ALLEGHENY RIVER BASIN

CONEWANGO CREEK
WATERSHED PROJECT SITE 19

CATTARAUGUS COUNTY, NEW YORK
INVENTORY No. NY 579

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Conewango Creek Watershed Project Site 19 (Inventory Number NY-579), Allegheny River Basin, Cattaraugus County, New York. Phase I Inspection Report.

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NEW YORK DISTRICT CORPS OF ENGINEERS
SEPTEMBER 1979

George Koch
DECLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of the Site 19 dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. These problem areas are as follows:
1. Seepage encountered at the toe of the downstream slope near the left (north) abutment contact;

2. Erosion at the left abutment contact of the downstream face caused by runoff from the very steep abutment slope;

3. Incomplete structural stability investigations which did not include seismic and the observed seepage forces.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, exploration, sampling and testing of soils in the vicinity of the seepage, and investigation of its source. In addition, stability analyses are required concerning the influence of seismic and seepage forces as recommended by the Corps of Engineers' "Guidelines" for Seismic Zone 2. Investigation of the cause of the left abutment contact erosion and remedial measures to repair these areas and inhibit future erosion is also required. These investigations must be completed within 1 year of notification; with remedial measures completed within the following construction season. In addition, repair of the abutment erosion must be completed during this construction season.

The following remedial actions should be completed during this construction season:

4. Repair the eroded area of the left abutment above the crest of the dam;

5. Remove the rock outcrops at the outlet of the plunge pool to prevent backing-up of plunge pool outflow, and periodically clean the soil and debris which has accumulated in the internal drainpipes.

6. Remove all tree growth which would inhibit flow at the entrance and exit of the auxiliary spillway. Provide a program of periodic cutting and mowing of the dam and auxiliary spillway surfaces, including debris removal from storms;

7. Repair the eroded access road and periodically monitor the erosion of the side channel adjacent to Bowen Road; repair as necessary;

8. Periodically monitor the left (north) abutment slope for signs of erosion and repair as required;

9. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference;

10. Develop an emergency action plan.

The total discharge capacity of the spillways is adequate for the Probable Maximum Flood (PMF).
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.
ALLEGHANY RIVER BASIN
CONEWANGO CREEK WATERSHED PROJECT
SITE 19 DAM
NY 579
PHASE I INSPECTION REPORT

- ASSESSMENT

- OVERVIEW PHOTOGRAPH

1 PROJECT INFORMATION 1

1.1 GENERAL 1
   a. Authority 1
   b. Purpose 1

1.2 DESCRIPTION OF PROJECT 1
   a. Description of Dam and Appurtenances 1
   b. Location 2
   c. Size Classification 2
   d. Hazard Classification 2
   e. Ownership 2
   f. Purpose of the Dam 2
   g. Design and Construction History 2
   h. Normal Operating Procedures 2

1.3 PERTINENT DATA 2
   a. Drainage Area 2
   b. Discharge at Dam Site 2
   c. Elevation 2
   d. Reservoir 3
   e. Storage 3
   f. Dam 3
   g. Spillway 3
   h. Auxiliary Spillway 3
   i. Reservoir Drain 3

2 ENGINEERING DATA 4

2.1 GEOLOGY 4

2.2 SUBSURFACE INVESTIGATION 4

2.3 EMBANKMENT AND APPURTENANT STRUCTURES 4

2.4 CONSTRUCTION RECORDS 4

2.5 OPERATION RECORD 5

2.6 EVALUATION OF DATA 5
3 VISUAL INSPECTION

3.1 FINDINGS
   a. General
   b. Embankment
   c. Principal Spillway
   d. Auxiliary Spillway
   e. Reservoir Drain
   f. Downstream Channel
   g. Reservoir

3.2 EVALUATION

4 OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

4.2 MAINTENANCE OF THE DAM

4.3 WARNING SYSTEM IN EFFECT

4.4 EVALUATION

5 HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

5.2 ANALYSIS CRITERIA

5.3 SPILLWAY CAPACITY

5.4 RESERVOIR CAPACITY

5.5 FLOODS OF RECORD

5.6 OVERTOPPING POTENTIAL

5.7 EVALUATION

6 STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY
   a. Visual Observations
   b. Design and Construction Data
   c. Post Construction Changes
   d. Seismic Stability

7 ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT
   a. Safety
   b. Adequacy of Information
   c. Urgency
   d. Need for Additional Investigation

7.2 RECOMMENDED MEASURES
PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Conewango Creek Watershed Project Site 19 Dam
I.D. No. N.Y. 579

State Located: New York
County Located: Cattaraugus
River Basin: Alleghany
Stream: Battle Creek (tributary of Conewango Creek)
Date of Inspection: August 28, 1979

ASSESSMENT

The examination of documents and visual inspection of the Site 19 dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. These problem areas are as follows:

1. Seepage encountered at the toe of the downstream slope near the left (north) abutment contact;
2. Erosion at the left abutment contact of the downstream face caused by runoff from the very steep abutment slope;
3. Incomplete structural stability investigations which did not include seismic and the observed seepage forces.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, exploration, sampling and testing of soils in the vicinity of the seepage, and investigation of its source. In addition, stability analyses are required concerning the influence of seismic and seepage forces as recommended by the Corps of Engineers’ "Guidelines" for Seismic Zone 2. Investigation of the cause of the left abutment contact erosion and remedial measures to repair these areas and inhibit future erosion is also required. These investigations must be completed within 1 year of notification; with remedial measures completed within the following construction season. In addition, repair of the abutment erosion must be completed during this construction season.

The following remedial actions should be completed during this construction season:

4. Repair the eroded area of the left abutment above the crest of the dam;
5. Remove the rock outcrops at the outlet of the plunge pool to prevent backing-up of plunge pool outflow, and periodically clean the soil and debris which has accumulated in the internal drainpipes.

6. Remove all tree growth which would inhibit flow at the entrance and exit of the auxiliary spillway. Provide a program of periodic cutting and mowing of the dam and auxiliary spillway surfaces, including debris removal from storms;

7. Repair the eroded access road and periodically monitor the erosion of the side channel adjacent to Bowen Road; repair as necessary;

8. Periodically monitor the left (north) abutment slope for signs of erosion and repair as required;

9. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference;

10. Develop an emergency action plan.

The total discharge capacity of the spillways is adequate for the Probable Maximum Flood (PMF).

George Koch, Chief
Dam Safety Section
New York State Department of Environmental Conservation
NY License No. 45937

Approved By: Col. Clark H. Benn
New York District Engineer

Date: 28 Sep 79
PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CONEWANGO CREEK WATERSHED PROJECT
SITE 19 DAM
I.D. NO. NY 579
DEC #88-3797
ALLEGHANY RIVER BASIN
CATTARAUGUS COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority
The Phase 1 inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection
Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances
The Site 19 dam consists of a 480 foot long homogeneous earth embankment, 65 feet high, with a principal and auxiliary spillway. The upstream slope is 1 vertical on 3.0 horizontal, and the downstream slope is 1 on 2.5. A 10 foot wide berm is located on the upstream slope at elevation 1489. The crest width is 20 feet.

An internal drainage system is located under the downstream portion of the dam to control the phreatic surface and provide a safe outlet for foundation seepage. A cutoff trench is located at the dam centerline to reduce seepage.

The principal spillway is a drop inlet structure consisting of a 2-stage reinforced concrete riser, a 24-inch diameter reinforced concrete pipe conduit, a plunge pool, and an excavated outlet channel.

The 200 foot wide auxiliary spillway, located beyond the right (south) abutment, is designed as an earth cut with vegetation. The side slopes are 1 on 3 and the channel is 400 feet long.

A 12-inch diameter cast iron pipe with reinforced concrete inlet serves as a reservoir drain. The drain is controlled by a manually operated 12-inch flat frame slide gate, the stem of which extends to the top of the principal spillway riser; having stem guides located on the inside of the riser.
b. Location
The dam is located on Battle Creek, a tributary of Conewango Creek and the Alleghany River, southwest of the Village of Randolph, New York.

c. Size Classification
The dam is 65 feet high and is classified as "intermediate" in size (40 to 100 feet in height).

d. Hazard Classification
The dam is classified as high hazard, because of its location immediately above the homes along Bowen Road (County Rt. #8) and above the Village of Randolph.

e. Ownership
The dam is owned and operated by Conewango Creek Watershed Commission, Mr. Donald V. Crowell, President, R.D. #2, South Dayton, New York 14138.

f. Purpose of the Dam
The dam is a floodwater retarding structure.

g. Design and Construction History
The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS). Construction of the dam was completed in September 1971 by Northern Demolition Company, Buffalo, New York. The SCS office located in Syracuse has all design and construction information.

h. Normal Operating Procedures
Normal flows are discharged through the principal spillway. This structure has sufficient capacity to store and discharge a 100-year flood without use of the auxiliary spillway. Storms in excess of this flood will discharge through the auxiliary spillway.

1.3 Pertinent Data

<table>
<thead>
<tr>
<th>a. Drainage Area (sq. mi)</th>
<th>2.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of dam (feet)</td>
<td>65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. Discharge at Dam Site (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Known Flood</td>
</tr>
<tr>
<td>Spillway at Auxiliary Spillway Crest (El. 1523.8)</td>
</tr>
<tr>
<td>Spillway at Maximum Design Pool (El. 1526.3)</td>
</tr>
<tr>
<td>Spillway at Maximum Pool (El. 1529.6)</td>
</tr>
<tr>
<td>Maximum Capacity of Reservoir drains</td>
</tr>
<tr>
<td>Total Discharge, Max. Pool</td>
</tr>
<tr>
<td>Average Daily Discharge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c. Elevation (ft. above MSL-Datum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Dam</td>
</tr>
<tr>
<td>Max. Design Pool</td>
</tr>
<tr>
<td>Auxiliary Spillway Crest</td>
</tr>
<tr>
<td>Principal Spillway Crest</td>
</tr>
<tr>
<td>Invert of Low Stage Inlet</td>
</tr>
<tr>
<td>Invert of Reservoir Drain Inlet</td>
</tr>
</tbody>
</table>
d. Reservoir (acres)
   Surface Area Top of Dam 19.2
   Surface Area at Crest of Auxiliary Spillway 16.3
   Surface Area at Spillway Crest 10.3
   Surface Area at Invert of Low Stage Riser 3.1

e. Storage (acre-foot)
   Top of Dam 391
   Auxiliary Spillway Crest 289
   Principal Spillway Crest 114
   Low Stage Riser Invert 20

f. Dam
   Type: Homogeneous earth with keyed earth cutoff and internal drain.
   Length (ft.) 480
   Upstream Slope 1:3.0
   Downstream Slope 1:2.5
   Crest Width (ft.) 20

g. Spillway
   Type: Ungated reinforced concrete drop inlet (2' x 6') rising 41 feet above 24-inch diameter reinforced concrete pipe invert; length of pipe 348 feet; plunge pool.
   Weir Length (ft.) 12.0

h. Auxiliary Spillway
   Type: Single grass-lined earth channel having trapezoidal grass section.
   Bottom Width (ft.) 200
   Side Slopes 1:3.0
   Length of Level Section (in profile) (ft.) 50
   Exit Slope (ft./ft.) 0.028

i. Reservoir Drain
   Type: 12-inch diameter cast iron pipe with reinforced concrete inlet.
   Control: Manually operated vertical slide gate mounted along inside of principal spillway riser.
SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

The Conewango Creek Watershed Project Site 19 Dam is located in the glaciated portion of the Appalachian Uplands (northern extreme of the Appalachian Plateau) physiographic province of New York State. These uplands were formed by the dissection of the uplifted but flat lying sandstones, siltstones, and shales of the Late Upper Devonian Period (345 to 365 million years ago). The plateau surface is represented by flat-topped divides with drainage generally southward toward the Allegheny River system. Glacial cover is generally thin, the deposits of which have resulted from glaciations during the Wisconsin glaciation, approximately 11,000 years ago.

2.2 SUBSURFACE INVESTIGATION

A subsurface investigation was conducted by SCS in 1968. This program consisted of 15 drill holes and 12 test pits at locations along the dam, auxiliary spillway, structural elements, and borrow area. Applicable subsurface information is included in Appendix G, Drawings #17 & 18.

In general, the soils in the vicinity are of glacial till origin, sandy gravels and gravelly sands overlying interbedded gray shales and sandstones, the shale exhibiting a highly weathered zone where covered by overburden. Depth to bedrock is extremely variable and in some borings was outcropping. The permeability of the upper surface soils is slow to very slow. The permeability of the lower surface soils is medium to rapid due to the lower percentage of fines.

2.3 EMBANKMENT AND APPURTENANT STRUCTURES

The dam was designed and construction supervised by SCS. "As-built" drawings of this dam are on file at the SCS office in Syracuse, New York. Selected drawings of the dam and appurtenances are included in Appendix G. The dam is a 65 foot high, 480 foot long, homogeneous earth embankment, having an earth cutoff trench and an internal drain system running parallel to the axis of the dam and outletting near the end of the principal spillway conduit. A reinforced concrete riser with a 24-inch diameter reinforced concrete pipe conduit and a plunge pool serves as the principal spillway. The reservoir drain system consists of a 12-inch diameter cast iron pipe and manually operated slide gate; is located upstream of the riser. The auxiliary spillway is a 200 foot wide vegetated earth channel located at the right (south) abutment.

2.4 CONSTRUCTION RECORDS

Complete construction records are available from the SCS office in Syracuse. No major changes were incorporated during construction.
2.5 OPERATION RECORD

Since the dam is an ungated floodwater retarding structure, no operating records are maintained regarding water levels. During periods of extreme rainfall, SCS personnel do monitor the reservoir.

2.6 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from Mr. Donald Lake, Head of the SCS Design Section in Syracuse, New York. This information appears adequate and reliable for Phase 1 inspection purposes.
SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General
Visual inspection of the Site 19 dam was conducted on August 28, 1979. The weather was cloudy and the temperature ranged in the seventies. The water surface was approximately 7 feet above the invert of the low stage inlet of the principal spillway riser (El. 1497 f).

b. Embankment
No signs of distress were observed on the crest or slopes of the earth embankment (See photos #1 & 2). However, the following conditions were noted at the left (north) abutment contact:

1. Three seepage points were observed near the toe of the dam at the left abutment contact (See photo #11):

   Point #1: Appeared to be a potential "pipe" (i.e., a cylindrical hole approximately 2 inches in diameter), hole appeared to be directed horizontally toward the left abutment, flow rate 2 to 5 gpm (See photo #13);

   Point #2: Located approximately 2 feet below Point #1; flow was noted emerging vertically from beneath a rock, flow rate 2 to 5 gpm (See photo #12);

   Point #3: Located approximately 3 feet south of Points 2 & 3, flow emerging from soil in erosion area associated with the abutment contact erosion mentioned below, flow rate 1 gpm.

   In all cases, no particle migration or discolored flow was observed.

2. Approximately 50 feet downstream from the crest, erosion at the abutment contact was observed (See photos #9 & 10). This erosion had occurred during a recent intense storm. The erosion continued down to the toe of the dam where deposition of the embankment was noted (See photos #5, 8 & 10). The maximum depth of erosion is approximately 3 feet. The erosion was initiated by the heavy runoff and the concentration of flow at the abutment contact by the very steep abutment slope.
3. A snowmobile trail along the crest and up the left abutment has initiated erosion of the very steep abutment soil. The eroded material has been deposited on the crest of the dam (See photo #14).

The embankment slopes and crest are heavily vegetated and require mowing. The 2 internal drains which outlet at the toe of the dam on either side of the principal spillway conduit were partially blocked with debris and soil. This blockage is believed to be a result of the backing-up of plunge pool water due to the constricting of outflow by rock outcrops at the outlet of the plunge pool (See photo #5). After the blockage was removed at each pipe, the following flow conditions were observed:

4. Seepage from the left (north) drain is estimated to be 3 to 5 gpm, with no particle migration or discolored flow. (See photos #6 & 8)

5. Seepage from the right (south) drain is estimated to be 1 to 2 gpm, with no particle migration. (See photo #7) The flow was rusty in nature and was observed to surge periodically. Every 2 to 5 seconds, the flow stopped completely then resumed its full flow. This surging is believed to be related to the surface tension of the water in the perforations of the pipe during low flow conditions.

c. Principal Spillway
The principal spillway consists of a vertical drop inlet structure, a reinforced concrete pipe founded on bedrock, and a plunge pool (See photos #4, 5 & 5). These components appear to be satisfactory with the exception of debris from a recent storm on top of the riser and the constricted outlet of the plunge pool.

d. Auxiliary Spillway
The vegetated auxiliary spillway (earth cut section) is located beyond the right (south) abutment of the dam (See photos #1, 2 & 3). This channel appears to be stable. Heavy vegetative growth in the channel requires mowing. In addition, tree growth at both the entrance and exit of the channel must be removed.

e. Reservoir Drain
The 12-inch diameter reservoir drain and manually operated slide gate may be used to lower the reservoir. This system is reported to be operational.

f. Downstream Channel
The downstream channel below the plunge pool is the original channel of Battle Creek. While some erosion of a side channel running parallel to Bowan Road (County Rt. #8) was observed, the downstream channel appears to be in reasonable condition. Extensive erosion was observed in the pipe backfill for the access road to the dam as it passes over the aforementioned side channel.
g. Reservoir
There are no visible signs of instability or sedimentation problems within the reservoir area. However, do to the steep left (north) abutment slope and the erosion encountered at the abutment contact, periodic observation is required to monitor future erosion problems.

3.2 EVALUATION
The problem areas observed during the inspection and the recommended remedial action or investigation are as follows:

1. Investigate the observed seepage at the toe of the dam to ascertain the extent and type of remedial action required;

2. Investigate the erosion of the left abutment contact on the downstream face and initiate repairs to prevent further erosion;

3. Repair the eroded area of the left abutment above the crest of the dam;

4. Remove the rock outcrops at the outlet of the plunge pool to prevent backing-up of plunge pool outflow, and clean the observed soil and debris from the internal drainpipes. Remove the tree growth noted at the entrance and exit of the auxiliary spillway;

5. Provide a program of periodic mowing and cutting of the embankment and auxiliary surfaces, including debris removal from storms;

6. Repair the eroded access road and periodically monitor the side channel to insure that future erosion does not endanger the dam and appurtenances;

7. Periodically monitor the left abutment slope for signs of erosion;

8. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system;

9. Develop an emergency action plan for notification of downstream residents and the proper governmental authorities.
SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The normal water surface elevation is approximated by the invert of the low stage inlet of the principal spillway riser. Downstream flows are limited by the 24-inch diameter principal spillway pipe, except during extreme periods of runoff when the auxiliary spillway is in service. The dam provides 269 acre-feet of flood storage between normal water level and the crest of the auxiliary spillway.

4.2 MAINTENANCE OF THE DAM

The dam is maintained by the Conewango Creek Watershed Commission. Maintenance of the dam is not considered satisfactory as evidenced by the blockage in the internal drain system, heavy vegetation and tree growth, and erosion of the access road.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect or in preparation.

4.4 EVALUATION

The dam and appurtenances have not been maintained in satisfactory condition as noted in "Section 3: Visual Inspection".
SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed of the Site 19 dam was made using the USGS 7.5 minute quadrangles for Kennedy and Ivory, New York. The watershed consists of woodlands and fields situated in a rural section. Relief is generally steep. The drainage area is 1370 acres or 2.14 square miles.

5.2 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and storage of the reservoir was performed using the Corps of Engineers HEC-1 computed program, incorporating the "Snyder Synthetic Unit Hydrograph" method, and the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the PMF in accordance with the recommended "guidelines" of the U.S. Army Corps of Engineers.

5.3 SPILLWAY CAPACITY

The principal and auxiliary spillways are ungated structures. The principal spillway operates under weir or orifice flow conditions depending upon the floodwater inflow to the reservoir pool. The auxiliary spillway was analyzed as a broad-crested weir having a discharge coefficient (c) of 3.087.

The spillways have sufficient capacity for discharging the peak outflow from the PMF. For this storm, the peak inflow is 4569 cfs and the peak outflow is 4530 cfs. When the spillways are discharging the peak outflow, the water surface will be 2.6 feet below the top of the dam. The maximum spillway capacity is calculated to be 8242 cfs. Further information concerning this analysis is included in Appendix D.

5.4 RESERVOIR CAPACITY

Normal flood control storage capacity of the reservoir between normal pool level and the crest of the auxiliary spillway is 269 acre-feet which is equivalent to a runoff depth of 2.4 inches over the drainage area. Surcharge storage capacity to the maximum high water elevation is an additional 102 acre-feet, equivalent to a runoff depth of 0.9 inches. Total storage capacity of the dam is 371 acre-feet, equivalent to 3.3 inches of direct runoff.

5.5 FLOODS OF RECORD

The maximum known flood occurred on August 7, 1979. The pool level at this time was reported to be approximately 9 feet above the principal spillway crest. The estimated discharge for this flood is as follows:

<table>
<thead>
<tr>
<th>Elevation (USGS)</th>
<th>Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1520</td>
<td>75</td>
</tr>
</tbody>
</table>
5.6 OVERTOPPING POTENTIAL

Analysis indicates the total discharge capacity of the spillways is sufficient to prevent overtopping of the dam by the PMF.

5.7 EVALUATION

This dam has sufficient capability to impound and adequately discharge floodwaters expected to result from the PMF.
SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations
No signs of major distress were observed in connection with the earth embankment. However, seepage was noted at the left abutment contact on the downstream face near the toe of the dam which requires further investigation.

b. Design and Construction Data
Stability analyses were conducted by SCS in 1969 during the design of the dam. The analyses were performed using the Modified Swedish Circle Method, assuming soil parameters of \( \phi = 24^\circ \) \( c = 250 \) psf and \( \gamma_d = 125.2 \)pcf. An additional analysis was also conducted assuming parameters of \( \phi = 30^\circ \) \( c = 425 \) psf and \( \gamma_d = 129.2 \) pcf. The results of the stability analyses are as follows:

<table>
<thead>
<tr>
<th>Case</th>
<th>Minimum Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Full drawdown, upstream slope = 1:3</td>
<td>1.24</td>
</tr>
<tr>
<td>10' berm at elevation 1489.5, ( \phi = 24^\circ ), ( c = 250 );</td>
<td></td>
</tr>
<tr>
<td>2. Full drawdown, same conditions as Case #1, ( \phi = 30^\circ ), ( c = 425 );</td>
<td>1.75</td>
</tr>
<tr>
<td>3. Steady state seepage, downstream slope = 1:2.5; no drain or berm ( \phi = 24^\circ ), ( c = 250 );</td>
<td>1.07</td>
</tr>
<tr>
<td>4. Steady state seepage, same conditions as Case #3 with internal drain ( @ \ c/b = 0.6 ).</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Case 1, 3 and 4 were conducted using soil parameters which resulted from compaction to 95% of Standard Density. Case 2 was conducted using 100% Standard Density Soil parameters. During design, the following recommendations were incorporated in the design of the dam as a result of these analyses:

1. Construct a homogeneous earth embankment of gravelly till materials compacted to a minimum density of 100% of Standard to provide adequate strength;

2. Provide a 1:3 upstream slope with a 10-foot wide berm at the permanent pool elevation of 1489.5;

3. Provide a 1:2.5 downstream slope with an internal drain located at a distance equal to 0.6 times the base width from the upstream toe of the dam.

Using these design considerations, the calculated factors of safety for the dam are in excess of the minimum factors recommended by the Corps of Engineers. No analysis similar to Case 4 was conducted using soil parameters consistent with the recommended 100% Standard Density. However, comparison of the values obtained for the upstream face (Case 1 & 2) indicates that an analysis for
the downstream slope using these soil parameters would result in a safety factor well in excess of the 1.5 minimum recommended factor. The dam is, therefore, considered to have adequate factors of safety for stability.

A summary of the analyses is included in Appendix F.

c. Post Construction Changes
No major post construction changes were noted during construction of the dam.

d. Seismic Stability
The dam is located in Seismic Zone 2. No stability analysis was conducted considering the effect of seismic forces as recommended by the Corps of Engineers' "Guidelines". In light of the seepage encountered at the toe of the dam and the lack of a seismic analysis, it is recommended that additional stability analyses be conducted.
SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety
The Phase 1 inspection of the Conewango Creek Watershed Project Site 19 dam did not reveal conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas which if left uncorrected may have the potential for the development of hazardous conditions. These areas are:

1. Seepage encountered at the toe of the dam near the left (north) abutment contact;
2. Erosion of the left abutment contact from abutment runoff;
3. Incomplete investigation of the structural stability of the dam concerning seepage encountered during the inspection and seismic forces.

b. Adequacy of Information
The information reviewed is considered adequate for Phase 1 inspection purposes.

c. Urgency
Investigation of the problem areas listed above must be initiated as soon as possible and completed within 1 year of notification to the owner. In addition, repair of the erosion at the abutment contact must be completed during this construction season. Investigation of the seepage noted should include, but not be limited to, exploration, sampling and testing of the soils in the vicinity of the seepage, and investigation of its source. In addition, stability analyses are required concerning the influence of seismic and seepage forces as recommended by the Corps of Engineers’ “Guidelines” for Seismic Zone 2. Investigation of the cause of the left abutment contact erosion and remedial measures to repair these areas and inhibit future erosion is also required. Remedial action, as a result of the investigations, should be completed within the following construction season. The remaining recommended measures listed below should be completed during this construction season.

d. Need for Additional Investigation
To prevent the development of potentially hazardous conditions, investigations are required in the following areas:

1. Seepage investigation at the toe of the dam;
2. Control of erosion of the left abutment contact;
3. Structural stability analysis of the dam concerning seismic and seepage forces.
7.2 **RECOMMENDED MEASURES**

a. Results of the aforementioned investigations will determine the type and extent of remedial measures required.

The following improvements may be accomplished by maintenance forces:

b. Repair the eroded area of the left abutment above the crest of the dam.

c. Remove the rock outcrops at the outlet of the plunge pool to prevent backing-up of plunge pool outflow, and clean the debris and soil which has accumulated in the internal drainpipes.

d. Remove all tree growth at the entrance and exit of the auxiliary spillway. Provide a program of periodic cutting and mowing of the embankment and auxiliary spillway surfaces, including removal of debris from storms.

e. Repair the eroded access road and periodically monitor the ongoing erosion of the side channel adjacent to Bower Road (County Rt. #8).

f. Periodically monitor the left (north) abutment slope for signs of erosion and repair as required.

g. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain system. Document this information for future reference.

h. Develop an emergency action plan for notification of downstream residents and the proper governmental authorities.
APPENDIX A

PHOTOGRAPHS
Downstream and Upstream Face of Dam
Note Auxiliary Spillway in Background
Photo #2 A&B
Auxiliary Spillway Looking Downstream
Photo #3

Principal Spillway Riser
Photo #4
Plunge Pool
Photo #5

Outlet of Principal Spillway Conduit
Photo #6
Right Internal Drain
Photo #7

Left Internal Drain
Photo #8
Erosion at Left Abutment Contact Viewed from Crest
Photo #9

Erosion Viewed from Toe of Dam
Photo #10
Seepage Near Left Abutment Contact and Toe
Photo #11

Seepage Point #2
Photo #12
APPENDIX B

ENGINEERING DATA CHECKLIST
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<th>Item</th>
<th>Plans</th>
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Yes all on file at SCS office in Syracuse
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<td>Operation and Maintenance Records Operation Manual</td>
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APPENDIX C

VISUAL INSPECTION CHECKLIST
VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam: Caneawago Creek Watershed Project, Site 19

I.D. #: NY 579, DEC # 88-3791

Location: Town Randolph, County Cattaraugus

Stream Name: Battle Creek

Tributary of: Caneawago Creek & Allegheny River

Longitude (W), Latitude (N): 79°00'30" / 42°08'48"

Hazard Category: C, High

Date(s) of Inspection: 8/30/79

Weather Conditions: Cloudy, 70's

b. Inspection Personnel

Kenneth Harmer, Robert McCarty - DEC

Stephen Yorton, Dexter Case - SCS, Batavia

c. Persons Contacted

Donald W. Lake Jr., SCS, Syracuse

d. History:

Date Constructed: September, 1971 (complete)

Owner: Caneawago Creek Watershed Commission

Designer: Soil Conservation Service, Syracuse

Constructed by: Northern Demolition

Budals, N.Y.

2) Technical Data

Type of Dam: Earth Embankment

Drainage Area: 1370 Acres

Height: 65 ft

Length: 980'

Upstream Slope: 1:3.0

Downstream Slope: 1:2.5

ten ft. wide

6 arm at 1489 (use)
2) Technical Data (Cont'd.)

External Drains: on Downstream Face: None @ Downstream Toe: None

Internal Components:
- Impervious Core: None, Homogeneous Earth
- Drains: Internal
- Cutoff Type: Compacted Earth
- Grout Curtain: None
3) **Embankment**

a. **Crest**

1. **Vertical Alignment**
   - **good**

2. **Horizontal Alignment**
   - **good**

3. **Surface Cracks**
   - **none**

4. **Miscellaneous**
   - Snowmobile trail at left abutment near crest
   - Has initiated erosion of abutment - eroded material is piled on crest (see photo)

b. **Slopes**

1. **Undesirable Growth or Debris, Animal Burrows**
   - Debris from growth or burrows
   - Recent storm
   - None except mowing of area for auxiliary spillway

2. **Sloughing, Subsidence or Depressions**
   - See abutment # 3-5

3. **Slope Protection**
   - None apparent

4. **Surface Cracks or Movement at Toe**
   - **none**

5. **Seepage**
   - See abutment # 3-6
   - None evident on slopes

6. **Condition Around Outlet Structure**
   - **No slope protection for scour**
   - Sediment pond backs up into internal drains causing deposition of debris & soil in pipes.
c. Abutments

Good condition except for left downstream abut.

(1) Erosion at Embankment and Abutment Contact extensive at crest

from scorable trail, t very extensive from swale in original grade below crest. Max. depth 3 foot, about 50' from crest to toe.

(2) Seepage along Contact of Embankment and Abutment 

Three points observed at toe near outlet cond.-left all.

see sketch on next page (*5): Point #1, potential "pipe": cylindrical hole 2" in diameter; Point #2, seepage from under rock; Point #3, seepage from erosion area. Point #1: 2' max. Point #2: 2-5' max.

Point #3: 1 ypm, all flow appears clear, no line migration.

(3) Seepage at toe or along downstream face

none evident - pluvial pool may mark flow

recommend dropping level of water in pool for examination.

d. Downstream Area - below embankment

(1) Subsidence, Depressions, etc. none

(2) Seepage, unusual growth none

(3) Evidence of surface movement beyond embankment toe none

(4) Miscellaneous

---

e. Drainage System

2 ft. coated corrugated metal pipes (10 inches in diem)
on each side of outlet pipe of principal spillway
(1) Condition of relief wells, drains, etc.

- Debris and soil blocking end of pipe from high level of plunge pool.

(2) Discharge from Drainage System

- Left pipe: 3.5 gpm flow
  - No practical migration

- Right pipe: Surging water 1.2 gpm, rusty color
  - No fine migration; cycle of surge at 5 seconds
  - Flow stops completely then flows fully again.

---

Diagram:

- Type of dam
- Erosion
- Deposition
- Extensive erosion
- Seepage Point #1
- Seepage Point #2
- Seepage Point #3
- Internal Drains
- Principal Spillway Conduit

Downstream Face of Dam
Looking Upstream
4) **Instrumentation**

(1) Monumentation/Surveys ________________

none other than for construction of dam

(2) Observation Wells __________

(3) Weirs __________

(4) Piezometers __________

(5) Other __________

5) **Reservoir**

a. Slopes __________ appear stable

b. Sedimentation __________ no problems reported
6) Spillway(s) (including tail race channel)

a. General  Standard SCP Design

b. Principle Spillway  good condition, pipe conduit bedded on bedrock, circular depressions in side of pipe from bullets (target practice?)

some debris on top from recent storm

c. Emergency or Auxiliary Spillway  vegetated earth channel at right abutment. Trees at entrance and exit of channel heavy vegetation in channel requires cutting of trees and mowing

d. Condition of Tail race channel

exit of plunge pool constrained so that flow backs up into internal drain pipes

e. Stability of Channel side/slopes

appears stable
7) Downstream Channel

a. Condition (debris, etc.) reasonably good condition
   small bridge controls flow through county R1#4B (Bowen Rd.)

b. Slopes some sections of side channel (see #8 below)
otherwise appears stable

c. Approximate number of homes numerous homes along county
   R1#4B, the stream then flows through the village of
   Randolph. Now approximates path of Bowen Rd. (County R1#8)

8) Miscellaneous channel running parallel to side of dam
   coming from flow along county R1#4B at right side enters downstream
   channel is 50-100ft below plunge pool. This channel is
   eroded substantially. Also an access road, which has a
   large diameter pipe beneath, has severely eroded backfill.
   This pipe is upstream of the aforementioned channel.
   Repair work on the channel & pipe is required.
9) Structural
   a. Concrete Surfaces
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      good condition

   b. Structural Cracking
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      none

   c. Movement - Horizontal & Vertical Alignment (Settlement)
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      none evident

   d. Junctions with Abutments or Embankments
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      appears good where observed

   e. Drains - Foundation, Joint, Face
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      good condition
      Soil bleeding drain pipes

   f. Water passages, conduits, sluices
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      good condition

   g. Seepage or Leakage
      ____________________________
      ____________________________
      ____________________________
      ____________________________
      none evident which is uncontrolled
h. Joints - Construction, etc. ________________________________

__________________________ appear good__________________________

i. Foundation ________________________________

principal spillway founded on
concrete pad founded on bedrock

j. Abutments ________________________________

k. Control Gates ________________________________

reported operational

l. Approach & Outlet Channels ________________________________

m. Energy Dissipators (plunge pool, etc.) ________________________________

plunge pool

requires work to lower pool level

see section 4 "Spillway(s)"

n. Intake Structures ________________________________

n. Intake Structures ________________________________

o. Stability ________________________________

appears stable

p. Miscellaneous ________________________________
APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS
## CHECK LIST FOR DAMS
### HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

### AREA-CAPACITY DATA:

<table>
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<th>Elevation (ft.)</th>
<th>Surface Area (acres)</th>
<th>Storage Capacity (acre-ft.)</th>
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<tr>
<td>1) Top of Dam</td>
<td>1529.6</td>
<td>19.2</td>
<td>391</td>
</tr>
<tr>
<td>2) Design High Water (Max. Design Pool)</td>
<td>1524.3</td>
<td>17.5</td>
<td>331</td>
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<tr>
<td>3) Auxiliary Spillway Crest</td>
<td>1523.8</td>
<td>16.3</td>
<td>288.7</td>
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<tr>
<td>4) Pool Level with Flashboards</td>
<td>N/A</td>
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<tr>
<td>5) Service Spillway Crest</td>
<td>1510.8</td>
<td>10.3</td>
<td>114.2</td>
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<tr>
<td>6) Inverted Low Stage</td>
<td>1490.0</td>
<td>3.1</td>
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### DISCHARGES

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<th>Volume (cfs)</th>
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<td>1) Average Daily</td>
<td>Varies</td>
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<td>2) Spillway @ Maximum High Water</td>
<td>824.2</td>
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<tr>
<td>3) Spillway @ Design High Water</td>
<td>1899</td>
</tr>
<tr>
<td>4) Spillway @ Auxiliary Spillway Crest Elevation</td>
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<tr>
<td>5) Low Level Outlet</td>
<td>31</td>
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<tr>
<td>6) Total (of all facilities) @ Maximum High Water</td>
<td>824.2</td>
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<tr>
<td>7) Maximum Known Flood</td>
<td>Aug 7, 1979 (E1 1520)</td>
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</table>
CREST: Earth Embankment
Type: Earth Embankment
Width: 20 ft
Length: 180 ft
Spillover: Principal Spillway 41 ft high, 2' x 6' concrete riser
Location: Center of upstream slope - Principal at right abutment of embankment - Auxiliary

SPILLWAY:

PRINCIPAL

Type: Vegetated Earth
Width: 200 ft

Type of Control
Uncontrolled

Controlled: Uncontrolled

Type of Control
(Flashboards; gate)

Number

Weir length = 120 ft
Size/Length

Length of level section 50 ft
Invert Material
Earth - Glacial Till

Anticipated Length of operating service 100-year storm

348.33 ft 24° R/C Pipe Chute Length 400 ft

21.8 ft Height Between Spillway Crest & Approach Channel Invert
(Weir Flow)
OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate Gate Sluice Conduit Penstock

Shape: Flat Frame Slide Gate Condl.: Round Cast Iron

Size: 12" Diameter

Elevations: Entrance Invert 1472.0
Exit Invert 1459.5
Tailrace Channel: Elevation 1458.5 Exposed Bedrock

HYDROMETEROLOGICAL GAGES:

Type: None

Location:

 Records:

Date -
Max. Reading -

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

none except for mechanically operated

slide gate of reservoir drain system
DRAINAGE AREA: 1370 Acres 2.14 square miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Forest and Farm Land

Terrain - Relief: Generally Steep

Surface - Soil: Glacial Till

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

Potential Sedimentation problem areas (natural or man-made; present or future)

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation:

Reservoir:

Length @ Maximum Pool N/A (Miles)

Length of Shoreline (@ Spillway Crest) N/A (Miles)
U.S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

DESIGN REPORT SUMMARY

I. GENERAL
A. Site
B. Elevation
C. Land use
D. Land use class
E. Soils

II. DESIGN DATA
A. Cutoff trench
B. Reservoir
C. Dam
D. Spillway

III. ENGINEERING DATA
A. Water supply
B. Storage capacity
C. Flood control
D. Evaporation
E. Seepage
F. Seepage losses
G. Seepage through foundation

IV. EARTHWORK
A. Height
B. Volume
C. Cross section

DESIGN SECTION, SYRACUSE, N. Y.

DESIgn Report Summary

Elev. 1489.0

Cutoff trench

Foundation

Cross section of Dam

DESIGN SECTION, SYRACUSE, N. Y.

Sheet 3
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<td>Invert of orifice</td>
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<td>Plus 100 yr. total</td>
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- Volume expressed in inches of runo from controlled watershed area of 1,370 acres.
- Refer to hydrologic criteria in National Engineering Memorandum SCS-27.(Rev.).
- 1/ Does not include 46.2 ac. ft. of sediment storage.
- 2/ Established in the planning phase to provide desired level of protection.

DESIGN SECTION, SYRACUSE, NY
Conewango Creek DAM  
Site 19, NY 579, Dec '87-3797

D.A. = Drainage area in square miles

L = River mileage from the given station to the upstream limit of the drainage area

Lca = River mileage from the station to the center of gravity of the drainage area

PMP = Probable Maximum Precipitation in inches

tp = Lag time from mid-point of unit rainfall duration, tr, to peak of unit hydrograph, in hours

tr = Unit rainfall duration (other than standard unit), in hours

Ct = Coefficient depending upon unit and drainage basin characteristics

Cp = from average 640 Cp = 400

D.A. = 2.14 square miles, L = 2.3 miles, Lca = 1.14 miles

PMP = 23 inches Ct = 2.0

Cp = 0.625

\[ tp = C_t \left( L - L_{ca} \right)^{0.3} = 2.0 \left( 2.3 - 1.14 \right)^{3} = 2.0 \times 2.67 \times 10^{-2} \]

\[ tr = \frac{tp}{5.5} = \frac{2.0 \times 2.67}{5.5} = 0.49 \text{ hours} \]

(Use 1/2 hr. hydrograph)

\[ t_{PR} = tp + 0.25 \left( tr - tr \right) = 2.67 + 0.25 \times 0.49 = 2.80 \text{ hr.} \]

From HMR 33 - Figure 2, Depth-Area-Duration

6-hour % = 111, 12-hour % = 123

24-hour % = 133, 48-hour % = 192
**FLUID HYDROGRAPH PACKAGE (ML-1)**
**DAM SAFETY VERSION** JULY 1978
**LAST MODIFICATION** 26 FEB 79
**MODIFIED FOR HONEYWELL APH 79**

**PLEASE REPORT ANY UNUSUAL OPERATING PROBLEMS TO MIKE TILSUK (RM. 423) PH: 7-5066**

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### HYDROGRAPH ROUTING

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**CAPACITY** 20.0
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Peak outflow is 4530, at time 42.50 hours.
PEAK FLOW AND SOTAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

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<td></td>
<td>(0.00)</td>
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<td>64.69 (129.30)</td>
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<td>1</td>
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<td>(0.00)</td>
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<td>64.37 (128.29)</td>
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### SUMMARY OF DAM SAFETY ANALYSIS

#### PLAN 1

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APPENDIX E

REFERENCES


APPENDIX F

STABILITY ANALYSES
Memorandum

TO: Richard J. Phillips, State Conservation Engineer, SCS, Syracuse, New York 13210

DATE: January 29, 1969

FROM: Lorn P. Dunnigan, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG 22-5, New York WP-08, Conewango Creek, Site No. 19 (Cattaraugus County)

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS-355A & B, Triaxial Shear Test Data, 3 tests, 5 sheets.
3. Form SCS-352, Compaction and Penetration Resistance, 3 sheets.
4. Form SCS-357, Summary - Slope Stability Analysis, 2 sheets.
5. Form SCS-130, Drain Materials, 1 sheet.

DISCUSSION

FOUNDATION

A. Classification: Bedrock occurs at surface in the stream channel and the lower abutments. Shallow deposits of glacial till occur to depths of 3 feet on the left abutment. High-blow-count glacial till occurs to depths of 20 feet or more in the upper right abutment.

B. Shear Strength: Shear strength of the high-blow-count glacial till foundation materials is expected to be greater than that of the compacted borrow materials.

C. Permeability: Field permeability tests in the gravelly till yielded an average permeability rate of approximately one foot per day.

EMBANKMENT MATERIALS

A. Classification: The glacial till borrow materials generally have 45% to 65% coarse-grained material. Two samples were submitted to the Laboratory. The SC-SM sample, 102.2 (69W852), had 89% passing the 3/4-inch screen, 72% passing the No. 4 screen, and 49% fines. The CL sample 105.1 (69W853) had 85% passing the 3/4-inch screen, 76% passing the No. 4 screen, and 56% fines.

B. Compacted Dry Density: Standard Proctor compaction tests (ASTM D698, Method A) on the minus No. 4 fractions of the two samples above give dry densities of 126.5 pcf for the SC-SM sample and 125.0 pcf for the CL sample. A standard Proctor test on the minus 3/4-inch fraction of the SC-SM sample 102.2 (69W852) yielded a dry density of 129.0 pcf.
C. **Shear Strength:** Consolidated undrained triaxial shear tests were made on the minus No. 4 material and the minus 3/4-inch material of the SC-SM sample, 102.2 (69ww52). The 1.4-inch triaxial test specimens on minus No. 4 material were molded at optimum moisture content to 95% Standard density and soaked for 7 days to saturate. Moisture contents when shear tested were approximately 87% of theoretical saturation. Total stress shear parameters of $\phi = 23.5^\circ$ and $c = 800$ psf were interpreted from the test data.

The 4-inch test specimens of the minus 3/4-inch material were molded to 95% of Standard density. The materials were molded with moisture contents that were 100% of theoretical saturation. The shear test data for the 4-inch specimens with an average density of 125.2pcf were interpreted to give saturated total stress shear parameters of $\phi = 24^\circ$ and $c = 250$ psf. Effective stress parameters of $\phi = 35^\circ$ and $c = 75$ psf were determined using the pore pressures measured in the test.

The material at 95% of Standard density had insufficient strength for the proposed 70-foot high dam so additional shear testing was done on 4-inch specimens of minus 3/4-inch material at 100% of Standard density. The shear test data for the 4-inch specimens with average densities of 129.2 pcf were interpreted to give saturated total stress shear parameters of $\phi = 30^\circ$ and $c = 425$ psf. Effective stress shear parameters were $\phi = 34.5^\circ$ and $c = 375$ psf.

D. **Consolidation:** Average consolidation potential of the gravelly till materials, compacted to 100% of Standard density on the minus 3/4-inch fraction, is estimated to be approximately 3% for the 64-foot high maximum section.

**STABILITY ANALYSIS**

Stability of the proposed embankment was checked using the SCS computer program. Embankment-only analyses of the maximum section were considered sufficient. The full drawdown analysis of the 3:1 upstream slope, using the shear parameters of $\phi = 24^\circ$ and $c = 250$ psf for material compacted to 95% of Standard density on the minus 3/4-inch fraction, gave a minimum safety factor of only 1.24. Shear parameters of $\phi = 30^\circ$ and $c = 425$ psf gave a minimum safety factor of 1.75 for the same analysis for the minus 3/4-inch material compacted to densities of 100% of Standard.

The downstream 2 1/2:1 slope with a drain at $c/b = 0.6$ gave a minimum safety factor of 1.53 for minus 3/4-inch material at 95% of Standard density. The downstream slope analysis was not made for material compacted to 100% of Standard density; however, a safety factor well over 1.5 would be obtained using the shear parameters for the minus 3/4-inch fraction at 100% Standard.
RECOMMENDATIONS

A. Site Preparation: The Laboratory concurs with the field recommendations of clearing all loose and weathered rock from the base of the dam on the exposed bedrock of the floodplain.

B. Centerline Cutoff: The Laboratory concurs with the field recommendations of a cutoff to sound bedrock in the left abutment and a 5-foot deep cutoff in the right abutment. A bottom width of 20 feet is recommended in the left abutment cutoff below the permanent pool elevation, and a bottom width of 10 feet in the right abutment cutoff.

C. Drainage: A 6 to 8-foot deep trench drain with perforated pipe is recommended at c/b = 0.6 on the right abutment up to elevation 1500.0 to relieve seepage pressures in the coarse, gravelly till and weathered bedrock. A shallow trench drain is suggested below permanent pool elevation in the left abutment and on the bedrock across the floodplain.

The base materials as represented by Sample 2.1 are broadly graded so the filter limits can be quite coarse. A steeply graded drain material is needed to avoid segregation in placing the drain and to insure adequate capacity. ASTM Road Aggregate No. 78 is suggested for the drain material. See attached Form SCS-130 for gradations.

D. Embankment Design: The following are recommended:

1. Provide a homogeneous embankment of gravelly till materials. Control embankment density on the minus 3/4-inch fraction. Compact to a minimum density of 100% of Standard (ASTM D698, Method C) to provide adequate strength. Place with moisture contents at or near optimum to obtain the lowest permeability and the most flexibility.

2. Provide 3:1 upstream slopes with a 10-foot berm at the permanent pool elevation.

3. Provide a 2 1/2:1 downstream slope.

4. Provide an overfill of 2.0 feet across the floodplain to compensate for residual embankment settlement after construction is complete.

Prepared by:  
Elgin F. Steele

Reviewed and Approved by:  
Lorn P. Dunnigan

Attachments  
cc: Richard J. Phillips (1)  
B. S. Ellis, Syracuse, N. Y.  
Jesse S. Wicks, Little Valley, N.Y. (2)  
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<td>Same conditions as trial #1.</td>
<td>1.34</td>
</tr>
<tr>
<td>11</td>
<td>2:1</td>
<td>Same conditions as trial #1.</td>
<td>1.09</td>
</tr>
</tbody>
</table>
APPENDIX G

DRAWINGS
Room 422

Robert F. Flacke,

September 6, 1979

Mr. Lloyd E. Thomas
State Conservation Engineer
Soil Conservation Service
U.S. Department of Agriculture
771 Federal Building
100 South Clinton Street
Syracuse, New York 13200

Re: Conewango Creek Watershed
Project Site 19 Dam
DEC #8B-3797
Alleghany River Basin

Dear Mr. Thomas:

In accordance with this Department's Dam Safety Inspection Program and the Federal Inspection Program, an inspection of Conewango Creek Watershed Project Site 19 Dam was conducted on August 28, 1979. Those in attendance were Stephen Yorton, Soil Conservation Service, Dexter Case, Soil Conservation Service, Robert McCarty, Department of Environmental Conservation, and Kenneth Harmer, Department of Environmental Conservation.

A Phase I report will be completed and sent to you in November 1979.

Our concern at this time is the concentrated seepage and erosion which is occurring at the interface between the earth embankment and the left abutment. This leakage, if coming through the structure, could lead to serious erosion under high head conditions.

This office, therefore, requests that you investigate the problem and take the necessary remedial measures as soon as possible, during this construction season. In the interim, you are required to monitor the areas of concentrated seepage during periods of heavy runoff to determine if piping is occurring under high reservoir conditions.
Please feel free to call either myself or Mr. Harmer if you should have any questions regarding the above. Telephone (518) 457-5557.

We would appreciate being informed of actions taken in this matter.

Thank you:

Sincerely,

Robert McCarty
Senior Civil Engineer
Dam Safety Section

cc: Mr. Henry Stamatael
    Mr. Stephen C. Yorton
    Mr. Donald Crowell

cc:kf
September 13, 1979

Mr. George Koch
Senior Civil Engineer
Dam Safety Section
NYS Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233

Dear George:

We are in receipt of a letter from your office dated 9/6/79 from Mr. Robert McCarty. As a result of the telephone conversation between Mr. McCarty and Donald Lake of our office, I inspected the above site on September 6th and Donald Lake and Harry Hirth inspected the site September 7th.

At the time of these inspections there was no concentrated seepage seen on the downstream left embankment abutment interface, though seepage through the shale on the left abutment further downstream was evident. This site will be monitored periodically and specifically at times of heavy runoff which can create high head conditions.

The gully eroded on the embankment near the left abutment will be repaired, the constricted area at the downstream end of the plunge pool will be cleaned out, the outlets of the drain pipes will be cleaned out and disturbed areas will be vegetated. This work will be accomplished by the local sponsors under operations and maintenance in the near future.

Sincerely,

Lloyd E. Thomas
State Conservation Engineer

cc: Henry Stamatel, Asst. STC, WR
    D. Clark, DC
    W. Wittmann, AC
    D. Shields
**List of Drawings**

Conewango Creek Watershed Project Site 19

<table>
<thead>
<tr>
<th>Description</th>
<th>Drawing Number</th>
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<tbody>
<tr>
<td>Plan of Storage Area</td>
<td>2</td>
</tr>
<tr>
<td>Plan of Structural Works</td>
<td>3</td>
</tr>
<tr>
<td>Cutoff Trench Excavation</td>
<td>4</td>
</tr>
<tr>
<td>Emergency Spillway</td>
<td>5</td>
</tr>
<tr>
<td>Fill Placement &amp; Principal Spillway Excavation</td>
<td>6</td>
</tr>
<tr>
<td>Drainage System</td>
<td>7 &amp; 8</td>
</tr>
<tr>
<td>Plan Profile of Principal Spillway</td>
<td>9</td>
</tr>
<tr>
<td>Riser Structural Details</td>
<td>10</td>
</tr>
<tr>
<td>Conduit Details</td>
<td>15</td>
</tr>
<tr>
<td>Log of Test Holes</td>
<td>17 &amp; 18</td>
</tr>
</tbody>
</table>
1. AREAS UNDER THE DAM (INCLUDING 1/2 FEET OUTSIDE THE UPSTREAM AND DOSSSTREAM TIES), EMERGENCY SPILLWAY (INCLUDING 1/2 FEET OUTSIDE THE CUY SLOPSES), AND NON-OE
AREA TO BE CLEAR AND CHUBBED. LIMITS OF AREA TO BE CLEAR AND CHUBBED SHALL BE STAKED IN THE FIELD BY THE ENGINEER.

2. DEPTHS AND LIMITS OF BORROW EXCAVATION SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER AS REQUIRED. SLOPES ON THE EDGE OF THE BORROW AREA SHALL BE NO STEEPER THAN 4 HORIZONTAL TO 1 VERTICAL. FOR ADDITIONAL DETAILS SEE 3.1.3.

3. AREAS UPSTREAM FROM DAM AND BELOW ELEVATION 1493.0 SHALL BE CLEAR. ALSO THE AREA 200 FEET WIDE ON THE RIGHT ABUTMENT BORDERED BY ELEV. 1493.0 AND THE LEFT CHANNEL OF THE EMERGENCY SPILLWAY (EXTENDED) IS TO BE CLEAR. LIMITS OF AREA TO BE CLEAR SHALL BE STAKED IN THE FIELD BY THE ENGINEER.

4. BOTTOM SECTILE OF THE EMERGENCY SPILLWAY TO BE COVERED WITH 6" OF TOP SOIL FROM STA. 1+00 TO APPROX. STA. 4+00.
SOILS DETAILS
SEE SHEETS 17 & 18 FOR DESCRIPTIONS OF TEST PITS AND DRILL HOLES SHOWN ON SHEETS 2, 3, 4, 5, 6, 7, 8 & 9.
CUTOFF TRENCH CONSTRUCTION DETAILS

1. Excavate into firm bedrock where trench bottoms on bedrock. All exposed rock in the bottom of trench shall be thoroughly cleaned of loose material prior to the backfilling operation.

2. Final depth of trench to be determined by the engineer at the time of construction.

AS BUILT

CONEWANGO CREEK WATERSHED
SITE 19
FLOODWATER RETARDING DAM
CATARARUGUS COUNTY, NEW YORK
CUTOFF TRENCH EXCAVATION
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J.E. POLULECH 1/68
W. GRAJNO JR 2/67

J.E. POLULECH 2/69
NY-2169-P
SECTION OF EMERGENCY SPILLWAY AT STATION 2+00.
TYPICAL FROM STATION 1+38 TO APPROX LEVEY 4+00
EXCAVATION LIMITS TO DESIGN BOTTOM FROM APPROX
STATION 0+00 TO STATION 1+50.

AS BUILT
3/1/71

CONEWANGO CREEK WATERSHED
SITE 19
FLOODWATER RETARDING DAM
CATTARAUGUS COUNTY, N.Y.
EMERGENCY SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J.E. POLULECH 8/68
B. BROSTEK 8/68

NY-269-P

F.O.M. SPC. 315 (MAY 1964)
### Earth Fill Requirements

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<th>Class</th>
<th>Definition</th>
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<td>A</td>
<td>100% of maximum density by ASTM D-155 Method</td>
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</table>

See Sheet 11 for description and location of materials B-C.

Maximum rock size placed in backfill compacted by means of hand tampering or manually directed power tampers or plate vibrators shall be 3 inches. Maximum lift thickness prior to compaction.

Water content at time of compaction:

For typical compaction curve see sheet 19.

### Construction Details

1. The foundation surface throughout the base area of the dam shall be scarified (except where foundation is bedrock) to a depth of 2 inches and compacted prior to placement of material.

2. Top soil that is suitable for use and not used in the specified area of the emergency spillway shall be incorporated within the silts of the earth fill as directed by the engineer.

### As Built

CONEWANGO CREEK WATERSHED

SITE 19

FLOODWATER RETARDING DAM
CATARARUGUS COUNTY, NEW YORK

FILL PLACEMENT & PRIN. SPwy EXCAVATION

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

J. E. POLULECH 1/69

W. E. GRAJKO Jr 1/69

J. E. POLULECH 1/69
DRAINAGE SYSTEM DETAILS

ALL DRAINAGE PIPE SHALL CONFORM TO SPECIFICATION 10
AND BE OF SPECIAL CEMENT LINEAR (W rais. T. D. 0 C. 3 CLASS) TYPE A (FULLY BITUMINOUS) COATED PIPE.
THE PIPE AT THE BOTTOM OF ALL EXCAVATIONS 45
SHOULDS BE APPROXIMATE THE REQUIRED PIPE DIAMETER 45
GRADIL WILL BE ESTABLISHED AT THE END OF THE TIME 45
OF CONSTRUCTION BY THE ENGINEER.

QUANTITY SUMMARY

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<tr>
<td>476</td>
<td>CU YDS DRAIN FILL</td>
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<tr>
<td>144</td>
<td>UN FT STRAIGHT SECTION OF PERFORATED PIPE</td>
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<tr>
<td>40</td>
<td>UN FT STRAIGHT SECTION OF NON-PERFORATED PIPE</td>
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<td>3</td>
<td>METAL END CAP</td>
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SECTION A-B

SECTION D-D

GRAIN SIZE DISTRIBUTION GRAPH FOR DRAIN FILL

CONEWANGO CREEK WATERSHED
SITE 19
FLOODWATER RETARDING DAM
CATTARAUGUS COUNTY, NEW YORK
DRAINAGE SYSTEM DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AS BUILT

9/25/69

J. POLUECH 1/69
W. E. GRAJNO Jr 1/69

NY-2169-P
PLAN OF DRAIN OUTLET (NOT TO SCALE)

PROFILE ALONG DRAIN OUTLETS (NOT TO SCALE)
Refer to Every No. 1 Fig. 37

PLAN VIEW

SCALE IN FEET

TOP OF CONSTRUCTED FILL
DETAILS SHEET A

TOP OF SETTLED FILL ELEV. 1529.6

The As Built joint sections and elevations using 20' lengths of pipe are shown on Job 94 of these plans. The revised location of the Anti-seep Collars is also shown on this sheet.

J. Lee

10 REINF. CONC. ANTI-SEEP COLLARS B 6.00 D. C. DETAIL SHEET IS 9A

356.33' OF NON-REINF. CONC. CRADLE DETAIL SHEET IS 9B 4.00

PROFILE ALONG E OF PRINCIPAL SPILLWAY

HOR. SCALE IN FEET

VERT. SCALE IN FEET
Fabrication Instructions

1. 140' Sections
   (1) 120' Section
      One (1) Spigot Ring Wall Fitting for No Wall

Pipe Suppliers Note

Cast Outside of Spigot Ring with Concrete on One 140' Section

When pipe is supplied in 200' length, the engineer will provide the contractor with a revision of this sheet showing order of installation and pipe invert elevations.

AS BUILT

CONEWANGO CREEK WATERSHED PROJECT
SITE 19
FLOODWATER RETARDING DAM
CATARATAGUS COUNTY, NEW YORK
PLAN PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

N. A. 3128 (APRIL 1963)
TOP PLAN

CONSTRUCTION JOINT

PLATE CONSTRUCTION JOINT

SECTION B-B

SCALE IN FEET
BOXED IN DIMENSIONS
NOT TO SCALE

CONSTRUCTION DETAILS
1. SPECIFIED BAR DIMENSIONS ARE MEASURED TO OUTSIDE EDGE OF ALL BENDS.
2. ARMS OF RING EQUAL 3 X BAR DIAMETERS FOR SIZES EQUAL TO OR LESS THAN 1 1/2.
3. THE 2- AND 3- DIAMETER IRON SPECIFIED CONCRETE SURFACES ARE CLEAR DISTANCES WHERE NOT OTHERWISE SPECIFIED.
   ALL REINFORCING STEEL SHALL BE PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MINIMUM OF 2" COVER. ALL REINFORCING STEEL PLACED IN CONCRETE POURED IN TUNNELS SHALL HAVE A MINIMUM OF 5" COVER.
4. ALL EXPOSED FACES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

PLATE CONSTRUCTION JOINT

SECTION B-B

CONSTRUCTION DETAILS
1. SPECIFIED BAR DIMENSIONS ARE MEASURED TO OUTSIDE EDGE OF ALL BENDS.
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SECTION B-B

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SECTION B-B

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PLATE CONSTRUCTION JOINT

SECTION B-B

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4. ALL EXPOSED FACES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.
**REINFORCED CONCRETE ANTI-SEEP COLLAR**

10 - Req'd.

**REINFORCED CONCRETE CRADLE**

**REINFORCED CONCRETE PIPE - JOINT DETAILS**
BAR TYPE

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<th>ANTI-SEEP COLLAR STEEL SCHEDULE</th>
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<td>Mark</td>
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<tr>
<td>------</td>
</tr>
<tr>
<td>A-1</td>
</tr>
<tr>
<td>A-2</td>
</tr>
<tr>
<td>A-3</td>
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<td>A-4</td>
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CRADLE STEEL SCHEDULE

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<th>SIZE</th>
<th>LENGTH</th>
<th>TYPE</th>
<th>TOTAL QMTH</th>
<th>TOTAL LENGTH</th>
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<tr>
<td>0.1</td>
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<td>5</td>
<td></td>
<td>46.5</td>
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<td>0.2</td>
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<td>5</td>
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<td>36.5</td>
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QUANTITIES (This Sheet Only)

STEEL
No. 4 Bar | 885-10 | 653 Lbs.
No. 5 Bar | 82-11  | 87 Lbs.

CONCRETE

REINFORCED 42 CU YDS.
NON-REINFORCED 42.5 CU YDS.

CONSTRUCTION DETAILS SEE SHEET 0.

SPIGOT WALL FITTING

CONEWANGO CREEK WATERSHED
SITE 19
FLOODWATER RETARDING DAM
CATTARAUGUS COUNTY, N.Y.
CONDUIT DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AS BUILT 9/31/71
### Material Descriptions

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<tr>
<th>Material Description</th>
<th>TP #105, Borrow Areas</th>
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<tr>
<td>A</td>
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<tr>
<td>Gravel, sandy, silty, 99% finer than 3&quot; (60% gravel, 21% sand, 19% plastic fines)</td>
<td>0.0 1.9 Topsoil</td>
</tr>
<tr>
<td>10&quot;) to 3&quot; (80% 3&quot;-6&quot;, 20% 6&quot;-12&quot;) max. size +3&quot;, brown, moist, wet, medium rapid permeability (in test pit); medium-very dense (N ranges from 14-20 blows/ft. with most of the material in the 20-30 blows/ft. range, glacial till.</td>
<td>1.0 10.0</td>
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<tr>
<td>D.S. 105.1 @ 19'-14&quot;</td>
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<tr>
<td>NOTE: Slight seep.</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Sand, gravelly, clayey, 98% finer than 3&quot; (60% gravel, 29% sand, 13% plastic fines)</td>
<td>0.0 0.6 Topsoil</td>
</tr>
<tr>
<td>10&quot;) to 3&quot; (60% 3&quot;-6&quot;, 34% 6&quot;-12&quot;, 1% +12&quot;) brown w/some mottling, moist, slow-medium permeability, LL and PI range from NP to IL 25, PI 7; loose very dense (N ranges from 6-14 blows/ft. with most of the material in the 20-30 blows/ft. range, glacial till.</td>
<td>0.0 0.6 Topsoil</td>
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<td>D.S. 102.3, 102.1, 102.2, 103.1, 201.1, 202.1</td>
<td>1.0 15.0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Gravel, silty, clayey, 99% finer than 3&quot; (60% gravel, 21% sand, 19% plastic fines)</td>
<td>1.0 15.0 Topsoil</td>
</tr>
<tr>
<td>10&quot;) to 3&quot; (80% 3&quot;-6&quot;, 20% 6&quot;-12&quot;) max. size +3&quot;, gray, moist, very slowly permeable, LL-22 PI-6, medium-dense (N ranges from 15-64 blows/ft. with most of the material in the 30-40 blows/ft. range, glacial till.</td>
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<td>D.S. 202.1 @ 21'-14&quot;</td>
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<td>NOTE: 30% +1&quot; Matt.</td>
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<td>D</td>
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<td>Topsoil, brown-black, soft, medium plasticity, organic matter.</td>
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<tr>
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<td>1.0 14.0</td>
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<td>14.0 14.0</td>
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<tr>
<td>NOTE: 40% +1&quot; Matt. water 14%</td>
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<td>E</td>
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<tr>
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<td>------------</td>
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<td>3/13/68</td>
</tr>
<tr>
<td>1548.2</td>
<td>5/13/68</td>
</tr>
<tr>
<td>1538.6</td>
<td>5/14/68</td>
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<td>1541.9</td>
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<td>Material B (GM)</td>
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<th>Ele.</th>
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<td>Material C (GC-GM)</td>
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<td>Material C (GC-GM)</td>
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<td>Topsoil Material D</td>
</tr>
<tr>
<td>1541.9</td>
<td>5/14/68</td>
<td></td>
<td>Topsoil Material D</td>
</tr>
<tr>
<td>1528.4</td>
<td>5/14/68</td>
<td></td>
<td>Topsoil Material D</td>
</tr>
<tr>
<td>1532.0</td>
<td>5/14/68</td>
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<td>Topsoil Material D</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Elev.</th>
<th>C/L of Dr.</th>
<th>Ele.</th>
<th>Layer Description</th>
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<tbody>
<tr>
<td>1578.3</td>
<td>3/13/68</td>
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<td>W.L.: 13.0</td>
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<tr>
<td>1548.2</td>
<td>5/13/68</td>
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<td>W.L.: 13.0</td>
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<tr>
<td>1538.6</td>
<td>5/14/68</td>
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<td>W.L.: 13.0</td>
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<td>1528.4</td>
<td>5/14/68</td>
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<td>W.L.: 13.0</td>
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<td>1532.0</td>
<td>5/14/68</td>
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<td>W.L.: 13.0</td>
</tr>
</tbody>
</table>

**Note:** The Elevations and C/L of Dr. are provided for each layer, along with the material type and water level (W.L.). The data suggests a detailed analysis of soil and material layers with specific elevations and conditions.
<table>
<thead>
<tr>
<th>TP &amp; C/L Drain, Elev. 145.0</th>
<th>TP #42 Drain, Elev. 145.0</th>
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</thead>
<tbody>
<tr>
<td>Material A (CA)</td>
<td>Material B (CA)</td>
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<td>Topsoil Material D</td>
<td>Topsoil Material D</td>
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<tr>
<td>0.9</td>
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<tr>
<td>Material B (SC-SC)</td>
<td>Material B (SC-SC)</td>
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<td>Material C (SC-SC)</td>
<td>Material D (SC-SC)</td>
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<td>0.6</td>
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</table>

**NOTES:**
- See section 4.8.2 of the Drainage Design Manual. (Page 2 of 3)
- The natural drainage system includes a series of drainage structures, such as storm sewers, culverts, and ditches, to carry surface water away from the site. (Page 3 of 3)
**TABLE FOR REFERENCE USE**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Measurement</th>
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</thead>
<tbody>
<tr>
<td>Centerline of dam</td>
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<tr>
<td>Borrow Area</td>
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</tr>
<tr>
<td>Emergency spillway</td>
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<tr>
<td>Centerline of oblique structure</td>
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<td>Stream channel</td>
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<td>Relief wells</td>
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</tbody>
</table>

**UNITED SOIL CLASSIFICATION SYSTEM SYMBOLS**

- **GW**: Well-graded gravels; gravel-sand mixtures
- **GP**: Poorly graded gravels
- **SM**: Silt or silt-sandy mixtures
- **SC**: Clay or clay-sandy mixtures
- **SW**: Well-graded sands; sand-gravel mixtures
- **SP**: Poorly graded sands
- **SM**: Silt or silt-sandy mixtures
- **SC**: Clay or clay-sandy mixtures
- **SL**: Silts; silt or fine sands; sandy or clayey silts
- **GL**: Clayey silts and organic silty clays or loams
- **GL**: Organic soils or silty clay loam or clay loam
- **GM**: Organic mud or silty clay loam or organic clay loam

**NOTES**: All classifications shown in the table are based on the results of samples representing the entire area. Significant variations from the present table are noted in the legend.

**ROCK SYMBOLS**

- **B**: Basalt
- **C**: Carbonate
- **G**: Granite
- **L**: Limestone
- **M**: Marls

**SAMPLES**

- **D**: Disturbed
- **U**: Undisturbed
- **C**: Core-tube

**KEY TO DRILL HOLE (OR) LOGS**
COMPACTION CURVE
FIELD SAMPLE NO. 1022
LABORATORY CLASSIFICATION—SC—SM
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COWEWOango CREEK WATERSHED

FLOODWATER RETAROAG DAM
CATARAGUS COUNTY, NEW YORK

LOGS OF TEST HOLES