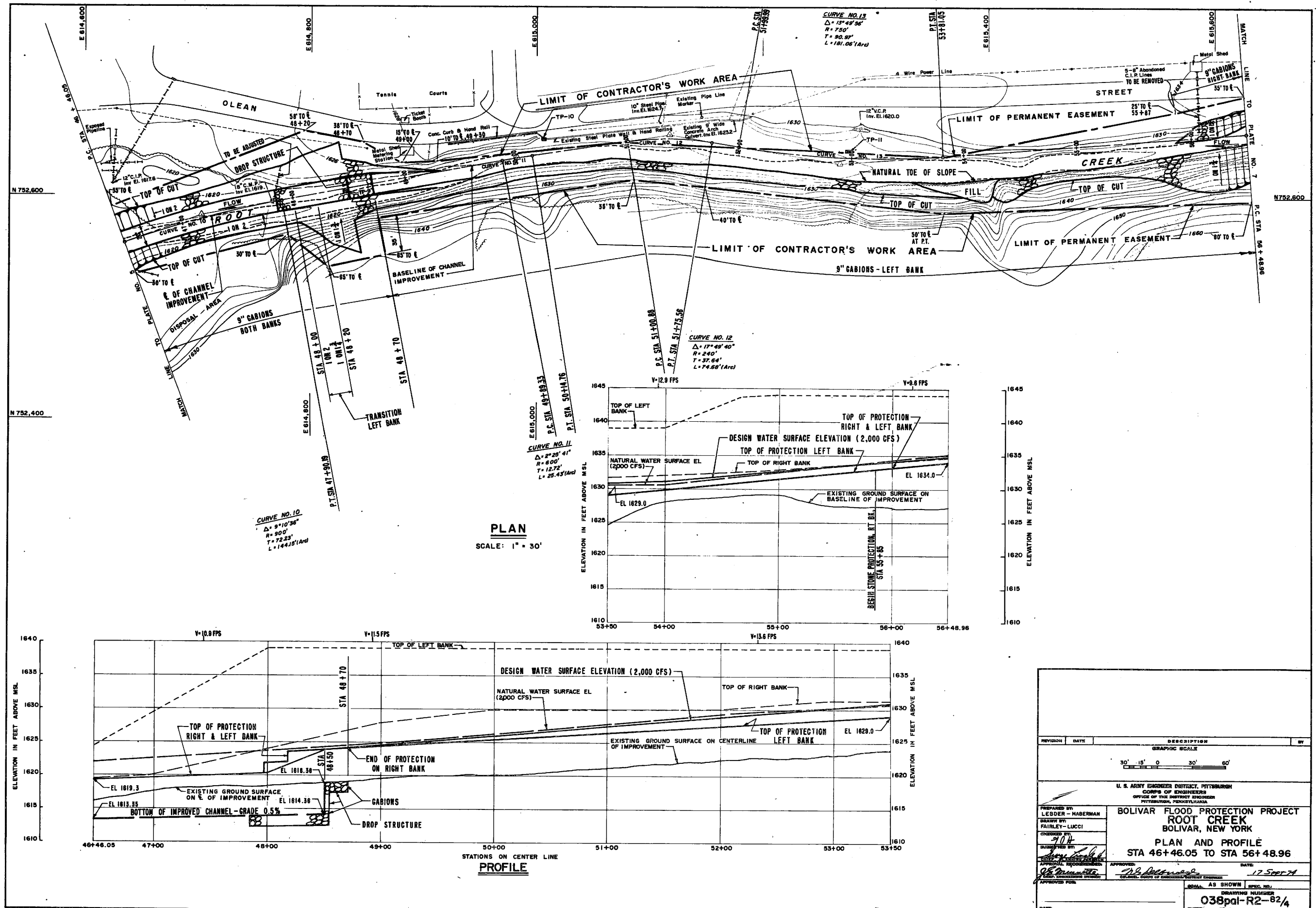




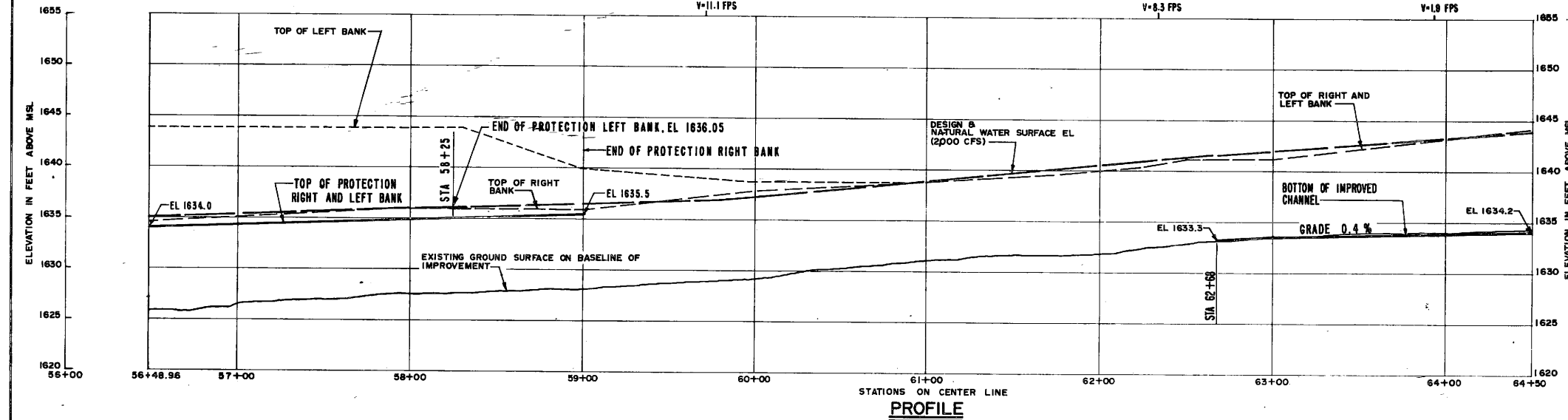
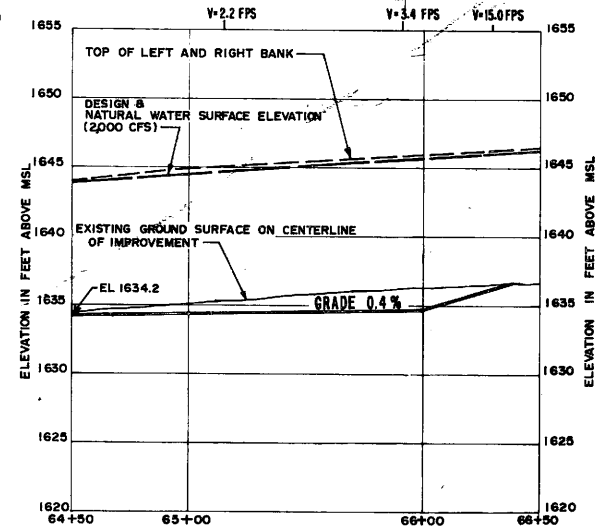
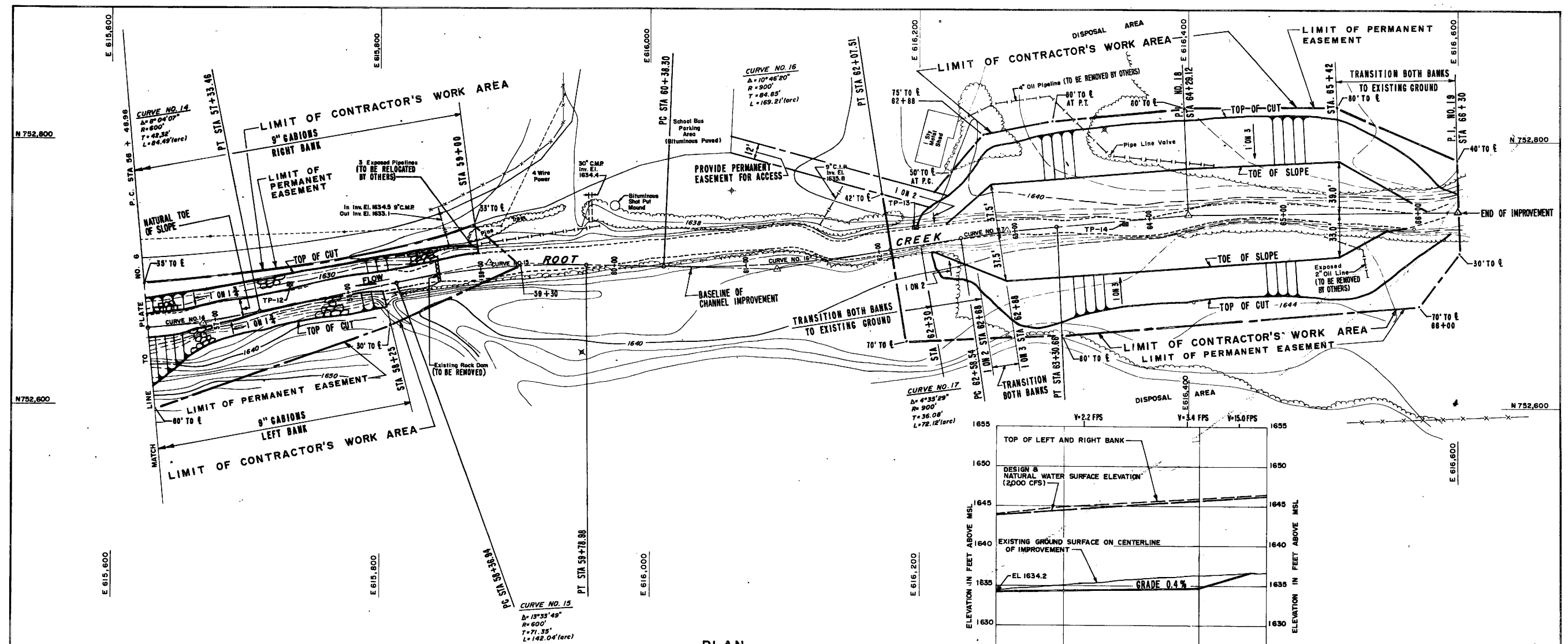


**PLAN**  
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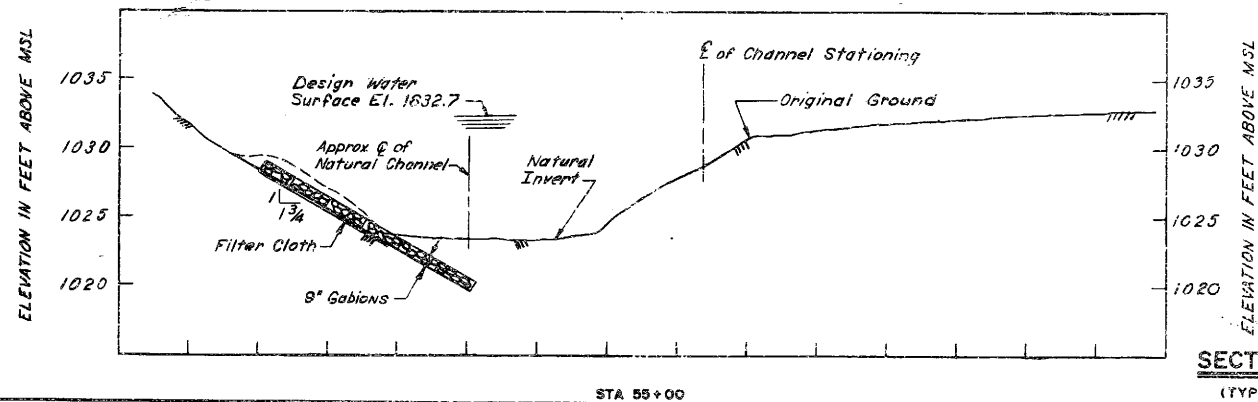
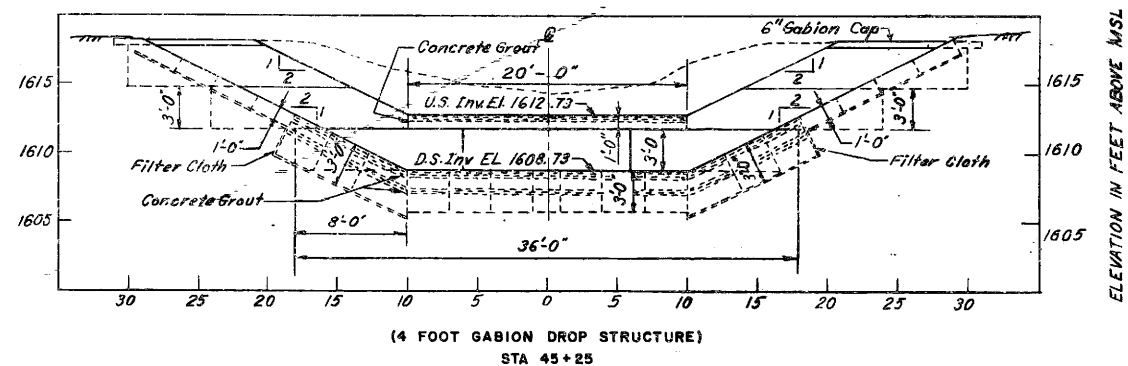
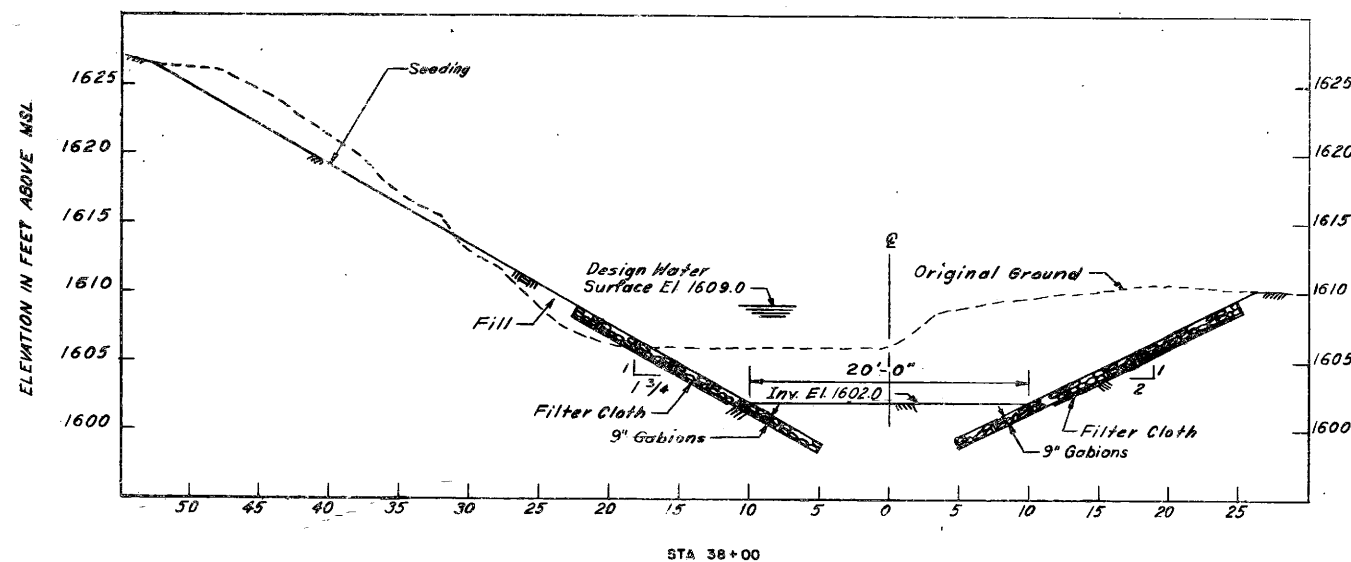
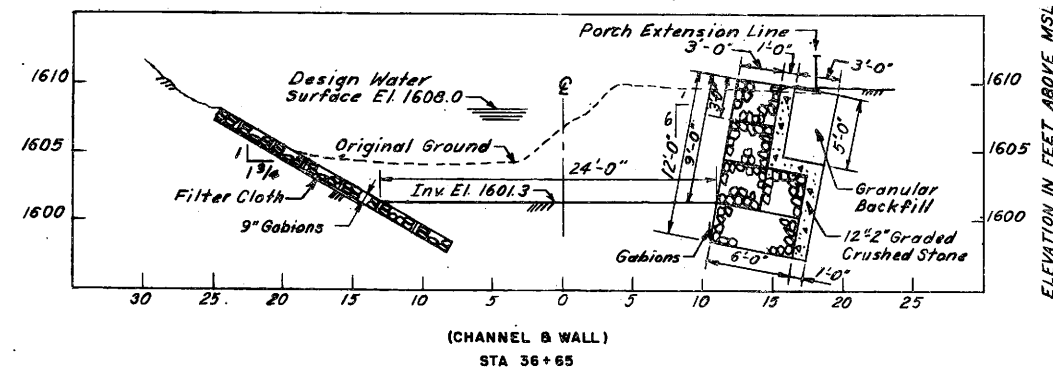
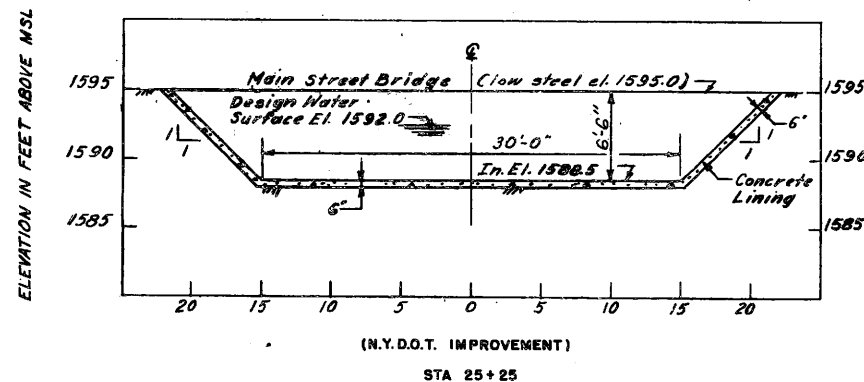
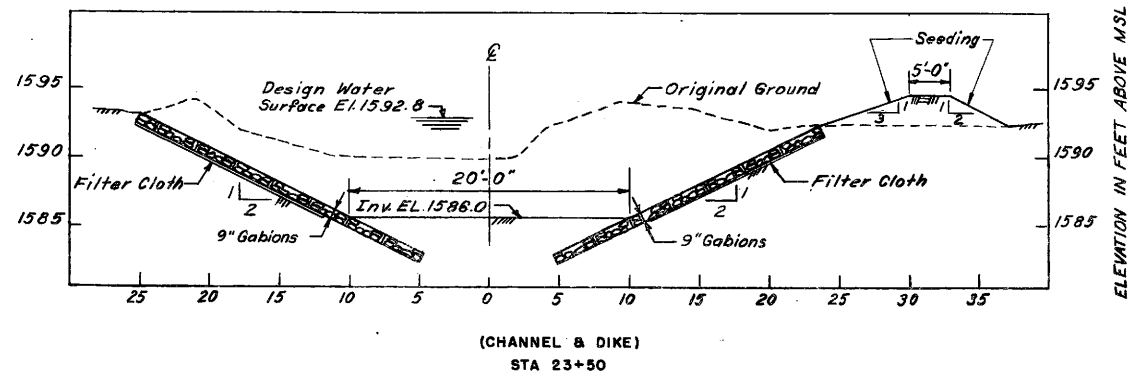
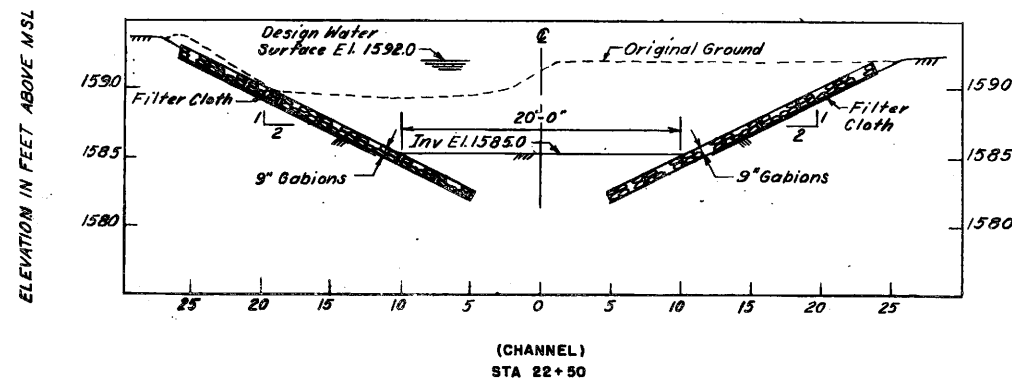








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<b>BOLIVAR FLOOD PROTECTION PROJECT</b> <b>ROOT CREEK</b> <b>BOLIVAR, NEW YORK</b> <b>PLAN AND PROFILE</b> <b>STA 56+48.96 TO STA 66+30</b>			
PREPARED BY: LEDDER - HABERMAN	DATE: 12 SEP 74		
DRAWN BY: FAIRLEY	DRAWING NUMBER: 038 pol-R2-82/5		
CHECKED BY: 9/14	SHEET OF		
APPROVED FOR: [Signature]			



REVISION	DATE	DESCRIPTION	BY
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AS SHOWN			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY HABERMAN		BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK	
DRAWN BY GRATZINGER		SECTIONS	
CHECKED BY 9/8/4		DATE 17 SEPT 74	
SUBMITTED BY J. S. Haberman		APPROVED FOR J. S. Haberman	
DATE 9/8/4		DRAWING NUMBER 038pal-R2-82/6	
APPROVED FOR		DATE	

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,080 E811,708		0°		14 NOV. 1973		TP-1		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1585.0	0.0						BROWN SANDY GRAVEL (GP) (SAND BAR)		TOP OF HOLE
1584.5	0.5						BROWNISH GRAY ORGANIC SILTY SAND (OL) W/TRACE GRAVEL AND ROOTLETS		
1582.0	3.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		
1579.7	5.3						GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		
1579.6	5.4						LIGHT BROWN SILTY SANDY GRAVEL (GM)		
1578.0	8.0						GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,088 E812,944		0°		13 NOV. 1973		TP-2		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1586.7	0.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		TOP OF HOLE
1583.7	3.0						BROWNISH GRAY SILTY SANDY GRAVEL (GM)		
1580.7	10.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,162 E813,381		0°		13 NOV. 1973		TP-3		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1601.5	0.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		TOP OF HOLE
1598.5	3.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF CLAY		
1592.0	9.5								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,274 E813,700		0°		14 NOV. 1973		TP-4		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1604.0	0.0						BROWNISH GRAY SANDY GRAVEL (GP)		TOP OF HOLE
1601.5	2.5						LIGHT BROWN SILTY CLAYEY SANDY GRAVEL (GC)		
1598.9	8.9								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,318 E813,938		0°		14 NOV. 1973		TP-5		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1608.2	0.0						GRAY GRAVELLY SAND (GP)		TOP OF HOLE
1604.2	4.0						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		
1598.2	10.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,348 E814,101 AT LEFT ABUTMENT DAVIS ST. BRIDGE		0°		15 NOV. 1973		TP-6		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1609.4	0.0						GRAYISH BROWN SILTY SANDY GRAVEL (GP)		TOP OF HOLE
1607.9	1.5						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		
1605.4	4.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,375 E814,000 AT RIGHT ABUTMENT DAVIS ST. BRIDGE		0°		14 NOV. 1973		TP-7		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1608.4	0.0						GRAYISH BROWN SILTY SANDY GRAVEL (GM)		TOP OF HOLE
1606.4	3.0						BROWN SILTY CLAYEY SANDY GRAVEL (GC)		
1604.4	5.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,477 E814,400		0°		15 NOV. 1973		TP-8		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1615.9	0.0						TOPSOIL		TOP OF HOLE
1614.4	1.5						GRAY SILTY SANDY GRAVEL (GP)		
1613.4	2.5						GRAYISH BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		
1611.9	4.0						GRAY SILTY SANDY GRAVEL (GM)		
1611.4	4.5						GRAYISH BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		
1609.9	6.0						BROWNISH GRAY SANDY GRAVEL (GP) W/TRACE OF SILT		
1604.9	11.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,803 E814,838		0°		15 NOV. 1973		TP-9		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1619.9	0.0						BROWN SILTY SANDY GRAVEL (GP) W/TRACE OF CLAY		TOP OF HOLE
1608.9	10.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,851 E815,000 AT W/S END OF RETAINING WALL		0°		16 NOV. 1973		TP-10		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1621.5	0.0						BROWN SILTY SANDY GRAVEL (GM)		TOP OF HOLE
1619.8	2.5						GRAYISH BROWN SILTY SANDY GRAVEL (GM) W/TRACE OF CLAY		
1617.0	4.5								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,841 E815,275		0°		15 NOV. 1973		TP-11		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1624.8	0.0						BROWN SANDY GRAVEL (GM) W/TRACE OF SILT		TOP OF HOLE
1622.1	2.5						BROWN SILTY FINE SAND (SM) W/FEW GRAVELS		
1619.8	5.0						BROWN GRAVELLY SAND (SP) W/TRACE OF SILT		
1618.6	8.0						BROWN SANDY GRAVEL (GP)		
1614.1	10.5								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,880 E815,733		0°		16 NOV. 1973		TP-12		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1629.2	0.0						BROWN SILTY SANDY GRAVEL (GM)		TOP OF HOLE
1628.2	3.0						GRAY SANDY SILTY CLAYEY GRAVEL (GC)		
1619.2	10.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,735 E816,187		0°		16 NOV. 1973		TP-13		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1633.0	0.0						BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		TOP OF HOLE
1623.0	10.0								BOTTOM OF HOLE

LOCATION		DIRECTION OF HOLE FROM VERTICAL		DATE HOLE STARTED		HOLE NO.		SIZE AND TYPE OF BIT OR SAMPLER	
N752,738 E816,932		0°		16 NOV. 1973		TP-14		J.D. 310 BACKHOE	
ELEVATION	DEPTH	LL	PL	VS	BLOWS PER FOOT	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CODE OF MATERIAL	REMARKS
1634.0	0.0						BROWN SANDY GRAVEL (GP) W/TRACE OF SILT		TOP OF HOLE
1628.0	6.0								BOTTOM OF HOLE

NOTE: Water was encountered at the top of all holes except TP-8 where it was encountered at 2.0' depth.

REVISION	DATE	DESCRIPTION	BY
GRAPHIC SCALE			
U. S. ARMY ENGINEER DISTRICT, PITTSBURGH CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER PITTSBURGH, PENNSYLVANIA			
PREPARED BY: N. IRR	DRAWN BY: N. BORDEN		
CHECKED BY: J. J. JAMES	APPROVED BY: J. J. JAMES		
BOLIVAR FLOOD PROTECTION PROJECT ROOT CREEK BOLIVAR, NEW YORK FOUNDATION EXPLORATION TEST PITS HOLES TP-1 TO TP-14 INCLUSIVE		DATE: 17 Sept 74	
SCALE: AS SHOWN		SHEET NO.: 038pal-R2-10/1	



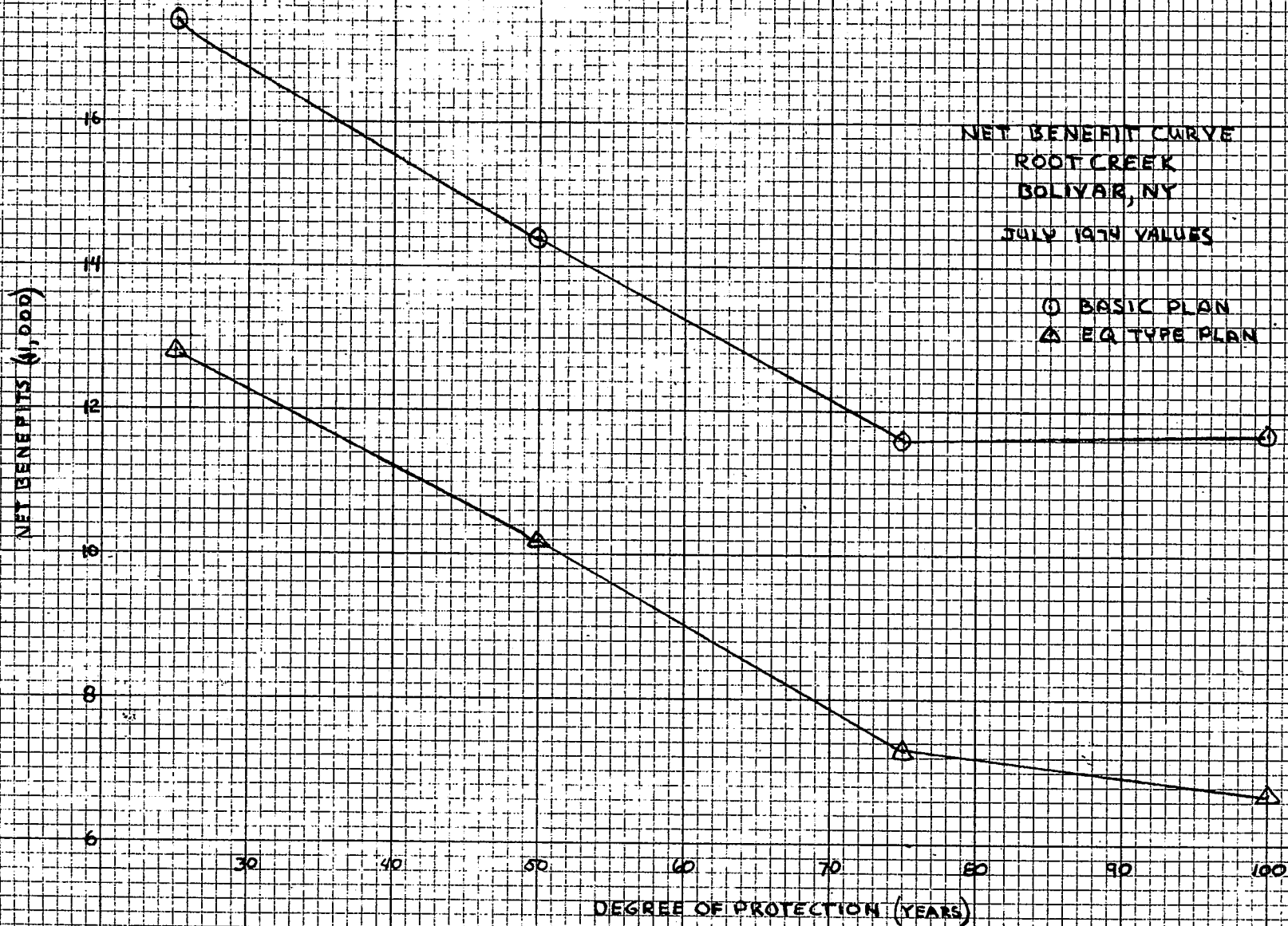
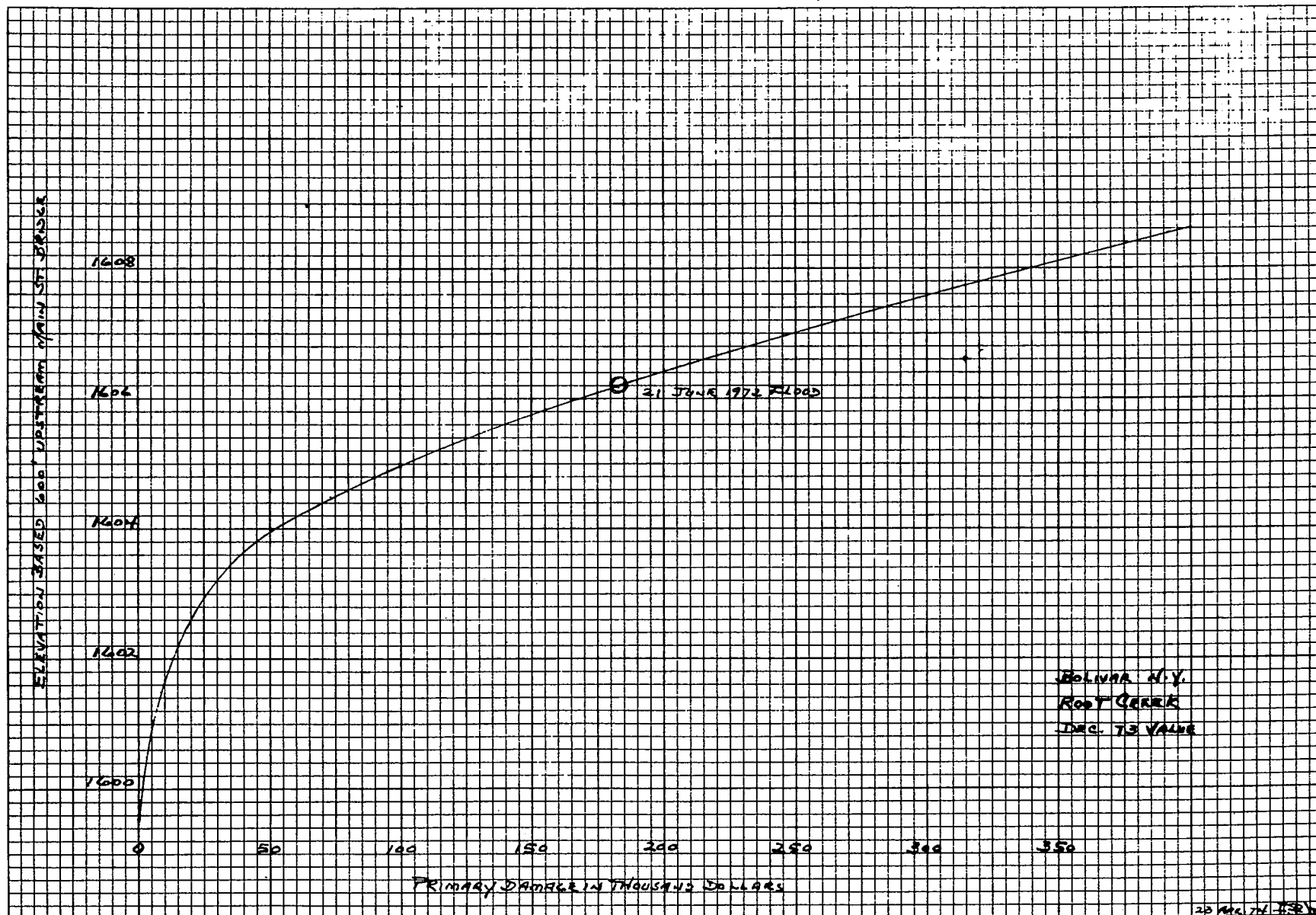


EXHIBIT A



**New York State Department of Environmental Conservation**

50 Wolf Road, Albany, New York ~~12201~~ 12233



OGDEN REID  
~~XXXXXXXXXXXX~~  
Commissioner

OFFICE OF PROGRAM DEVELOPMENT, PLANNING AND RESEARCH  
PROGRAMMING AND ANALYSIS BUREAU

February 11, 1975

Colonel Max R. Janairo, Jr.  
District Engineer  
Department of the Army  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

Dear Colonel Janairo:

This letter is with reference to the proposed Root Creek Flood Protection at Bolivar, New York. In our letter of January 13, 1975, we provided comments on the Draft Detailed Project Report and stated that the Department of Environmental Conservation is willing to provide the necessary assurances of local cooperation for any project that is engineeringly and environmentally sound and economically justified.

After sending that letter we received your letter of January 7, 1975, requesting a statement of willingness to comply with the terms of local cooperation for the proposed project. In telephone conversations with Messrs. DeMario and Haberman of your staff, we learned that your higher authority requires a letter of intent specifying those items of local cooperation appropriate to this project, rather than the general statement which we furnished.

It has been our practice in recent years to furnish letters of intent to participate in various projects whenever required without listing the specific items of cooperation. We feel that a general statement of intent to participate is sufficient until such time as it becomes necessary to enter into a formal agreement of local cooperation. The four other Corps of Engineers Districts with which we work have found the general letters of intent sufficient prior to execution of formal agreements.

EXHIBIT B



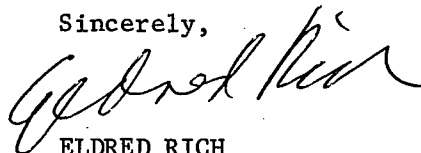
February 11, 1975

In view of the request from your higher authority that you obtain from us a more specific assurance of our intent, we reaffirm willingness to participate in a local protection project for Root Creek at Bolivar, New York, which is determined to be engineeringly and environmentally sound and meets local needs. Our participation will include the following items:

1. Provide without cost to the United States all lands, easements and rights-of-way including suitable borrow and spoil disposal areas as determined by the Chief of Engineers as necessary to the construction of the project, at a presently estimated cost of \$24,000.
2. Adjust utilities as necessary without cost to the United States.
3. Hold and save the United States free from damages due to the construction works and maintenance of the project excepting, however, damages due to the fault or negligence of the United States or its contractors.
4. Prescribe and enforce regulations to prevent obstruction or encroachment on channels and interior ponding areas which would reduce their flood carrying capacity or hinder maintenance and operation, and control development in the project area to prevent an undue increase in the flood damage potential.
5. Maintain the project works after completion in accordance with regulations prescribed by the Secretary of the Army.
6. At least annually notify interests affected that the improvement will not provide complete protection from floods greater than the design conditions.
7. Comply with Section 221 of P.L. 91-611.

In the future we prefer to furnish general letters of intent during preliminary phases of planning and design, as discussed above.

Sincerely,



ELDRED RICH  
Assistant Director for  
Programming & Analysis

RLK/ea

EXHIBIT B



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE  
BUREAU OF SPORT FISHERIES AND WILDLIFE  
John W. McCormack Post Office and Courthouse  
BOSTON, MASSACHUSETTS 02109

MAY 17 1974

District Engineer  
Pittsburgh District, Corps of Engineers  
New Federal Building  
1000 W. Liberty Street  
Pittsburgh, PA 15222

Dear Sir:

This letter is a supplement to our preliminary report dated February 27, 1974 on fish and wildlife aspects of the proposed Root Creek flood protection plan for Bolivar, Allegany County, New York. It has been prepared in view of additional information which you recently submitted to our Upper Darby, Pennsylvania office.

Since it is now clearly evident that the monetary costs involved with the construction of an upstream reservoir on Root Creek would be exceedingly high, we feel that our original recommendation calling for such construction cannot be reasonably justified.

As was also previously stated in our preliminary report, our main concern was centered upon potential adverse effects of project construction on the downstream trout fishery resource of Little Genessee Creek. Since the proposed plan of improvement for Root Creek would widen the existing channel, remove stream bank vegetation, and reduce stream flow velocities; increased water temperatures can be expected to occur, particularly during periods of hot weather and low stream flow. Such warming will increase water temperatures downstream in Little Genessee Creek to levels unsuitable for trout. Construction of a low flow channel along the shaded side of the stream bed would minimize warming of Root Creek flows during low flow periods. It will be necessary, however, to plant fast growing trees and shrubs along the excavated banks in order that stream shading be provided as rapidly as possible.

Consequently, to minimize the environmental risks associated with the warming of Root Creek, the Bureau of Sport Fisheries and Wildlife recommends that:

1. A low-flow channel be constructed along the shaded side of the excavated stream bed in Root Creek.
2. Fast growing trees and shrubs be planted along the excavated stream banks of Root Creek.

Please advise us of any action taken by your office regarding our recommendations.

Sincerely yours,

*Robert A. Shultz*  
Regional Director

ACTING





DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
AREA OFFICE  
GRANT BUILDING, 560 MAIN STREET, BUFFALO, NEW YORK 14202

March 1, 1974

AREA OFFICES  
Buffalo, New York  
Camden, New Jersey  
New York, New York  
Newark, New Jersey  
San Juan, Puerto Rico

REGION II  
REGIONAL OFFICE  
NEW YORK, NEW YORK

IN REPLY REFER TO:  
2.2PT

•Colonel N.G. Delbridge  
District Engineer  
Dept. of the Army  
Corps of Engineers  
Federal Bldg.  
1000 Liberty Ave.  
Pittsburgh, Pa. 15222

Dear Colonel Delbridge:

This office acknowledges receipt of your report letter dated December 11, 1973. Inadvertently the letter was sent to our Regional Office and time was lost in forwarding it to this office for a response.

We have completed our review of your plan for flood protection at Bolivar, New York. We have no objections to your proposed plan of channel improvement to provide protection from the 100 year flood at Bolivar, N.Y.

Sincerely,

*Frank D. Cerabone*  
Frank D. Cerabone  
Area Director

EXHIBIT D

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

700 East Water Street, Syracuse, New York 13210

March 13, 1974

Colonel N. G. Delbridge  
District Engineer  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

Re: Root Creek, Bolivar, N. Y.  
Detailed Project Report

Dear Colonel Delbridge:

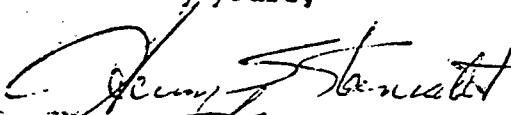
We have reviewed your memo describing the Section 205 project report currently being prepared for the flood problems connected with Root Creek in Bolivar, New York.

We note particularly your finding that a reservoir for 100-year protection, alone and in combination with channel work, is unfeasible. The other measures described would appear to be worthwhile alternatives to study in more detail.

The Soil Conservation Service does not have any project-type activities underway or planned that would affect this project.

We appreciate the opportunity to comment on this proposal.

Sincerely yours,



A. C. Addison  
State Conservationist

cc: Eudell F. Bivens, Watershed Planning Leader, SCS, Syracuse  
Eugene C. Hanchett, AC, SCS, Batavia, New York  
Kermit Kruse, DC, SCS, Belmont, New York





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

26 FEDERAL PLAZA

NEW YORK, NEW YORK 10007

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

MAR 12 1974

Dear Colonel Delbridge:

We have received your request for comments relative to your Detailed Project Report under preparation for a flood control project on Root Creek in Bolivar, Allegheny County, New York that would consist of channel widening and deepening, debris basin and channel drop structures and bridge reconstruction in coordination with NYDOT.

Our comments and questions are as follows:

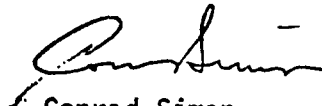
1. Has the NYDOT obtained permits to channelize the 600 feet of the creek involved in their project and for the construction of the bridge? Why is it necessary for the NYDOT to include channelization as a part of their project?
2. A more detailed description of the proposed project should be provided, including the number and location of drop structures, the size of the debris basin, the extent of the proposed widening and deepening, any easements or property purchases required, and the movement or removal of any buildings. Is the sheet pile wall indicated on sheet Number 2 already in existence, or is it yet to be constructed?
3. How often will maintenance of the channel be required? This can have a serious effect on the biota of the river through habitat destruction. The types and condition of the biota should be noted, the value, if any, of the stream as a fishery and/or source of recreation and the water quality. Is the stream used as a water supply?
4. The aesthetic values of the area at present and as they will be affected by the proposed system are also of importance.
5. A description of the frequency, height and extent of the flooding and damages incurred relative to those of the 100 year flood should be included.



6. Will the project affect the internal drainage of the village?
7. Where would the spoil from the stream banks and bed be deposited?
8. The extent of the construction impacts and inconveniences should be pointed out.
9. How serious would be the effect, in the downstream regions, of the storm water moving more quickly downstream?
10. Besides gabions, what other methods of bank stabilization could be used? Revegetating the area with dense growth could stabilize the soil and be more aesthetically pleasing than a rock filled mattress.
11. The consequences of additional development as a result of the project should be included. An increase in development would decrease the amount of infiltration, thereby increasing runoff and so flood water heights. This would lower the effect of the project, with less water causing higher floods.

We appreciate the opportunity to comment on the proposed project and hope our reply is of value to you.

Sincerely yours,



Conrad Simon  
Director

Environmental Programs Division



IN REPLY REFER TO:

# United States Department of the Interior

NATIONAL PARK SERVICE  
Mid-Atlantic Region

~~NORTHEAST REGION~~

143 SOUTH THIRD STREET  
PHILADELPHIA, PA. 19106

(MAR)PSA

APR 2 1974

Col. N. G. Delbridge, District Engineer  
Department of the Army  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

Dear Col. Delbridge:

Thank you for your letter and information concerning the Root Creek, Bolivar, New York flood protection project. Our principal concern in this matter would be historic and archaeological resources. Since the project involves channel work within a developed area, the chances of disturbing cultural values are not too great. However, the possibility that buried prehistoric sites may be present always exists. We, therefore, recommend that the project area be inspected by a professional archeologist to establish the presence or absence of cultural resources. Should such be found, they should be considered fully in the environmental impact statement.

Should you have any questions, please do not hesitate to contact Mr. Wilfred Husted, Archeologist, of this office.

Sincerely yours,

Benjamin J. Zerbey  
Acting Regional Director  
Mid-Atlantic Region



'76

Let's Clean Up America For Our 200th Birthday

EXHIBIT G



NEW YORK STATE PARKS & RECREATION South Swan Street Bldg. South Mall, Albany, New York 12223 Information 518 474-0456  
Alexander Aldrich, Commissioner

April 16, 1974

Department of the Army  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

ATTENTION: ORPED-P

Re: Root Creek, Bolivar, New York;  
Detailed Project Report

Gentlemen:

This office has reviewed the proposal for flood protection along Root Creek in Bolivar and a staff member has made an on-site inspection of the project area.

We have determined, as a result of the visit to the area, that no structures of historic or architectural merit will be affected. However, we are concerned with sites of archeological value in the area in question.

According to our files, several sites have been recorded in the vicinity of Root Creek, and we have been advised by a professional archeologist that it is very likely that there are more sites here than we have knowledge of at the present time.

We recommend, therefore, that prior to any construction a systematic survey be conducted by a recognized archeologist and that the presence or absence of archeological remains be fully reported.

We suggest that you contact either this office or Dr. Ellis F. McDowell, Anthropology-Sociology, SUNY College at Cortland, Cortland, New York 13045 for the names of archeologists who would be available to do such work.

Sincerely,

*Lewis C. Rubenstein*

Lewis C. Rubenstein  
National Register Supervisor  
Division for Historic Preservation

LCR:cak

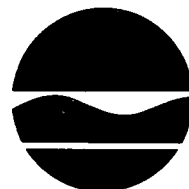
cc: Dr. Robert E. Funk, State Archeologist  
Ms. Ann Webster Smith, Compliance Officer, Advisory Council on  
Historic Preservation

EXHIBIT H



**New York State Department of Environmental Conservation**

50 Wolf Road, Albany, New York ~~XXXX~~ 12233



Ogden Reid  
~~XXXXXXXXXXXXXXXXXXXX~~  
Commissioner

OFFICE OF PROGRAM DEVELOPMENT, PLANNING AND RESEARCH  
PROGRAMMING AND ANALYSIS BUREAU

January 13, 1975

Mr. J. S. Minotte, Chief  
Engineering Division  
Department of the Army  
Pittsburgh District, Corps of Engineers  
Federal Building  
1000 Liberty Avenue  
Pittsburgh, Pennsylvania 15222

Dear Mr. Minotte:

We have completed our review of the Draft Detailed Project Report for the Root Creek Flood Protection Project, located in Bolivar, Allegany County, New York and have the following comments:

Section 73 of the Water Resources Development Act of 1974 states that a minimum of 80% of the costs of a non-structural solution to flood protection are attributable to the Federal Government. Non-structural alternatives should be considered on an equal basis with structural solutions. Alternatives examined should include flood-proofing and flood plain regulation, acquisition and relocation. We feel it is inadequate to consider only the possibility of privately-financed flood-proofing.

The section on flood insurance should be rewritten to reflect the changes in the 1973 Federal Legislation and the 1974 New York State Legislation (copy enclosed). The Village of Bolivar has been notified that it must participate in the Federal Flood Insurance Program. If the Village fails to meet the requirements for participation by its Federally mandated deadline, the State will take the necessary steps to insure Village participation in the program.

Our experience in project maintenance leads us to believe that your \$3000 estimate of annual maintenance costs is too low and that \$9000 would be a more accurate estimate. We estimate that channel maintenance will cost approximately \$5000 annually, while the removal of material from the debris basin approximately \$2500. It is mandatory that the debris basin be adequately maintained to insure the design life of the gabions. The balance of the costs is attributed to the unknown maintenance requirements of the gabion structures, because of this Department's unfamiliarity in maintaining gabions.

EXHIBIT I

January 13, 1975

The most efficient and inexpensive means of brush control is the use of chemical herbicides. Unfortunately, these chemicals are very corrosive. Although the gabions are vinyl coated, it is questionable whether the vinyl coating can be maintained during placement, normal maintenance operations or from abrasion and sheer of stream load. Either a more expensive and less efficient method of brush control will be required, or the design life of the gabions will be endangered by the use of corrosive herbicides. Maintenance of gabions is labor intensive and, therefore, expensive. It may be possible to minimize some of the wear to the gabions and maintenance expense by spoiling some of the fine material on the upper half of the gabions and seeding this covering.

We appreciate having the opportunity to comment on this draft report. We hope that the final DPR will answer or incorporate these comments. As always, this Department is willing to provide the required assurances of local cooperation for any project that is engineeringly and environmentally sound and economically feasible.

Sincerely,



ELDRED RICH  
Assistant Director for  
Programming & Analysis

ANG/ea  
Enclosure

BOLIVAR, NEW YORK  
LOCAL FLOOD PROTECTION PROJECT

\* ROOT CREEK

DETAILED PROJECT REPORT

APPENDIX I

HYDROLOGY



BOLIVAR, NEW YORK  
LOCAL FLOOD PROTECTION PROJECT  
ROOT CREEK  
DETAILED PROJECT REPORT  
APPENDIX I  
HYDROLOGY

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2	Climate	1
3	Temperatures	2
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8	Standard Project Flood

BOLIVAR, NEW YORK  
LOCAL FLOOD PROTECTION PROJECT  
ROOT CREEK  
DETAILED PROJECT REPORT  
APPENDIX I  
HYDROLOGY

SECTION I - BASIN CHARACTERISTICS

1. GENERAL TOPOGRAPHY

a. Root Creek is a tributary of Little Genesee Creek, which is a tributary of Oswayo Creek, which flows into the Allegheny River. Located in western New York in Allegany County, Root Creek enters the Little Genesee Creek at Bolivar, New York.

b. The Root Creek basin lies entirely in Allegany County, New York, and has its source at the Allegheny River basin's western divide at approximate elevation 2380. From this source, it flows for approximately 6.25 miles due west to where it enters Little Genesee Creek. The Root Creek basin has a total drainage area of 9.1 square miles and is approximately five miles long and two miles wide. The Root Creek basin and project location are shown on Plate 1.

c. The average channel slope is 60 feet per mile from the mouth to stream mile three. The slope then increases in the headwater portion to 125 feet per mile. The height of banks varies from 1 to 10 feet. Valley profiles are shown on Plate 2.

d. The Root Creek basin above the project has approximately 90 percent of its area in forest and the remaining 10 percent in open and developed land. The urban development is chiefly along the main stream. State Route 17 follows the stream along the valley.

SECTION II - CLIMATOLOGY

2. CLIMATE

a. The climate of the Root Creek area is temperate with a normal seasonal variation in temperature. The area is in a region of variable air mass activity; weather changes are usually gradual, but may have frequent and rapid changes resulting from passage of fronts associated with air mass movements. The normal percent of possible sunshine during the year varies from about 35 percent during the winter to about 60 percent in the summer. Precipitation equal to or greater than 0.1 inch occurs about 167 days per year and approximately 85 days per year during the construction season, May through November. Prevailing wind direction is from the west or has a westerly component.

b. A summary of climatology is presented in Table 1. The two stations used were selected as representative of the project area because of their close proximity to it. The information is based on data published in "Climatological Data" -- New York; "Climatic Summary of the United States", Section 81, Western New York (data up to and including the year 1930); "Supplement to the Climatic Summary for New York for the years 1930 through 1952"; "Hourly Precipitation Data" - New York for 1952 through 1972.

### 3. TEMPERATURES

The mean monthly and annual temperatures are fairly uniform throughout the basin of its small area. The normal daily average temperature varies from a minimum of 18.6° F. in January to a maximum of 64.9° F. in July. For the period of record, the highest temperature was 101° F. and the lowest temperature was -6° F. occurring in July and January, respectively. The temperatures for this basin are above 32° F. on the average of 225 days per year (frost free period) and above 90° F. about 10 days per year. (From "Climatic Atlas of the United States" June 1968).

### 4. PRECIPITATION

a. Precipitation data are available from the U. S. Weather Bureau Stations at Bolivar since June 1890 and at Wellsville, shown on Plate 1, since June 1955. These stations are located at the mouth of Root Creek and 12 miles east of Bolivar, New York, respectively. The mean monthly precipitation varies from a minimum of 2.18 inches in February to a maximum of 4.39 inches in June. Table 2 lists precipitation stations and pertinent data.

b. The late spring-summer rains frequently result from storms of convective or orographic origin. These types of storms are usually localized with high intensity cells and are of short duration. Precipitation during the fall, winter and early spring seasons is usually the result of the passage of low-pressure systems over the area. Wave disturbances along a quasi-stationary front produce an occasional period of prolonged precipitation.

c. The mean annual snowfall for this basin is approximately 100 inches. Continuous snow cover usually lasts for several weeks at a time and is not uncommon to last for two to three months.

## SECTION III - HYDROLOGY

### 5. STREAM GAGING STATIONS AND RECORDS

The first and only stream gaging station in the Root Creek basin was established in December 1972 when the Corps of Engineers installed a wire-weight gage at the Davis Street Bridge in Bolivar. No stage discharge



TABLE 1  
CLIMATIC SUMMARY

Station	Years of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<u>Mean Monthly and Annual Precipitation (Inches)</u>														
Bolivar	82	2.67	2.26	2.78	3.15	3.65	4.14	4.16	3.50	3.36	2.88	2.82	2.69	38.06
Wellsville	18	1.98	2.09	2.45	3.17	3.05	4.64	3.15	2.65	2.56	2.38	3.02	2.10	33.24
Mean for Basin		2.32	2.18	2.61	3.16	3.35	4.39	3.65	3.07	2.96	2.63	2.92	2.39	35.65
<u>Mean Temperature (Degrees Fahrenheit)</u>														
Bolivar	28 :1896-1925	22.9	22.1	32.9	43.8	54.5	62.5	66.7	65.1	58.6	48.7	37.1	25.9	45.1
Bolivar	3 :1970-1972	18.6	20.3	27.7	40.5	53.5	60.9	64.9	63.9	60.0	48.9	36.7	31.7	43.9

TABLE 2  
PRECIPITATION STATIONS

Station	County, N.Y.	Approx. Elevation	Records Available: From	To	Gage Type	Gage Operating Agency
Bolivar	Allegany	1580	Jun 1890	Date	:Recording	:U.S. Weather Ser.
Wellsville	Allegany	1510	Jun 1955	Date	:Recording : and Non- :Recording	:U.S. Weather Ser.

relation has been computed because of the brief period of record at the Davis Street gaging station but a discharge curve has been developed by backwater computation for a Damage Reference point 600 feet unstream of the Main Street Bridge. Stage discharge curves for natural and improved conditions are shown on Plate 3.

## 6. FLOOD OF RECORD

a. General - There have been no significant rises on Root Creek since the establishment of the present gage in December 1972. The only flood history available for this basin is based on high water marks, newspaper accounts and information obtained from residents of the area. A list of floods is shown in Table 3.

b. Storm and Flood of 23 June 1972 - "Agnes", the first hurricane of the 1972 season, formed as a tropical depression off the Yucatan Peninsula in the Gulf of Mexico at about 6 p.m. on 15 June 1972. At about noon of 19 June she made her landfall near Panama City, Florida. At noon on 22 June, "Agnes" was just off the New Jersey coast moving westward into northern Pennsylvania. Then after a slow loop in western and central Pennsylvania, a weakening "Agnes" moved north through New York State and was absorbed by the storm center over Pennsylvania. Total rainfall for the Root Creek basin for the period 20 June to 23 June was 12.09 inches with most of this rain occurring during the early part of 21 June.

TABLE 3

### HIGHEST KNOWN FLOODS

<u>Flood</u>	<u>Elevation at Main Street Bridge (ft. above m.s.l.)</u>
June 1972	1600.5
Feb 1959	1599.7
July 1970	1599.6
Sept. 1967	1599.6

## 7. FLOOD FREQUENCY

Since runoff records for Root Creek are non-existent, a regional analysis using basins with similar characteristics to Root Creek was used to develop a flood frequency at Bolivar. The flow frequency developed is shown on Plate 4. A flood stage frequency for the natural and improved conditions was developed by applying the flow frequency to the stage discharge relation. These curves are shown on Plate 5.

## 8. UNIT HYDROGRAPH

a. A synthetic three-hour unit hydrograph was developed for Bolivar with runoff distribution proportioned by basin area, shape, main channel length and slope to other basins having similar characteristics. The three-hour unit hydrograph for Root Creek is shown on Plate 6.

b. The unit hydrograph for Root Creek at Bolivar was used to reproduce the June 1972 storm hydrograph. The rainfall values recorded at Bolivar and Wellsville were averaged and assumed to be representative of the Root Creek basin. Infiltration rates, as determined by computations of the June 1972 storm over the upper Allegheny River basin, were used for the storm over Root Creek. The rainfall excess was applied to the unit hydrograph and the peak flow of 2200 c.f.s. agreed with the flow determined by backwater computations. The reproduced storm hydrograph is shown on Plate 7.

## 9. STANDARD PROJECT FLOOD

a. The standard project flood is defined as one which would be exceeded in magnitude only on rare occasions. It establishes a standard for design of structures that would provide a higher degree of flood protection without regard to economic or other practical limitations. The magnitude of the SPF is approximately 40 to 50 percent of the maximum probable flood.

b. The standard project flood for Root Creek, at Bolivar, has been adopted as the flood which would be caused by a storm with rainfall as set forth in Civil Engineering Bulletin No. 52-8, Office of Chief of Engineers, dated 26 March 1952, subject: "Standard Project Flood Determinations". On the basis of this rainfall, the standard project storm would have a maximum six-hour intensity rainfall of 11.18 inches and 17.03 inches in 24 hours. The total 4-day rainfall was computed to be 20.55 inches. Infiltration computed for storms in the upper Allegheny River basin, for the season in which the standard project flood would normally occur, has assumed to be applicable. The total assumed losses for the standard project flood were 2.33 inches with total runoff of 18.22 inches of which 16.58 inches would occur within 24 hours. The peak of the natural inflow hydrograph is 7,600 c.f.s. The standard project flood hydrograph is shown on Plate 8.

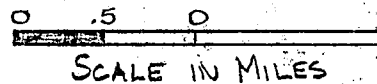
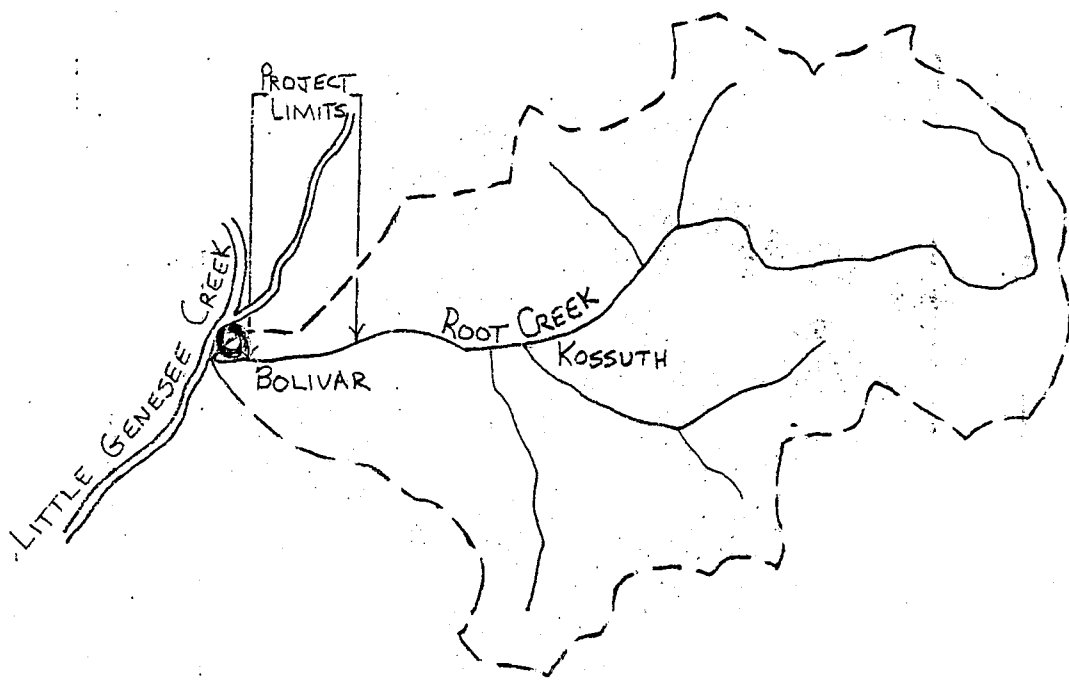
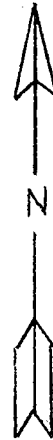
## 10. DESIGN DISCHARGE

The June 1972 computed flood discharge of 2,000 c.f.s. was used as the design discharge for the Root Creek project. This flood flow was derived from rainfall and unit hydrograph analysis. A check was made by using a backwater profile and actual high water marks.



## 11. NORMAL STREAM FLOW CHARACTERISTICS

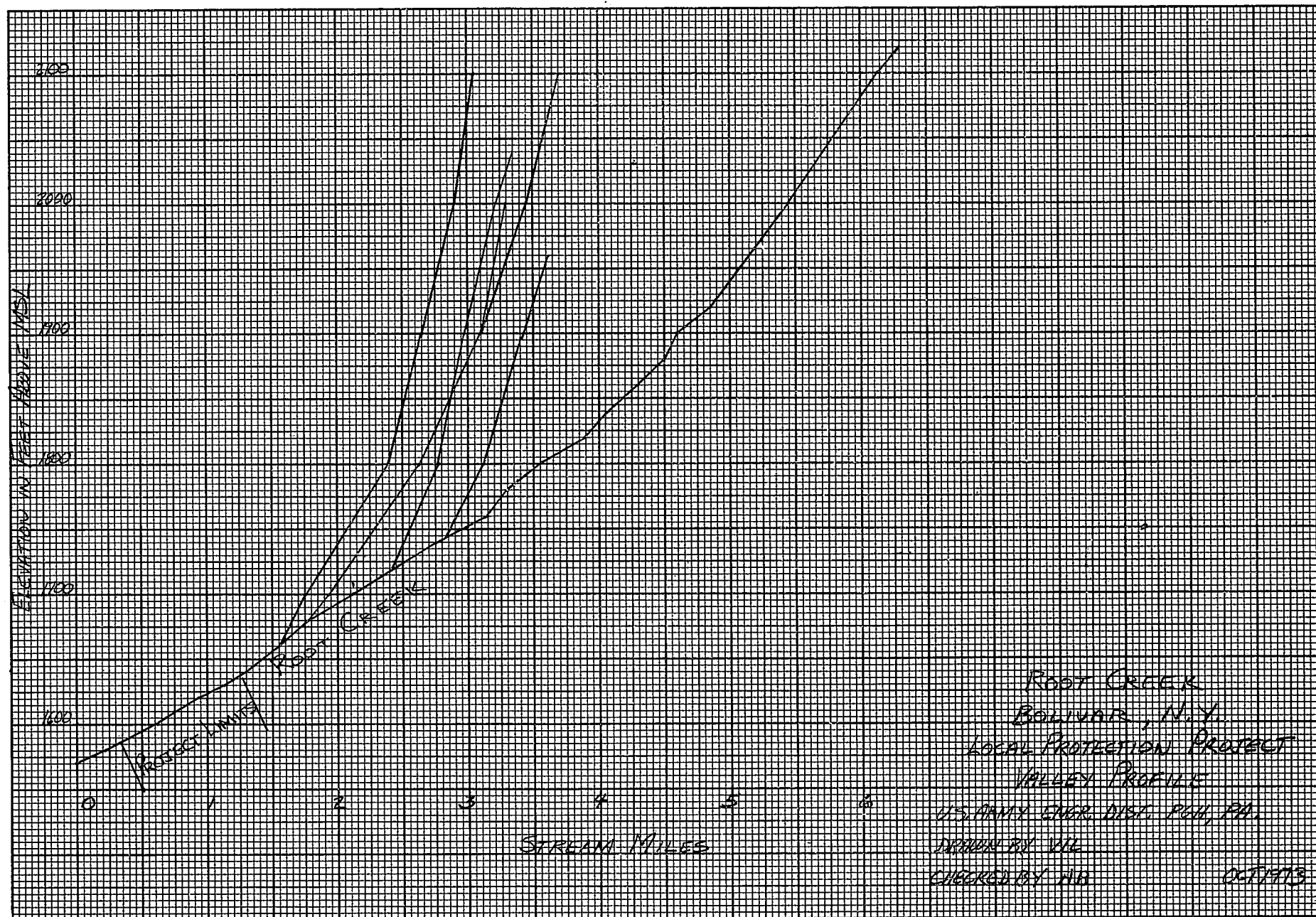
Root Creek is a perennial stream that often experiences low flow that exists through most of the summer. This low flow condition consists of 1"-3" of slow-moving water with several small, and often isolated shallow ponds that after a few days become stagnant.

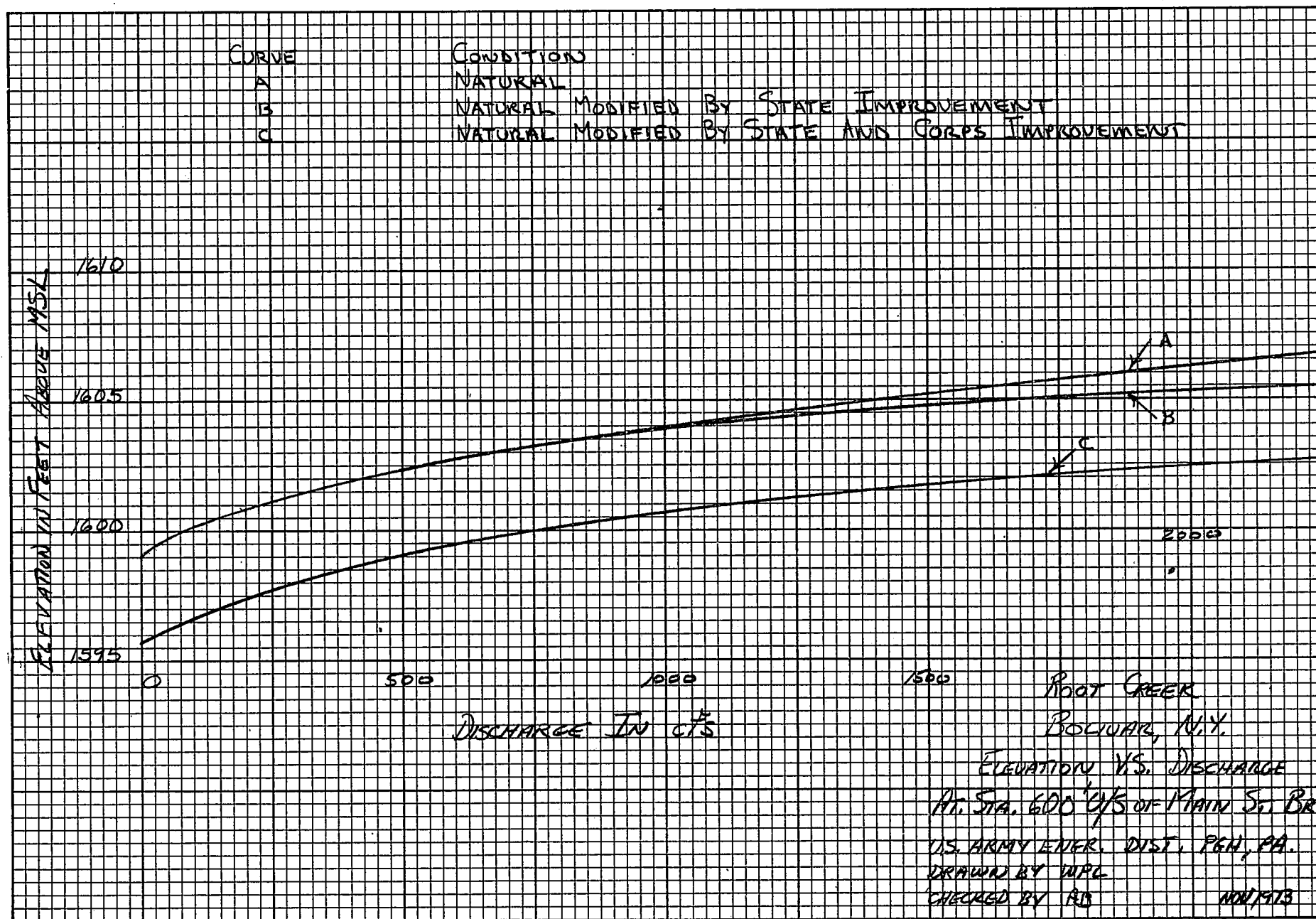


LEGEND

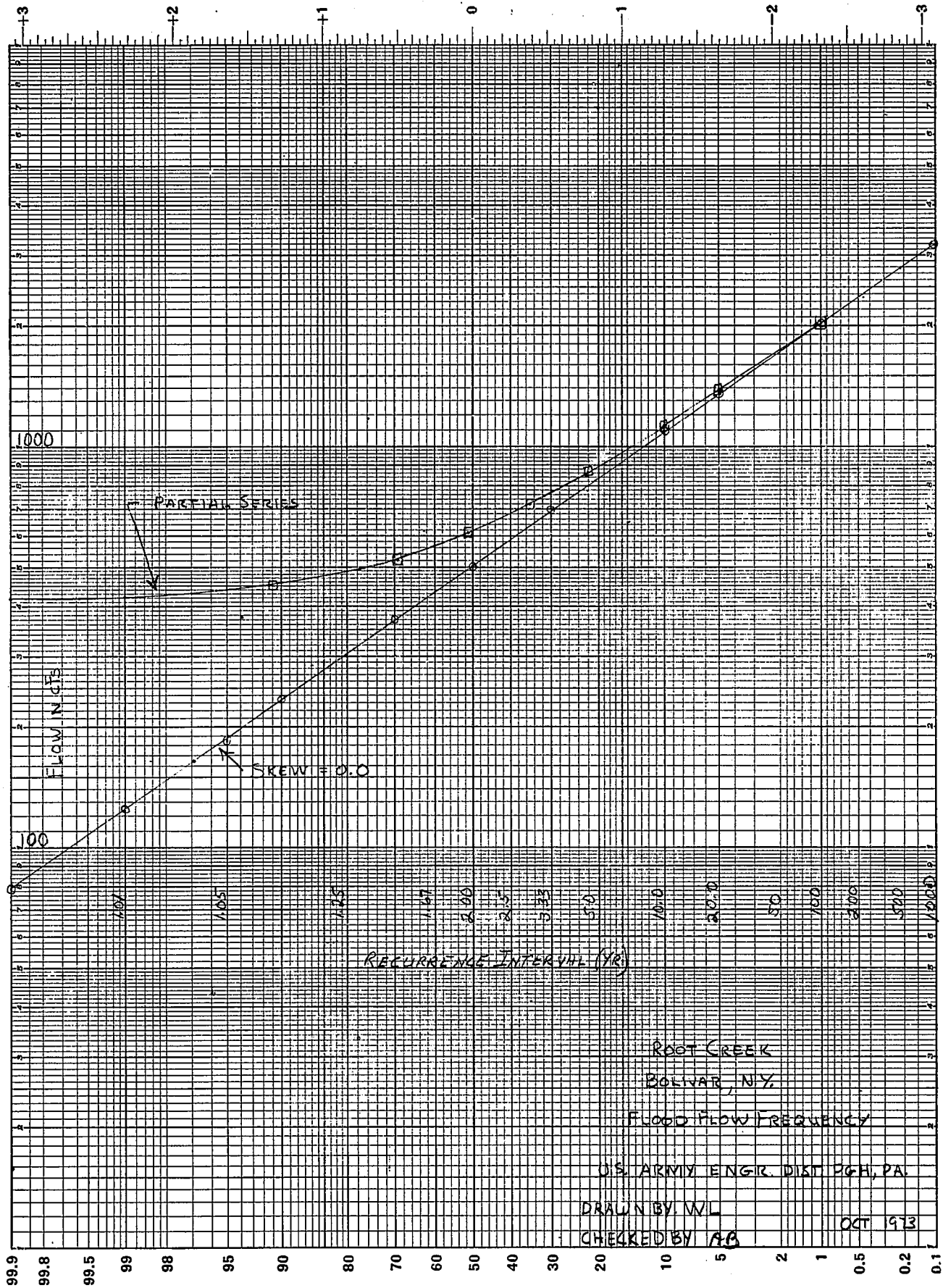
○ - PRECIPITATION STATION

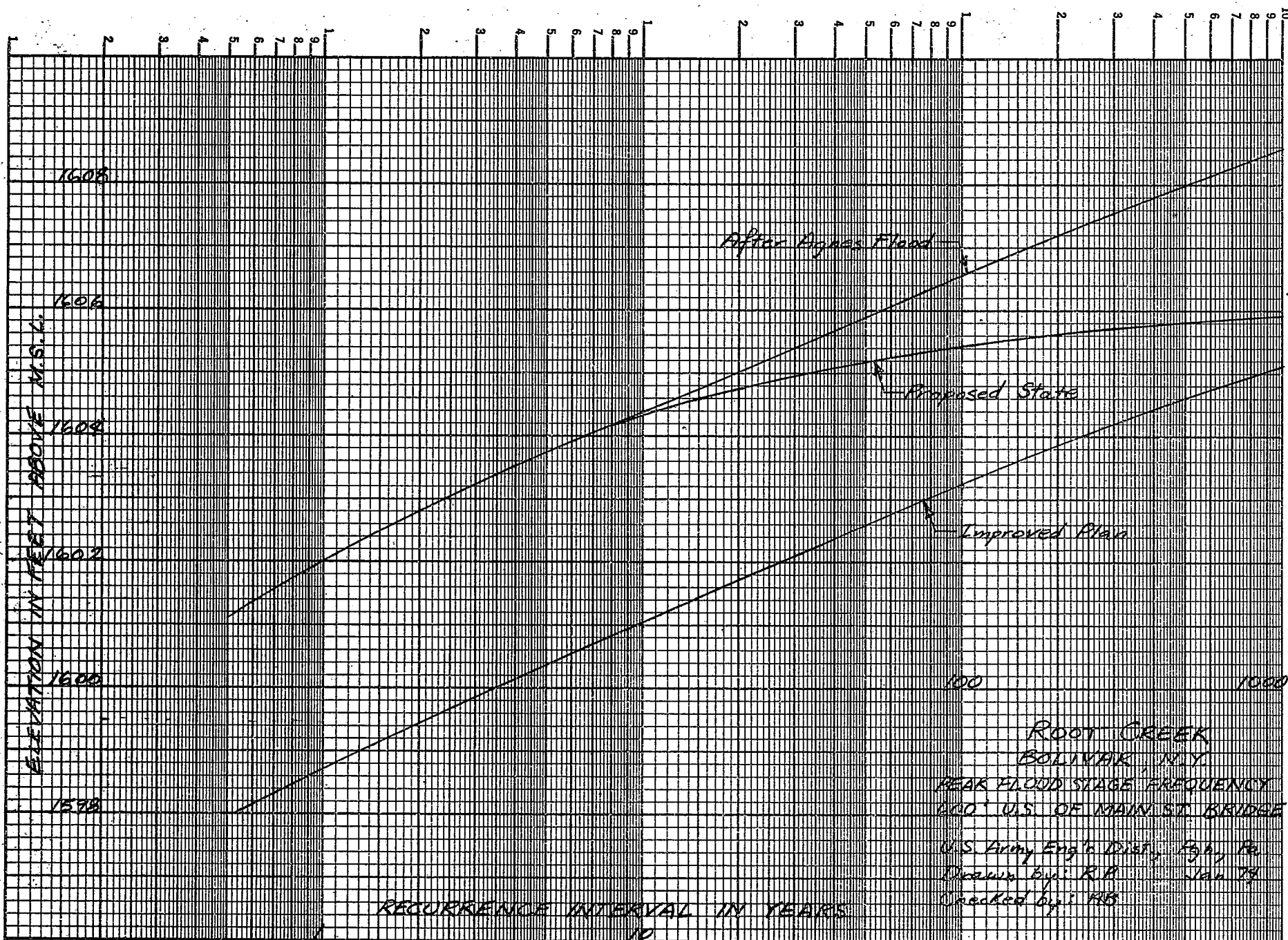
ROOT CREEK  
BOLIVAR N.Y.  
LOCAL FLOOD PROTECTION  
LOCATION MAP  
US ARMY ENGINEER DIST. P&H, PA.  
DRAWN BY WL  
CHECKED BY AR OCT 1973











RUNOFF  
 CFS  
 1000  
 500  
 0

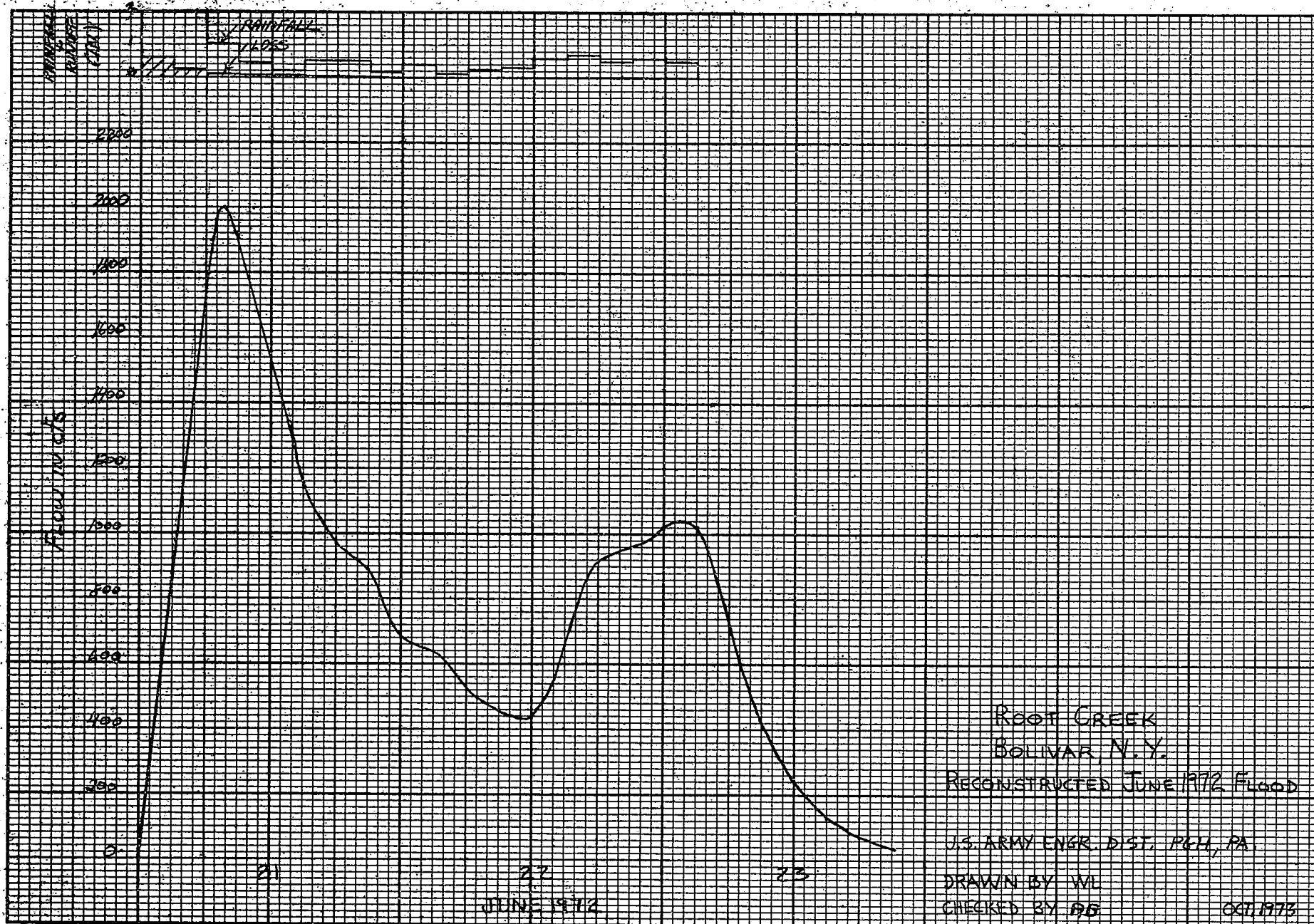
Q  
 1000  
 500  
 0

1200  
 1000  
 800  
 600  
 400  
 200  
 0

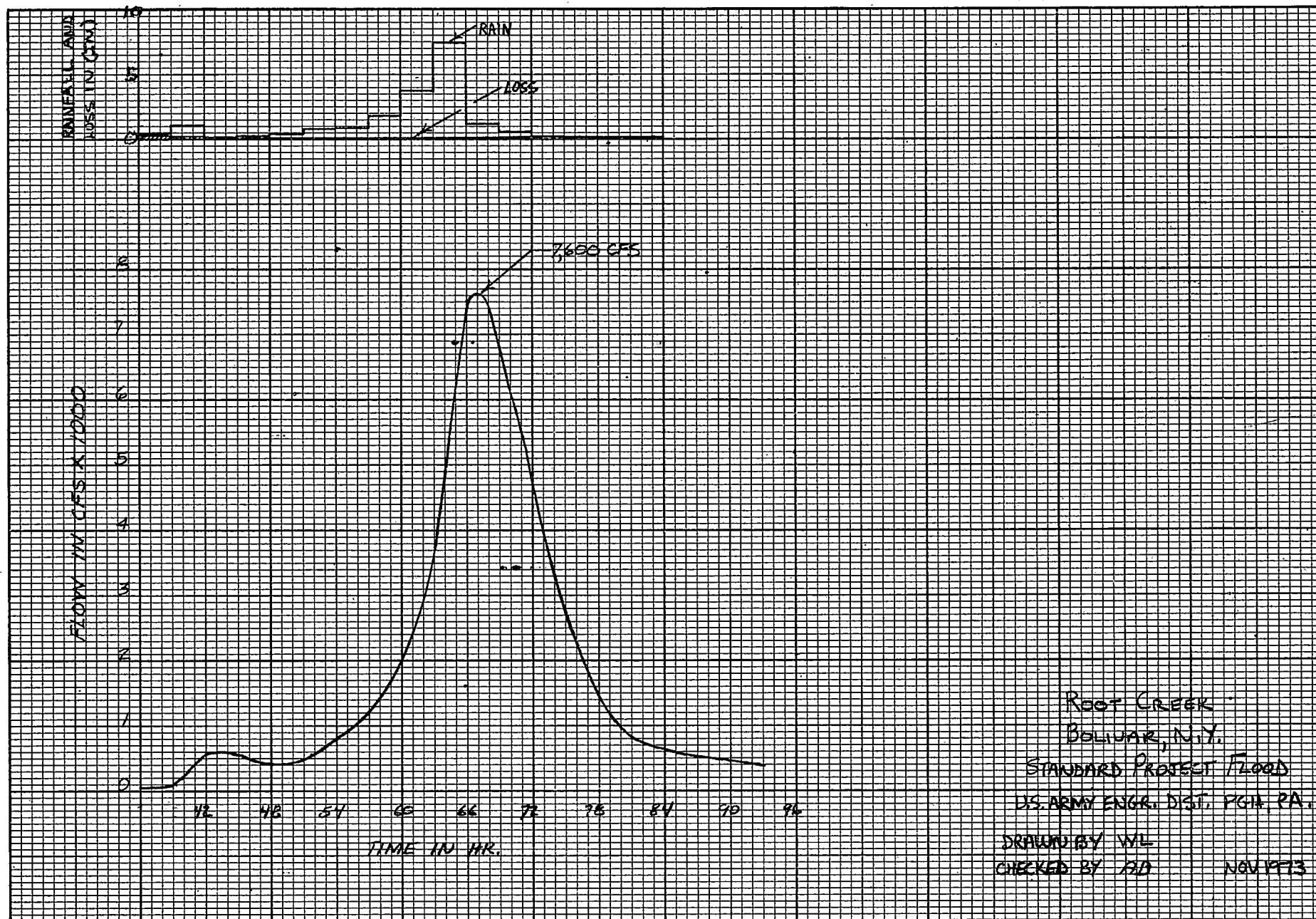
12 24 36 48  
 TIME IN HOURS

ROOT CREEK  
 BOLIVAR, N.Y.  
 3 HOUR UNIT HYDROGRAPH  
 U.S. ARMY ENGR DIST. PAH, PA.  
 DRAWN BY WIL  
 CHECKED BY 778  
 OCT 1973

PLATE 6 APPENDIX 1







BOLIVAR, NEW YORK

LOCAL FLOOD PROTECTION PROJECT

ROOT CREEK

DETAILED PROJECT REPORT

APPENDIX II

HYDRAULICS

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LOCAL FLOOD PROTECTION PROJECT  
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HYDRAULICS

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BOLIVAR, NEW YORK  
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HYDRAULICS

1. DESIGN DISCHARGE

The June 1972 computed discharge of 2,000 c.f.s. was adopted as the design flow. This flood flow was derived from rainfall and unit hydrograph analysis as explained in Appendix I, "Hydrology".

2. PROPOSED IMPROVEMENT

a. The channel would be excavated from station 16+20 to 48+50. The channel bottom width would be 20 feet wide with side slopes varying between 1 on 2 and 1 on 1.75 with an invert grade of one-half of one percent. Gabions would provide the necessary slope protection as shown on Plates 3-7 of the main report. A detailed discussion of the gabions together with other features of the project are covered in the main report under Section V, "Plan of Improvement".

b. The channel improvement would include a reach between station 24+20 and 28+57 which is to be constructed by the New York Department of Transportation in conjunction with the replacement of the Main Street Bridge. This would consist of a 30 ft. wide concrete-lined trapezoidal channel and a 4 ft. high drop structure.

c. Five gabion drop structures would be provided as shown below in paragraph 5, Table 1, to control the effective gradient and thereby reduce velocities and channel erosion without otherwise excessive excavation requirements.

d. Upstream from the project, a debris basin 75 ft. wide by 30 ft. long would be provided to trap a major portion of debris and bed load which otherwise would increase channel maintenance downstream.

3. MODEL TESTS

Model tests were not considered necessary for the design of this project.

4. HYDRAULIC PROFILE COMPUTATIONS

a. Water surface profiles for the design flow of 2000 c.f.s. and for a 1.3 year flow of 500 c.f.s. in the proposed channel improvement are shown on Plate 1 of this appendix. The natural profile for the design flow is



labeled, "Flood of June 1972 in August 1972 Channel". This was necessitated because of the significant bulldozing which took place shortly after the June 1972 flood to remove considerable deposition from the channel. Consequently, the natural profile represents existing conditions. Improved channel computations begin at critical depth at station 19+00 where higher flows break out of the channel at the end of the small rolled fill dike.

b. Hydraulic Elements - Hydraulic elements were obtained from soundings in the creek and topography along the banks, as shown on Plates 3-7 of the main report.

c. Profile Computations - Water-surface profiles before and after proposed improvement were obtained using Corps of Engineers computer programs developed for subcritical and supercritical flows.

(1) Flood of June 1972 - As mentioned above, the natural flood was translated to post-June 1972 channel conditions. Data on post-June 1972 roughnesses was derived from verification of the July 1970 flood (1200 c.f.s.) in the pre-June 1972 channel together with a field inspection of the post-June 1972 channel. The average channel roughness was judged to be 0.036 after the significant bulldozing and some realignment as compared to an average of 0.043 previously.

(2) Improved Scheme - An average "n" value of 0.033 was assumed for the proposed channel except where concrete is proposed by the State of New York. This would allow for alignment changes, channel bed roughening where unprotected, and for light vegetation to establish itself in the gabions on the slopes. The critical slope for this condition is 1.1% which is double the proposed channel slope of 0.5%. The adoption of 0.5% bottom gradient is intended to save on excavation and to provide depths greater than 1.1 times critical depth for flow stability.

(3) Losses - Friction losses were governed by the roughnesses previously given. Eddy losses were assumed to be 0.10 and 0.30 times the differences in velocity heads for contracting and expanding reaches, respectively, whenever encountered. Bend losses are not significant enough to be separated from friction losses and are included in the roughness coefficient.

## 5. GENERAL PROJECT DATA

a. The beginning and end of project improvement were established by economic and hydraulic considerations to provide maximum practical protection. Proposed reduction in flood heights are shown throughout the project on Plate 1 of this appendix. At the damage reference point, 600 ft. upstream from Main Street, the reduction would be about 3.4 ft. at design flow.

b. Two improvement schemes, labeled "200" and "250", are shown on Plate 1 of this appendix. The schemes are identical except for the profile between stations 24+15 and 33+00 which results from providing a 30 ft. wide crest at the drop at station 27+37 as proposed by the State of New York versus a 20 ft. wide crest. Hydraulically, scheme 200 is preferable over scheme 250 because the 30 foot crest (scheme 250) causes critical depth to form at the end of the return transition to the 20 foot channel, 50 feet upstream. This would initiate supercritical flow upstream from and across the drop whereas scheme 200 (20 foot crest at drop) holds control at the drop and at once builds a backwater curve upstream. Nevertheless, scheme 250, based on the State proposal should function satisfactorily since the channel downstream will be concrete lined.

c. Hydraulic jumps for the design flow (2000 cfs) and the 1.3 year flow (500 cfs) are tabulated on Plate 1 of this appendix. All jumps are weak or undular and have no special requirements other than proper length of pool. The lengths would be 4 times the conjugate depths for undular and 4.4 times for weak jumps. Special protection would be provided based on the low-turbulence charts of Hydraulic Design Criteria, HDC 712-1.

d. Velocities for the improved project would average about 8.7 ft./sec. for the design flow except where influenced by the drop structures where they would be higher. The comparative value for the 1.3 year flow would be 5.8 ft./sec.

e. As shown on Plate 1 of this appendix, the flow line for the improved design flow reverts to approximately natural conditions immediately because of the grade-restoring drop structure. Computations upstream from the project indicate that flow is essentially at critical depth except where the debris basin would be located. The velocities in the debris basin would average 2 ft./sec. for the design flow and 1.2 ft./sec. for 500 cfs, a 1.3 year flow. The basin should function effectively with these low velocities.

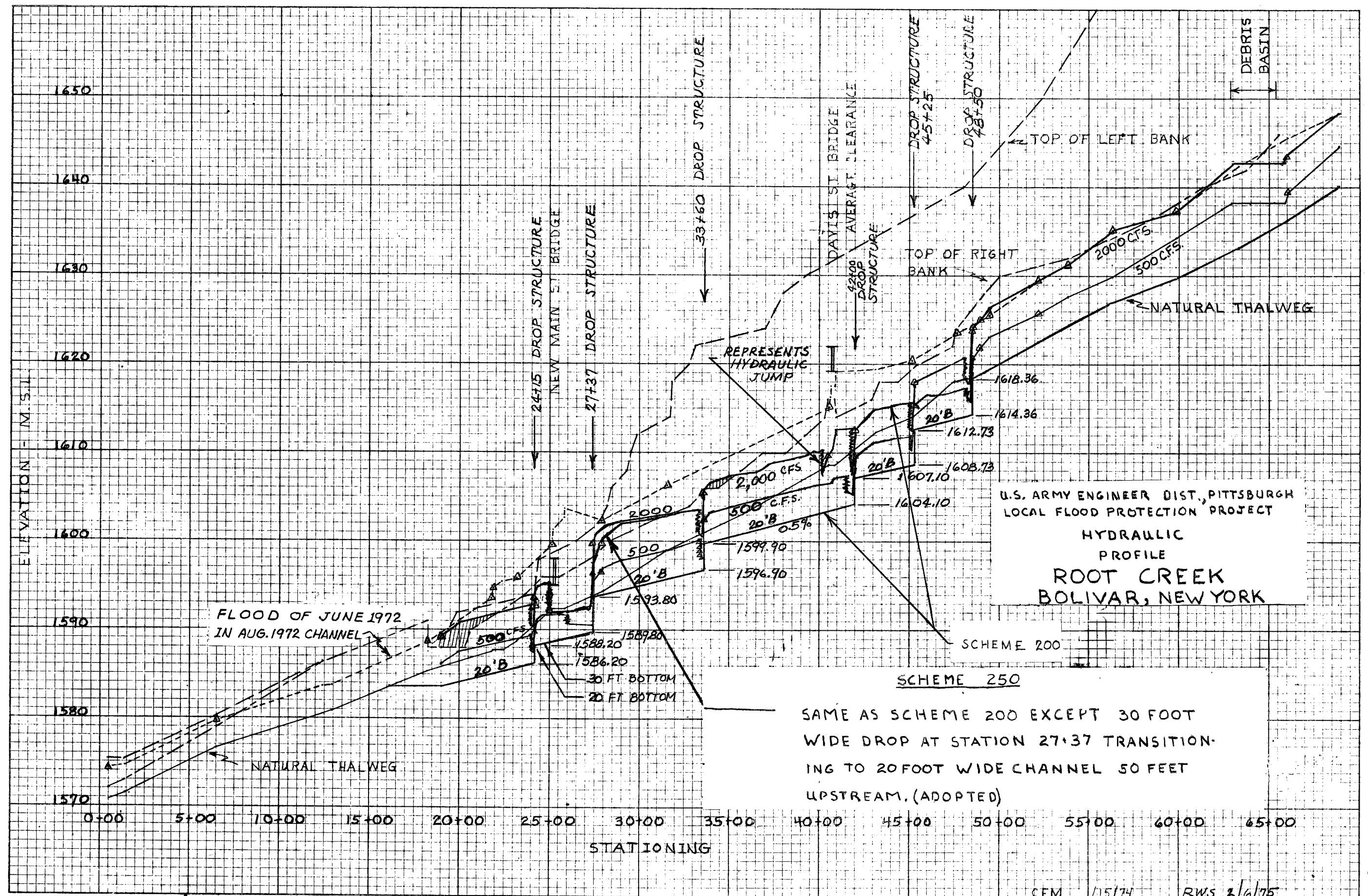
TABLE 1

## DROP STRUCTURES

<u>Station</u>	<u>Flow</u>	<u>Drop Height (feet)</u>	<u><math>V_1</math></u>	<u>F</u>	<u>Basin Action</u>
24+15	500	2	11.06	1.41	Undular
	2000		17	1.5	Undular
27+37 (State of New York)	500	4	9.40	1.28	Undular
	2000		17.54	1.65	Undular-Weak
33+60	500	3	9.53	1.33	Undular
	2000		17	1.5	Undular
42+00	500	3	8.4	1.1	Undular
	2000		20.75	1.9	Weak
45+25	500	4	12.2	1.62	Undular-Weak
	2000		17.4	1.5	Undular
48+50	500	4	9.6	1.15	Undular
	2000		16.7	1.4	Undular

## 6. OTHER SCHEMES INVESTIGATED

Other improvements which were investigated consisted of varying the bottom grade of the channel and/or siting drop structures at other locations to find the best scheme. More details on these schemes are provided in the main report.





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LOCAL FLOOD PROTECTION PROJECT  
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FOUNDATION INVESTIGATION

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LOCAL FLOOD PROTECTION PROJECT  
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FOUNDATION INVESTIGATION

1. EXPLORATION

There were 14 test pits excavated in November 1973 within the limits of the proposed improvement as shown located on Plates Nos. 3 through 7. The pits depths ranged between 4.5 feet and 11 feet, and were dug to determine the character of materials within the Root Creek channel. Jar samples were taken within each pit at pertinent intervals and sent back to the Pittsburgh District laboratory for visual classifications. Two bag samples representative of the channel material were also sent to the laboratory for visual classification and sieve analysis. Logs of the test pits are shown on Plate 9.

2. SOIL CLASSIFICATION

The channel materials, in general, are composed of 60% gravels, 30% sands, and 10% silts and clays, and classify as silty sandy gravel and clayey sandy gravel.

3. GEOLOGY

Bolivar is located on the maturely dissected Appalachian Plateau just south of the terminal moraine of the southern advancing Wisconsin ice sheet and within the small outwash valley of the Little Genesee Creek. The streambed of Root Creek (tributary to the Little Genesee Creek and flowing through Bolivar) consists of glacial outwash which is at least fifty (50) feet thick and generally composed of local flat and slabby heterogeneous gravels with scarce bedding features. The bedrock floor and walls of the valley are composed of horizontally bedded upper Devonian shales and siltstones at the very top of which are some remnants of Mississippian shales and thin sandstones. There are no bedrock outcrops within the project limits.

4. SLOPE STABILITY

a. The criteria for choosing safe design slopes for this project are principally founded on relating the natural bank geometry and soil composition to the desired bank geometry, and deducing as to whether stability has been improved, unchanged, or compromised. This approach was necessarily applied on the left bank in the three reaches between approximate Stations 29+00 and 42+00, 47+00 and 53+00, and 55+00 and 59+00, where the natural slopes are the highest (15 feet to 30 feet) and the steepest (30 degrees to 55 degrees). The soil composition within these reaches is uniform and about the same composition as that found in the creek bed, except

that the silt and clay content (at the expense of the cobble and gravel fraction) is probably 5% to 10% higher. Utilizing this information, a slope design cut of 1 vertical on 1-3/4 horizontal (30 degrees) was chosen as a safe economical cut within these three reaches on the left bank. In most areas this design improves slope stability and in no area does it compromise slope stability. Further, except as noted below, there are no structures or other improvements near the top of the slope.

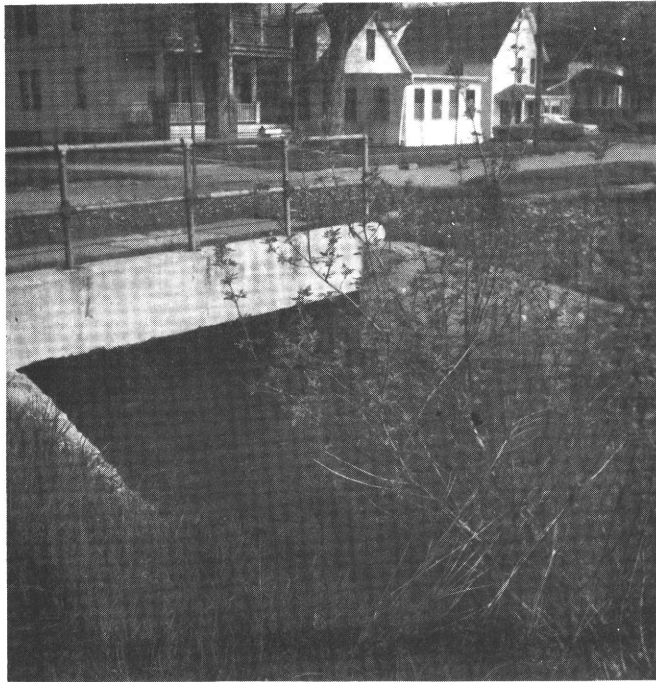
b. Particular attention, however, had to be paid to the reach on the left bank between Stations 31+75 and 33+50 where several structures stand close to the top edge of the natural embankment. Here, also, is found the most marginally stable section (Station 32+66 on the left bank) involving a two story frame dwelling surcharge on top of a 20 foot high embankment with a 50 degree to 55 degree natural slope. In order to determine whether the proposed channel improvement would jeopardize this particular reach, a relative stability analysis was performed on the critical section (32+66).

c. A critical circular arc failure surface was first found through this section without including the proposed channel improvement. Iterative calculations were then performed to determine the angle of internal friction needed (excluding the cohesive strength parameter) for a factor of safety of one. Phi was found to be 34 degrees. Employing this angle of internal friction, another critical circular arc failure surface was found for the section that included the proposed channel improvement. The soil mass and surcharge above this failure surface was safe by a factor of 1.65. This supports an intuitive conclusion that the proposed left bank channel cut within this area has been designed for enough away from the toe of the natural embankment so as not to aggravate the stability of that bank any further.

d. To reduce the possibility of the undisturbed natural embankment sliding into the new channel on its own and thus further jeopardizing the structures above (between Stations 31+75 and 33+50 on the left bank), a wedge of soil excavated from the new channel will be placed at a slope of 2 horizontal to 1 vertical against the natural embankment at its toe, wherever possible, to act as a counter weight and toe support. This support further increases the calculated stability (for arcs intersecting the new channel) of this slope section to 1.8.



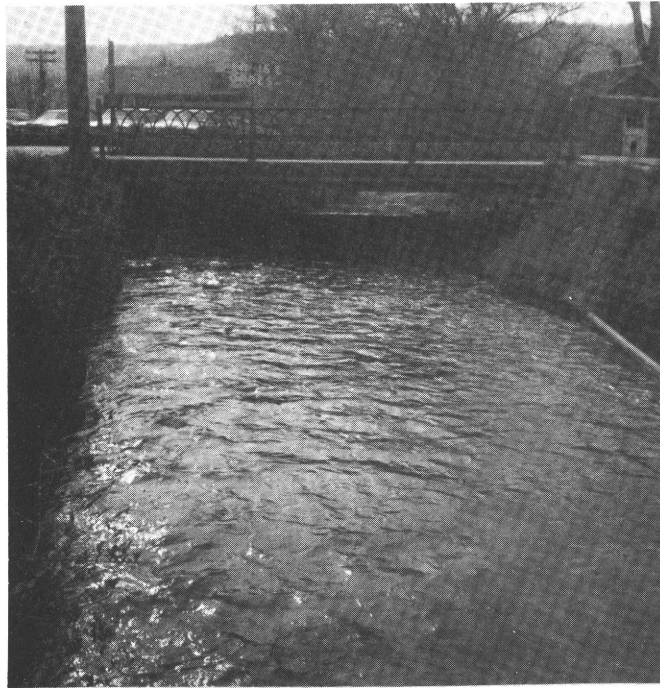
PHOTOGRAPHS



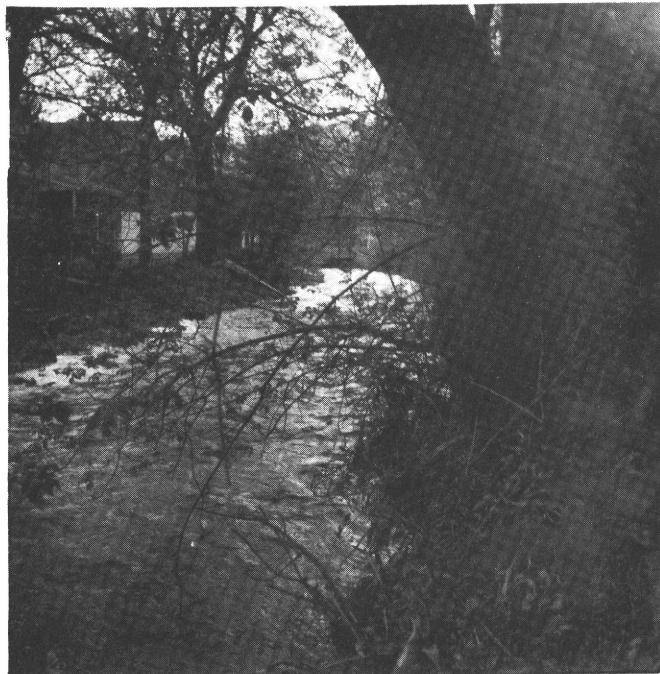
Station 22+00, First Street Bridge which is  
to be removed by NYDOT



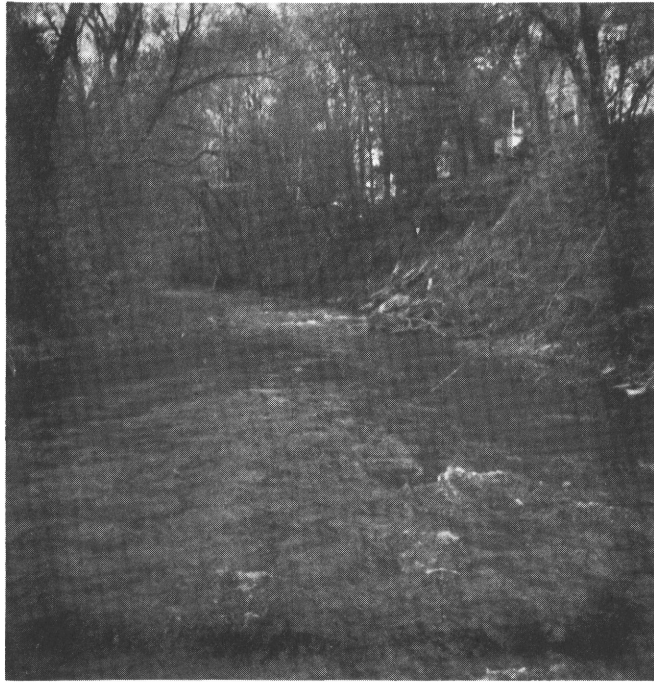
Station 21+00 to 19+00 - looking downstream



.Station 28+00 to 24+00 - looking downstream  
and the Main Street Bridge which is to be  
replaced by NYDOT



Station 24+00 to 22+00 - looking downstream



Station 32+00 to 34+00 - looking upstream



Station 32+00 to 28+00 - looking downstream





Station 45+00 to 42+00 - looking downstream



Station 42+00 to 38+00 - looking downstream  
and Davis Street Bridge



Station 54+00 to 48+50 - looking downstream



Station 45+00 to 48+70 - looking upstream



Station 64+50 to 62+50 - looking downstream  
(Area of proposed debris basin)



Station 58+00 to 55+00 - looking downstream