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NATIONAL DAM SAFETY PROGRAM. ISCHUA CREEK WATERSHED PROJECT, SI--ETC(U)
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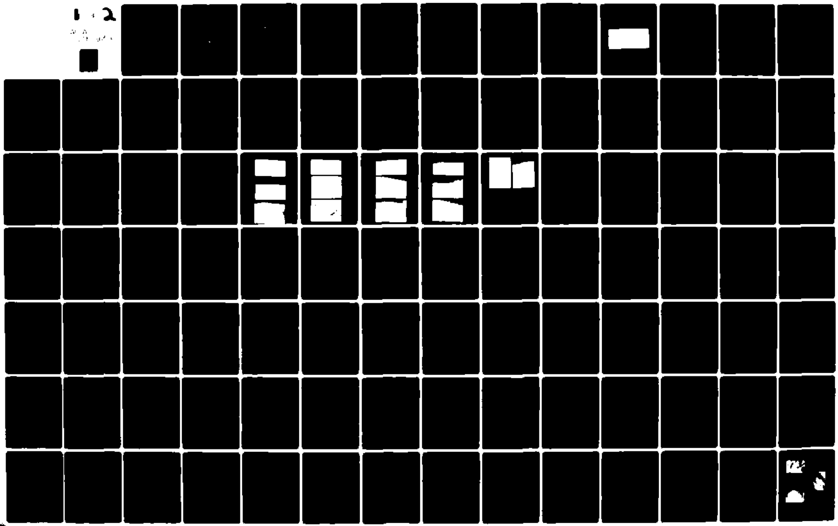

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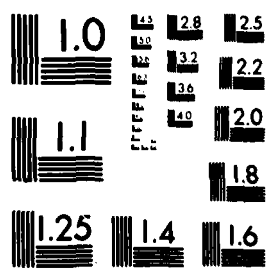

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National Dam Safety Program	Ischua Creek - Site 4
Visual Inspection	Cattaraqus County
Hydrology, Structural Stability	Allegheny
	Saunders Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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 available engineering documents and visual inspection of the Ischua Creek Site 4 Dam did not reveal conditions which constitute a hazard to human life and property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

ALLEGHENY RIVER BASIN

ISCHUA CREEK WATERSHED PROJECT
SITE 4

CATTARAUGAS COUNTY, NEW YORK

INVENTORY NO. N.Y. 626

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by

THOMSEN ASSOCIATES

105 CORONA AVE. GROTON, N.Y.

Prepared for

DEPARTMENT OF THE ARMY

NEW YORK DISTRICT, CORPS OF ENGINEER

NEW YORK, NEW YORK

JULY 1980

CONTRACT NO. DACW-51-79-C0001

DISCLAIMER NOTICE

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.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM,
ISCHUA CREEK WATERSHED PROJECT,
SITE 4
(I.D. ~~NO.~~ Number N.Y. 626),
ALLEGHENY RIVER BASIN,
CATTARAUGUS COUNTY, NEW YORK.
Phase I Inspection report

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(12) 153
(10) Brian L. Thompson
Gary L. Wood
(15) DACW51-79-C-00??

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PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	Ischua Creek Watershed Ischua Creek-Site 4 Inventory No. N.Y. 626
STATE LOCATED:	New York
COUNTY:	Cattaraugus County
RIVER BASIN:	Allegheny
STREAM:	Saunders Creek
DATE OF INSPECTION:	May 6, 1980 See Vicinity Map & Topographic Map, Appendix F

ASSESSMENT

The examination of available engineering documents and visual inspection of the Ischua Creek Site 4 Dam did not reveal conditions which constitute a hazard to human life and property.

The total discharge capacity of the combined principal and auxiliary spillways is adequate to impound and safely discharge the floodwater resulting from the Probable Maximum Flood, therefore, the spillway is deemed to be adequate.

The computed maximum discharge velocities in the auxiliary spillways are in excess of that normally accepted for grass-lined channels.

Deficiencies noted for this structure include cracks in the principal spillway outlet pipe and an inoperable reservoir drain gate. These deficiencies were known in advance of this inspection and plans were initiated to correct same during the Summer of 1980. An investigation into auxiliary spillway erodability during periods of heavy runoff should be completed within 18 months from the time of approval of this report. In addition, an emergency preparedness plan for notification and evacuation of downstream residents should be developed within 6 months.

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APPROVED BY 10 SEP 1980

New York District Engineer
Colonel W. M. Smith, Jr.

View of upstream slope from
north side of embankment

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I. D. No. N.Y. 626
ALLEGHENY RIVER BASIN
CATTARAUGUS COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the New York State Department of Environmental Conservation by Contract No. D-201458. This study was performed in accordance with the terms of the above contract and the "Recommended Guidelines for Safety Inspection of Dams" to fulfill the requirements of the National Dam Inspection Act, Public Law 92-327.

b. Purpose of Inspection

This inspection was conducted to obtain available data concerning design and construction of the dam, evaluate said data, to inspect existing conditions at the dam, to identify and evaluate deficiencies and/or hazardous conditions which may threaten life and property of downstream residents, and to recommend additional or remedial action to mitigate such hazards where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Ischua Creek Watershed Project Site 4 consists of an earth dam with a principal spillway outlet pipe passing from a reinforced concrete riser structure through the embankment and two (2) grass lined earth auxiliary spillways passing around the north and south ends of the embankment.

The dam embankment, which is composed of compacted glacial till soils, has a height of 51 feet, a crest length of 900 feet and a crest width of 18 feet. The upstream slope is 1 vertical on 3 horizontal and the downstream slope is 1 vertical on 2.5 horizontal. The crest and exposed slopes are grass covered. An earth cutoff trench of varying depth and width keys the embankment into relatively impervious foundation soils. The principal spillway consists of a 3 foot by 9 foot I.D. reinforced concrete riser structure, a 36 inch I.D. circular reinforced concrete pipe, and a plunge pool cut into glacial till and lined with 18 inches of riprap. Normal pool elevation is maintained by an orifice in the riser structure at elevation 1684.2. A reservoir drain consisting of a 24 inch I.D. bituminous coated corrugated metal pipe extends from a point in the reservoir east of the riser structure to the base of the riser structure. A vertical slide gate mounted along the upstream side of the riser controls the flow through the reservoir drain.

Two auxiliary spillways along the north and south ends of the embankment are cut primarily into dense glacial till soils. The north auxiliary spillway has a bottom width of 100 feet whereas the south auxiliary spillway is 200 feet wide at the base.

The dam has an internal drainage system consisting of a toe drain trench filled with sand and gravel filter material with 8 inch diameter perforated bituminous coated corrugated metal (B.C.C.M.) collector pipes bedded in the filter material at the base of the embankment near the downstream toe. The perforated pipe section of the drainage system is parallel to and 88 feet downstream from the dam centerline. Seepage is collected and diverted through this pipe to a non-perforated 8 inch diameter B.C.C.M. pipe and outletted to either side of the principal spillway outlet pipe into the plunge pool. (These outlets are shown on the photo of the outlet pipe and plunge pool.)

b. Location

The Ischua Creek Watershed Project Site 4 is located on Saunders Creek approximately 3/4 mile northeast of the Village of Franklinville.* A two lane asphaltic concrete road (Hardy Road) crosses Saunders Creek approximately 2000 feet downstream of the dam and parallels the south auxiliary spillway.

c. Size Classification

The dam is 51 feet in height and has a maximum storage capacity of 1011 acre-feet (top of embankment). This structure is therefore in the intermediate size category as defined by the Corps of Engineers, Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The dam is classified as high hazard because of the number of residents located along the downstream channel in the Village of Franklinville.

e. Ownership

The dam is owned and operated by the Cattaraugus County Watershed District. The local contracting officer is Mr. Edward Smith of Franklinville, New York. His telephone number is 716-676-3427.

f. Purpose of Dam

The dam is a floodwater retarding structure.

g. Design and Construction History

The dam was designed by U. S. Department of Agriculture, Soils Conservation Service (SCS) between the period 1959

*Note that the SCS Design Report has this direction reversed.

through 1961. The dam was constructed by Sack Brothers, Inc. during the period from August 1962 to September 1963. The SCS office in Syracuse, New York has the design report which contains hydrologic-hydraulic data, soils and geology reports, and a stability analysis of the embankment. In addition, this office has the as-built drawings, contract documents and other pertinent data related to this structure.

h. Normal Operational Procedure

Normal flows are discharged through an orifice in the intake riser structure through the principal spillway. The orifice is the primary control when the reservoir is between elevations 1684.2 and 1703.2. Reservoir levels between 1703.2 and 1713.0 are discharged through both the orifice and over the riser crest. The reservoir has sufficient capacity to store and the principal spillway to discharge 237 cfs without discharge occurring in the auxiliary spillways.

1.3 PERTINENT DATA

a. Drainage Area (sq. mil) 4.1

b. Discharge at Damsite (cfs)

Reservoir Drain at Orifice Crest (1684.2)	70
Orifice at Riser Crest (1703.2)	110
Principal Spillway at Auxiliary Spillway Crest (1713.0)	237
Principal Spillway at Design High Water (1715.9)	243
Auxiliary Spillway at Design High Water (1715.9)	4457
Total Spillway Capacity at Top of Dam (1717.2)	8650

c. Elevation (ft. above MSL, taken from Design Report and As-built Drawings)

Top of Dam	1717.2
Design Maximum High Water	1715.9
Sediment Pool - Orifice Crest	1684.2
Intake Riser Crest (Principal Spillway)	1703.2
Auxiliary Spillway Crest	1713.0
Steambed at Centerline of Dam	1666.2

d. Reservoir (ft)

Length of maximum pool	3700
Length of sediment pool	300

e. Storage (acre-feet)

Sediment Pool (taken from Design Report)	31
Crest of Riser (flood storage above sediment pool)	302
Design High Water(flood storage above sediment pool)	912
Top of Dam (flood storage above sediment pool)	1011

f. Reservoir Surface (acres)

Sediment Pool	5.6
Crest of Riser	26.2
Design High Water	73.0
Top of Dam	80.0

g. Dam (Taken from Design Report)

Type: Homogeneous Earth Embankment with keyed earth cutoff trench and toe drains parallel to dam centerline

Length: (ft)	900
Height: (ft)	51
Top Width (ft)	18
Side Slopes: Upstream (V:H)	1:3
Downstream (V:H)	1:2.5

Zone: None

Impervious Core: None

Cutoff: Compacted earth cutoff trench of Embankment Material

Grout Curtain: None

h. Principal Spillway (Taken from Design Report)

Type: 36" outlet pipe from 3 ft x 9 ft I.D. reinforced concrete riser structure rising 36.93 feet above the base elevation (outlet invert) 1668.1

Size of Orifice Crest Elevation	1684.2
Riser Crest Elevation:	1703.2
Gates:	Uncontrolled

i. Auxiliary Spillways

Type: Channel cut into glacial till soils, trapezoidal cross section, grass lined

Bottom Width (ft):	North Spillway	100
	South Spillway	200
Side Slopes (V:H):		1:3
Length of Level or Control Section (ft):		20
Exit Slope (%)	North	4
	South	6

j. Reservoir Drain

Type: 24" I.D. Bituminous coated corrugated metal pipe

Length: (ft) 24.5

Control: Manually operated vertical slide gate mounted on the upstream side of the Concrete Riser Structure

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. General Geology

The Ischua Creek damsite number 4 is located in the vicinity of the Village of Franklinville, in southwestern New York State; this area is situated at the northern extremity of the Appalachian Plateau physiographic province.

Local bedrock consists of interbedded shales, siltstones and sandstones of the Canadaway and overlying Conneaut Groups which are of upper Devonian age. Although the regional dip of rock units in this province is very gently southward, this dip is so slight that, over relatively small areas, the stratigraphy may be considered essentially horizontal.

Overlying this local bedrock are deposits associated with Pleistocene glaciation of the area. These deposits include glacial till (ground moraine) on uplands and slopes, and outwash deposits (stratified granular material) filling or forming the floor of present or past stream channels.

Although geologic reconnaissance has revealed no major or active faults in this area, the Village of Franklinville is situated in a region classified between Zone 2 and Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams. We note the Attica, New York area, located roughly 35 miles to the north, has been the site of numerous seismic events of moderate intensity.

b. Subsurface Investigation

NOTE: The following information was extracted from the Design Report prepared by the SCS.

The subsurface investigation conducted by the SCS consisted of a total of 8 test borings and 28 test pit excavations. A total of 2 test borings and 5 test pit excavations were advanced along the dam axis. An additional 3 test pits were excavated along the principal spillway. Within the two emergency spillways a total of 6 test borings and 12 test pits were advanced. Since additional borrow was needed beyond that within the emergency spillway cut areas 8 more test pit excavations were made in the borrow area.

It should be noted that in the flood plain (which corresponds to the area of maximum embankment height) the 2 test borings advanced penetrated between 15 and 22 feet below the as-built bottom of the cutoff trench.

c. Subsurface Conditions

The overburden soils encountered at this site are composed of alluvial sand and gravel within the flood plain underlain by a dense glacial till at depths ranging from 3 to 9 feet below the former ground surface. Above the flood plain in the valley slopes a thin veneer of topsoil overlays the dense glacial till. The till at this site is a heterogeneous mixture of silt, sand and embedded gravel. The clay fraction is quite low in the range of 5 to 8 percent by weight.

The underlying bedrock is a sandstone with interbedded shale layers as described in the previous section. The bedrock is quite shallow on the north side of the valley and outcrops downstream of the dam in the north abutment. Along the south side of the valley the bedrock was not encountered within the depth of the subsurface investigation which extended to at least 31 feet below the valley floor.

Seeps were detected in the north side of valley during the subsurface investigation and a rusty length of pipe was protruding from one of these seeps exiting from the bedrock. This same condition was found during the visual inspection conducted on May 6, 1980. In fact a rusty length of pipe was found just downstream from abutment-embankment contact.

Clear water was flowing from and around the pipe. This may be the same pipe discussed in the January 1959 Geology Report by the Soil Conservation Service.

2.2 DESIGN RECORDS

The dam was designed by the Soil Conservation Service, who prepared a design report, contract specifications and engineering drawings. Portions of the design folder have been included with this report in Appendix E. In addition a number of as-built drawings prepared by SCS have been included in Appendix F of this report.

2.3 CONSTRUCTION RECORDS

The records of construction were made by SCS and are available from the Syracuse, New York office. Changes from original design are noted on the as-built plans in Appendix F.

2.4 OPERATION RECORDS

The dam was designed as an uncontrolled, floodwater retarding structure and therefore no operating records are maintained regarding reservoir level or spillway discharge. The structure is monitored by SCS personnel and representatives of the Cattaraugus County Watershed District during periods of heavy rainfall.

2.5 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from the Soil Conservation Service as well as the New York State Department of Environmental Conservation Files.

The available documents reviewed in connection with the Phase I inspection are considered adequate and reliable.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Site 4 Dam was conducted on May 6, 1980. The weather at the time of the inspection was clear with temperatures in the seventies. The reservoir level was at the crest of the orifice, elevation 1684.2.

b. Embankment

The embankment appeared in excellent, well-maintained condition. No evidence of seepage, sloughing, misalignment, cracking or other deleterious conditions was observed. The surface drainage system, which is composed of stone gutters on the downslope side at the abutment-embankment contact, was clean and in good condition.

The internal drainage system is composed of two (2) 8 inch diameter bituminous coated corrugated metal pipes surrounded by "filter" material and extending parallel to the dam centerline providing drainage at the embankment-foundation contact. These pipes outlet parallel to the principle spillway into the plunge pool. There was no discharge from these pipes on the day of the inspection.

c. Principal Spillway

The principal spillway consists of a reinforced concrete riser structure with a 1'0" high by 2'8" wide orifice at elevation 1684.2 and the riser crest at elevation 1703.2. One 36 inch I.D. reinforced concrete pipe bedded on a concrete cradle transports reservoir water from the riser structure to the plunge pool and outlet channel. In general, these components were in satisfactory condition. However, the outlet pipe is cracked at several locations, as shown on the plan contained in a report prepared by SCS and included in Appendix D of this report. The condition of the cracked outlet pipe was first discovered in August 1976 during an inspection by the SCS.

Subsequent to this first inspection, the spillway pipe was reinspected in July 1977, October 1977 and May 1979 and "no apparent change" was noted. Included in Appendix D is a copy of the "Engineering Investigation Report-Ischua Creek Watershed-Site 4" prepared by the Syracuse office of the soil Conservation Service concerning the cracked principal spillway outlet pipe. This pipe will be drilled and the soil surrounding the pipe grouted in the vicinity of the cracks. Once grouting is completed the cracks will be cleaned and patched with an epoxy cement. This work will reportedly occur during the Summer of 1980. Other deficiencies include the evidence of erosion along south (left) bank of plunge pool and the growth of 1 to 2 inch diameter trees in the outlet channel extending from the downstream edge of the plunge pool a distance of approximately 100 feet. A slight amount of debris was present around the trash rack of the orifice in the riser structure.

d. Auxiliary Spillways

The auxiliary spillways for this structure are located at the north and south ends of the dam, and were in excellent condition at the time of the inspection. The south auxiliary spillway is located in an earth cut whereas the north auxiliary spillway is situated in an earth and rock cut. Both spillways were subsequently lined with topsoil and support a healthy grass cover.

e. Reservoir Drain

The reservoir is drained by a 24 inch I.D. bituminous coated corrugated metal pipe and manually operated slide gate which is attached to the upstream side of the riser structure. The slide gate was reported to be inoperative at the time of the inspection and this condition will be corrected during the Summer of 1980.

f. Downstream Channel

The plunge pool is lined with riprap and a growth of 1 to 2 inch diameter trees lines the downstream channel from the downstream edge of the plunge pool for a distance of about 100 feet (as previously noted).

g. Reservoir Area

The area surrounding the reservoir is primarily pasture land with gentle slopes. No signs of slope instability were observed.

3.2 EVALUATION

The visual inspection of this dam revealed the following deficiencies:

1) Cracks in principal spillway outlet pipe (to be repaired during Summer 1980).
2) Reportedly inoperative reservoir drain (to be corrected in Summer 1980).
3) Slight amount of debris build up around the orifice trash racks.
4) Erosion along the south side of the plunge pool.
5) Tree growth in downstream channel 100 feet beyond plunge pool.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

4.1 PROCEDURES

The normal reservoir level is controlled by the crest elevation of the orifice in the riser structure. Downstream flows are limited by the flow through the orifice and over the riser crest which discharge 237 cfs when the reservoir is at the crest of the auxiliary spillways.

4.2 MAINTENANCE OF DAM

The dam is maintained by the owner, Cattaraugus County Watershed District. Normal maintenance consists primarily of cutting the grass of the embankment and auxiliary spillways about 2 times a year. Debris is cleared from the trash rack during the summer months.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect, however, the dam is monitored during periods of heavy runoff by represenatives of SCS and the owner.

4.4 EVALUATION

The operation and maintenance procedures for this structure are satisfactory.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed draining into the reservoir pool area was accomplished using the USGS 7.5 minute quadrangles for Franklinville, New York. The drainage area measures 4.1 square miles and consists primarily of open fields and woodlands. The topography throughout the drainage area consists of rolling hills with moderate to steep side slopes that range from approximately 5 to 20 percent.

5.2 ANALYSIS CRITERIA

The analysis of the floodwater retarding capability of the dam was performed using the Corps of Engineers HEC-1 computer program, Dam Safety version. This program develops an inflow hydrograph based upon the "Snyder Synthetic Unit Hydrograph" and then utilizes 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 spillway components of the dam include a principal spillway as well as two auxiliary spillways. The principal spillway consists of a 36" reinforced concrete pipe and a 3' x 9' reinforced concrete riser. For stages above the riser crest, the riser spillway contribution includes the weir flow over the crest of the riser as well as an orifice flow. The orifice measures 2'-8" in width and 1 foot in height and is located at the normal pool elevation of 1684.2 on the side of the riser. Principal spillway discharge is controlled by the orifice and the riser up to the stage of 1706.2. Above this stage the principal spillway discharge is controlled by the 36" diameter outlet pipe. The two auxiliary spillway channels are of trapezoidal sections with bottom widths of 100 feet and 200 feet and side slopes of 3 horizontal to 1 vertical. Discharge through the auxiliary spillways was calculated at the control section and assumed a weir coefficient of 3.0.

The combined spillways have sufficient capacity for discharging the peak outflow for the Probable Maximum Flood (PMF). For the PMF, the peak inflow is 8,666 cfs and the peak outflow is 8,608 cfs. The computed total spillway capacity for a water surface elevation at the top of dam is 8,650 cfs.

During the PMF storm event the maximum discharge velocity through the auxiliary spillways occurs along the exit slopes and is computed to be 9.99 fps and 11.77 fps for the north and south auxiliary spillways, respectively. In addition, the total duration of auxiliary spillway discharge for the PMF is 21.5 hours.

5.4 RESERVOIR CAPACITY

Storage capacity of the reservoir between the emergency spillway crests and the top of dam is 29 acre-feet, which is equivalent to a runoff depth of 1.32 inches over the drainage area. The normal storage capacity of the dam is 1042 acre-feet with flood storage capacity of the reservoir between the orifice crest and top of the dam of 1011 acre-feet.

5.5 FLOODS OF RECORD

Due to the lack of reliable information, no attempt was made to calculate the discharge for the flood of record.

5.6 OVERTOPPING POTENTIAL

Analysis using the PMF indicates that the dam does have sufficient spillway capacity to discharge the PMF storm event and will not be overtopped.

5.7 EVALUATION

At full PMF, the reservoir surface elevation is 0.05 feet below the top of the dam and the height of water in the auxiliary spillway is 4.15 feet.

The maximum discharge velocities through the auxiliary spillway is in excess of the normally accepted maximum velocity for grass lined spillways of 8 fps. Therefore, there exists the potential for erosion of the spillway channels during heavy runoff.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

No signs of instability were observed in connection with the earth embankment during this inspection. It appears that an unsuitable subgrade condition in connection with improper backfilling methods may have caused the crack development in the principal spillway outlet which is covered by the inspection reports included as Appendix D. The leakage noted during the inspections was clear water and no piping was suspected. However, to insure piping has not occurred the soil surrounding the pipe in the vicinity of the cracks will be grouted.

b. Design and Construction Data

At least two (2) slope stability analyses were performed by SCS for the embankment during the design phase. The soil strength parameters utilized in the analyses were based on consolidated undrained (R) triaxial shear tests. The tests were conducted on remolded proposed embankment materials compacted to at least 95 percent of the maximum dry density attainable through the Standard Proctor Compaction Test (ASTM D-698). The samples were saturated prior to the consolidation phase of the test. The shear strength parameters used in the analyses are as follows:

Sample No.	Internal Friction Angle (degrees)	Cohesion (psf)
62W331	26.5	575

We note the tests were conducted on remolded materials having a gradation less than the No. 4 sieve size.

The method of analysis used was the Swedish slip-circle method. The results of the downstream slope are shown in the design report in Appendix E. The conditions of the failure arc investigated assumed the reservoir level at the auxiliary spillway crest, no toe drainage and the failure arc passing only through the embankment. A factor of safety of 1.92 was computed for the above conditions, and it was further noted in the design folder a similar factor of safety was determined for the upstream slope under rapid drawdown conditions.

Although the stability analyses were cursory the embankment slopes are of normal configuration for a homogeneous earth embankment composed of recompacted glacial till soils.

Design of the crest width and longitudinal camber for settlement considerations as well as the cutoff trench width and depth are in accordance with standard practice. The design and construction of the internal drainage system is of conventional design for homogeneous earth embankment dams.

c. Erosion Protection

The design documents do not appear to address in-service erosion protection of the auxiliary or spillway channels.

The sodded slopes of the embankment appear to have performed satisfactorily and can be expected to continue to do so.

The case of the auxiliary spillway is somewhat less certain, however. The calculated maximum discharge velocity and duration of flow over the control section are higher than would normally be considered permissible for sodded channels.

d. Seismic Stability

No seismic stability analyses were performed as part of the dam design.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I inspection of the Ischua Creek Watershed Site 4 dam did not reveal conditions which constitute a hazard to human life or property. The earth embankment is considered structurally stable and the spillways are capable of retarding and safely discharging floodwaters resulting from the Probable Maximum Flood (PMF).

b. Adequacy of Information

The information which was reviewed is considered to be adequate for Phase I study purposes with the following reservations:

- o The stability analysis consisted of only two trial failure surfaces, neither of which penetraced the foundation material.
- o The record does not indicate that consideration was given to the potential of erosion during the relatively long duration of flow in the auxiliary spillway.

c. Need for Additional Investigation

It is recommended that the following additional investigation or study be undertaken:

- o An evaluation of the auxiliary spillway erodability and the possible need for additional protection.

d. Urgency

An emergency preparedness plan for notification and evacuation of downstream residents should be developed and implemented within 6 months. The evaluation of the auxiliary spillway erodability and the possible need for additional protection should be undertaken within 6 months and completed within 18 months.

7.2 RECOMMENDED REMEDIAL MEASURES

a. Repair cracked principal spillway outlet pipe and slide gate mechanism (as has been programmed for Summer 1980).

b. Provide a procedure for periodic inspections including operation and lubrication of slide gate mechanism.

c. Remove trees and brush from downstream channel from end of plunge pool downstream to original contact limit.

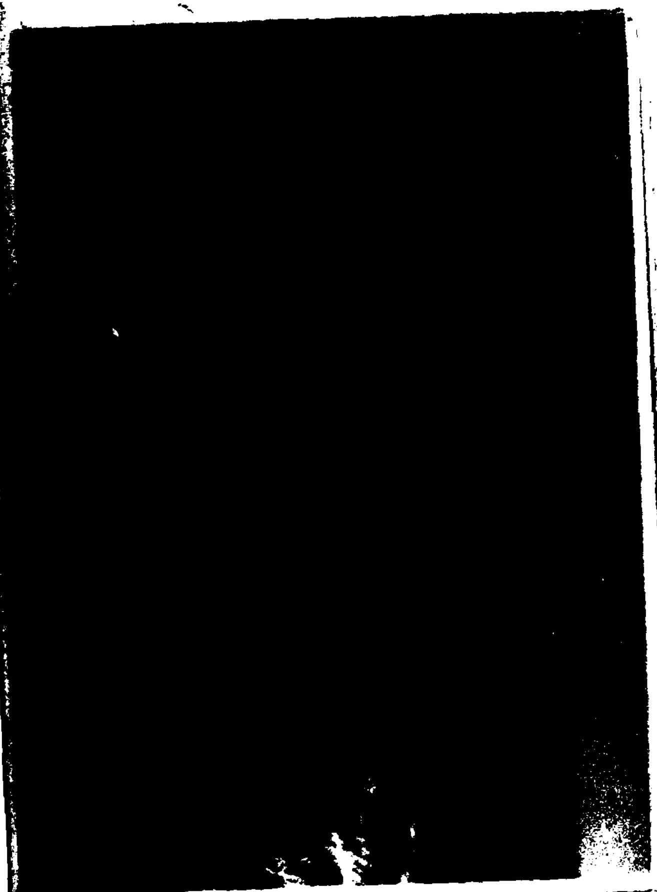
d. Regrade outlet channel to original design 8 foot base dimension with (V:H) 1:2 side slopes to match existing ground surface.

e. Line south side of plunge pool in areas of eroded banks with riprap.

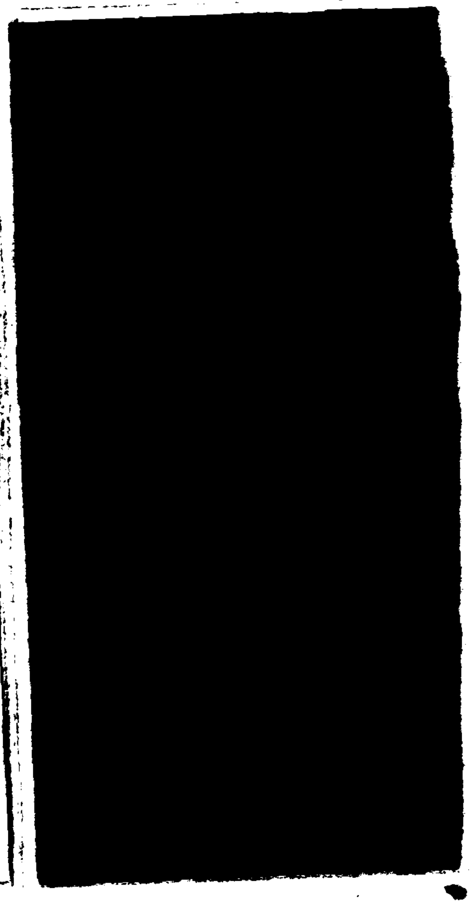
f. Develop and implement a warning system and evacuation plan for downstream residents and proper authorities in the event of large auxiliary spillway discharge.

APPENDIX A

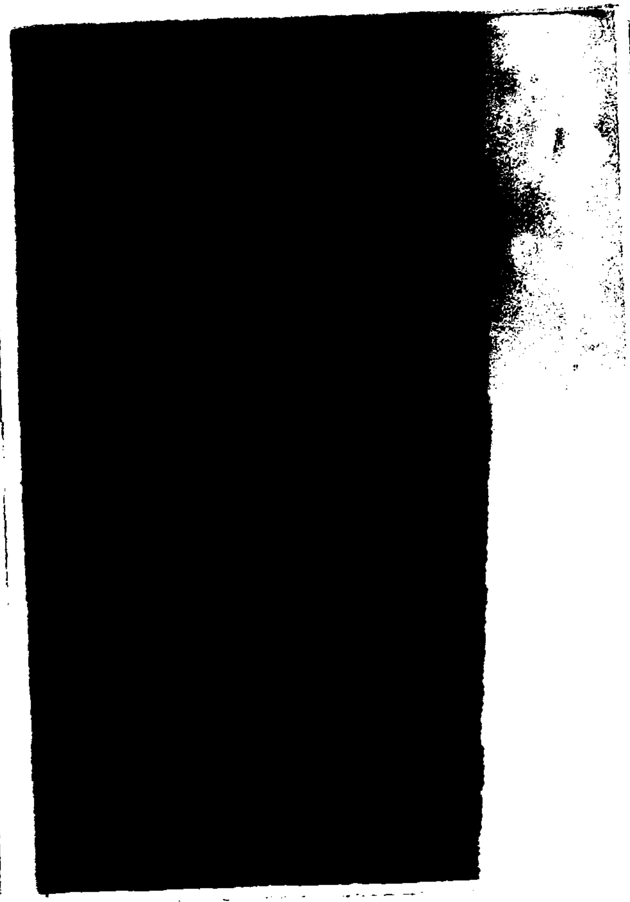
PHOTOGRAPHS



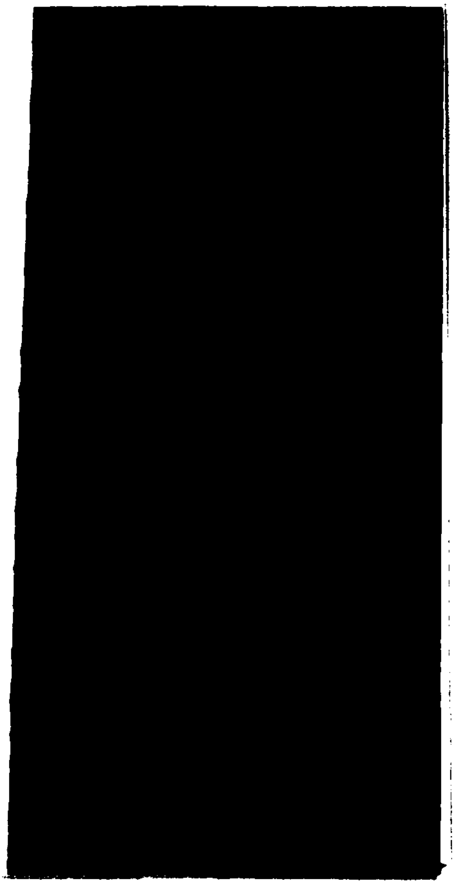
Downstream slope from south abutment. Note trees growing in left side of photo at north abutment and seepage emerging (see 3rd photo following)



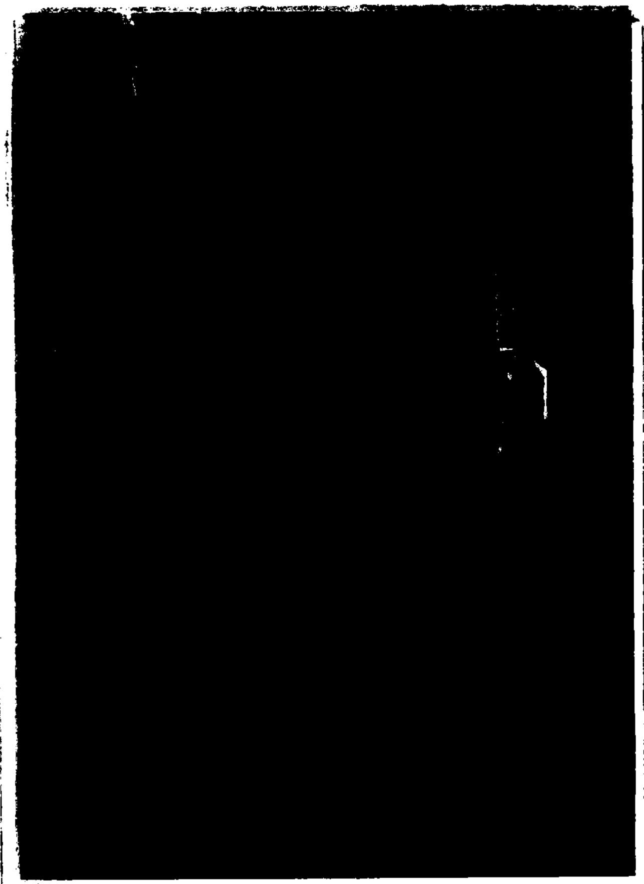
Overview of upstream slope from north side.



View of upstream slope from north side of embankment.

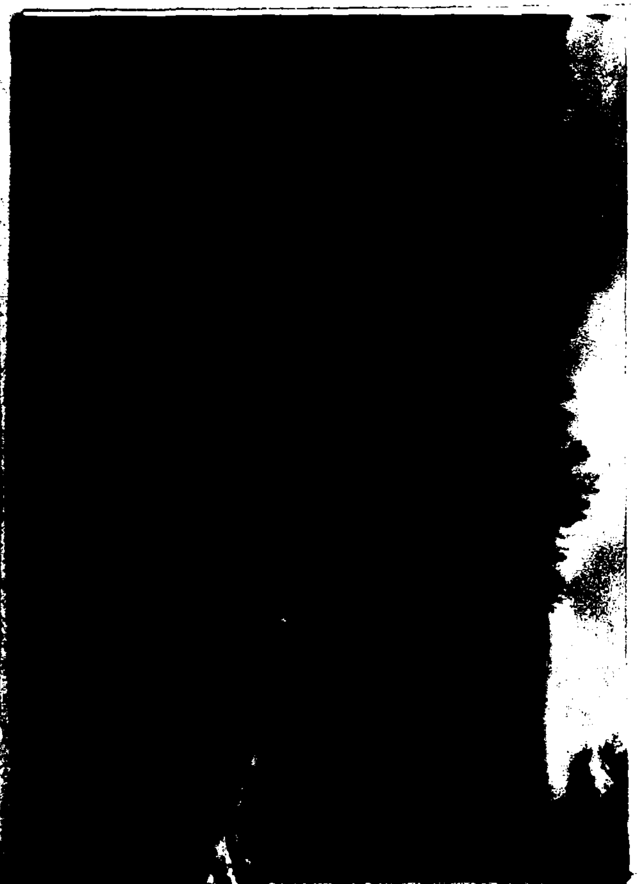


View of downstream slope from south side of downstream valley.

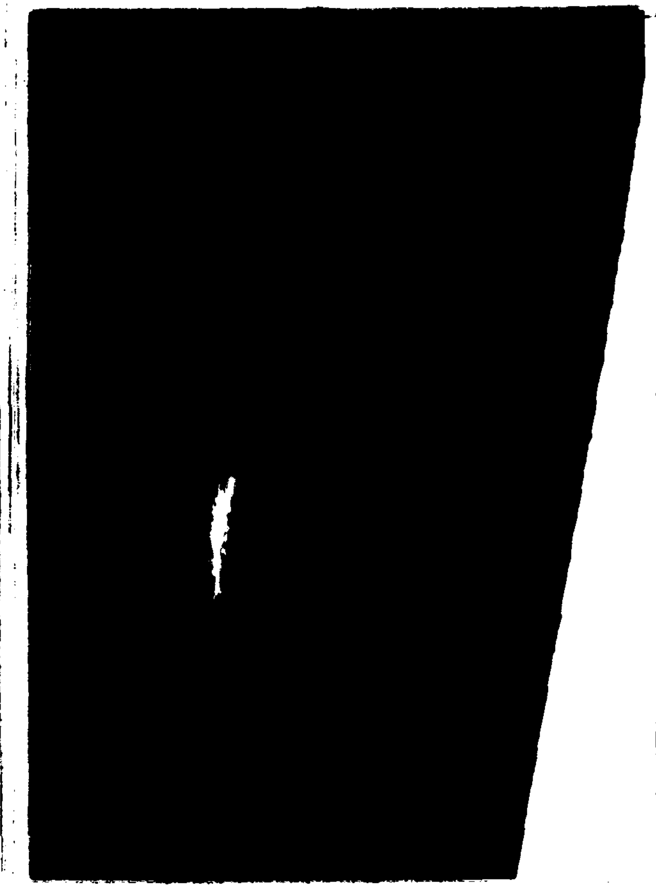


View showing downstream slope, outlet pipe, toe drain pipe, and plunge pool.

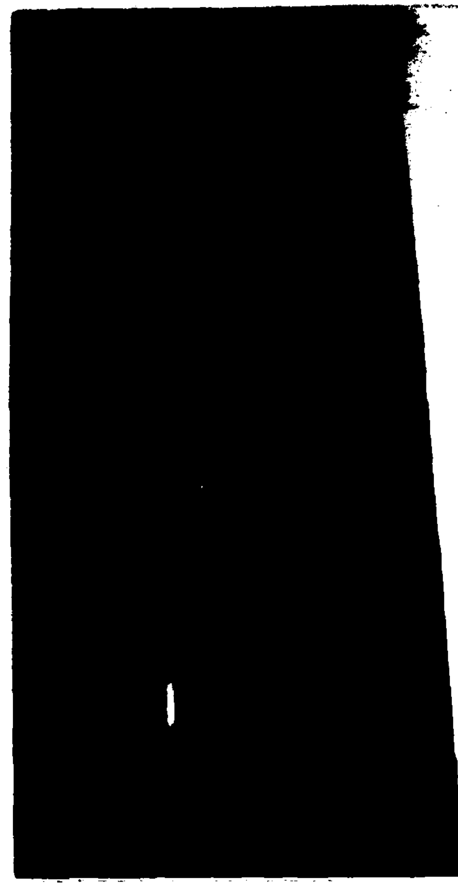
Close-up showing seepage from north abutment near the toe.



View of erosion along south side of pool.

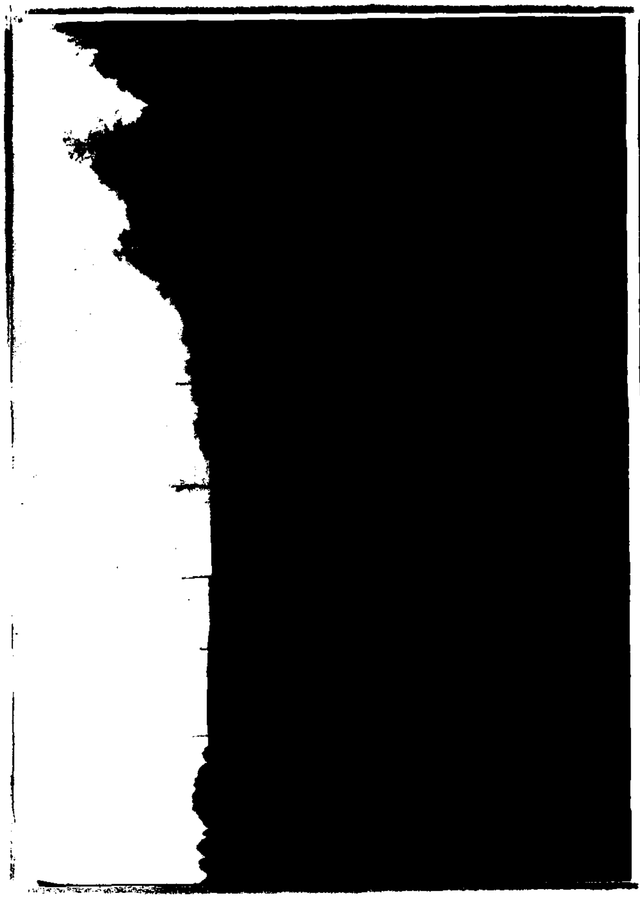


Detailed view of outlet pipe, toe drain pipes, and stone gutter.

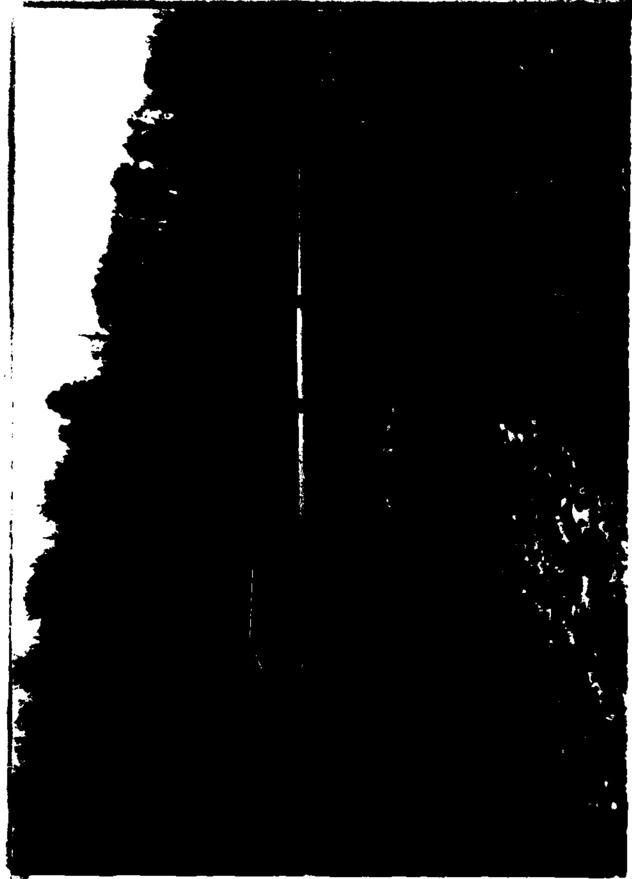


View of outlet pipe and plunge pool.

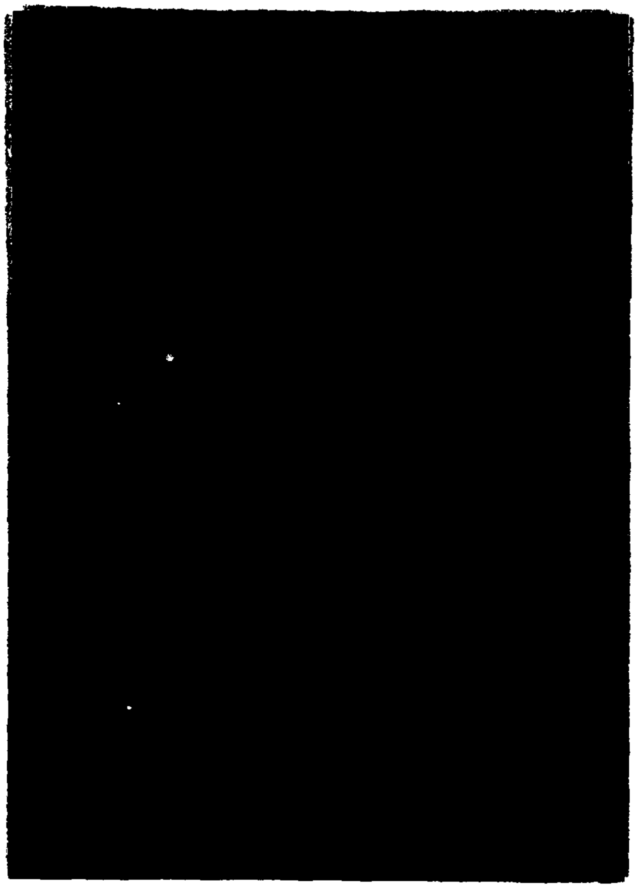
View of south spillway looking downstream.



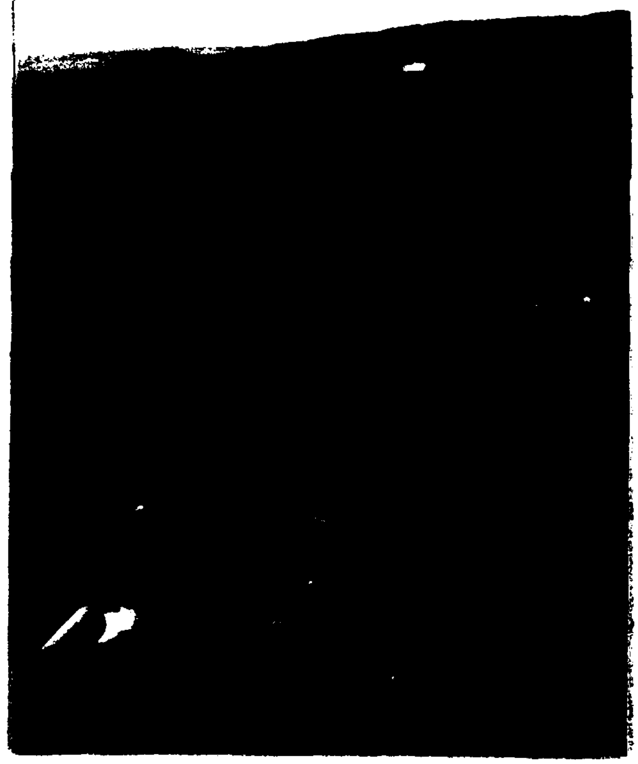
View of north spillway looking downstream.



View looking downstream at first channel obstruction.



View of intake structure (note debris accumulated on trash rack, and bullet hole in concrete).



View of plunge pool and downstream channel from crest of dam.

APPENDIX B

VISUAL INSPECTION CHECKLIST

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VISUAL INSPECTION CHECKLIST

1) **Basic Data**

a. General

Name of Dam Ischua Creek - Site 4

Fed. I.D. # 25-3060 DEC. Dam No. NY 626

River Basin Allegheny

Location: Town Franklinville County Cattaraugus

U.S.G.S. Quadrangle Franklinville

Stream Name Saunders Creek

Tributary of Ischua Creek

Latitude (N) 42°20'45" Longitude (W) 78°26'14"

Type of Dam Earth Dam

Hazard Category C High

Date(s) of Inspection 5/6/80

Weather Conditions Clear & Mild

Reservoir Level at Time of Inspection 1684.2 Controlled by orifice on Intake Structure

Tailwater Level at Time of Inspection ≈ 1660.5

b. Inspection Personnel Charles T. Gaynor II - Thomsen Associates

Paul Ehrenberg - N&T Harry Hersh & Don Lake - SCS

Ed Smith - Cattaraugus County Watershed District

c. Persons Contacted (Including Address & Phone No.)

Dale Clark - SCS local - 716-699-2326

Robin Warrender - DEC - Albany - 518-457-5557

Don Lake & Harry Hersh - SCS - Syracuse Office - 315-423-5503

d. History:

Date Constructed 8/62 - 9/63 Date(s) Reconstructed None

Designer Soil Conservation Service

Constructed by Sack Bros Inc.

Owner Cattaraugus County Watershed District - O&M

e. Seismic Zone Boundary Zone 2 - Zone 3

(See Algermissen's Map - Corps of Engineers Guidelines)

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VISUAL INSPECTION CHECKLIST

2) Embankment

a. Characteristics

1) Embankment Material Glacial Till - 26-44% of - #200 sieve size, 5-8% Clay Size, 6" Max

2) Cutoff Type Cutoff Trench

3) Impervious Core None - Dam is homogeneous

4) Internal Drainage System Drain Trench + Drain Trench w/ 8" C.M.P. Perforated Pipe

5) Miscellaneous

b. Crest

1) Vertical Alignment Good

2) Horizontal Alignment Good

3) Surface Cracks None

4) Miscellaneous

c. Upstream Slope

1) Slope(Estimate)(V:H) 1:3

2) Undesirable Growth or Debris, Animal Burrows None

3) Sloughing, Subsidence or Depressions None

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VISUAL INSPECTION CHECKLIST

4) Slope Protection *Grass Covered*

5) Surface Cracks or Movement at Toe *None*

d. Downstream Slope

1) Slope (Estimate - V:H) *1:2.5*

2) Undesirable Growth or Debris, Animal Burrows *NONE*

3) Sloughing, Subsidence or Depressions *NONE*

4) Surface Cracks or Movement at Toe *NONE*

5) Seepage *Natural Seep Beyond Stone Gutter along Right Abutment in Natural Slope with pipe from seep (Note: This seep was described in Kesbay Design Report by SCS)*

6) External Drainage System (Ditches, Trenches; Blanket)

Stone Gutters along Abutment - Embankment Contact

7) Condition Around Outlet Structure *Good*

8) Seepage Beyond Toe *None*

e. Abutments-Embankment Contact

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1) Erosion at Contact NONE

2) Seepage Along Contract Natural Seep see notes on Downstream Slope

3) Drainage System

a. Description of System Internal toe drain trench to drain trench w/ 8"ϕ perforated CMP parallel to Dam ℄ (88' from Dam ℄)

b. Condition of System unobservable

c. Discharge from Drainage System NONE

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

South End Elev. 1712.22 Sta. 0+00 on Dam ℄

North End Elev. 1756.19 Sta. 15+05 on Dam ℄

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VISUAL INSPECTION CHECKLIST

5) Reservoir

a. Slopes Right Side (U.S.) ~~1:5~~ 5-10°
Left Side 1:2

b. Sedimentation Unobservable

c. Unusual Conditions Which Affect Dam NONE

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.)
Bridge located at intersection of Downstream Channel & Hardy Corner Rd.

b. Seepage, Unusual Growth Natural Seepage along Former Stream Channel

c. Evidence of Movement Beyond Toe of Dam None

d. Condition of Downstream Channel Plunge Pool some evidence of Erosion along left side (See Photo) Beyond Plunge Pool Channel is Rock lined 1-2" ϕ for approx 100'

7) Spillway(s) (Including Discharge Conveyance Channel)

Concrete Riser Inlet Structure with orifice control for Normal Pool & 1-36" I.D. R.C. Outlet Pipe

a. General Orifice @ Elevation - 1684.2
Riser Crest @ Elevation - 1703.2
Entrance Elev. 1668.1 (at Riser) Exit Elev. 1662.5

b. Condition of Service Spillway Good yet Gate Stem is Inoperable, 36" I.D. R.C. Pipe is cracked at Several Locations (See Report by SCS + As built drawings)

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VISUAL INSPECTION CHECKLIST

c. Condition of Auxiliary Spillway Good - Grass Lined Channel Design Max. Spillway Elevation 1713.0 (Both North & South Sides)

d. Condition of Discharge Conveyance Channel Slight Erosion on South Side of Plunge Pool, Trees (1-2" ϕ) in and on Channel Bank from end of Plunge Pool downstream ≈ 100'

8) Reservoir Drain/~~Outlet~~

Type: Pipe ✓ Conduit ____ Other ____

Material: Concrete ____ Metal ✓ B.C.C.M. Other ____

Size: 24" I.D. Length 24.5'

Invert Elevations: Entrance 1669.5 Exit 1668.6 (in Riser Structure

Physical Condition (Describe): Unobservable ✓

Material: ____

Joints: ____ Alignment ____

Structural Integrity: ____

Hydraulic Capability: ____

Means of Control: Gate ✓ Valve ____ Uncontrolled ____

Operation: Operable ____ Inoperable ✓ Other ____

Present Condition (Describe): Condition of Inoperable Gate to be further investigated and corrected by Cattaraugus County Watershed District within the month

Misc. - No Warning System or Evacuation Plan
- Yearly Inspection by SCS & Cattaraugus Co. Watershed Dist.
- During Major Storms Inspection by SCS + Cattaraugus Co Watershed Dist.
- Ed Smith indicated reservoir level has passed over riser crest @ Elev. 1703.2 (Normal Pool - 1684.2)

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9) Structural

a. Concrete Surfaces Good - Riser Intake Structure
Several Bullet holes with 1/2 to 3/4"
penetration

b. Structural Cracking Cracks in Spillway Outlet Pipe
See As built Drawings & Report by SCS

c. Movement - Horizontal & Vertical Alignment (Settlement)
NONE

d. Junctions with Abutments or Embankments

e. Drains - Foundation, Joint, Face

f. Water Passages, Conduits, Sluices

g. Seepage or Leakage

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h. Joints - Construction, etc. Tight

i. Foundation

j. Abutments

k. Control Gates Reservoir Drain Inoperable to be repaired Summer 1980

l. Approach & Outlet Channels

m. Energy Dissipators (Plunge Pool, etc.)

n. Intake Structures Concrete Riser Intake Structure

o. Stability

p. Miscellaneous

APPENDIX C

HYDROLOGIC/HYDRAULIC ENGINEERING
DATA AND COMPUTATIONS

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CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

		Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1)	Top of Dam	1717.2	32.2	1042
2)	Design High Water (Max.Design Pool)	1715.9	730	943
3)	Auxiliary Spillway Crest	1713.0	530	735
4)	Pool Level with Flashboards	N.A.	N.A.	N.A.
5)	Service Spillway Crest	1703.2	26.2	323
6)	Orifice Crest	1684.2	5.6	31

DISCHARGES

		Volume (cfs)
1)	Average Daily	Unknown
2)	Spillway @ Maximum High Water (TOP OF DAM)	247
3)	Spillway @ Design High Water (Elev. 1515.9)	243
4)	Spillway @ Auxiliary Spillway Crest Elevation	237
5)	Low Level Outlet	70
6)	Total (of all facilities) @ Maximum High Water	3150
7)	Maximum Known Flood	Unknown

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~~OUTLET STRUCTURES~~/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate ✓ Sluice ____ Conduit ____ Penstock ____

Shape: Circular

Size: 24" I.D.

Elevations: Entrance Invert 1662.5

Exit Invert 1668.6

Tailrace Channel: Elevation No Applicable

HYDROMETEROLOGICAL GAGES:

Type: None

Location: ____

Records:

Date - ____

Max. Reading - ____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

Reservoir Drain with manually controlled slide gate

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[illegible]

CREST: ELEVATION: [illegible]

Type: Homogeneous Earth Embankment

Width: 18 feet Length: 900 feet

Spillover: Concrete Riser Structure

Location: Near Maximum Section of Dam Upstream Embankment

SPILLWAY:

PRINCIPAL		EMERGENCY
Orifice – 1684.2 Riser Crest – 1703.2	Elevation	1713.0
Con	Type	Trapezoidal Grass Lined Channel
	Width	South – 200' North – 100'

<u>Type of Control</u>

PRINCIPAL		EMERGENCY
Yes	Uncontrolled	Yes
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	Grass lined over topsoil underlain by [illegible]
	Anticipated Length of operating service	21.5 hours @ PMF
	Chute Length	
Not Applicable	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	2% Entrance Slope

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DRAINAGE AREA: 4.1 sq miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Pasture

Terrain - Relief: 5 to 50 percent

Surface - Soil: Heterogeneous Mixture of Silt, Sand & Clay

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

No Changes Planned

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

Normal Pool is designed as a 50 year Sediment Pool

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

Approximately 1000 ft. of Hardy Road would be inundated with a maximum water depth of about 10 feet during the PMF.

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

Location: NONE

Elevation:

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Drainage Area = 4.1 sq. mile

Estimation of Lag time (t_p)

$$t_p = C_t(.955)(L \cdot L_c)^{.3} + .25 t_R = 1.85 \times .955\,(3.78 \times 1.32)^{.3} + .25(.5)$$
$$= 2.99 \text{ hr.}$$

slope of the basin $= \frac{1960 - 1720}{12000} \times 100 = 2\%$

Check of Lag Time

Using Linsley, Kohler & Paulhus equation

$$\text{Lag } (t_p) = 0.72 \left(\frac{L \cdot L_c}{\sqrt{S}}\right)^{.38}$$

$$= .72 \left(\frac{3.78 \times 1.32}{\sqrt{.02}}\right)^{.38} = 2.79 \text{ hr.}$$

In HEC-1 input $t_p = 3.0$ & $C_p = .63$ were used to develop Snyder's unit hydrograph

Probable Maximum Precipitation

From Hydrometeorological Report #33, Proable Maximum Precipitation = 22.5 inches (For 200 sq. mile - 24 hour duration)

Depth-Area-Duration Relationship (Zone 2)

6 hour - 116%
12 hour - 127%
24 hour - 141%

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JOB HYDROLOGIC STUDY DAM # N.Y. 626
SHEET NO. ______ OF ______
CALCULATED BY P.S. DATE 6/2/80
CHECKED BY ______ DATE ______
SCALE ______

STAGE - STORAGE DATA

Elevation (ft.)	Surface Area (Acres)	Avg. Area (Acres)	INCREMENTAL STORAGE (Acre ft)	Total Storage (Acre ft)	Remarks
1684.2	5.6		0	0	Surface Areas are directly taken from S.C.S. design report since they are computed with maps of 2 foot and 5 foot contour intervals.
1703.2	26.2	15.9	302	302	
1713.0	59.2	42.7	418	720	
1715.9	73.0	66.1	192	912	
1717.2	80.0	76.5	99	1011	
1718.2	98.0	89.0	89.0	1100	

NOTE: Storage for other stages for HEC-1 input were interpolated from Stage-Storage curve.

FORM 204 Available from NEBS INC Townsend, Mass 01470

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SCALE ____

STAGE-DISCHARGE COMPUTATION

Normal Pool Elevation - 1684.2
Elevation of Crest of Riser - 1703.2
Emergency Spillway Elevn. - 1713.0
Elevation of top of dam - 1717.2
Elevation of Tailwater - 1660.5

Size of Orifice - 2'8" x 1'
Size of Outlet Pipe - 36" ϕ, So = .021
Length of pipe - 266.3', n = .012
EL. @ Inlet of Pipe - 1668.1
Riser Opening - 9' x 1'-2" (2)

Assumptions:

1. A constant coefficient of discharge of 0.7 was assumed to compute discharge through Orifice.
2. To compute the discharge through the riser, Weir flow equation was used for the reservoir stage below the top of riser. For all reservoir stage above the top of riser Orifice flow equation was used.
3. Coefficient of Weir = 3.0
4. Bureau of Public Roads Hydraulic Engineering Circular #5 was used to compute Headwater assuming Inlet & outlet control. Long hand calculations were made to compute headwater beyond the limit of the chart.
5. In computing discharge through emergency spillway, all routing Velocity and friction loss were ignored.
6. Tailwater Elevation was ignored since the outlet pipe is discharging into a plunge pool.

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SCALE ______

STAGE - DISCHARGE COMPUTATIONS (CONT'D.)

ELEV.	STAGE	Orifice Discharge	Inlet Control HW/D	Inlet Control HW	Outlet Control $\frac{d_c+d}{2}$	Outlet Control H	Outlet Control HW	Control HW	Riser & Pipe H	Riser & Pipe DISCHARGE	Emerg. Spillway DISCHARGE	TOTAL DISCHARGE
ft.	ft.	c.f.s.		ft.	ft.	ft.	ft.	ft.	ft.	c.f.s.	c.f.s.	c.f.s.
1684.2	0											0
1686.2	2	18	-	-	2.2	.25	-	-				18
1688.2	4	28	-	-	2.37	.70	-	-				28
1690.2	6	35	1	3	2.40	1.10	-	3				35
1692.2	8	41	1.12	3.4	2.52	1.50	-	3.4				41
1694.2	10	46	1.22	3.7	2.60	1.88	-	3.7				46
1696.2	12	51	1.36	4.1	2.65	2.25	-	4.1				51
1698.2	14	55	1.48	4.4	2.70	2.70	-	4.4				55
1700.2	16	59	1.60	4.8	2.75	3.05	.20	4.8				59
1702.2	18	62	1.70	5.1	2.77	3.30	.47	5.1				62
									Riser	control		
1704.2	20	66	4.6	13.8	3.0	13.0	10.4	13.8	1.0	54	-	120
1706.2	22	27	-	28.0	3.0	37.4	34.8	34.8		182	-	210
									Pipe	control		
1708.2	24	-	-	-	3.0	42.7	40.1	40.1	40.1	224	-	224
1710.2	26	-	-	-	3.0	44.7	42.1	42.1	42.1	230	-	230
1712.2	28	-	-	-	3.0	46.7	44.1	44.1	44.1	235	-	235
1714.2	30	-	-	-	3.0	48.7	46.1	46.1	46.1	240	1200	1440

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JOB [illegible]
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CHECKED BY ______ DATE ______
SCALE ______

STAGE - DISCHARGE COMPUTATIONS (CONTD.)

ELEV.	STAGE	Orifice	Inlet control		Outlet control			Control	Riser & Pipe		Emerg. spillway	Discharge over top of dam	Total
		Discharge	HW/D	H.W	$\frac{dc+d}{2}$	H	HW	HW	H	Discharge	Discharge		Discharge
ft.	ft.	c.f.s.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	c.f.s.	c.f.s.	c.f.s.	c.f.s.
1716.2	32	-	-	-	3.0	50.7	48.1	48.1	48.1	245	5400	-	5645
1717.2	35	-	-	-	3.0	51.7	49.1	49.1	49.1	247	8400	-	8650
1718.2	36	-	-	-	3.0	52.7	50.1	50.1	50.1	249	11700	1905	13355

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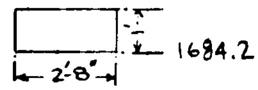
SAMPLE CALCULATIONS

ORIFICE DISCHARGE

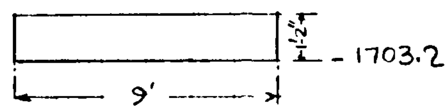


STAGE @ 1698.2, $Q = CA\sqrt{2gH}$

$C = 0.7$, $A = 2.66 \times 1 = 2.66\ \square'$ $H = 1698.2 - 1684.7 = 13.5$

$Q = .7 \times 2.66 \times \sqrt{64.4 \times 13.5} = 55$ c.f.s.

RISER DISCHARGE



STAGE @ 1706.2 $Q = CA\sqrt{2gH}$

$C = 0.7$, $A = 2 \times 9 \times 1.16 = 20.88\ \square'$

$H = 1706.2 - 1703.8 = 2.4'$

$Q = .7 \times 20.88 \times \sqrt{64.4 \times 2.4} = 182$ c.f.s.

Computed Head with Q = 182 cfs indicates that the orifice will be submerged. Therefore, orifice discharge will be greatly reduced. By trial and error the total combined discharge through orifice and riser was computed. Total discharge of 210 cfs was assumed and with this discharge HW (inlet & outlet control) were computed.

Controlling HW (outlet control) = 34.8

∴ Water Surface El. in the riser box = 1668.1 + 34.8 = 1702.9 > 1685.2

∴ ΔH for Orifice = 1706.2 − 1702.9 = 3.3'

∴ Discharge thru Orifice = $CA\sqrt{2gH} = .7 \times 2.66\sqrt{64.4 \times 3.3} = 27$ c.f.s.

∴ Total Discharge = 182 + 27 = 209 c.f.s. = 210 c.f.s.

PIPE CONTROL

At stage of 1708.2, the computed headwater with combined discharge was more than the stage elevation. Therefore, it was assumed pipe controls and it is outlet control.

∴ HW = 1708.2 − 1668.1 = 40.1

HW = H + ho − LSo ∴ H = 40.1 − 3.0 + 5.6 = 42.7

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB ______
SHEET NO ______ OF ______
CALCULATED BY P.S. DATE 6/2/79
CHECKED BY ______ DATE ______
SCALE ______

$$H = \left(1 + ke + \frac{29\,n^2 L}{R^{4/3}}\right) V^2/2g$$

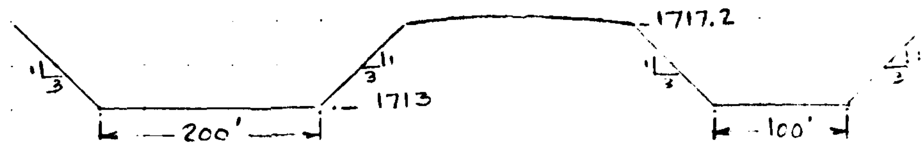
$$42.7 = \left(1 + .1 + \frac{29(.012)^2 \times 266.3}{(.75)^{4/3}}\right) V^2/2g$$

$$42.7 = 2.73\ V^2/2g \qquad V = 31.73 \text{ ft/sec}$$

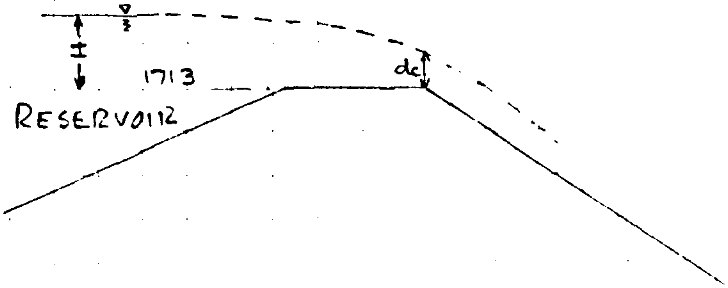
$$\therefore Q = A \times V = 7.068 \times 31.73 = 224 \text{ c.f.s.}$$

EMERGENCY SPILLWAY

Stage @ 1716.2



Q thru Pipe,
HW = 1716.2 − 1668.1 = 48.1
H = 48.1 − 3 + 5.6 = 50.7



$50.7 = 2.73\ V^2/2g,\ V = 34.6'/\text{sec}$

$Q = 7.068 \times 34.6 = 245$ c.f.s.

Discharge thru Emergency spillways,
$H = 1716.2 - 1713 = 3.2'$
Neglecting approach velocity & friction loss, $H = dc + Vc^2/2g$

Computations involve assuming a discharge thru each spillway and calculate dc and $Vc^2/2g$ to balance two sides of the equation. Table 8-5 of King & Brater "Handbook of Hydraulics was used to compute dc.

Thru 100' wide trapezoidal channel, $Q = 1800$ c.f.s., $k'c = .018$, $dc/b = .021$
$dc = 2.1$, $Vc = 1800/223.2 = 8.06'/\text{sec}$, $Vc^2/2g = 1.0$ $\therefore dc + \frac{Vc^2}{2g} = 3.1 \simeq 3.2'$

Thru 200' wide trapezoidal channel computed $Q = 3600$ c.f.s.

$\therefore$ Total Discharge = 1800 + 3600 + 245 = 5645 c.f.s.

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SHEET NO ______ OF ______
CALCULATED BY ______ DATE ______
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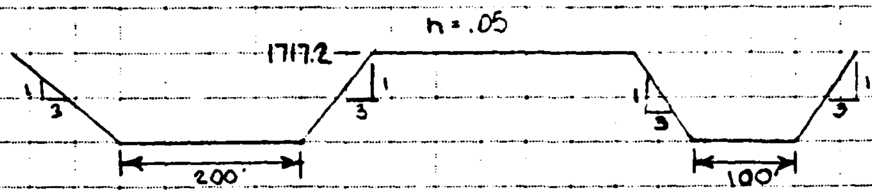
SCALE ______

Auxilliary Spillways

Downstream Slope = 6% (South)

Downstream Slope = 4% (North)



Maximum Discharge thru emergency spillway = 8,400 cfs @ 1717.2

Q = 5600 cfs thru 200' bw trapezoidal section
Q = 2800 cfs thru 100' bw " "

Using Table 7-11 pp 7-36 of King & Brater "Handbook of Hydraulics"

$K' = \frac{5600 \times .055}{(200)^{8/3} \times (.06)^{1/2}}$

$d/b = .0115$

$d = .0115(200) = 2.3'$

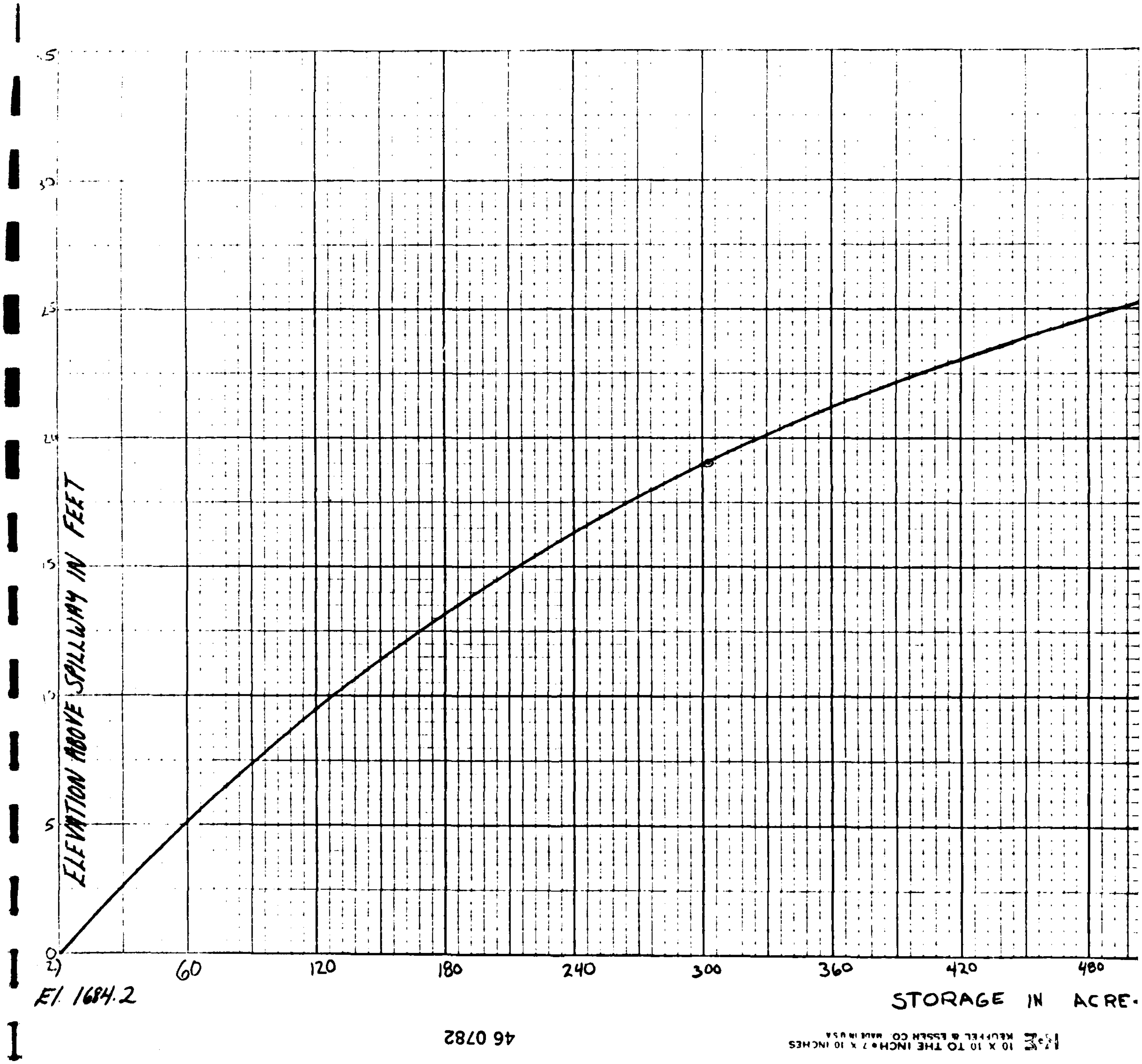
$V = 5600/475.9 = \underline{11.77'/sec}$

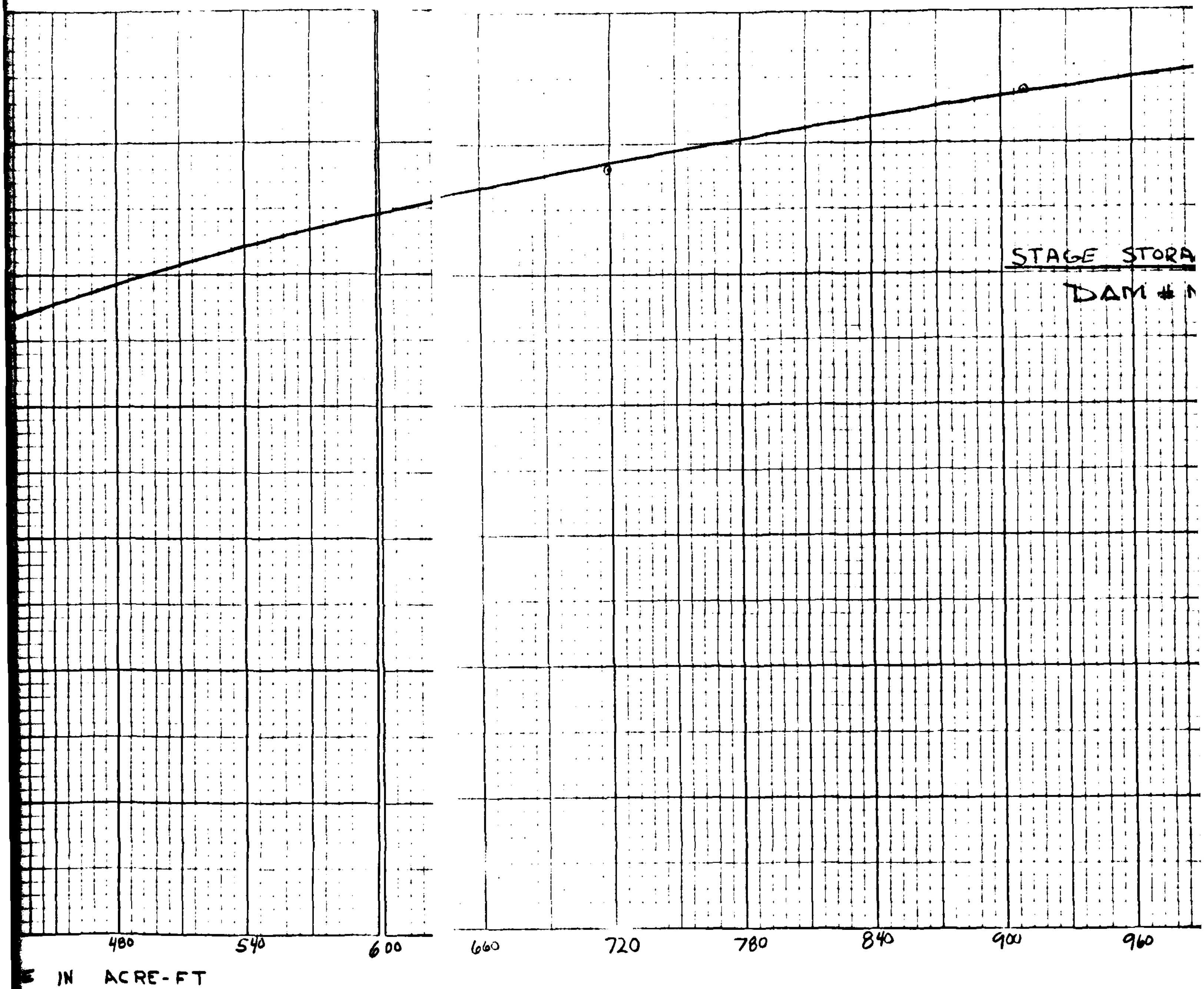
$K' = \frac{2800 \times .055}{(100)^{8/3}(.04)^{1/2}} = .00357$

$d/b = .026$

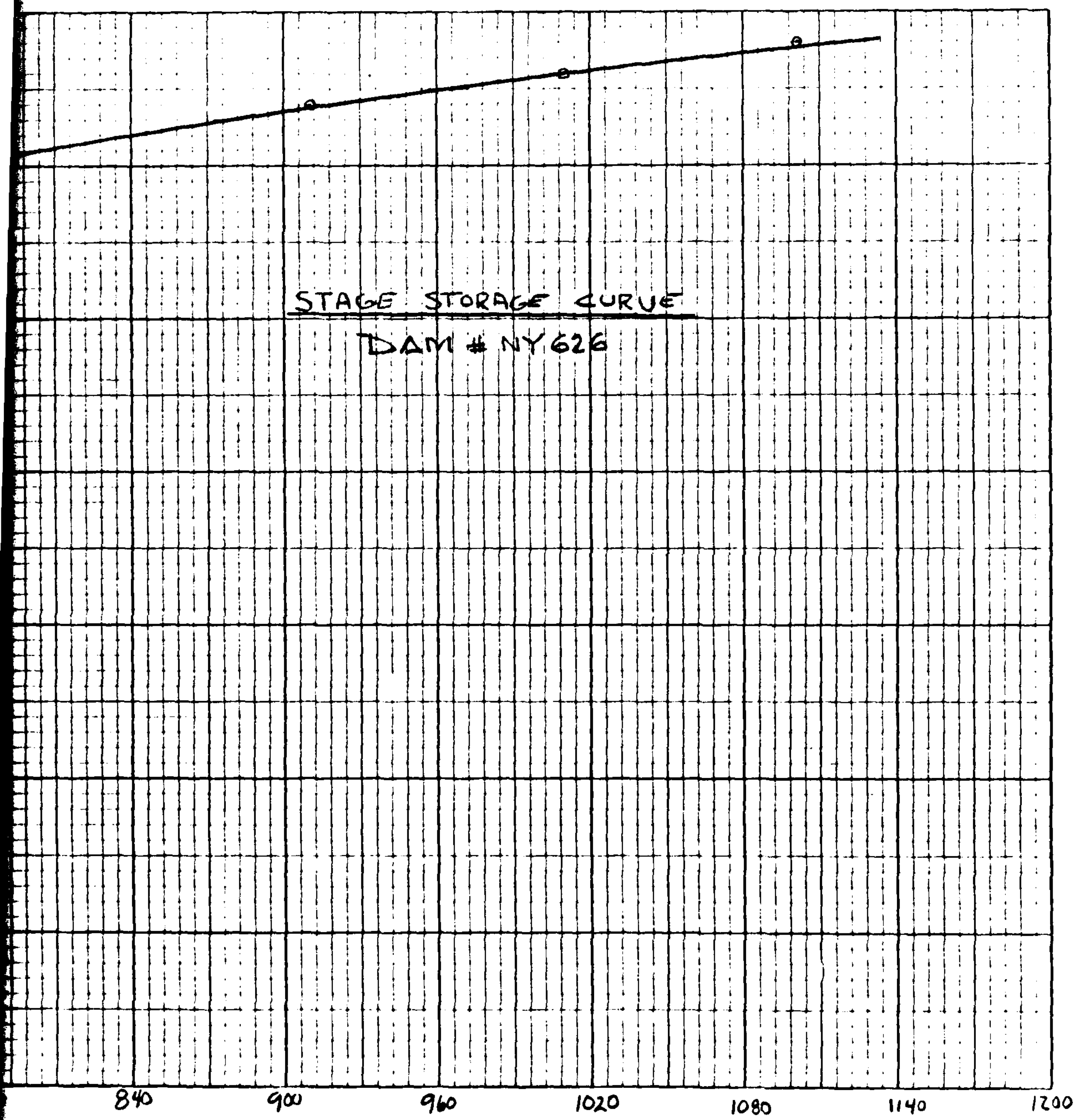
$d = .026(100) = 2.6$

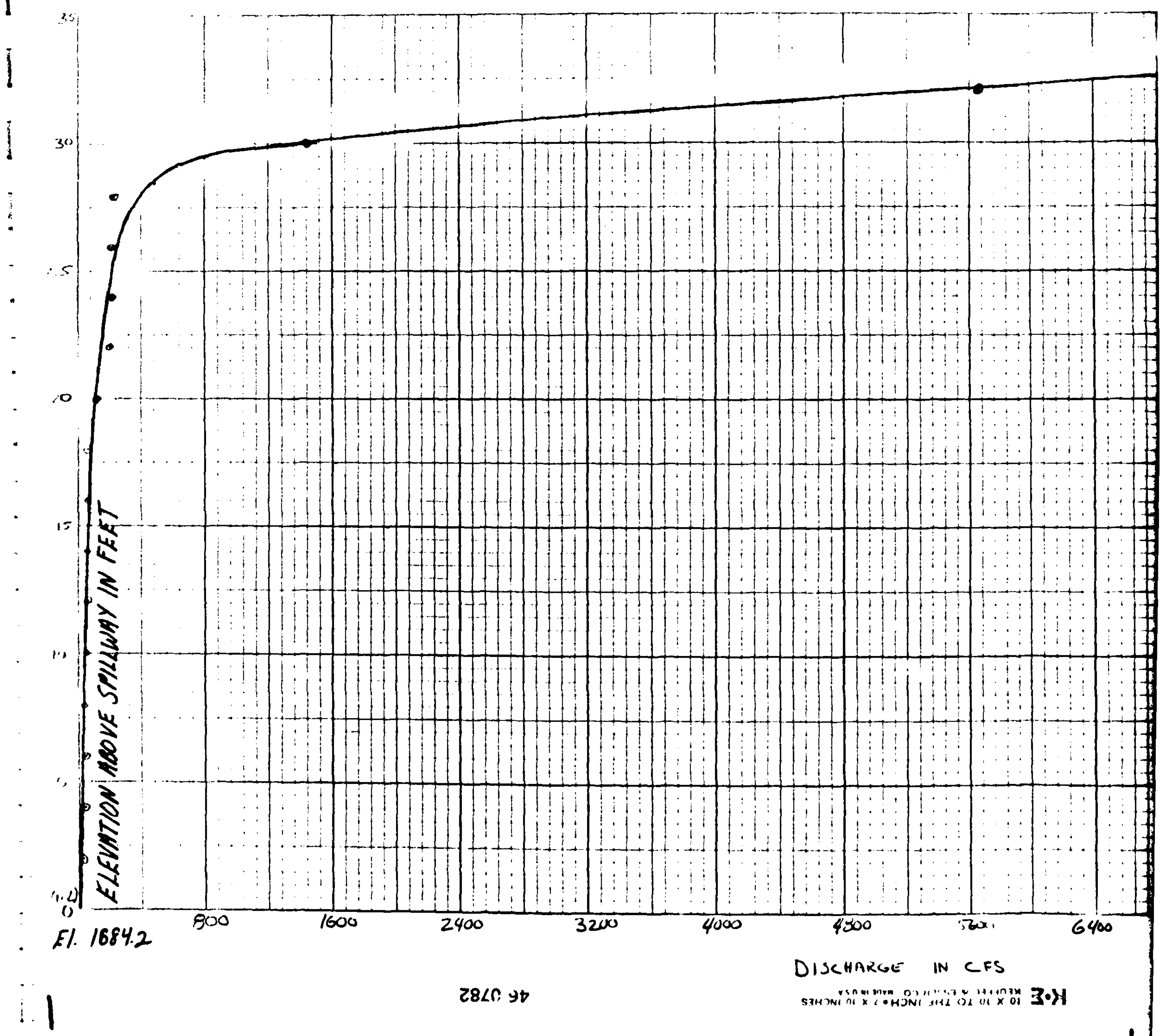
$V = 2800/280.3 = \underline{9.99'/sec}$


ELEVATION ABOVE SPILLWAY IN FEET
5
0
60
120
180
240
300
360
420
480
El 1684.2
STORAGE IN ACRE-

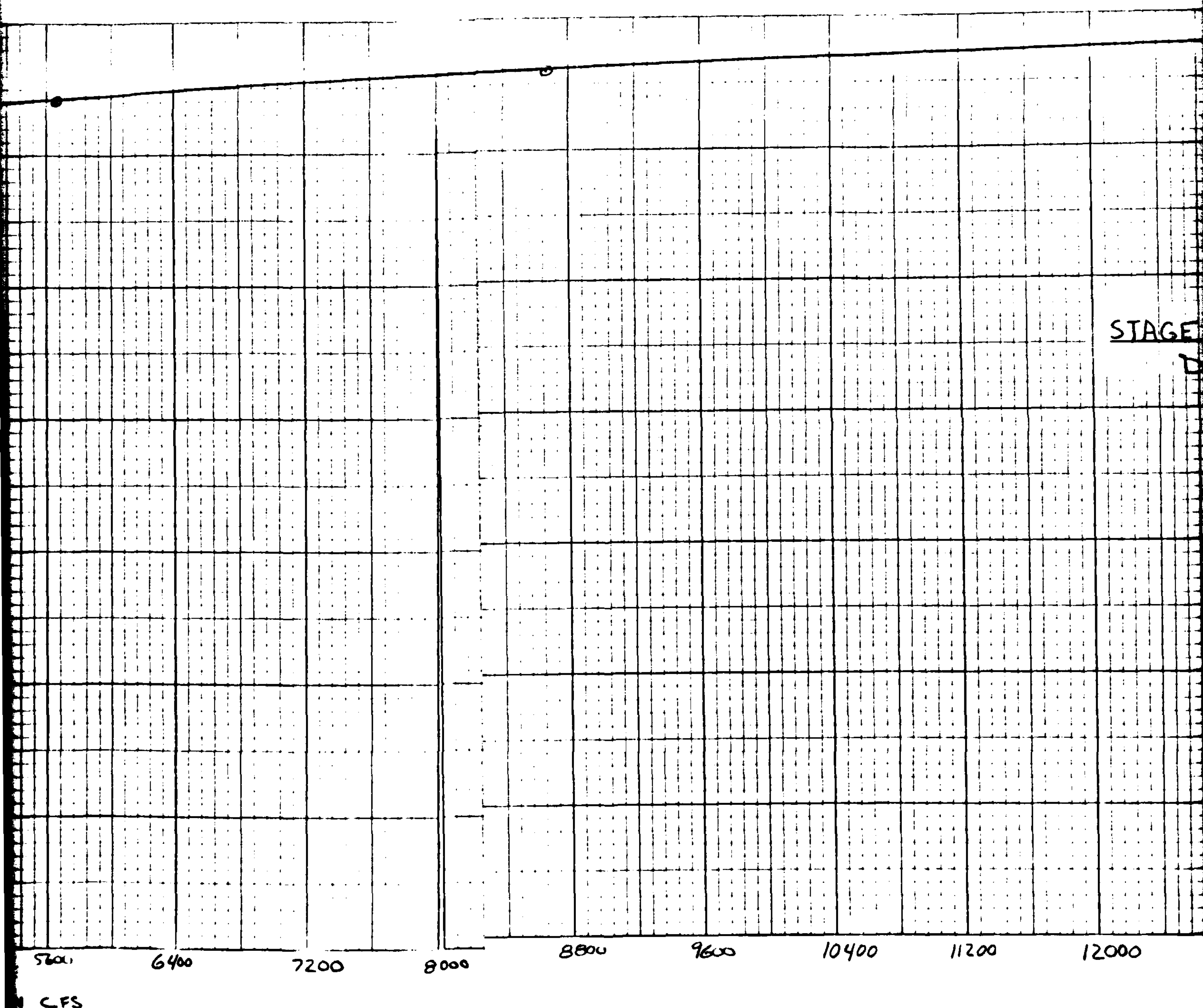


12

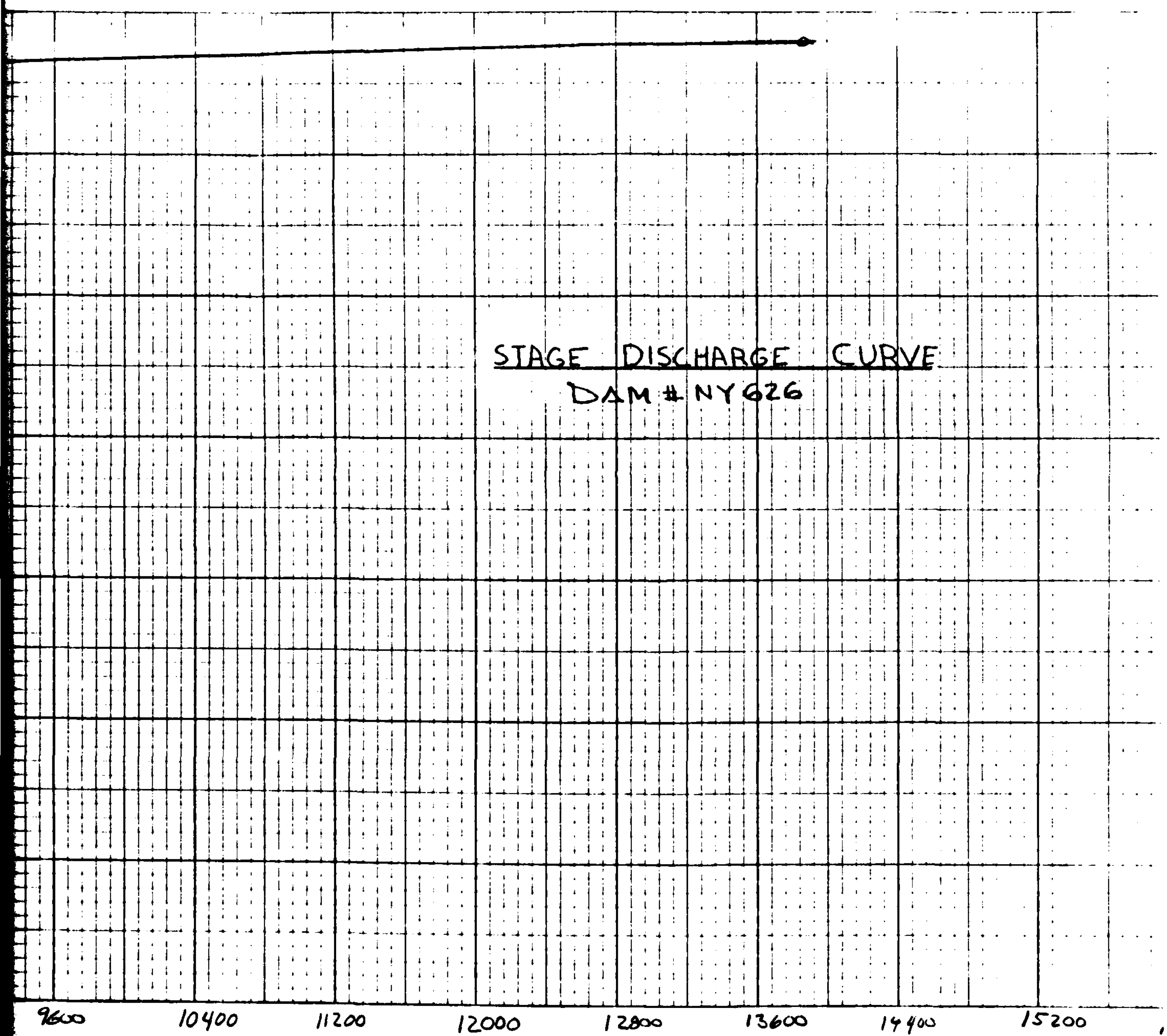

STAGE STORAGE CURVE
DAM # NY626
840
900
960
1020
1080
1140
1200



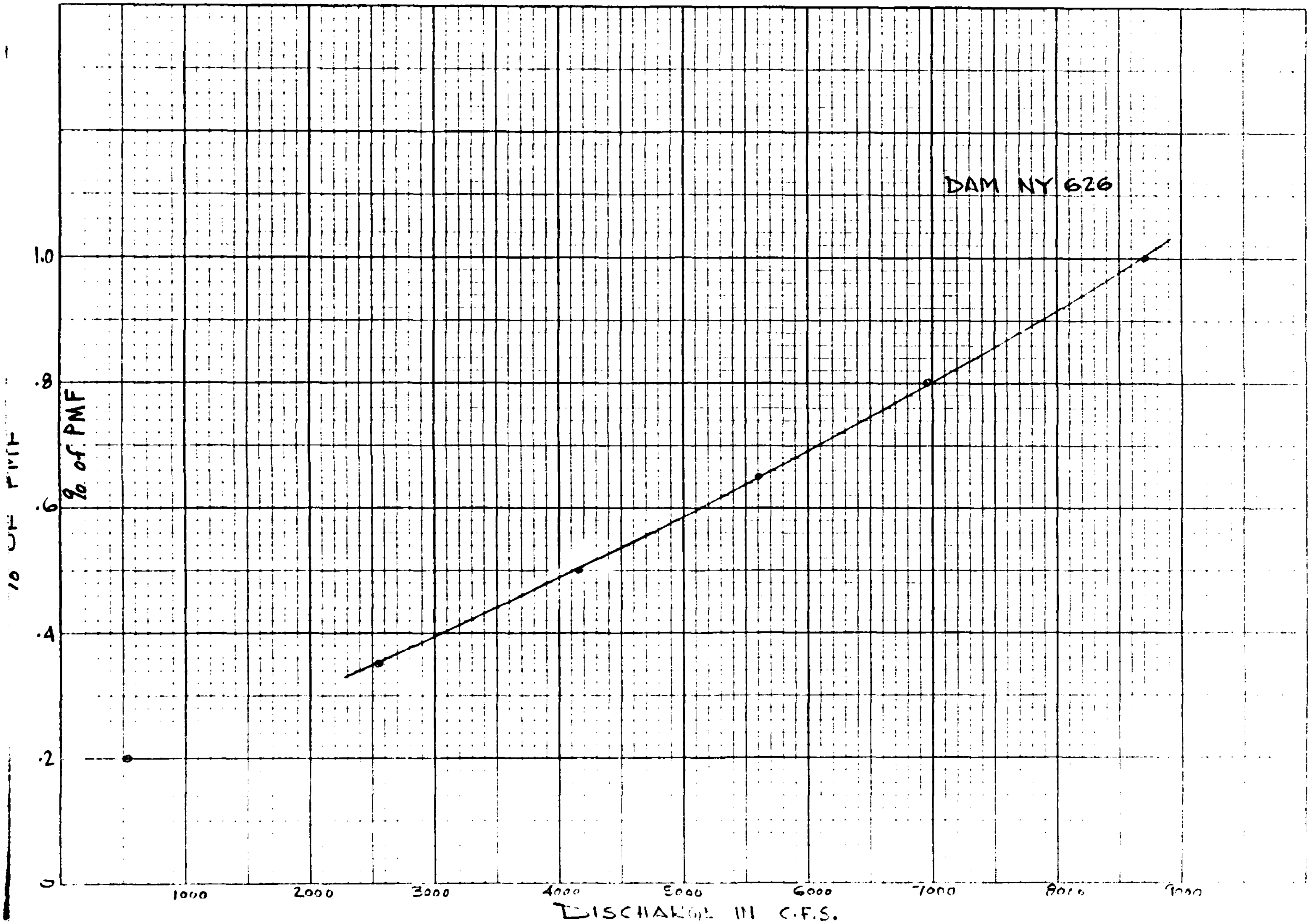
35
30
25
20
15
10
5
0
800
1600
2400
3200
4000
4800
5600
6400
ELEVATION ABOVE SPILLWAY IN FEET
El. 1684.2
DISCHARGE IN CFS
46 0782
K+E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



STAGE
5600
6400
7200
8000
8800
9600
10400
11200
12000
CFS


STAGE DISCHARGE CURVE
DAM # NY626
9600
10400
11200
12000
12800
13600
14400
15200

46 0782


DAM NY 626
% of PMF
1.0
.8
.6
.4
.2
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
DISCHARGE IN C.F.S.

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*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
*********************************
     1                A1                ANALYSIS OF DAM OVERTOPPING USING RATIOS O
     2                A2              HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF
     3                A3                  RATIOS OF PMF ROUTED THROUGH THE RESERVO
     4                B    100        0        30        0        0        0        0
     5                B1     5
     6                J      1        6         1
     7                J1    .2      .35        .5      .65       .8        1
     8                K      0        1         0        0        0        0        1
     9                K1      CALCULATION OF INFLOW HYDROGRAPH
    10                M      1        1       4.1       0       4.1       0        0
    11                P      0     22.5   .   116      127      141       0        0
    12                T      0        0         0        0        0        0        1
    13                W   3.00     .625
    14                X     -2      -.1         2
    15                K      1        2         0        0        0        0        1
    16                K1      ROUTING OF INFLOW HYDROGRAPH
    17                Y      0        0         0        1        1
    18                Y1     1        0         0        0        0        0       -1
    19                Y2     0       50       100      175      340      415      690
    20                Y2  1100
    21                Y3     0       35        46       55      120      210      235
    22                Y3 13855
    23                K     99
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 ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF N.Y.626
   RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
0       30       0       0       0       0       0       0       0

6        1
5       .5     .65      .8       1
1        0       0       0       0       1       0       0       0
TION OF INFLOW HYDROGRAPH
1      4.1       0     4.1       0       0       0       0       0
5   .  116     127     141       0       0       0       0       0
0        0       0       0       0       1      .1       0       0
5
1        2
2        0       0       0       0       1       0       0       0
 OF INFLOW HYDROGRAPH
0        0       1       1
0        0       0       0       0      -1
0      100     175     340     415     690     800     935    1010

5       46      55     120     210     235    1440    5645    8650
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
END OF NETWORK	

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

         TIME OF EXECUTION      15-JUL-80   10:03:54

                                          ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
                                      HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF N.Y.626
                                          RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

                                                         JOB SPECIFICATION
                         NQ       NHR      NMIN     IDAY      IHR      IMIN    METRC     IPLT     IP
                        100         0        30        0        0         0        0        0
                                                   JOPER      NWT     LROPT    TRACE
                                                       5        0         0        0

                                             MULTI-PLAN ANALYSES TO BE PERFORMED
                                                  NPLAN= 1 NRTIO= 6 LRTIO= 1
                         RTIOS=     0.20     0.35     0.50     0.65     0.80     1.00


                **********          **********          **********          **********

                                                   SUB-AREA RUNOFF COMPUTATION

                           CALCULATION OF INFLOW HYDROGRAPH

                                       ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAM
                                           1        0        0        0        0        0

                                                       HYDROGRAPH DATA
                        IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW     I
                            1        1     4.10     0.00     4.10     0.00    0.000        0

                                                         PRECIP DATA
                                SPFE      PMS       R6      R12      R24      R48      R72
                                0.00    22.50   116.00   127.00   141.00     0.00     0.00     (
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                                            LOSS DATA
                    LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL
                        0     0.00     0.00     1.00     0.00     0.00     1.00     1.00     0.10

                                                      UNIT HYDROGRAPH DATA
                                               TP=  3.00     CP=0.63    NTA=  0

                                                          RECESSION DATA
                                         STRTQ=    -2.00     QRCSN=    -0.10     RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.86 AND R= 5.37 IN

                       UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG=   2.99 HOURS, CP=
                   35.        130.        257.        392.        501.        559.        554.       (
                  278.        231.        192.        159.        132.        109.         91.
                   43.         36.         30.         25.         20.         17.         14.
                    7.          6.          5.
```

```
ING USING RATIOS OF PMF
SIS OF SAFETY OF N.Y.626
HROUGH THE RESERVOIR

FICATION
 IMIN    METRC     IPLT     IPRT    NSTAN
    0        0        0        0        0
 LROPT    TRACE
    0        0


S TO BE PERFORMED
O= 6 LRTIO= 1
  0.80   1.00


*****           **********           **********

F COMPUTATION


TAPE      JPLT      JPRT    INAME  ISTAGE     IAUTO
   0         0         0       1       0         0

PH DATA
  TRSPC    RATIO    ISNOW    ISAME    LOCAL
   0.00    0.000        0        0        0

 DATA
   R24      R48      R72      R96
141.00     0.00     0.00     0.00


DATA
KS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
00     1.00     1.00     0.10     0.00     0.00

GRAPH DATA
=0.63     NTA=  0

ON DATA
=    -0.10    RTIOR= 2.00
ARE TC= 6.86 AND R= 5.37 INTERVALS

ES, LAG=   2.99 HOURS, CP= 0.63  VOL= 1.00
        559.       554.       488.       404.       336.
        109.        91.        75.        62.        52.
         17.        14.        12.        10.         8.
```

2

O						END-OF-PERIOD FLOW			
MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD
1.01	0.30	1	0.08	0.00	0.08	8.	1.02	1.30	5
1.01	1.00	2	0.08	0.00	0.08	7.	1.02	2.00	5
1.01	1.30	3	0.08	0.00	0.08	7.	1.02	2.30	5
1.01	2.00	4	0.08	0.00	0.08	6.	1.02	3.00	5
1.01	2.30	5	0.08	0.00	0.08	6.	1.02	3.30	5
1.01	3.00	6	0.08	0.00	0.08	5.	1.02	4.00	5
1.01	3.30	7	0.08	0.00	0.08	5.	1.02	4.30	5
1.01	4.00	8	0.08	0.00	0.08	5.	1.02	5.00	5
1.01	4.30	9	0.08	0.00	0.08	4.	1.02	5.30	5
1.01	5.00	10	0.08	0.00	0.08	4.	1.02	6.00	6
1.01	5.30	11	0.08	0.00	0.08	4.	1.02	6.30	61
1.01	6.00	12	0.08	0.00	0.08	4.	1.02	7.00	6
1.01	6.30	13	0.17	0.12	0.05	8.	1.02	7.30	6
1.01	7.00	14	0.17	0.12	0.05	23.	1.02	8.00	6
1.01	7.30	15	0.17	0.12	0.05	53.	1.02	8.30	6
1.01	8.00	16	0.17	0.12	0.05	98.	1.02	9.00	6
1.01	8.30	17	0.17	0.12	0.05	156.	1.02	9.30	67
1.01	9.00	18	0.17	0.12	0.05	220.	1.02	10.00	6
1.01	9.30	19	0.17	0.12	0.05	283.	1.02	10.30	6
1.01	10.00	20	0.17	0.12	0.05	339.	1.02	11.00	7
1.01	10.30	21	0.17	0.12	0.05	385.	1.02	11.30	71
1.01	11.00	22	0.17	0.12	0.05	423.	1.02	12.00	7
1.01	11.30	23	0.17	0.12	0.05	455.	1.02	12.30	7
1.01	12.00	24	0.17	0.12	0.05	481.	1.02	13.00	7
1.01	12.30	25	1.04	0.99	0.05	534.	1.02	13.30	7
1.01	13.00	26	1.04	0.99	0.05	666.	1.02	14.00	7
1.01	13.30	27	1.25	1.20	0.05	914.	1.02	14.30	7
1.01	14.00	28	1.25	1.20	0.05	1298.	1.02	15.00	7
1.01	14.30	29	1.57	1.52	0.05	1814.	1.02	15.30	7
1.01	15.00	30	1.57	1.52	0.05	2436.	1.02	16.00	8
1.01	15.30	31	1.90	1.85	0.05	3127.	1.02	16.30	8
1.01	16.00	32	6.03	5.98	0.05	3991.	1.02	17.00	8
1.01	16.30	33	1.46	1.41	0.05	5085.	1.02	17.30	8
1.01	17.00	34	1.46	1.41	0.05	6259.	1.02	18.00	8
1.01	17.30	35	1.15	1.10	0.05	7367.	1.02	18.30	8
1.01	18.00	36	1.15	1.10	0.05	8223.	1.02	19.00	8
1.01	18.30	37	0.13	0.08	0.05	8666.	1.02	19.30	8
1.01	19.00	38	0.13	0.08	0.05	8600.	1.02	20.00	8
1.01	19.30	39	0.13	0.08	0.05	8044.	1.02	20.30	8
1.01	20.00	40	0.13	0.08	0.05	7227.	1.02	21.00	9
1.01	20.30	41	0.13	0.08	0.05	6340.	1.02	21.30	9
1.01	21.00	42	0.13	0.08	0.05	5449.	1.02	22.00	9
1.01	21.30	43	0.13	0.08	0.05	4617.	1.02	22.30	9
1.01	22.00	44	0.13	0.08	0.05	3899.	1.02	23.00	9
1.01	22.30	45	0.13	0.08	0.05	3303.	1.02	23.30	9
1.01	23.00	46	0.13	0.08	0.05	2808.	1.03	0.00	9
1.01	23.30	47	0.13	0.08	0.05	2398.	1.03	0.30	9
1.02	0.00	48	0.13	0.08	0.05	2057.	1.03	1.00	9
1.02	0.30	49	0.00	0.00	0.00	1772.	1.03	1.30	9
1.02	1.00	50	0.00	0.00	0.00	1528.	1.03	2.00	1

S

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL
CFS	8666.	6652.	2535.	1268.	1
CMS	245.	188.	72.	36.	
INCHES		15.09	23.01	23.98	

END-OF-PERIOD FLOW

LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
0.08	8.	1.02	1.30	51	0.00	0.00	0.00	1314.
0.08	7.	1.02	2.00	52	0.00	0.00	0.00	1123.
0.08	7.	1.02	2.30	53	0.00	0.00	0.00	951.
0.08	6.	1.02	3.00	54	0.00	0.00	0.00	840.
0.08	6.	1.02	3.30	55	0.00	0.00	0.00	784.
0.08	5.	1.02	4.00	56	0.00	0.00	0.00	732.
0.08	5.	1.02	4.30	57	0.00	0.00	0.00	683.
0.08	5.	1.02	5.00	58	0.00	0.00	0.00	637.
0.08	4.	1.02	5.30	59	0.00	0.00	0.00	594.
0.08	4.	1.02	6.00	60	0.00	0.00	0.00	554.
0.08	4.	1.02	6.30	61	0.00	0.00	0.00	517.
0.08	4.	1.02	7.00	62	0.00	0.00	0.00	483.
0.05	8.	1.02	7.30	63	0.00	0.00	0.00	450.
0.05	23.	1.02	8.00	64	0.00	0.00	0.00	420.
0.05	53.	1.02	8.30	65	0.00	0.00	0.00	392.
0.05	98.	1.02	9.00	66	0.00	0.00	0.00	366.
0.05	156.	1.02	9.30	67	0.00	0.00	0.00	341.
0.05	220.	1.02	10.00	68	0.00	0.00	0.00	318.
0.05	283.	1.02	10.30	69	0.00	0.00	0.00	297.
0.05	339.	1.02	11.00	70	0.00	0.00	0.00	277.
0.05	385.	1.02	11.30	71	0.00	0.00	0.00	259.
0.05	423.	1.02	12.00	72	0.00	0.00	0.00	241.
0.05	455.	1.02	12.30	73	0.00	0.00	0.00	225.
0.05	481.	1.02	13.00	74	0.00	0.00	0.00	210.
0.05	534.	1.02	13.30	75	0.00	0.00	0.00	196.
0.05	666.	1.02	14.00	76	0.00	0.00	0.00	183.
0.05	914.	1.02	14.30	77	0.00	0.00	0.00	171.
0.05	1298.	1.02	15.00	78	0.00	0.00	0.00	159.
0.05	1614.	1.02	15.30	79	0.00	0.00	0.00	149.
0.05	2436.	1.02	16.00	80	0.00	0.00	0.00	139.
0.05	3127.	1.02	16.30	81	0.00	0.00	0.00	129.
0.05	3991.	1.02	17.00	82	0.00	0.00	0.00	121.
0.05	5085.	1.02	17.30	83	0.00	0.00	0.00	113.
0.05	6259.	1.02	18.00	84	0.00	0.00	0.00	105.
0.05	7367.	1.02	18.30	85	0.00	0.00	0.00	98.
0.05	8223.	1.02	19.00	86	0.00	0.00	0.00	91.
0.05	8666.	1.02	19.30	87	0.00	0.00	0.00	85.
0.05	8600.	1.02	20.00	88	0.00	0.00	0.00	80.
0.05	8044.	1.02	20.30	89	0.00	0.00	0.00	74.
0.05	7227.	1.02	21.00	90	0.00	0.00	0.00	69.
0.05	6340.	1.02	21.30	91	0.00	0.00	0.00	65.
0.05	5449.	1.02	22.00	92	0.00	0.00	0.00	60.
0.05	4617.	1.02	22.30	93	0.00	0.00	0.00	56.
0.05	3899.	1.02	23.00	94	0.00	0.00	0.00	53.
0.05	3303.	1.02	23.30	95	0.00	0.00	0.00	49.
0.05	2808.	1.03	0.00	96	0.00	0.00	0.00	46.
0.05	2398.	1.03	0.30	97	0.00	0.00	0.00	43.
0.05	2057.	1.03	1.00	98	0.00	0.00	0.00	40.
0.00	1772.	1.03	1.30	99	0.00	0.00	0.00	37.
0.00	1528.	1.03	2.00	100	0.00	0.00	0.00	35.
				SUM	25.38	22.58	2.80	126865.
					(645.)	(573.)	(71.)	(3592.42)

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
6652.	2535.	1268.	126844.
188.	72.	36.	3592.
15.09	23.01	23.98	23.98

R

MM		383.34	584.35	609.16	609.16
AC-FT		3296.	5028.	5241.	5241.
THOUS CU M		4069.	6202.	6465.	6465.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

2.	1.	1.	1.	1.	1.	1.	1.	
1.	1.	2.	5.	11.	20.	31.	44.	
77.	85.	91.	96.	107.	133.	163.	260.	
625.	798.	1017.	1252.	1473.	1645.	1733.	1720.	1
1266.	1090.	923.	780.	661.	562.	480.	411.	
263.	225.	190.	168.	157.	146.	137.	127.	
103.	97.	90.	84.	78.	73.	68.	64.	
52.	48.	45.	42.	39.	37.	34.	32.	
26.	24.	23.	21.	20.	18.	17.	16.	
13.	12.	11.	11.	10.	9.	9.	8.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1733.	1330.	507.	254.	25369.
CMS	49.	38.	14.	7.	718.
INCHES		3.02	4.60	4.80	4.80
MM		76.67	116.87	121.83	121.83
AC-FT		660.	1006.	1048.	1048.
THOUS CU M		814.	1240.	1293.	1293.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

3.	2.	2.	2.	2.	2.	2.	2.	
1.	1.	3.	8.	18.	34.	54.	77.	
135.	148.	159.	166.	187.	233.	320.	454.	
1095.	1397.	1760.	2191.	2578.	2878.	3033.	3010.	2
2219.	1907.	1616.	1365.	1156.	983.	839.	720.	
460.	393.	335.	294.	274.	256.	239.	223.	
181.	169.	158.	147.	137.	128.	119.	111.	
91.	84.	79.	74.	69.	64.	60.	56.	
45.	42.	39.	37.	34.	32.	30.	28.	
23.	21.	20.	18.	17.	16.	15.	14.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3033.	2326.	887.	444.	44395.
CMS	86.	66.	25.	13.	1257.
INCHES		5.28	8.05	8.39	8.39
MM		134.17	204.52	213.21	213.21
AC-FT		1154.	1760.	1835.	1835.
THOUS CU M		1424.	2171.	2263.	2263.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

4.	4.	3.	3.	3.	3.	3.	2.
2.	2.	4.	11.	26.	49.	78.	110.
192.	212.	227.	241.	267.	333.	457.	649.
1564.	1996.	2542.	3129.	3663.	4111.	4333.	4300.
3170.	2724.	2309.	1950.	1652.	1404.	1199.	1029.
657.	561.	475.	420.	392.	366.	341.	318.
259.	241.	225.	210.	195.	183.	171.	159.
129.	121.	113.	105.	98.	91.	85.	80.
65.	60.	56.	53.	49.	46.	43.	40.
32.	30.	28.	26.	25.	23.	21.	20.

5	609.16	609.16
.	5241.	5241.
.	6465.	6465.

R PLAN 1, RTIO 1

1.	1.	1.	1.	1.
20.	31.	44.	57.	68.
133.	183.	260.	363.	487.
1645.	1733.	1720.	1609.	1445.
562.	480.	411.	354.	306.
146.	137.	127.	119.	111.
73.	68.	64.	59.	55.
37.	34.	32.	30.	28.
18.	17.	16.	15.	14.
9.	9.	8.	7.	7.

R	72-HOUR	TOTAL VOLUME
.	254.	25369.
.	7.	718.
0	4.80	4.80
7	121.83	121.83
.	1048.	1048.
.	1293.	1293.

R PLAN 1, RTIO 2

2.	2.	2.	2.	1.
34.	54.	77.	99.	119.
233.	320.	454.	635.	853.
2878.	3033.	3010.	2816.	2529.
983.	839.	720.	620.	535.
256.	239.	223.	208.	194.
128.	119.	111.	104.	97.
64.	60.	56.	52.	49.
32.	30.	28.	26.	24.
16.	15.	14.	13.	12.

R	72-HOUR	TOTAL VOLUME
.	444.	44395.
.	13.	1257.
5	8.39	8.39
2	213.21	213.21
.	1835.	1835.
.	2263.	2263.

R PLAN 1, RTIO 3

3.	3.	2.	2.	2.
49.	78.	110.	141.	169.
333.	457.	649.	907.	1218.
4111.	4333.	4300.	4022.	3613.
1404.	1199.	1029.	886.	764.
366.	341.	318.	297.	277.
183.	171.	159.	149.	139.
91.	85.	80.	74.	69.
46.	43.	40.	37.	35.
23.	21.	20.	19.	17.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VO
CFS	4333.	3326.	1267.	634.	63
CMS	123.	94.	36.	18.	1
INCHES		7.55	11.50	11.99	1
MM		191.67	292.17	304.58	30
AC-FT		1649.	2514.	2621.	2
THOUS CU M		2034.	3101.	3233.	3

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

5.	5.	4.	4.	4.	4.	3.
2.	2.	5.	15.	34.	64.	101.
250.	275.	296.	313.	347.	433.	594.
2633.	2594.	3305.	4068.	4789.	5345.	5633.
4121.	3542.	3001.	2534.	2147.	1825.	1559.
854.	730.	618.	546.	510.	476.	444.
336.	314.	293.	273.	255.	238.	222.
168.	157.	146.	137.	127.	119.	111.
84.	78.	73.	68.	64.	59.	55.
42.	39.	37.	34.	32.	30.	28.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VO
CFS	5633.	4324.	1648.	824.	82
CMS	160.	122.	47.	23.	2
INCHES		9.81	14.95	15.59	1
MM		249.17	379.83	395.95	39
AC-FT		2144.	3266.	3407.	3
THOUS CU M		2645.	4031.	4202.	4

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

6.	6.	5.	5.	5.	4.	4.
3.	3.	6.	18.	42.	78.	124.
308.	338.	364.	385.	427.	533.	731.
2502.	3193.	4068.	5007.	5894.	6578.	6933.
5072.	4359.	3694.	3119.	2643.	2247.	1918.
1051.	898.	761.	672.	627.	585.	546.
414.	386.	360.	336.	314.	293.	273.
207.	193.	180.	168.	157.	146.	137.
103.	97.	90.	84.	78.	73.	68.
52.	48.	45.	42.	39.	37.	34.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VO
CFS	6933.	5321.	2028.	1015.	101
CMS	196.	151.	57.	29.	2
INCHES		12.07	18.40	19.19	1
MM		306.67	467.48	487.33	48
AC-FT		2639.	4022.	4193.	4
THOUS CU M		3255.	4962.	5172.	5

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 6

8.	7.	7.	6.	6.	5.	5.
4.	4.	8.	23.	53.	98.	156.
385.	423.	455.	461.	534.	666.	914.
3127.	3991.	5085.	6259.	7367.	8223.	8666.
6340.	5449.	4517.	3899.	3303.	2808.	2398.

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	3326.	1267.	634.	63422.
23.	94.	36.	18.	1796.
	7.55	11.50	11.99	11.99
	191.67	292.17	304.58	304.58
	1649.	2514.	2621.	2621.
	2034.	3101.	3233.	3233.

OGRAPH AT STA 1 FOR PLAN 1, RTIO 4

4.	4.	4.	3.	3.	3.	3.
15.	34.	64.	101.	143.	184.	220.
313.	347.	433.	594.	844.	1179.	1584.
4068.	4789.	5345.	5633.	5590.	5229.	4697.
2534.	2147.	1825.	1559.	1337.	1152.	993.
546.	510.	476.	444.	414.	386.	360.
273.	255.	238.	222.	207.	193.	180.
137.	127.	119.	111.	104.	97.	90.
68.	64.	59.	55.	52.	48.	45.
34.	32.	30.	28.	26.	24.	23.

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	4324.	1648.	824.	82449.
60.	122.	47.	23.	2335.
	9.81	14.95	15.59	15.59
	249.17	379.83	395.95	395.95
	2144.	3268.	3407.	3407.
	2645.	4031.	4202.	4202.

OGRAPH AT STA 1 FOR PLAN 1, RTIO 5

5.	5.	4.	4.	4.	4.	3.
18.	42.	78.	124.	176.	226.	271.
385.	427.	533.	731.	1039.	1451.	1949.
5007.	5894.	6578.	6933.	6880.	6436.	5781.
3119.	2643.	2247.	1918.	1646.	1418.	1222.
672.	627.	585.	546.	510.	475.	444.
336.	314.	293.	273.	255.	238.	222.
168.	157.	146.	137.	127.	119.	111.
84.	78.	73.	68.	64.	59.	55.
42.	39.	37.	34.	32.	30.	28.

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	5321.	2028.	1015.	101475.
96.	151.	57.	29.	2873.
	12.07	18.40	19.19	19.19
	306.67	467.48	487.33	487.33
	2639.	4022.	4193.	4193.
	3255.	4962.	5172.	5172.

OGRAPH AT STA 1 FOR PLAN 1, RTIO 6

6.	6.	5.	5.	5.	4.	4.
23.	53.	98.	156.	220.	283.	339.
461.	534.	666.	914.	1298.	1814.	2436.
6259.	7367.	8223.	8666.	8600.	8044.	7227.
3899.	3303.	2808.	2398.	2057.	1772.	1528.

1314.	1123.	951.	840.	784.	732.	683.	637.	594
517.	483.	450.	420.	392.	366.	341.	318.	297
259.	241.	225.	210.	196.	183.	171.	159.	149
129.	121.	113.	105.	98.	91.	85.	80.	74
65.	60.	56.	53.	49.	46.	43.	40.	37

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8666.	6652.	2535.	1268.	126844.
CMS	245.	188.	72.	36.	3592.
INCHES		15.09	23.01	23.98	23.98
MM		383.34	584.35	609.16	609.16
AC-FT		3298.	5028.	5241.	5241.
THOUS CU M		4069.	6202.	6465.	6465.

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HYDROGRAPH ROUTING

ROUTING OF INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE
2	1	0	0	0	0	1	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

AGE 0.00 50.00 100.00 175.00 340.00 415.00 690.00
1100.00

LOW 0.00 35.00 46.00 55.00 120.00 210.00 235.00
13855.00

STATION 2, PLAN 1, RTIO 1

OUTFLOW

2.	2.	2.	2.	2.	1.	1.	1.	
1.	1.	1.	1.	2.	2.	3.	4.	
8.	11.	13.	15.	18.	20.	24.	30.	3
44.	48.	53.	64.	85.	109.	164.	212.	21
227.	230.	233.	304.	458.	514.	517.	490.	45
361.	318.	277.	241.	235.	234.	234.	234.	23
232.	232.	231.	231.	230.	230.	229.	228.	22
227.	226.	225.	225.	224.	223.	222.	222.	22
220.	219.	218.	217.	217.	216.	215.	214.	21
212.	211.	211.	209.	200.	190.	182.	173.	16

STOR

2.	2.	2.	2.	2.	2.	2.	2.	
2.	2.	2.	2.	2.	3.	4.	5.	
12.	15.	18.	22.	25.	29.	35.	43.	5
92.	119.	155.	199.	252.	313.	377.	440.	50
601.	640.	672.	698.	710.	716.	716.	713.	7
702.	698.	694.	691.	687.	684.	680.	676.	6
661.	[illegible]	650.	644.	638.	632.	625.	618.	6

84.	732.	683.	637.	594.	554.
92.	366.	341.	318.	297.	277.
96.	183.	171.	159.	149.	139.
98.	91.	85.	80.	74.	69.
49.	46.	43.	40.	37.	35.

24-HOUR	72-HOUR	TOTAL VOLUME
2535.	1268.	126844.
72.	36.	3592.
23.01	23.98	23.98
584.35	609.16	609.16
5028.	5241.	5241.
6202.	6465.	6465.

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RAPH ROUTING

ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0	0	0	1	0	0

TING DATA

ISAME	IOPT	IPMP		LSTR
1	0	0		0

AMSKK	X	TSK	STORA	ISPRAT
0.000	0.000	0.000	-1.	0

00	340.00	415.00	690.00	800.00	935.00	1010.00
00	120.00	210.00	235.00	1440.00	5645.00	8650.00

2, PLAN 1, RTIO 1

OUTFLOW

2.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	7.
18.	20.	24.	30.	36.	39.
85.	109.	164.	212.	218.	223.
458.	514.	517.	490.	451.	406.
235.	234.	234.	234.	233.	233.
230.	230.	229.	228.	228.	227.
224.	223.	222.	222.	221.	220.
217.	216.	215.	214.	214.	213.
200.	190.	182.	173.	165.	158.

STOR

2.	2.	2.	2.	2.	2.
2.	3.	4.	5.	7.	9.
25.	29.	35.	43.	54.	70.
252.	313.	377.	440.	500.	554.
710.	716.	716.	713.	710.	706.
687.	684.	680.	676.	671.	666.
638.	632.	625.	618.	611.	604.

597.	590.	583.	575.	568.	560.	552.	544.
521.	512.	504.	496.	488.	480.	472.	464.
439.	431.	423.	414.	406.	399.	391.	384.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	517.	381.	265.	164.	16437.
CMS	15.	11.	7.	5.	465.
INCHES		0.86	2.40	3.11	3.11
MM		21.95	61.04	78.94	78.94
AC-FT		189.	525.	679.	679.
THOUS CU M		233.	648.	838.	838.

MAXIMUM STORAGE = 716.

STATION 2, PLAN 1, RTIO 2

OUTFLOW

3.	3.	3.	3.	3.	3.	3.	3.
2.	2.	2.	3.	3.	3.	5.	6.
15.	18.	22.	26.	31.	35.	37.	41.
54.	70.	94.	134.	213.	222.	232.	991.
2407.	2138.	1843.	1567.	1387.	1270.	1137.	1005.
669.	579.	500.	431.	377.	336.	303.	276.
235.	235.	234.	234.	234.	233.	233.	232.
231.	230.	230.	229.	229.	228.	227.	227.
225.	224.	223.	223.	222.	221.	221.	220.
218.	217.	216.	216.	215.	214.	213.	213.

STOR

4.	4.	4.	4.	4.	4.	4.	4.
4.	3.	3.	4.	4.	5.	7.	9.
21.	26.	32.	38.	44.	51.	61.	75.
163.	212.	274.	352.	443.	547.	659.	759.
831.	822.	813.	804.	795.	784.	772.	760.
730.	721.	714.	708.	703.	699.	696.	694.
688.	686.	683.	679.	675.	671.	667.	662.
646.	640.	634.	627.	621.	614.	607.	600.
578.	571.	563.	556.	548.	540.	532.	524.
500.	492.	484.	476.	468.	460.	452.	443.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

75.	568.	560.	552.	544.	536.	528.
96.	488.	480.	472.	464.	455.	447.
14.	406.	399.	391.	384.	378.	371.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
381.	265.	164.	16437.
11.	7.	5.	465.
0.86	2.40	3.11	3.11
21.95	61.04	78.94	78.94
189.	525.	679.	679.
233.	648.	838.	838.

AXIMUM STORAGE = 716.

TATION 2, PLAN 1, RTIO 2

OUTFLOW

3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	5.	6.	9.	12.
26.	31.	35.	37.	41.	45.	49.
134.	213.	222.	232.	991.	1993.	2525.
567.	1387.	1270.	1137.	1005.	882.	769.
431.	377.	336.	303.	276.	254.	235.
234.	234.	233.	233.	232.	232.	231.
229.	229.	228.	227.	227.	226.	226.
223.	222.	221.	221.	220.	219.	218.
216.	215.	214.	213.	213.	212.	211.

STOR

4.	4.	4.	4.	4.	4.	4.
4.	4.	5.	7.	9.	12.	17.
38.	44.	51.	61.	75.	96.	125.
352.	443.	547.	659.	759.	818.	835.
804.	795.	784.	772.	760.	749.	739.
708.	703.	699.	696.	694.	692.	690.
679.	675.	671.	667.	662.	657.	651.
627.	621.	614.	607.	600.	593.	586.
556.	548.	540.	532.	524.	516.	508.
476.	468.	460.	452.	443.	435.	427.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

2

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2525.	1586.	617.	342.	34156.
CMS	72.	45.	17.	10.	967.
INCHES		3.60	5.60	6.46	6.46
MM		91.40	142.23	164.03	164.03
AC-FT		786.	1224.	1411.	1411.
THOUS CU M		970.	1510.	1741.	1741.

MAXIMUM STORAGE = 835.

STATION 2, PLAN 1, RTIO 3

OUTFLOW

4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	3.	3.	4.	4.	5.	7.	9.	12.
21.	26.	32.	36.	38.	40.	43.	47.	51.
79.	106.	164.	218.	230.	1083.	3141.	4062.	4140.
3499.	3067.	2636.	2239.	1896.	1608.	1406.	1296.	1172.
921.	806.	700.	607.	533.	476.	431.	394.	362.
310.	288.	266.	249.	235.	235.	235.	234.	234.
233.	233.	232.	232.	232.	231.	230.	230.	229.
228.	228.	227.	226.	226.	225.	224.	224.	223.
221.	221.	220.	219.	219.	218.	217.	216.	216.

STOR

5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	6.	7.	10.	13.	18.
30.	38.	46.	54.	63.	74.	88.	109.	139.
236.	305.	393.	502.	633.	767.	855.	864.	867.
866.	852.	838.	826.	815.	805.	797.	787.	776.
753.	742.	732.	724.	717.	712.	708.	704.	702.
697.	695.	693.	691.	690.	688.	685.	683.	679.
671.	667.	662.	657.	652.	646.	640.	634.	628.
615.	608.	601.	594.	586.	579.	572.	564.	556.
541.	533.	525.	517.	509.	501.	493.	485.	477.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4140.	2731.	985.	522.	52212.
CMS	117.	77.	28.	15.	1478.
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
1586.	617.	342.	34156.
45.	17.	10.	967.
3.60	5.60	6.46	6.46
91.40	142.23	164.03	164.03
786.	1224.	1411.	1411.
970.	1510.	1741.	1741.

IMUM STORAGE = 835.

TION 2, PLAN 1, RTIO 3

OUTFLOW

4.	4.	4.	4.	4.	4.	4.
4.	4.	5.	7.	9.	12.	17.
6.	38.	40.	43.	47.	51.	57.
8.	230.	1063.	3141.	4062.	4140.	3888.
9.	1896.	1608.	1406.	1298.	1172.	1044.
7.	533.	476.	431.	394.	362.	334.
9.	235.	235.	235.	234.	234.	234.
2.	232.	231.	230.	230.	229.	229.
6.	226.	225.	224.	224.	223.	222.
9.	219.	218.	217.	216.	216.	215.

STOR

5.	5.	5.	5.	5.	5.	5.
5.	6.	7.	10.	13.	18.	24.
4.	63.	74.	88.	109.	139.	181.
2.	633.	767.	855.	864.	887.	879.
6.	815.	805.	797.	787.	776.	764.
4.	717.	712.	708.	704.	702.	699.
1.	690.	688.	685.	683.	679.	675.
7.	652.	646.	640.	634.	628.	621.
4.	586.	579.	572.	564.	556.	549.
7.	509.	501.	493.	485.	477.	469.

STAGE

.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
2731.	985.	522.	52212.
77.	28.	15.	1478.
[illegible]	[illegible].93	9.[illegible]7	9.[illegible]7

.2

MM	157.38	226.95	250.74	250.74
AC-FT	1354.	1953.	2158.	2158.
THOUS CU M	1670.	2409.	2661.	2661.

MAXIMUM STORAGE = 887.

STATION 2, PLAN 1, RTIO 4

OUTFLOW

5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	6.	9.	12.
28.	34.	37.	39.	42.	45.	48.	51.
107.	189.	219.	232.	1489.	4291.	5229.	5529.
4551.	3987.	3427.	2911.	2464.	2090.	1778.	1520.
1138.	1010.	880.	774.	683.	613.	556.	509.
402.	374.	348.	324.	302.	281.	262.	245.
235.	234.	234.	234.	233.	233.	232.	232.
230.	230.	229.	229.	228.	227.	227.	226.
224.	223.	223.	222.	221.	221.	220.	219.

STOR

7.	7.	7.	7.	7.	7.	7.	7.
7.	6.	6.	7.	7.	9.	12.	17.
39.	49.	59.	70.	82.	97.	116.	144.
308.	398.	511.	654.	802.	892.	922.	931.
900.	882.	864.	847.	833.	821.	811.	803.
772.	761.	749.	739.	731.	724.	719.	715.
705.	703.	700.	698.	696.	694.	692.	691.
685.	682.	678.	675.	670.	666.	661.	656.
639.	633.	626.	620.	613.	606.	599.	592.
570.	562.	555.	547.	539.	531.	523.	515.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5529.	3884.	1360.	705.	70536.
CMS	157.	110.	39.	20.	1997.
INCHES		8.81	12.34	13.34	13.34
MM		223.86	313.49	338.74	338.74
AC-FT		1926.	2697.	2915.	2915.
THOUS CU M		2376.	3327.	3595.	3595.

MAXIMUM STORAGE = 931.

STATION 2, PLAN 1, RTIO 5

MM	157.38	226.95	250.74	250.74
[illegible]	1354.	1953.	2158.	2158.
[illegible]	1670.	2409.	2661.	2661.

MAXIMUM STORAGE = 887.

STATION 2, PLAN 1, RTIO 4

OUTFLOW

5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	6.	9.	12.	16.	22.
37.	39.	42.	45.	48.	51.	58.	80.
219.	232.	1489.	4291.	5229.	5529.	5435.	5065.
3427.	2911.	2464.	2090.	1778.	1520.	1376.	1264.
866.	774.	683.	613.	556.	509.	469.	434.
348.	324.	302.	281.	262.	245.	235.	235.
234.	234.	233.	233.	232.	232.	231.	231.
229.	229.	228.	227.	227.	226.	225.	225.
223.	222.	221.	221.	220.	219.	218.	218.

STOR

7.	7.	7.	7.	7.	7.	7.	7.
6.	7.	7.	9.	12.	17.	23.	31.
59.	70.	82.	97.	116.	144.	183.	237.
511.	654.	802.	892.	922.	931.	928.	916.
864.	847.	833.	821.	811.	803.	794.	784.
749.	739.	731.	724.	719.	715.	711.	708.
700.	698.	696.	694.	692.	691.	689.	687.
678.	675.	670.	666.	661.	656.	650.	645.
626.	620.	613.	606.	599.	592.	585.	577.
555.	547.	539.	531.	523.	515.	507.	499.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
5529.	3884.	1360.	705.	70536.
157.	110.	39.	20.	1997.
	8.81	12.34	13.34	13.34
	223.86	313.49	338.74	338.74
	1926.	2697.	2915.	2915.
	2376.	3327.	3595.	3595.

[illegible] STORAGE = 931.

[illegible] 2, PLAN 1, RTIO 5

2

OUTFLOW

6.	6.	6.	6.	6.	6.	6.	6.	6
6.	6.	6.	6.	6.	8.	11.	15.	20
34.	37.	40.	43.	46.	48.	51.	56.	75
168.	217.	230.	1293.	4383.	5864.	6671.	6884.	6679
5516.	4889.	4213.	3582.	3033.	2572.	2189.	1870.	1605
1311.	1187.	1055.	930.	827.	745.	679.	623.	575
494.	459.	426.	398.	371.	346.	323.	301.	281
244.	235.	235.	235.	234.	234.	234.	233.	233
232.	231.	231.	230.	230.	229.	229.	228.	227
226.	225.	225.	224.	223.	223.	222.	221.	221

STOR

9.	9.	9.	9.	9.	9.	8.	8.	8
8.	8.	8.	8.	9.	11.	15.	21.	28
49.	60.	73.	87.	102.	120.	144.	178.	227
380.	490.	630.	787.	894.	940.	961.	966.	961
931.	911.	889.	869.	851.	836.	824.	814.	805
768.	777.	765.	753.	744.	737.	731.	725.	721
714.	710.	708.	705.	702.	700.	698.	696.	69
691.	689.	687.	685.	682.	678.	675.	670.	66
656.	650.	645.	639.	633.	626.	620.	613.	60
592.	585.	577.	570.	562.	555.	547.	539.	53

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6884.	4984.	1740.	890.	89022.
CMS	195.	141.	49.	25.	2521.
INCHES		11.31	15.79	16.83	16.83
MM		287.23	401.12	427.52	427.52
AC-FT		2471.	3451.	3679.	3679.
THOUS CU M		3048.	4257.	4537.	4537.

MAXIMUM STORAGE = 966.

STATION 2, PLAN 1, RTIO 6

OUTFLOW

8.	8.	8.	8.	8.	7.	7.	7.	[illegible]
7.	7.	7.	7.	8.	10.	13.	18.	[illegible]
37.	41.	44.	47.	49.	52.	56.	75.	[illegible]
215.	228.	1139.	4351.	6378.	7661.	8371.	8608.	63
6870.	5980.	5193.	4401.	3768.	3214.	2736.	2338.	20
1467.	1363.	1243.	1115.	1003.	913.	837.	771.	7
616.	573.	534.	497.	464.	432.	403.	376.	3
305.	265.	266.	248.	235.	235.	235.	234.	2

OUTFLOW

6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	8.	11.	15.	20.	26.
0.	43.	46.	48.	51.	56.	75.	102.
0.	1293.	4383.	5864.	6671.	6884.	6679.	6162.
3.	3582.	3033.	2572.	2189.	1870.	1605.	1413.
5.	930.	827.	745.	679.	623.	575.	532.
8.	398.	371.	346.	323.	301.	281.	262.
5.	235.	234.	234.	234.	233.	233.	232.
1.	230.	230.	229.	229.	228.	227.	227.
5.	224.	223.	223.	222.	221.	221.	220.

STOR

9.	9.	9.	9.	8.	6.	8.	8.
8.	8.	9.	11.	15.	21.	28.	38.
3.	87.	102.	120.	144.	178.	227.	294.
0.	787.	894.	940.	961.	966.	961.	948.
9.	869.	851.	836.	824.	814.	805.	797.
5.	753.	744.	737.	731.	725.	721.	717.
8.	705.	702.	700.	698.	696.	694.	692.
7.	685.	682.	678.	675.	670.	666.	661.
5.	639.	633.	626.	620.	613.	606.	599.
7.	570.	562.	555.	547.	539.	531.	523.

STAGE

.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
6884.	4984.	1740.	890.	89022.
195.	141.	49.	25.	2521.
	11.31	15.79	16.83	16.83
	287.23	401.12	427.52	427.52
	2471.	3451.	3679.	3679.
	3048.	4257.	4537.	4537.

MAXIMUM STORAGE = 966.

STATION 2, PLAN 1, RTIO 6

OUTFLOW

[illegible]	8.	8.	7.	7.	7.	7.	7.
7.	7.	8.	10.	13.	18.	25.	33.
4.	47.	49.	52.	56.	75.	99.	154.
9.	4351.	6378.	7661.	8371.	8608.	8349.	7703.
3.	4461.	3768.	3214.	2736.	2338.	2006.	1727.
3.	1115.	1003.	913.	837.	771.	714.	662.
3.	497.	464.	432.	403.	376.	351.	327.
5.	[illegible]	235.	235.	235.	234.	234.	234.

,2

233.	233.	232.	232.	232.	231.	230.	230.
228.	228.	227.	226.	226.	225.	224.	224.

STOR

11.	11.	11.	11.	11.	11.	11.	11.
10.	10.	10.	10.	12.	14.	19.	26.
61.	76.	92.	110.	129.	151.	182.	225.
475.	613.	773.	893.	953.	985.	1003.	1009.
956.	944.	921.	897.	875.	857.	842.	829.
802.	793.	782.	770.	760.	752.	745.	739.
725.	721.	717.	714.	711.	708.	705.	703.
696.	695.	693.	691.	690.	688.	685.	682.
671.	667.	662.	657.	652.	646.	640.	634.
614.	608.	601.	594.	586.	579.	572.	564.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6608.	5429.	2251.	1138.	113832.
CMS	244.	182.	64.	32.	3223.
INCHES		14.59	20.43	21.52	21.52
MM		370.51	519.00	546.67	546.67
AC-FT		3188.	4466.	4704.	4704.
THOUS CU M		3932.	5508.	5802.	5802.

MAXIMUM STORAGE = 1009.

********** ********** ********** **********

232.	232.	231.	230.	230.	229.	229.
226.	226.	225.	224.	224.	223.	222.

STOR

11.	11.	11.	11.	11.	10.	10.
10.	12.	14.	19.	26.	36.	47.
110.	129.	151.	182.	225.	285.	368.
893.	953.	985.	1003.	1009.	1002.	986.
897.	875.	857.	842.	829.	818.	809.
770.	760.	752.	745.	739.	734.	729.
714.	711.	708.	705.	703.	701.	698.
691.	690.	688.	685.	682.	679.	675.
657.	652.	646.	640.	634.	628.	621.
594.	586.	579.	572.	564.	556.	549.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
5429.	2251.	1138.	113832.
182.	64.	32.	3223.
14.59	20.43	21.52	21.52
370.51	519.00	546.67	546.67
3188.	4466.	4704.	4704.
3932.	5508.	5802.	5802.

AXIMUM STORAGE = 1009.

********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECO
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECO
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS				
OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO
				0.20	0.35	0.50	0.65	0
HYDROGRAPH AT	1	4.10	1	1733.	3033.	4333.	5633.	69
	(	10.62)	(	49.06)(	85.89)(	122.69)(	159.50)(	196.
ROUTED TO	2	4.10	1	517.	2525.	4140.	5529.	68
	(	10.62)	(	14.63)(	71.50)(	117.22)(	156.55)(	194.

MARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
ER SECOND (CUBIC METERS PER SECOND)
MILES (SQUARE KILOMETERS)

	RATIOS APPLIED TO FLOWS			
IO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
0.35	0.50	0.65	0.80	1.00
3033.	4333.	5633.	6933.	8666.
5.89)(	122.69)(	159.50)(	196.31)(	245.39)(
2525.	4140.	5529.	6884.	8608.
1.50)(	117.22)(	156.55)(	194.94)(	243.76)(

APPENDIX D

ENGINEERING INVESTIGATION REPORT BY SCS
(CRACK INVESTIGATION)

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

SYRACUSE, NEW YORK

ENGINEERING INVESTIGATION REPORT

ISCHUA CREEK WATERSHED

SITE 4

Investigating Committee

Donald E. Wallin, Civil Engineer, NETSC, Broomall, PA
Donald W. Lake, Jr., Civil Engineer, SCS, Syracuse, NY
Harry G. Hirth, Civil Engineer, Syracuse, NY

Project:	Ischua Creek Watershed Cattaraugus County, New York
Location:	Approximately 12 miles north of the city of Olean, New York and 40 miles south of Buffalo, New York
Site Number:	Floodwater Retarding Structure #4 Located approximately 3/4 mile northeast of the village of Franklinville, New York
Problems:	Cracks in the 36 inch diameter principal spillway conduit.
Dates of Inspection	August 1976, July 1977, October 1977, and May 1979

Floodwater Retarding Structure #4 is a class C structure having a drainage area of 4.1 sq. miles, fill height of 51 feet and containing about 103,000 cu. yds. of fill. This structure was built during the period from August 1962 to September 1963 by Sack Bros. Inc.

PROBLEMS

In August 1976, SCS conducted an inspection of principal spillways in the Ischua Creek Watershed. During this inspection cracks were discovered in the 36 inch conduit on this site. These cracks had developed in the pipes between joints C & D and E & F (attached sheet 7 of 11 of construction drawing, Exhibit 9) as shown in Exhibits 1-8 attached. Also, there are two other pipe lengths that show lime deposits.

PRINCIPAL SPILLWAY CONDUIT DESIGN

Designed in 1961	O.D.	3.52 ft. (Reinforced Cradle)	
Prestressed pipe	.001	Crack	11,108 #/LF
Non Prestressed	.01	Crack	14,774 #/LF

Redesigned in 1962 for change in O.D. 3.94 ft.

	.001	Crack	12,322 #/LF
	.01	Crack	16,388 #/LF

Certification from manufacturer, Exhibit 10:

Three edge bearing @ .01 crack 16,500 #/LF

CONSTRUCTION

Work was started on this site on August 24, 1962, and completed August 31, 1963. Pipe was delivered to the site on September 11, started laying pipe on September 17, and completed with cradle October 2. During this period, Job Diary refers to problems in construction such as: "informed contractor joint "L" not closed in tight enough; shut job down due to rain, joint "B" settled over 3 inches; suggest superintendent get drainage.....in areas A, B, C, and D along pipe and cradle S.G., no pipe to be laid in muck; jacking pipe up to grade; low temperature on concrete this morning, 36°; checked RCP 36 inch at joint "Q", jack same up to grade; checked point "Q" again (.02 low), informed superintendent to jack same up; joint "Q" and.....went out of alignment on RCP, informed superintendent to take out and recompact S.G. and replace pipe in workman-like manner; pipe became damaged trying to straigten same in alignment, checked 36 inch RCP and found same OK; several references to wet conditions and orders to remove backfill to bottom of cradle and replace, informed contractor no equipment to pass over pipe or structure with less than 2 feet of cover; warned contractor of running with dozer over 36 inch RCCP; today contractor had shown very little respect to instructions given him covering specifications, don't care attitude; November 4 to May 14, 1963, winter shutdown; May 15, informed contractor to keep equipment off pipe until fill has two feet of compacted fill over it; contractor finished placing fill in first 2 feet over 36 inch RCP."

OPERATION AND MAINTENANCE

Operation and maintenance have been annually conducted without inspection of the conduit. In August 1976, an inspection was made by SCS which in turn discovered these problems. Therefore, it is impossible to determine at what period between construction in 1963 until they were discovered in 1976, that these cracks began to develop. Additional inspections were conducted in 1977 and 1979 with no apparent change.

OBSERVATIONS AND FINDINGS

The revised design of the conduit, based on furnished outside dimension required 16,388 #/lin. ft. (7/24/62) while manufacturers specification sheet lists under design conditions: In accordance with AWWA C-302, three edge bearings at .01 inch crack 16,500 #/lin. ft. (7-18-62). No documentation exists as to the origin of this figure which could have been an actual break of this pipe, a break from an equal pipe or a mathematical computation of some kind.

Many problems with the contractor were recorded in the Job Diary; holding pipe to line and grade, getting adequate compaction in structure backfill, equipment operating too close to pipe, and statements that contractor had little respect for contract requirements. Any or all of these items could have damaged or weakened pipe during construction. At this time all SCS personnel that were involved in the construction have left the Service and are unavailable for comment.

The cracks in pipe lengths C-D and E-F are in close proximity to anti-seep collars. Differential settlement in these areas may have contributed to the pipe cracking.

An analysis of required longitudinal steel was done in accordance with Design Note #9. See Exhibit 11. The longitudinal area of steel required by this analysis is 11.42 sq. in. That actually provided by six No. 3 bars listed on Exhibit 10 is 0.66 sq. in. This does not include additional longitudinal reinforcement being provided by the two cages of mesh. The contract documents do not state the size or type of mesh, so the additional cross sectional area of steel can not be determined, but it would seem unreasonable to assume the mesh would provide the additional area (10.76 in^2) needed. Therefore, the pipe appears to be grossly lacking in longitudinal reinforcements.

It is important to recognize that the procedures in Design Note #9, used for determining the required area of longitudinal steel, were unavailable at the time this dam was designed and these same procedures were developed as a result of similar problems with this type of pipe (AWWA 302). AWWA 302 pipe has been used on very few sites in the state of New York and has not been used at all for more than ten years.

GEOLOGY

A review of the geologic investigation was made and can be summarized by the narrative from the report. "The heavy, blue gray till underlying the entire extent of the proposed principal spillway results in a very good foundation condition. DH1, in the vicinity of TP-302, had blow counts in the vicinity of 25-30 at spillway grade. TP 303 revealed either a large boulder or bedrock at about spillway grade. Just to be safe, I recommend that the downstream end of the pipe be moved 20 feet towards the stream. This should result in completely uniform conditions along the spillway." As-built plans indicate entire structure was relocated in design 20 to 30 feet towards the stream.

REPAIR

This structure has been inspected by the pipe manufacturer and their recommendation is that pipe be drilled and a silica gel grounted into the soil around the pipe. After this is accomplished, the cracks should be veed out and filled with lead wool and hydraulic cement. This cost was estimated to be approximately $5,800 in 1977.

RECOMMENDATION

It is recommended that the repair work described above be done at federal cost. This is based on the fact that during construction, many problems occurred that could have resulted in damage to the pipe, and on a national level, we have discouraged the use of this type of pipe because of similar cracking problems.

Donald E. Wallin
Design Engineer
Broomall, Pennsylvania

Donald W. Lake, Jr.
Head, Design Section
Syracuse, New York

Harry G. Hirth,
Construction Engineer
Syracuse, New York

Concurred By:

State Conservation Engineer

EXHIBIT 1

OCTOBER 27, 1977, OKRA AND LIME DEPOSITS FROM CRACK DEVELOPED IN SIDEWALL OF 36" RCP.

EXHIBIT 2

JULY 21, 1977, CLOSE UP VIEW OF LOCATION SHOWN IN EXHIBIT 1.

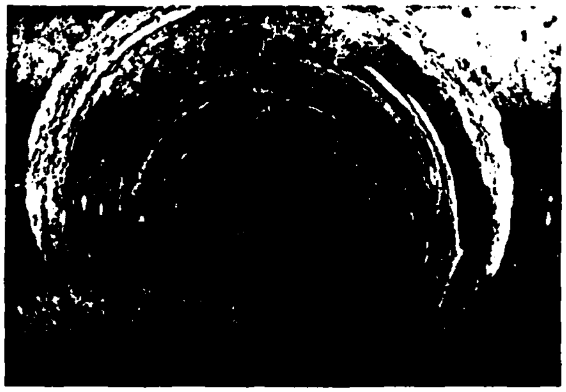


EXHIBIT 3

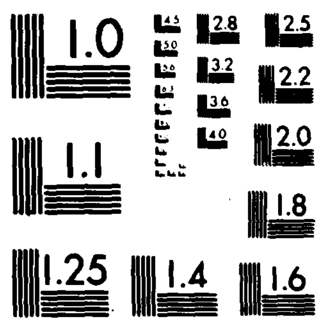
OCTOBER 27, 1977, LIME DEPOSITS LOOKING DOWNSTREAM IN 36" RCP NEAR JOINT E.

AD-A090 934 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ISCHUA CREEK WATERSHED PROJECT, SI--ETC(U)
SEP 80 B L THOMSEN, G L WOOD DACW51-79-C-0001

UNCLASSIFIED NL

2 of 2

END
DATE
FILMED
11-80
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

EXHIBIT 4

JULY 21, 1977, UPSTREAM CRACK IN TOP LEFT OF 36" RCP NEAR CENTER OF PIPE LENGTH C-D.

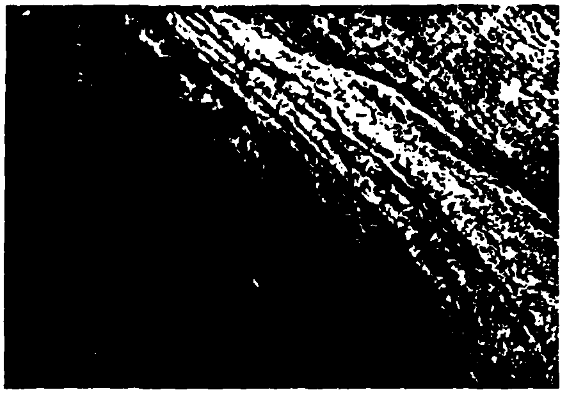


EXHIBIT 5

JULY 21, 1977, UPSTREAM CRACK IN TOP RIGHT OF 36" RCP NEAR CENTER OF PIPE LENGTH C-D.

EXHIBIT 6

JUNE 18, 1979, SAME CRACK AS SHOWN IN EXHIBIT 4 WITH NO APPRECIABLE CHANGE IN CONDITION.

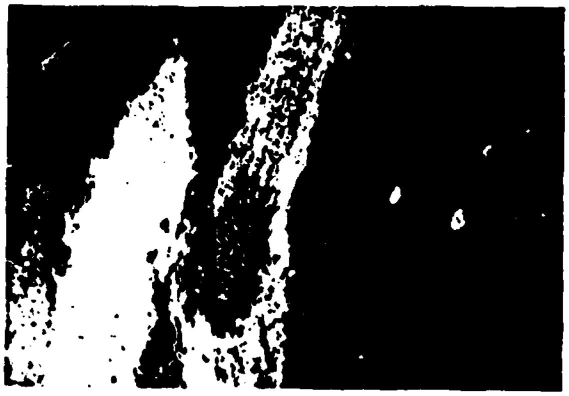


EXHIBIT 7

OCTOBER 27, 1977, LIME DEPOSITS FROM SMALL CRACK IN SIDEWALL OF 36" R.C.P.

EXHIBIT 8

JUNE 18, 1979, PHOTO OF SAME CRACK AS SHOWN IN EXHIBIT 7, WITH NO APPRECIABLE CHANGE IN CONDITION.

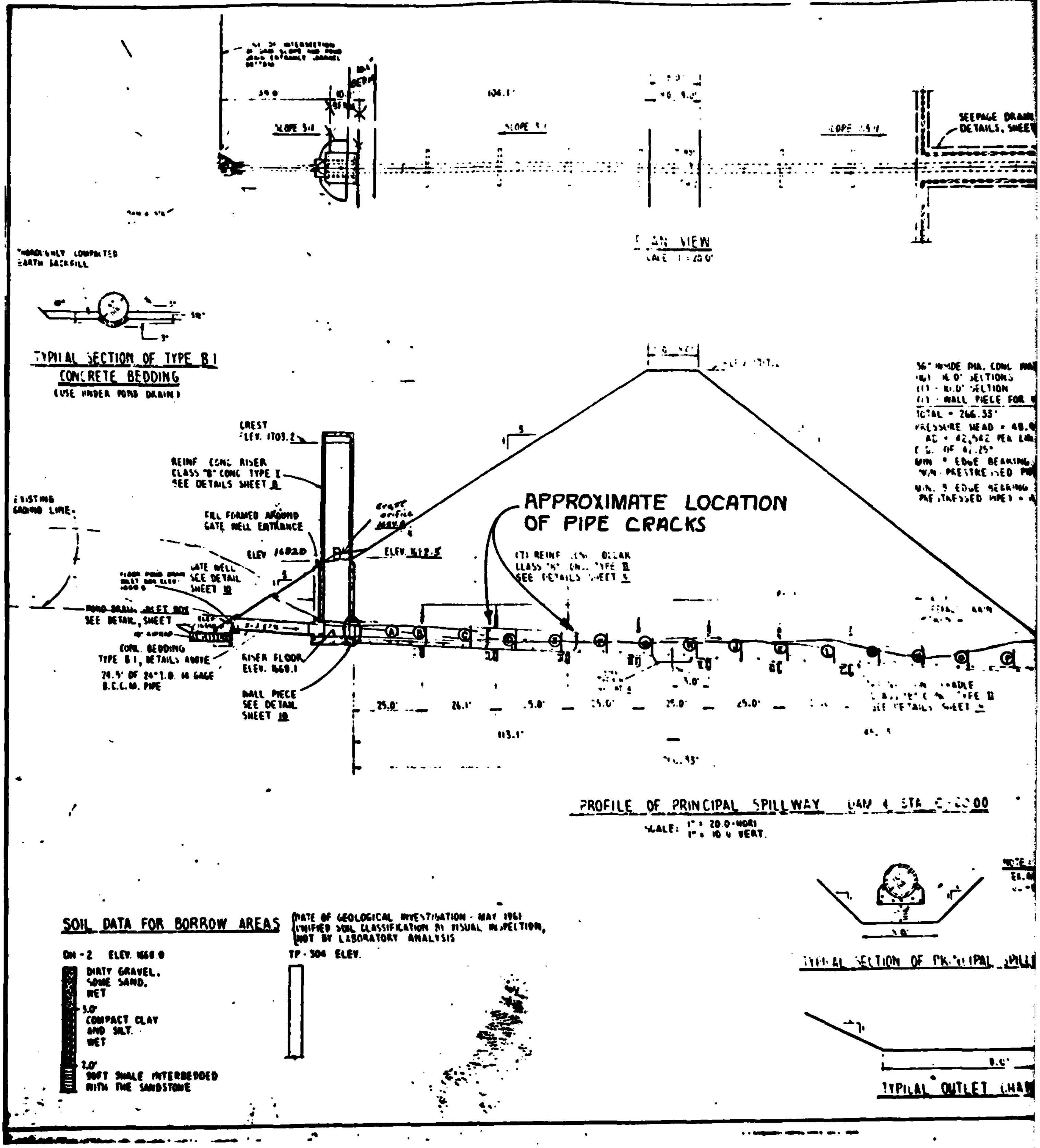
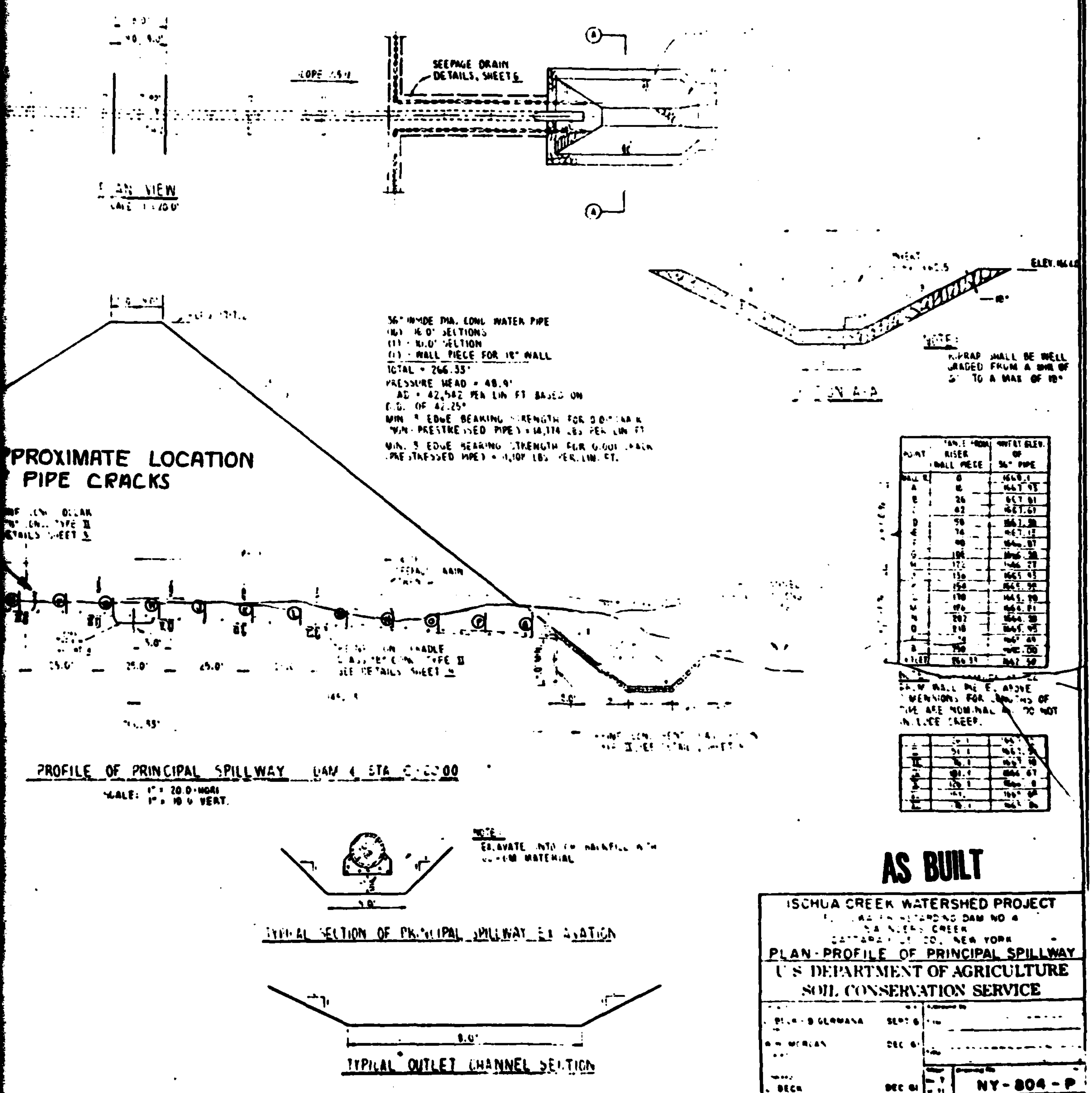

PLAN VIEW
SEEPAGE DRAIN DETAILS, SHEET
THOROUGHLY COMPACTED EARTH BACKFILL
TYPICAL SECTION OF TYPE B1 CONCRETE BEDDING
(USE UNDER POND DRAIN)
CREST ELEV. 1705.2
REINF. CONC. RISER CLASS "B" CONC. TYPE I SEE DETAILS SHEET 8
EXISTING GROUND LINE
FILL FORMED AROUND GATE WELL ENTRANCE
APPROXIMATE LOCATION OF PIPE CRACKS
GATE WELL SEE DETAIL SHEET 10
POND DRAIN INLET BOX SEE DETAIL SHEET
CONC. BEDDING TYPE B1, DETAILS ABOVE
RISER FLOOR ELEV. 1660.1
WALL PIECE SEE DETAIL SHEET 10
TOTAL = 266.33'
PROFILE OF PRINCIPAL SPILLWAY
SCALE: 1" = 20.0' HORI. 1" = 10.0' VERT.
SOIL DATA FOR BORROW AREAS
DATE OF GEOLOGICAL INVESTIGATION - MAY 1961
UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION, NOT BY LABORATORY ANALYSIS
DH-2 ELEV. 1668.0
DIRTY GRAVEL, SOME SAND, WET
COMPACT CLAY AND SILT. WET
SOFT SHALE INTERBEDDED WITH THE SANDSTONE
TP-304 ELEV.
TYPICAL SECTION OF PRINCIPAL SPILL
TYPICAL OUTLET CHAN

EXHIBIT 9



SEEPAGE DRAIN DETAILS, SHEET 6
PLAN VIEW
SECTION A-A
NOTE:
RIPRAP SHALL BE WELL GRADED FROM A MIN. OF 6" TO A MAX. OF 18"
36" INSIDE DIA. CONC. WATER PIPE
TOTAL = 266.33'
PRESSURE HEAD = 48.9'
APPROXIMATE LOCATION PIPE CRACKS
PROFILE OF PRINCIPAL SPILLWAY
SCALE: 1" = 20.0' HORIZ. 1" = 10.0' VERT.
NOTE:
EXCAVATE INTO ... BACKFILL WITH ... MATERIAL
TYPICAL SECTION OF PRINCIPAL SPILLWAY EXCAVATION
TYPICAL OUTLET CHANNEL SECTION
AS BUILT
ISCHUA CREEK WATERSHED PROJECT
CATTARAUGUS CO., NEW YORK
PLAN-PROFILE OF PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NY-804-P

SPECIFICATION NO.

Exhibit 10

FOR 36" REINFORCED CONCRETE PRESSURE PIPE W/RUBBER & STEEL JOINT (SP-1)
ISCHUA CREEK WATERSHED DAM NO. 4
CATTARAUGUS COUNTY, NEW YORK
U.S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

SEE DRAWING D-2-712-36" Mk'd 7-17-62

Pipe Size	36	inches
Footage	268	feet
Design Conditions:		
In Accordance with AWWA C-302		
Three edge Bearing at .01" crack	16,500	lb./l.f.
Maximum Head	49	feet
Steel Design:		
Total Cage Area (Mesh)	1.299	sq.in./ft.
No. of Cages	2	
Cage Areas		
Inside	0.731	sq.in./ft.
Outside	0.568	sq.in./ft.
Longitudinals 3/8" ø Bars Equally Spaced in inside cage	6	
Joint Rings:		
Spigot Ring - Special section x 4-1/2 inches wide with 14 Ga. x 4" wide steel band		
Bell Ring 3/16" x 6 inches		
Both zinc coated		
Wall Thickness	5-5/8	inches
Joint Depth	3-3/8	inches
Average Creep	0.03	feet
Average Length	16.03	feet
Job Consists of:		
(16) Straights	256.48	feet
(1) Short (10'-3" O.A.)	10.00	feet
(1) Wall Fitting (Spigot)	--	feet
	266.48'	

LOCK JOINT PIPE CO. EAST ORANGE, N. J.

COMPILED LJ CHECKED D.L. APPROVED DATE

New York Isc..a Creek Site 4

D. Lake 10/16/79 DEW 10/26/79 Exhibit 11

Requirement's of Design Note #9

Re: Design Note #9

Pg 4, equation (7)

$$A_s = \frac{4.33\ C_f\ \gamma\ b_c\ H_c\ (L/2)}{f_s}$$

where:

C_f = friction coefficient

γ = avg. wt. of embankment soil

b_c = outside diameter of conduit

H_c = height of fill over conduit

L = section length of pipe (feet)

f_s = allowable steel stress

$$A_s = \frac{(4.33)(.25)(138\ \text{lbs}/\text{ft}^3)(3.94')(48.5')(16/2)'}{20{,}000\ \text{lbs}/\text{in}^2}$$

Using C_f = 0.25 for the constructed condition.

$\therefore\ A_s = \underline{\underline{11.42\ in^2\ \text{required}}}$

From Exhibit 10

Longitudinal reinforcement shows 6, 3/8" diameter bars equally spaced in inside cage.

$A_{s\,(\text{Provided})} = (6)(.1105) = .6636\ in^2$ for No. 3 bars

Additional longitudinal reinforcement would be provided from the two cages of mesh reinforcement, but it would be unreasonable to assume that the amount lacking could be made up by the mesh alone.

Construction records don't state the size and type of mesh reinforcement in the pipe and the areas can't be broken down for use.

APPENDIX E

DESIGN FOLDER

DESIGN REPORT

ISCHUA CREEK WATERSHED PROJECT
SITE NO. 4, SAUNDERS CREEK
CATTARAUGUS COUNTY, NEW YORK

This floodwater retarding dam is located on Saunders Creek, a tributary of Ischua Creek. It is located approximately one mile northwest of the town of Franklinville in Cattaraugus County, New York. Sheet 4 of this report is a transparent overlay which when placed on the Franklinville 15' quadrangle published by the U. S. Geological Survey, will assist in locating the dam. The dam is on property owned by Carl Forward and Ed Bednarski.

This dam has been classified as a class (c) structure in accordance with criteria as established in Washington Engineering Memorandum SCS-27.

The drainage area above the dam is 4.10 square miles.

The purpose of this dam is to provide temporary storage for the runoff from 2,624 acres, which will reduce flooding downstream. This temporary storage is gradually released through the principal spillway at the low stage and high stage elevations.

The components of the dam are a compacted earth fill, principal spillway, two emergency spillways and a combined drainage system for the dam and foundation.

The principal spillway consists of a 36-inch reinforced concrete water pipe and a 3' x 9' reinforced concrete riser.

The vegetated emergency spillways (base width 100 & 200 ~~150~~ feet) will not be used until the runoff exceeds 3.2 inches for a 6-hour duration storm.

The inflow hydrographs used in the design of this structure were developed by the method described in the Engineering Handbook, Hydrology, section 4, part 3.21, USDA, SCS.

The flood routing procedure used in the design is described in the Engineering Handbook, Hydraulics, section 5, USDA, SCS. This flood routing procedure was used to determine the maximum stages shown in the following table.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. NY-804-R SHEET 1 OF 4 DATE 11/22/61

DESIGN REPORT

Factor Which Determines Stage	Surface Area Acres	Runoff in Inches	Peak Inflow CFS	Peak Outflow CFS	Elev. of Maximum Stage	Storage in Ac.-Ft.	Element of Structure Determined by Maximum Stage
50 year sediment accumulation	4.8	-	-	-	1682.5	31	Crest of orifice
5 year frequency storm	26.2	1.5	788	-	1703.2	295	Crest of riser
100 year frequency storm moisture condition III	59.2	3.2	1682	-	1713.0	689	Check of emergency spillways
1.75x6 hour point rainfall moisture condition II	73.0	9.4	4940	3800	1715.9	888	Design high water
2.5 x6 hour point rainfall moisture condition II	80.0	14.7	7452	6800	1717.2	968	Check top of dam

The duration of flow and the maximum velocity in the emergency spillway for the design storm is 7.69 hours and 7.25 feet per second, respectively.

The time to empty the pool from the crest of the emergency spillway to the crest of the orifice is 5.0 days.

The geology report and Soil Mechanics Laboratory report were used to determine the adequacy of the design. Copies of these reports are attached.

The following publications were used in the design of this dam:

NE Handbook No. 5, Hydraulics
NE Handbook No. 4, Hydrology
NE Handbook No. 6, Structural Design
Technical Releases Nos. 2, 5 and 10

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. NY-804-R SHEET 2 OF 4 DATE 11/22/61

9.5

1

Ischua Creek Watershed
Site #4.

Changes Made

(1) Original stage storage curve was based on a 5' contour interval map.

A new stage-storage curve was computed based on a 2' contour interval map up to elev. 1686 and a 5' contour interval map from elev. 1690 to 1720

(2) The more accurate curve indicated less storage at the lower elevations ∴ the sediment pool elev. (crest of orifice) was increased from elev. 1682.5 to elev. 1684.2

3) The surface area of the sediment pool increased from 4.8 ac. to 5.6 ac.

4) Check of storage in low stage

(a) Using TR #10 and limiting the storage in the low stage (elev. of crest of riser remains the same as in the original design - 1703.2) the required release rate of the orifice was determined)

(b) The release rate is increased from 49 cfs to 65 cfs. This increase will not effect the desired benefits downstream.

(c) Size orifice changes from 1'x2' to 1'x2'-8"

(5) Check for min. elev of crest of emergency spill. Using TR #10 three conditions were checked. All resulted in lower elevations than in original design

(6) Flood routing for DHW and freeboard in original design was started @ elev. 1687.0 (5 day draw down). Flood routing can be started @ 1686.0 or lower (6 day drawdown) ∴ It appears that flood routing again is not necessary since the elev of top of dam and crest of em. spillway will not be changed (at least not increased)

(7) Summary

	Redesign		original
Crest of Orifice	1684.2		1682.5
Crest of Riser	1703.2	same	1703.2
Crest of Em. Spill.	1713.0	same	1713.0
Top of Dam	1717.2	same	1717.2
Orifice Size	1'x2'-8"		1'-2'
Sediment pool area	5.6 ac.		4.8 ac.

x

N.Y.
LCI
Site #4 - Summary Sheet

Ischua Creek Watershed
NY-804

pg #1

Top Settled Fill ________ El. 1717.2

Crest Em. Spillway ________ El. 1713.0

Crest of Riser ________ El. 1703.2

Sediment Pool ________ El. 1684.2

Sediment Pool Area ________ 5.6 Ac.

Orifice Size ________ 1' x 2'-8"

X

Sheet # 2
2/6/61
Tyler
Ny 804

Design criteria

1. Structure Classification "C"

2. Set elevation of Permanent Pool to store 50 yrs sediment minus allocation for Flood pool

3. This is a two stage structure

4. Riser Crest is set by routing 5 yr. storm thru a 2'x1' orifice

5. Emergency Spillway Crest is set by routing a 100 yr. storm through a 36" Principal Spillway Pipe.

6. Riser Dimensions 3'x9' (inside)

7. Set design high Water & Freeboard by recommended suggestions in memo 47 E+WPU.

8. Width of Emergency Spillway - 2 - 150' Side slopes 3

9. Dam Fill - Upstream Slope 3:1
   Berms 2
   Downstream Slope 2½:1

RECONCILIATIO SHEET

Sheet 15
NY 804

	UNIT	WORK PLAN	DESIGN	REMARKS
DRAINAGE AREA	SQ MI.	4.1	4.1	
STORAGE CAPACITY				
SEDIMENT	AC.FT.	31	31	
FLOODWATER DETENTION	AC.FT.	679	689	
WATER SUPPLY	AC.FT.	—	—	
SURFACE AREA				
SEDIMENT POOL	AC.	7.5	5.8	
FLOODWATER DETENTION POOL	AC.	66.5	59.2	
WATER SUPPLY	AC.	—	—	
MAXIMUM HEIGHT OF DAM	FT	51	51	
VOLUME OF FILL	CU.YD.	103050	78,?03	
EMERGENCY SPILLWAY				
TYPE		Earth	Earth	
FREQ of USE	YR.	100yr	100yr	
DESIGN STORM RAINFALL				
DURATION	HR	6	6	
TOTAL	IN.	12.4	12.4	
BOTTOM WIDTH	FT.	300	2-150'	
DESIGN DEPTH	FT.	3.0	2.9	
DESIGN CAPACITY	CFS	3990	3800	
FREEBOARD	FT.	1.5	1.3	
TOTAL CAPACITY	CFS.	6150	6800	
PRINCIPAL SPILLWAY CAPACITY	CFS.	189	189	
CAPACITY EQUIVALENTS				
SEDIMENT VOLUME	IN	0.14	0.14	
SPILLWAY STORAGE	IN.	1.96	1.28	
DETENTION VOLUME	IN.	3.14	3.15	
CLASS OF STRUCTURE		C	C	

NY.
LCI
Site #4 - Summary Sheet

Ischua Creek Watershed
NY-804

P1 #1

Top Settled Fill ________________ El. 1717.2

Crest Em. Spillway ________________ El. 1713.0

Crest of Riser ________________ El. 1703.2

Sediment Pool ________________ El. 1684.2

Sediment Pool Area ________________ 5.6 Ac

Orifice Size ________________ ~~[illegible]~~" 1'-4"x2'-0" LCI 5/15/63

Revised Calculation
Raise Orfice from 1682.5 to 1684.2

Sheet 16

Summary Sheet

Job Name — Reservoir #4
Job No. — NY-804

Top of Settled Fill	El. 1717.2
Design High Water	El. 1715.9
Crest of Emergency Spillway	El. 1713.0
Crest of Riser	El. 1703.2
Sediment Pool	El. ~~1682.5~~ 1684
Principal Spwy. Outlet	El. 1662.5
Top of Dam Width	18.0 Ft.
Emergency Spwy. Widths	100.0 Ft. North 200.[illegible]
Berm Width (1) Upstream	10.0 Ft.
Berm Elevation	168[illegible]5 to 168[illegible]
Size of Riser	3.0'x9.0'
Size of Orifice	~~2'x1'~~ 1'x2'
Size of Principal Spwy.	36"
Length of Principal Spwy.	266.0'
Height of Dam	51.0'
Dam Side Slopes:	
Downstream	2½:1
Upstream	3:1
Emergency Spwy. Side Slopes	3:1
Drainage Area	2624 Acres
Floodwater Detention Capacity	687 Ac-Ft.
Sediment Storage	31 Ac-Ft.
Sediment Pool Area	~~5.8~~ 5.6 Acres

SCS 326
12-56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PRELIMINARY DESIGN DATA-CLASS C STRUCTURE

Isobua Creek (NAME) WATERSHED WORK PLAN New York (STATE)

STRUCTURE NO. 4 DRAINAGE AREA 2624 ACRES

(VALUES GIVEN IN INCHES REFER TO INCHES OVER THE WATERSHED)

1. PRECIPITATION

P_A (1.5x6-HR. VALUE) 13.9 INCHES

P_B (2.5x6-HR. VALUE) 19.8 INCHES

2. RUNOFF FOR

HYDROGRAPH A 1/ (P_A AND CONDITION III) 9.4 INCHES

HYDROGRAPH B 2/ (P_B AND CONDITION II) 14.7 INCHES

3. PEAK INFLOW RATE FOR

HYDROGRAPH A 1/ 4940 C. F. S.

HYDROGRAPH B 2/ 7452 C. F. S.

4. PEAK OUTFLOW RATE

PRINCIPAL SPILLWAY

LOW STAGE 40.2 C. F. S.

HIGH STAGE 187.7 C. F. S.

EMERGENCY SPILLWAY

DESIGN CAPACITY 3800 C. F. S.

MAXIMUM CAPACITY (TO TOP OF DAM) 6800 C. F. S.

5. STORAGE AT ELEVATION OF

PRINCIPAL SPILLWAY

LOW STAGE	0.14	INCHES	31	ACRE-FEET
HIGH STAGE	1.49	INCHES	326	ACRE-FEET
EMERGENCY SPILLWAY-CREST	3.29	INCHES	720	ACRE-FEET
HIGH WATER LINE-DESIGN CAPACITY	4.20	INCHES	919	ACRE-FEET
HIGH WATER LINE-MAXIMUM CAPACITY	4.56	INCHES	999	ACRE-FEET

6. EMERGENCY SPILLWAY

CRITICAL VELOCITY AT DESIGN CAPACITY-CONTROL SECTION 7.25 F. P. S.

DURATION OF FLOW THROUGH SPILLWAY FOR DESIGN HYDROGRAPH 7.69 HOURS

BOTTOM WIDTH AT CONTROL SECTION 2(150') FEET

LENGTH, CONTROL SECTION TO EXIT 60&485 FEET

CONSTRUCTED IN (EXCELLENT)-(GOOD)-(FAIR)-(POOR) EROSION RESISTING MATERIALS Good

1/ DESIGN HYDROGRAPH-VALUES USED TO DETERMINE EMERGENCY SPILLWAY DIMENSIONS FOR SAFE VELOCITES

2/ MAXIMUM PROBABLE HYDROGRAPH-VALUES USED TO DETERMINE EMERGENCY SPILLWAY FREEBOARD

(CONTINUED ON REVERSE)

7. ELEVATION OF POOL AT

PRINCIPAL SPILLWAY

LOW STAGE .... 1682.5 .... FEET

HIGH STAGE .... 1703.2 .... FEET

EMERGENCY SPILLWAY—CREST .... 1713.0 .... FEET

HIGH WATER LINE—DESIGN CAPACITY .... 1715.9 .... FEET

HIGH WATER LINE—MAXIMUM CAPACITY .... 1717.2 .... FEET

8. EARTH FILL

ELEVATION TOP OF SETTLED FILL .... 1717.2 .... FEET

MAXIMUM HEIGHT OF FILL .... 51.2 .... FEET

9. APPROVED AS CLASS C DESIGN

DATE ______________________ SIGNED ______________________
STATE CONSERVATION ENGINEER

DATE ______________________ SIGNED ______________________
HEAD, E. W. P. UNIT

GEOLOGY REPORT

REPORT NO. NY-804-G

Prepared By B. S. Ellis
Geologist
SCS, Syracuse, New York

H. S. Atkinson
State Conservation Engineer
SCS, Syracuse, New York

STATE New York WATERSHED Ischua Creek

SITE NUMBER 4 LOCATION Franklinville, N.Y.

INVESTIGATED BY B.S. Ellis DATE May 1961

EQUIPMENT USED Backhoe, Acker Drill Rig

SITE DATA:

DRAINAGE AREA 4.10 4.05 SQ. MILES, 2624 (2,592) ACRES

TYPE OF STRUCTURE Earth Fill CLASS C PURPOSE Flood Control

HEIGHT OF FILL 51 FEET: LENGTH OF FILL 920 FEET

VOLUME OF FILL (COMPACTED) 98,903 (above ground) CU.YDS.

LOCATION OF SPILLWAY North & South Abutments

ALLOCATED STORAGE:

	Surface Area (Acres)	Volume (Ac. Ft.)
Sediment	5.8	31
Floodwater	59.2	689

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. NY-804-G SHEET 1 OF 26 DATE June 1961

GEOLOGY REPORT

SURFACE GEOLOGY & PHYSIOGRAPHY

This site is located in the Allegheny Plateau physiographic province. The topography in the area is generally of the glacial-depositional type of the Binghamton drift. Morainal deposits are very common in the area. The material in the uplands is predominantly till with occasional kames and kame terraces of gravel.

The valley slopes, or abutments, range from about 8% to a maximum of 28%, with a short distance of bluff-like topography just off the valley floor. The flood plain itself is about 200 feet wide at the C/L of the dam.

Sandstone is exposed on the north abutment, and is of Devonian Age. It is generally thick-bedded, ranging up to 24" thick, with the majority being about 12". There are some shaly zones that are weathered and open on the face of the outcrop. These constitute only a fraction of the total profile, however. Regional dip is 50 feet to the mile in a generally southwesterly direction. There is some jointing discernible, trending generally north-south.

Two or three minor seeps were observed in the bedding planes of the sandstone on the north abutment.

The channel downstream from the structure is reasonably stable under present conditions. It is paved with large (6" to 18") flags ranging up to 3" in thickness. Installation of the structure should have little effect on this channel.

SUBSURFACE GEOLOGY

<u>Centerline of Dam</u>

Two drill holes and five backhoe test pits were dug along the C/L of the dam. DH-1, on the south edge of the flood plain, was carried to a depth of 31.5 feet. It was sampled at the 5 and 10 feet depths and then continuously below 10 feet. (TP-302, dug near DH-1, provides a continuous profile from 0-10 feet.) There were no low volume-weight materials encountered. A boulder was encountered at the 7 foot depth and the hole was not cased below this depth. There was little or no caving, indicating the density of the material. Blow count averaged around 35/foot down to the 20 foot depth and then jumped to around 200. The material was moist to a depth of 25 feet and then changed to a dry material. At the 21 foot depth, an 8" boulder was cored. The material sampled in the spoon was

GEOLOGY REPORT

visually classified as a CL. However, backhoe test pits 301 and 302, in the same blue gray material, were visually classified as GM. The material is a very dense till, with numerous large cobbles. It is a toss up to classify without a sieve analysis, and might go either way.

DH-2, on the north edge of the flood plain, encountered rock at a depth of 7 feet. The rock was cored from 7 feet to 13 feet. Recovery amounted to about 3 feet for this distance. The material over the rock is a brown, compact till.

Backhoe test pits 3 and 4 on the north side of the valley were dug to depths of 10 and 6 feet, respectively. In general, both pits were in a very dense silt with numerous small gravels and occasional cobbles. There was a very slight seepage at the 8 foot depth in TP-3, and none in TP-4.

TP-5 and 6 on the south side of the valley revealed about 6 feet of tight, fine-grained brown till, (CL) underlain by 2 feet of coarser till and then sandier material below the 8 foot depth. TP-5 was carried to a depth of 5 feet and TP-6 to a depth of 9 feet.

TP-7 was dug in what appeared to be a soft spot in the flood plain. However, the material is dense and relatively dry below the 3 foot depth and consists of a blue-gray till. The matrix is a CL with a fairly good gradation of +4's up to 3".

Several minor seep zones were observed along the bedrock face on the north abutment. These seeps occur along the bedding planes of the sandstone.

Principal Spillway

Three test pits were dug along the C/L of the principal spillway. One at the riser location, one at the outlet and one at midpoint. No samples were taken of the material.

All of the pits revealed a very dense blue-gray till at design grade, overlain by alluvial gravel or brown till.

TP-303 had a very large boulder, or bedrock at grade elevation.

Emergency Spillway

Twelve test pits and six drill holes were drilled in the emergency spillways. Two samples were taken of the material in the north spillway and are from the south.
ONE

GEOLOGY REPORT

Bedrock was encountered along the north edge of the north spillway. The estimated volume of this rock to be excavated is 6,000 cu. yds.

The material overlying the rock and in the rest of the north spillway is quite uniform. It is a dense glacial till, consisting of approximately 30-40% +4 material tightly embedded in the matrix.

At design grade, the material is not particularly erosive.

In the south spillway, four test pits were dug along the C/L with the backhoe, starting at 3+00 upstream and ending at the level section. Dense brown till, slightly coarser and cleaner than on the north side, overlies a sandier material.

Borrow Area

Eight backhoe test pits were dug in an area east of the north spillway. The material, considering a composited profile, is uniform. One composited sample from test pit 103 was taken as representative of the material in the area.

In general, the entire area has 4 or 5 feet of silt with considerable +4 material in it, underlain by a coarser till that classified visually as a GM. The northern portion of the area is shallow (9'-10') to weathered bedrock.

Based on an 8 foot overall depth, there are approximately 56,000 cu. yds. of material available in this area.

Construction Materials

There was no source of clean gravel or suitable filter material revealed on this site during this investigation.

Rip rap will probably be available from the rock excavation in the north spillway.

Water

There was very little seepage in any of the test pits, and ground water observations in the drill holes would be invalidated by the influence of drilling water. Water for construction purposes will have to come from impounding the surface stream in the vicinity of the dam site.

GEOLOGY REPORT

CN - 60
JAN. 1959

SUPPLEMENT TO GEOLOGY REPORT
ISCHUA CREEK WATERSHED
SITE 4

(For In-Service Use Only)

INTERPRETATIONS AND RECOMMENDATIONS

Centerline of Dam

Foundation materials along the C/L of this structure are competent. The abutments consist generally of a dense brown till material. The north abutment, above the bedrock, consists of a very dense matrix with tightly bound cobbles and occasional boulders. This matrix, probably an ML or CL, is consistent to the depth of the test pits. The south abutment, on the other hand, has a sandier, more permeable material underlying the relatively impermeable till. This sand occurs at a depth of about 8 feet.

The valley bottom, or flood plain, has bedrock at a depth of 7 feet on the north side and very dense, blue gray till to at least a depth of 31 feet on the south side. The minimum blow count on this material was 14 at a depth of 5 feet. From 10 to 20 feet, the count averages around 35 and then jumps into the +100 range.

For a height of about 15-20 feet above the valley floor on the north abutment, sandstone is exposed. There has been considerable weathering of the soft shale beds between the sandstone layers, with a resultant slumping of large blocks of the sandstone.

It appears from the foregoing that differential settlement will not be a problem on this site, in spite of the fact that we have bedrock at a shallow depth (7') on the north side of the valley and deeper than 31 feet on the south side, less than 170 feet away. The material on the south side is dense enough to preclude any settlement for this depth of fill. The abutments are a good heavy till, so no problem exists in that quarter.

I recommend, however, that the weathered rock on the north side of the valley be removed. It should be cleaned back to a regular face of fresh, solid rock. There is a considerable amount of soft shale that is interbedded with the sandstone. This shale broke up during core drilling, resulting in frequent recoveries of 50%. Undisturbed, and covered with fill, this shale should not present any problem with respect to permeability or settlement.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. NY-804-G SHEET 1 OF 3 DATE June 1961

GEOLOGY REPORT

As mentioned in the beginning of this report, there are several seeps in the bluff on the north side of the valley, the highest being approximately 12 feet above the flood plain. At the time of this investigation (May 1961), there was probably 1 to 2 gallons per minute flowing from them. I noticed what appeared to be some sort of spring development on one. A rusty length of pipe protruded from a large crevasse in the rock, with water coming out of it as well as around it. The old road used to run through the valley, so it is a possibility. I mention this because it does give some indication that the seeps are not strictly wet-weather. It seems feasible to include drainage on this side of the fill to take care of this water. There are no discernible seeps on the south abutment. Considering the material, this is to be expected.

Principal Spillway

The heavy, blue gray till underlying the entire extent of the proposed principal spillway results in very good foundation conditions. DH-1, in the vicinity of TP-302, had blow counts in the vicinity of 25-30 at spillway grade. TP-303 revealed either a large boulder or bedrock at about spillway grade. Just to be safe, I recommend that the downstream end of the pipe be moved 20 feet toward the stream. (See dashed line on site plan view.) This should result in completely uniform conditions along the spillway.

Emergency Spillway

North - Bedrock was encountered in three drill holes in this spillway. By using the three point system and assuming plane conditions on the rock surface, a volume of 6,000 cu. yds. of rock excavation was computed. In the absence of very close hole spacing, it would be nearly impossible to define this rock both vertically and laterally, especially the latter. It seems safe to assume that at least a partial bluff condition exists, as at the lower elevation. Because of the interbedded shale, this rock should not be too difficult to excavate. I do not believe it can be ripped, but should blast rather readily.

The unconsolidated material at spillway grade is satisfactory. It is rather resistant to erosion and vegetation should establish readily.

The length of the slopes on the uphill side of the spillway excavation approach the area whereby it seems some erosion control is necessary. There is also the possibility of seepage emerging at the contact of the mantle and the bedrock, although the material in the drill holes was on the dry side.

GEOLOGY REPORT

South - There seems to be two problems connected with this spillway, as planned. One concerns the need for a dike from a point just below the level section upstream to somewhere beyond the C/L of dam intersection. Possibly realignment and relocation of the level section will alter this somewhat.

The second problem is that of the material at design grade from the level section downstream. It is quite erodible. I would recommend planning on over-excavating and backfilling with more resistant material that would also allow better establishment of vegetation.

Borrow Areas

In addition to the emergency spillways, a borrow area was investigated to the east of the north spillway. The investigation of this was not completed, however. Legal difficulties forced a cancellation of further work in this area. It will probably be necessary to go back sometime in the future and finish the job. The area south of the present borrow, if the material is satisfactory, would probably lend itself better to hauling onto the fill, at least from the standpoint of station-yards.

The borrow-excavation-fill relationship is tabulated in this manner:

Total Fill (above gound)	98,903	
Loss Factor (X1.5)		148,000
South Spillway	19,000	
North Spillway (Less Rock)	73,000	
Borrow Area (Needed)	56,000	
		148,000

This 56,000 cu. yds. of extra needed borrow can be obtained from the area east of the north spillway.

R. S. Ellis
Geologist, SCS
Syracuse, N.Y.

TO : W. S. Atkinson, State Conservation Engineer, DATE: August 24, 1961
SCS, Syracuse, New York

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory,
SCS, Lincoln, Nebraska

SUBJECT: New York WP-2, Ischua Creek, Site No. 4
Preliminary Report

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS 355, Triaxial Shear Test Data, 3 sheets.
3. Form SCS 352, Compaction and Penetration Resistance Report, 4 sheet.
4. Form SCS 353, Grain Size Distribution Graph, 2 sheets.
5. Form SCS 357, Summary - Slope Stability Analysis, 1 sheet.
6. Geological Plans and Profiles.

DISCUSSION

FOUNDATION:

No samples were submitted for analyses.

Interbedded sandstone and shale is exposed at the base of the right abutment. The bedrock contact drops off rather sharply under the flood plain section. A test hole 31 feet deep at the base of the left abutment did not penetrate the bedrock.

On the right abutment, above the bedrock exposure, the material is logged as a dense till, and ranges from ML to GM. The material on the south or left abutment is logged as a dense CL and GM till to an 8-foot depth. The dense till is underlain by a more permeable sandy material classed as SM. The depth of the SM was not determined.

Flood plain materials consist of several feet of alluvial gravel and gravelly sands. In general, it appears that the alluvium is from 3 to 5 feet thick. It is noted, however, that the alluvium could be as much as 7 to 9 feet thick in test hole 301.

The material underlying the alluvial gravels is logged as a dense till and was classified as a CL or GM.

Blow count data was obtained in test hole No. 1. There is some question as to the moisture content of the till. The geologic report and the moisture column on the drillers log refers to this material as moist to a 20-foot depth. We note a discrepancy on the drillers log, in the visual classification and remarks column, where this same zone is referred to as dry. High blow count was obtained. However, we cannot relate blow count to saturated shear strength without a better idea of the moisture content. With the present information, we don't know whether the high blow count is due to a dry till or whether the till is actually near saturation and feels moist because it is extremely dense.

Roy S. Decker
Subj: New York WP-2, Ischua Creek, Site No. 4
Preliminary Report

EMBANKMENT:

A. Classification: Four borrow samples were submitted from the emergency spillways and the borrow area. The four samples are very similar. They have from 26 to 44 percent fines with 5 to 8 percent 2 micron clay. The samples are classed as GC-GM and GM.

B. Compacted Density: Standard Proctor compaction tests were made on the minus No. 4 size fraction. The minus No. 4 densities ranged from 116.5 p.c.f. to 123.0 p.c.f.

Maximum density and optimum moisture content for various percentages of material larger than No. 4 size are shown on the attached compaction reports.

C. Permeability: A permeability test was made on Sample 62W331. The test was made on material passing the 1-inch size. The test was made at 95 percent of Standard Proctor density with a correction applied for 22 percent gravel. No percolation occurred in 6 days.

D. Shear Strength: Triaxial shear tests were made on Samples 62W331 and 62W333. The samples were regraded as shown on the attached Forms SCS 353. Four-inch diameter shear specimens were tested. The regraded material was molded to 95 percent of Standard density at saturation. Similar strength values were obtained on both materials. The difference can be attributed to the higher density and better gradation of Sample 62W333.

In addition to the four-inch diameter shear tests, a shear test was made on the minus # 4 size fraction. This test was made to check the effect of gradation and specimen size on shear strength. The test data is attached for informational purposes and the test is not charged to this site.

SLOPE STABILITY:

Stability of the proposed slopes was checked with a trial failure arc through the downstream section of the embankment only. With a full phreatic line, a 2 1/2:1 slope showed a factor of safety of 1.92. Under sudden drawdown a 3:1 upstream slope, with 10-foot berms as proposed, would have a factor of safety in the same range as that obtained on the downstream slope.

It must be emphasized that this analysis applies to the embankment and does not consider the foundation strength.

RECOMMENDATIONS

We do not have enough information on the foundation to make specific recommendations for a Class C embankment of this size.

We recommend that in-place density tests be made and disturbed samples from the same zones be submitted for classification. In addition to in-place density tests, we suggest field permeability tests to determine drainage requirements.

In-place density tests should be taken of the alluvial gravel and the underlying till in the flood plain, and in the till on the abutments.

Field permeability tests should be made in the alluvial gravel, and in the underlying till, and also in the dense CL till and in the SM on the south abutment.

In addition to the in-place density determinations and field permeability tests, we recommend another test hole at about sediment pool elevation on the south abutment. The test hole should penetrate to about elevation 1664. This would provide information on stratification in the south abutment.

The in-place density tests and disturbed classification samples will provide a basis for estimating shear strength and consolidation potential. The field permeability tests will provide a basis determining drainage requirements and cutoff depth. In this respect, we are concerned primarily with the need for drainage in the south abutment and in the flood plain. For instance, it may be possible that the alluvial gravels are permeable enough to serve as a blanket drain.

The field permeability tests should be made in accordance with designation E-19 in the "Bureau of Reclamation Earth Manual". The test is designated as field permeability test (well permeameter method).

Additional information on the geologic history of this valley would also be helpful. Based on the present information, it appears that this could be either a valley entrenched into a glacial drift deposite that parrallels an interbedded sandstone and shale escarpment, or a valley deeply entrenched in the bedrock and backfilled with glacial till. The SM on the south abutment may indicate a stratified drift or a residual sand layer over the bedrock.

On the basis of the present information, we would recommend a cutoff trench through the alluvial gravel and into the dense till.

Seeps on the north abutment in the interbedded shale and sandstone indicate a need for drainage in this section of the valley.

We concur with the geologist's recommendation to remove the weathered rock on the north side to solid rock under the entire embankment area.

Prepared by:
Lorn P. Dunnigan
Lorn P. Dunnigan

Attachments

cc: H. M. Kautz, Upper Darby, Pa.
Bernard S. Ellis, Syracuse, New York
Henry W. Davis, Penn Yan, New York
Jesse Wicks, Little Valley, N. Y. (2)

Reviewed and Approved by:
R. B. Phillips
Roland B. Phillips

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MECHANICAL ANALYSIS
GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT

LOCATION AND DESCRIPTION		DEPTH	FIELD CLASSIFICATION	FINES					SANDS						GRAVEL			
				0.002 mm	0.005	0.02	0.05	#200 0.074	#100 0.149	#60 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 25.4
K SITE NO. 4																		
y Spillway	L. bag	1-8'	SM,GM	7	10	21	35	44	47	49	50	52	55	60	66	69	75	80
y Spillway	L. bag	1-9'	ML GM	8	10	20	31	36	38	39	40	42	47	55	64	68	72	7[illegible]
y Spillway	L. bag	1-8'	GM	7	9	18	30	39	44	49	52	57	61	68	75	78	82	85
	L. bag	1-10'	[illegible] GM	5	8	14	21	26	28	30	31	35	40		61	67	73	7[illegible]

SOIL MECHA... LABORATORY ... Sheet ... of 1

...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
... OF DRY WEIGHT						ATTERBERG LIMITS					MOISTURE - DENSITY RELATIONSHIPS (STANDARD / MODIFIED)			UNDISTURBED SAMPLE DATA		Gs	SPECIAL TESTS			
GRAVEL								UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %								Shear	Compaction	Permeability
3/8"	1/2"	3/4"	1"	1 1/2"	3"	LL	PI				CURVE NO	DRY DENSITY	OPTIMUM H_2O	DRY UNIT WEIGHT	H_2O				Den.	K
6	69	75	80	86	90	22	5	GC-GM		21	1					2.61 2.69	COARSE FINES		R.	
		DRY DENSITY < #4 MATERIAL										116.5	12.5							
	68	72	77	83	88	24	7	GC-GM		14	2					2.62 2.72	COARSE FINES	✓	1080	0
		DRY DENSITY < #4 MATERIAL										119.0	13.0							
	78	82	85	89	92	19	3	GM		29	3					2.62 2.72	COARSE FINES			
		DRY DENSITY < #4 MATERIAL										121.0	11.0							
1	67	73	79	87	89	22	6	GC-GM		8	4					2.61 2.73	COARSE FINES			
		DRY DENSITY < #4 MATERIAL										123.0	11.0					✓		

SCS-[illegible] (Rev. 6/69)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

Sample number *62W333*

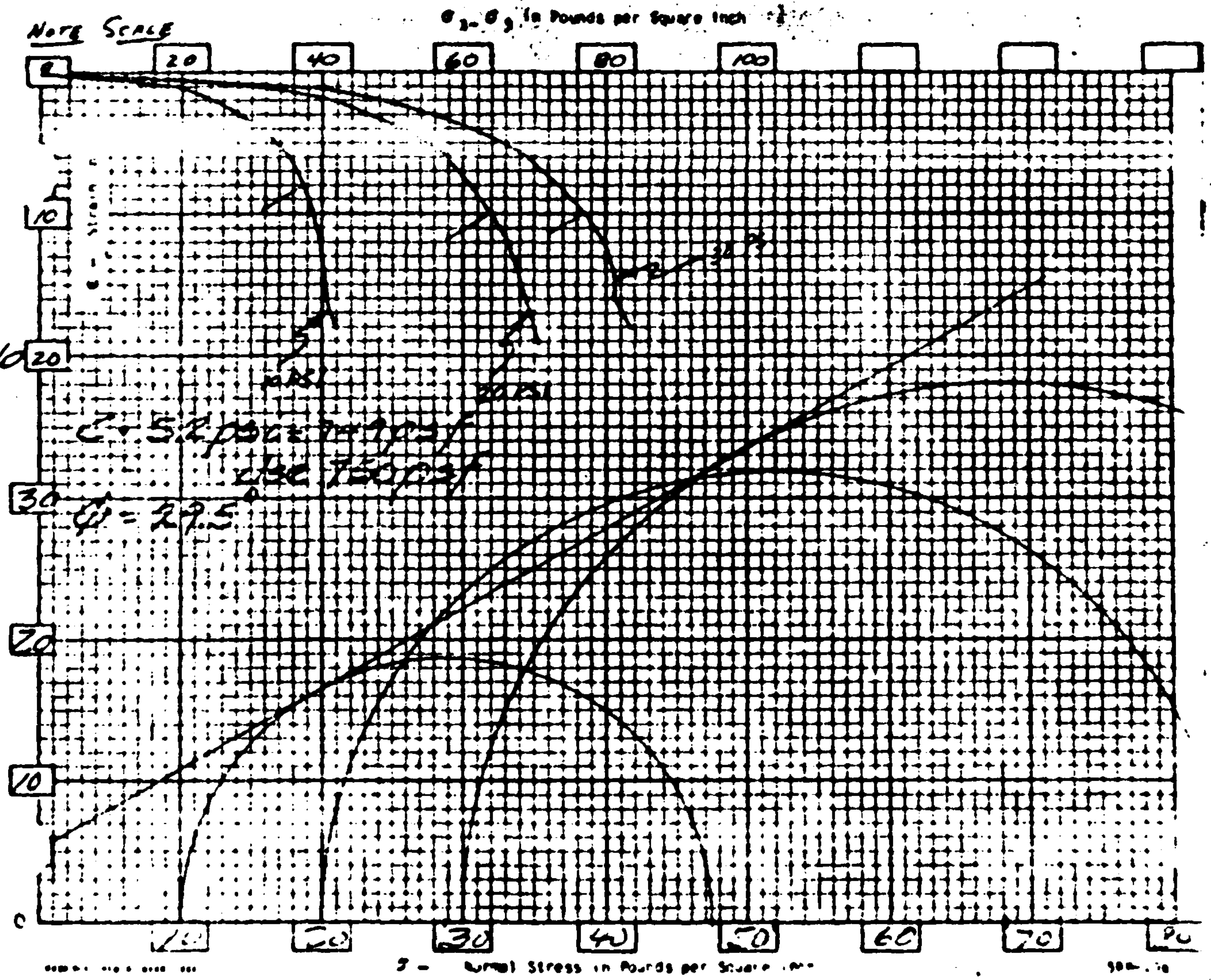
Project *ISCHUA CREEK SITE No. 4* Location *NEW YORK*

Moisture-Density Data
Standard ☒ Max. γ *131.0* pcf
Modified ☐ Optimum Moisture *8* %
Curve no. ___ of ___
L.L. *22* P.I. *6* Class *GC-GM* G_s *2.68*
% Finer Than: 0.002mm ___ 0.005mm ___ #200 ___
Other Factors Affecting Shear:
% Dispersion ______ % Salt ______
Other: *Molded @ Sat*

Specifications:
Specimen: Height ___ Max. Size *≤1"* Diameter *4.0* Material
☒ Consolidated ☐ Drained
☐ Unconsolidated ☒ Undrained
☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
☒ Remolded and Tested at: *95* % of ☒ Standard ☐ Modified
with w= ______ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☒ Saturated

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	% Sat. @ Start	End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Final e_f	Stress at Failure $\sigma_1-\sigma_3$	% Strain at Failure ε	Internal Friction φ Tan φ	Unit Cohesion
124.9	95.3	11.8	92.9	10.5	10	0.3399	0.3009	57.5	8	φ 29.5°	5.2 psi
125.5	95.8	11.8	95.2	10.4	20	0.3333	0.3009	63.8	10	Tan φ	750 psf
124.9	95.3	11.8	92.9	10.2	30	0.3399	0.2947	76.2	10		



SOIL MECHANICS LABORATORY

Sample number GCW 33

TRIAXIAL SHEAR TEST DATA

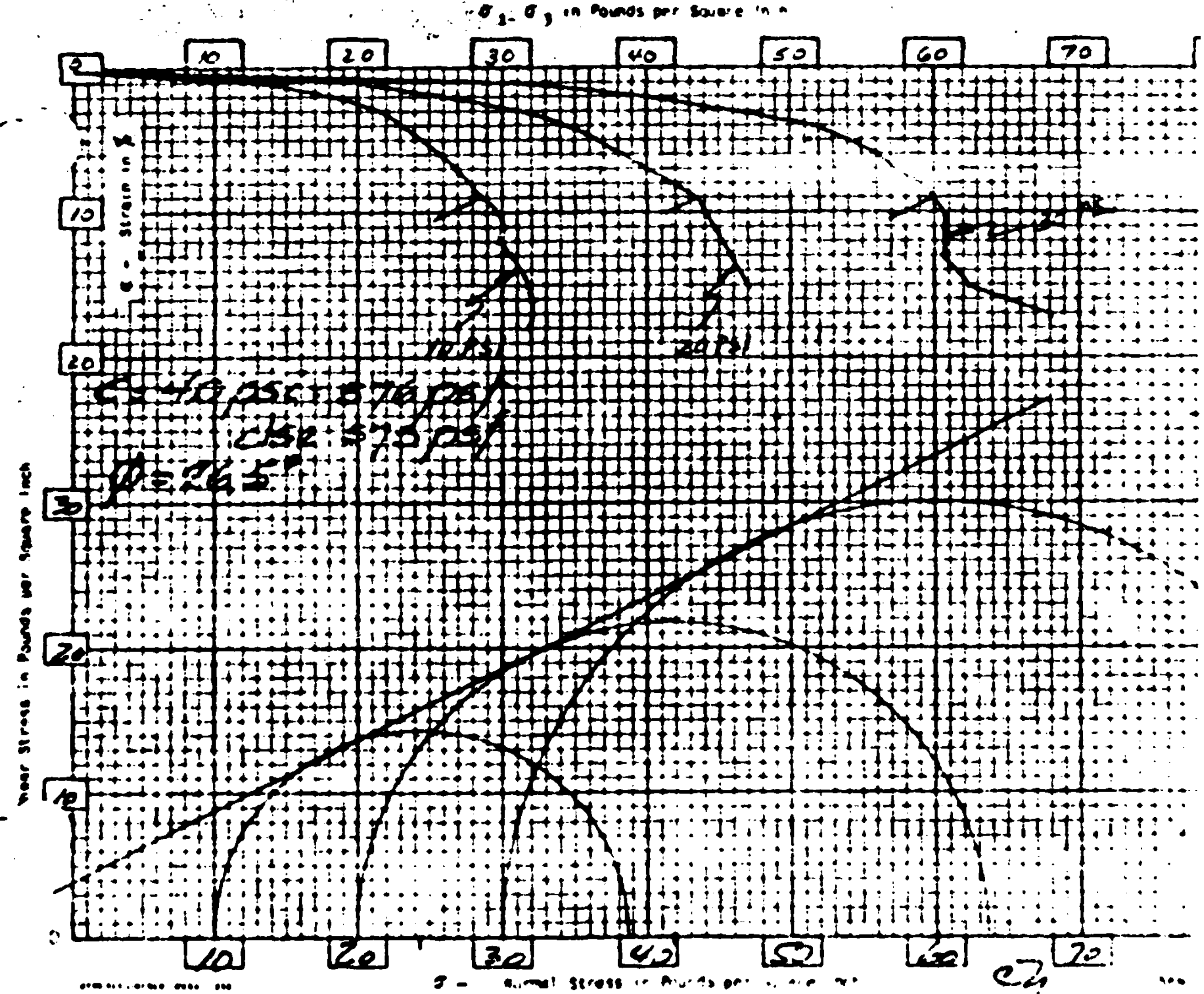
Project *Iscelua Cr Site No. 4* Location *New York*

Moisture-Density Data
Standard ☑ Max. γ *127.0* pcf
Modified ☐ Optimum Moisture *10.0* %
Curve No. ___ of ___
L.L. *29* P.I. *7* Class *GC-GM*
% Finer Than 0.002mm *8* : .05mm *10* .02mm *34*
Other Factors Affecting Shear:
% Dispersion *14* % Salt ___
Other: *Molded @ Sat.*

Specifications:
Specimen: Max. Height ___ Size ___ Diameter *4.0* Material
☑ Consolidated ☐ Drained
☐ Unconsolidated ☑ Undrained
☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturated
☑ Remolded and Tested at: *95* % of ☑ Standard ☐ Modified
with w = ___ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☑ Saturated

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	Moisture Content % Sat. @ Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion c
121.7	*95.8*	*13.1*	*98.6*	*11.9*	*10*	*.3744*	*.3399*	*286*	*9*	ϕ *26.5°*	*4.0* psi
120.5	*94.9*	*14.0*	*96.6*	*12.0*	*20*	*.3885*	*.3313*	*435*	*9*		*575* psf
121.7	*95.8*	*13.7*	*97.8*	*11.6*	*30*	*.3744*	*.3201*	*600*	*9*	Tan ϕ	



C-7

SCS-[illegible] (Rev. [illegible])

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

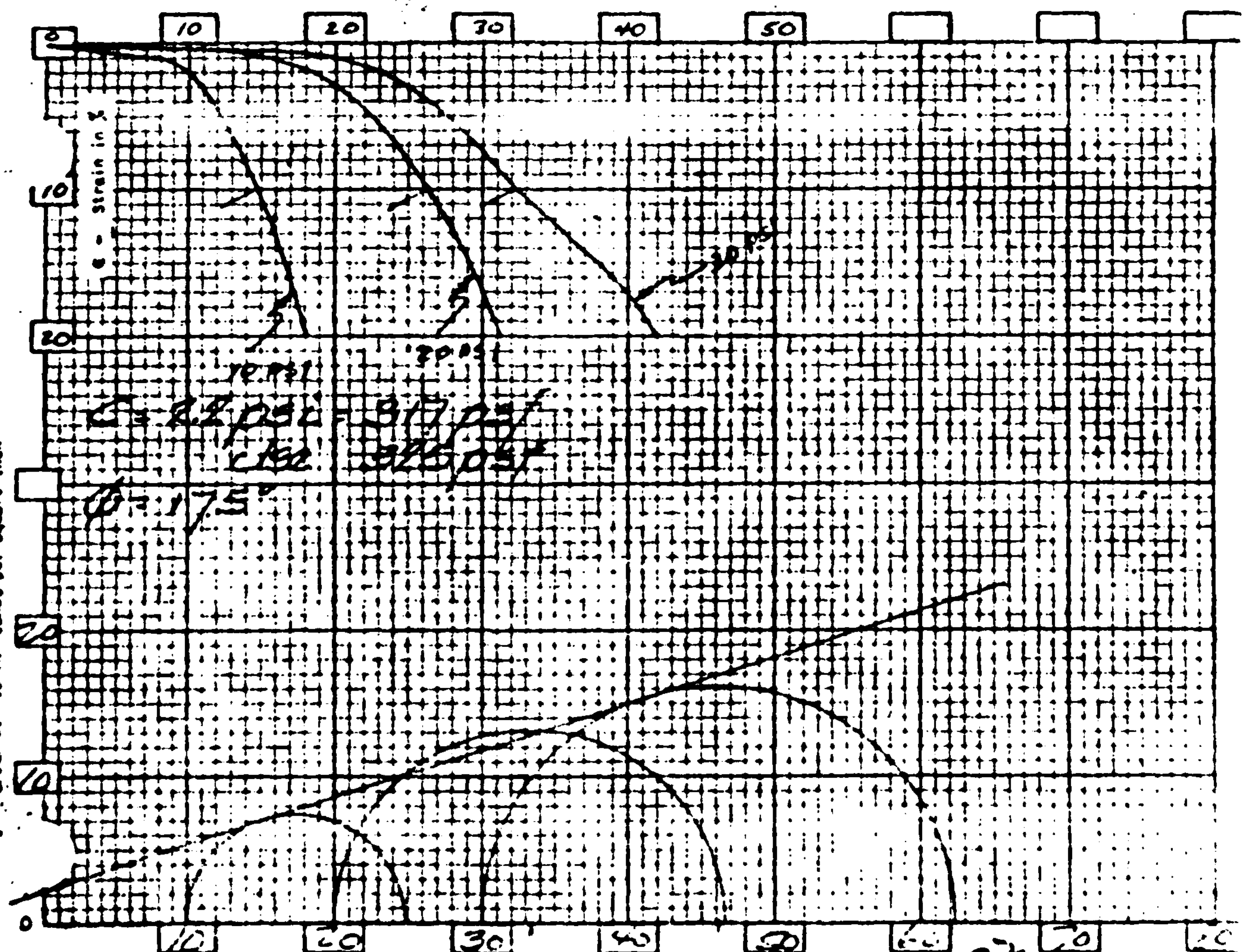
Sample number 62W331

Project Tecnua Cr. Site No. 4 Location New York

Moisture-Density Data	Specifications:
Standard ☑ Max. γ 119.0 pcf	Specimen: Max. Height ___ Size ___ Diameter 1.4 Material
Modified ☐ Optimum Moisture 13.0 %	☐ Consolidated ☐ Unconsolidated ☐ Drained ☐ Undrained
Curve No. ___ of ___	☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
L.L. ___ P.I. ___ Class ___ G_s 2.72	☑ Remolded and Tested at: 95 % of ☑ Standard ☐ Modified
% Finer Than: 0.002mm ___ 0.005mm ___	with e_o ___ % which is
Other Factors Affecting Shear: % Dispersion ___ % Salt ___	☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☑ Saturated
Other: ___	

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	Moisture Content % Sat. @ Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_o	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion
114.9	96.6	17.0	96.6	15.4	10	0.4782	0.4281	14.5	10	ϕ 17.5°	2.2 psi 325 psf
111.1	93.4	17.1	88.1	14.6	20	0.5281	0.4316	26.4	10		
111.1	93.4	17.1	88.1	14.3	30	0.5281	0.4166	32.5	10	Tan ϕ	



C-7

SCS-352 Rev. (10/58)

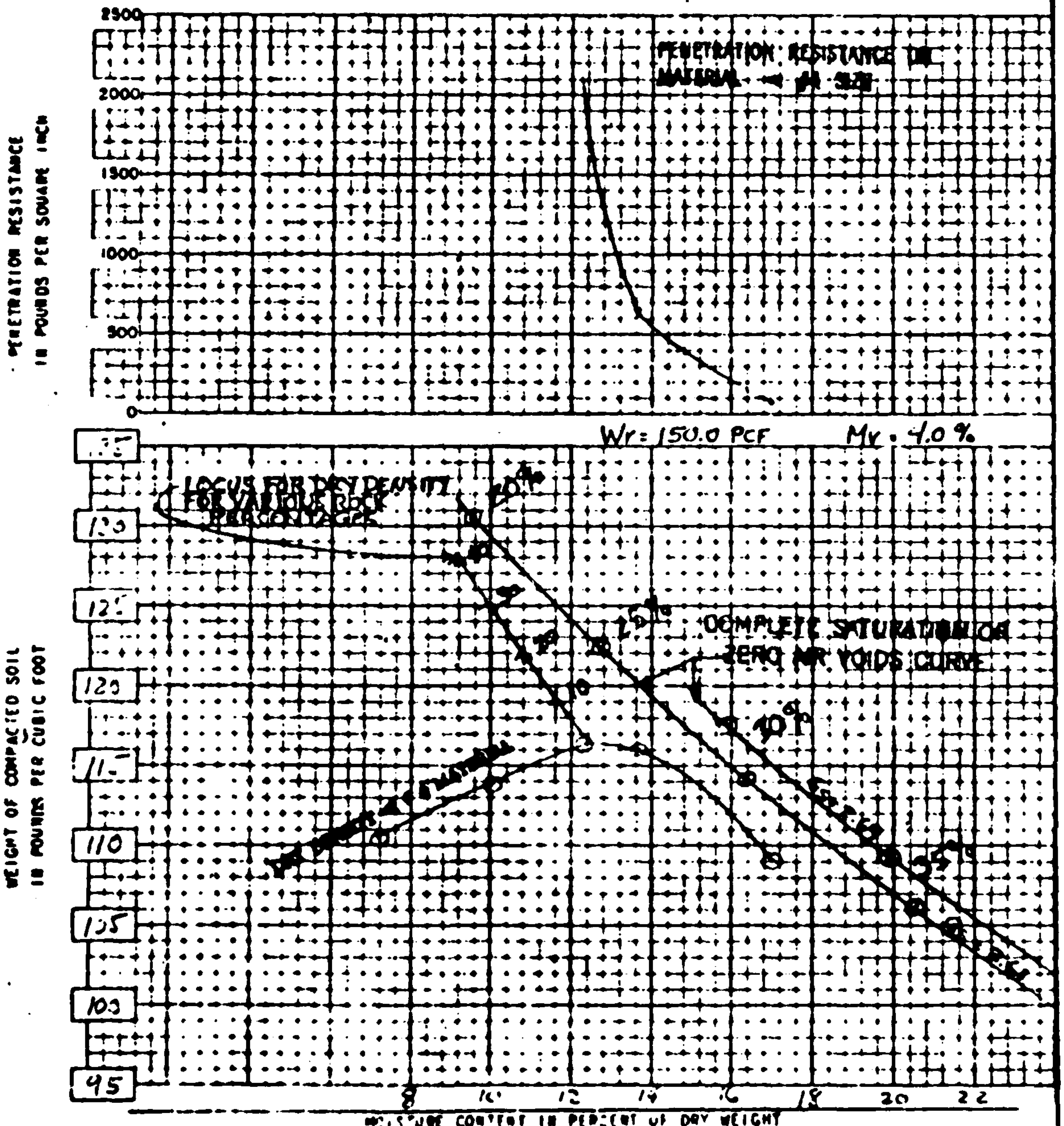
SOIL MECHANICS LABORATORY

COMPACTION AND PENETRATION RESISTANCE REPORT

Date ________ Sample No.: Field 2081 Lab 62W 330

Project ________ Location ________

Sample Location and Depth EM SPWY DEPTH 1-2'



TYPE OF TEST	TEST PROCEDURE	
[X] Standard Proctor	Weight of rammer 5.5 lbs.	Classification GC-GM
[ ] Modified AASHO	Drop 12 inches	Material compacted represents 60 percent of the sample and passed #4 sieve
[ ] Other ______	Lifts 3	(Sp. Gr.) Gs = 2.61 p #4, 2.69 r #4
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 1 of 4

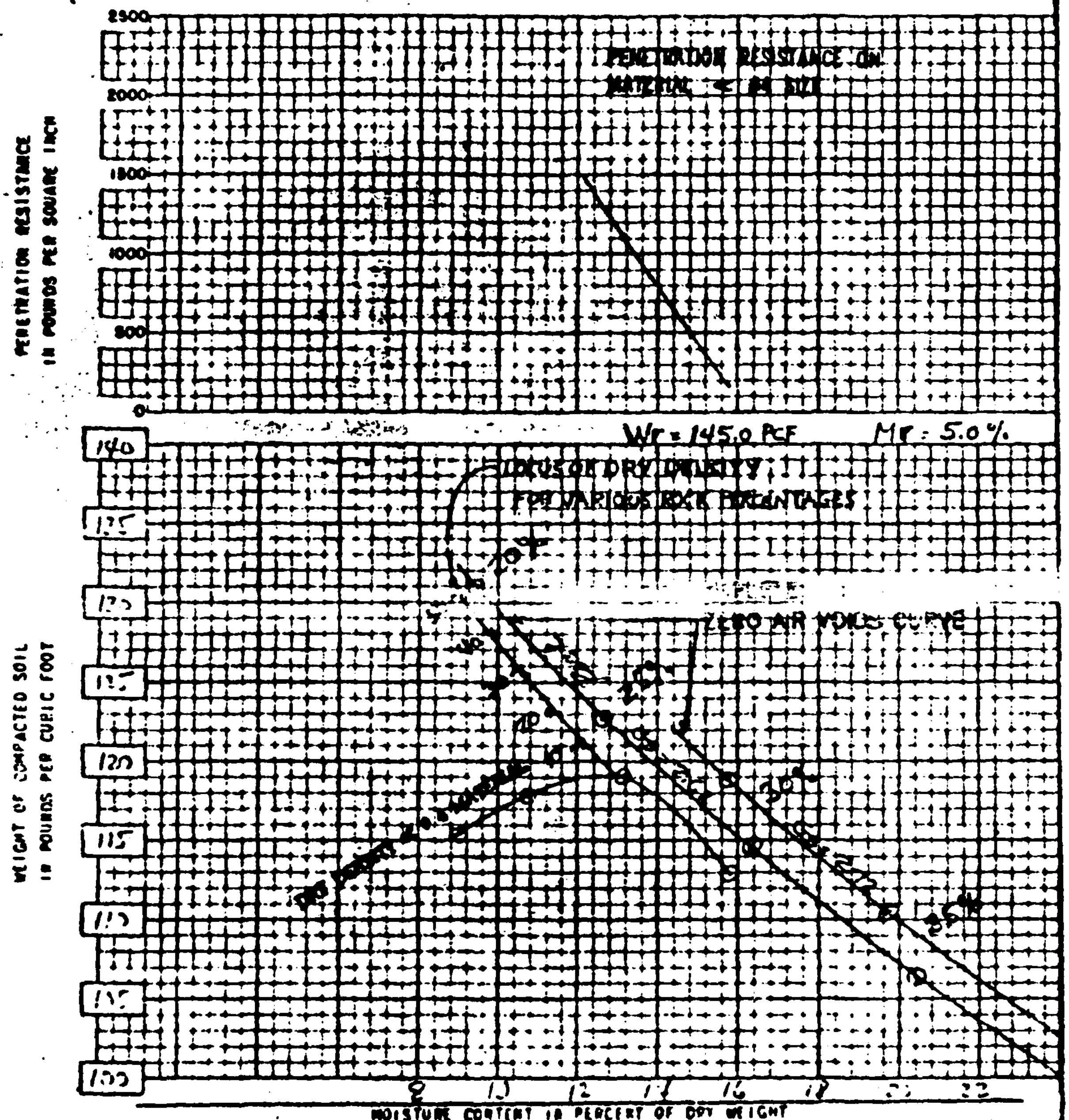
SBM-26

COMPACTION AND PENETRATION RESISTANCE REPORT

Date ______ Sample No.: Field 213.1 Lab 62W331

Project [illegible] Creek #9 Location [illegible]

Sample Location and Depth EM SPWY DEPTH 1-9'



TYPE OF TEST	TEST PROCEDURE	Classification GC-GM
[X] Standard Proctor	Weight of Hammer 5.5 lbs.	Material compacted represents 55 percent of the sample and passed #4 sieve
[ ] Modified AASHO	Drop 12 Inches	(Sp. Gr.) Gs= [illegible]
[ ] Other ______	Lifts 3	Curve 2 of 4
	Vol. of Cylinder 1/30 Cu.Ft.	

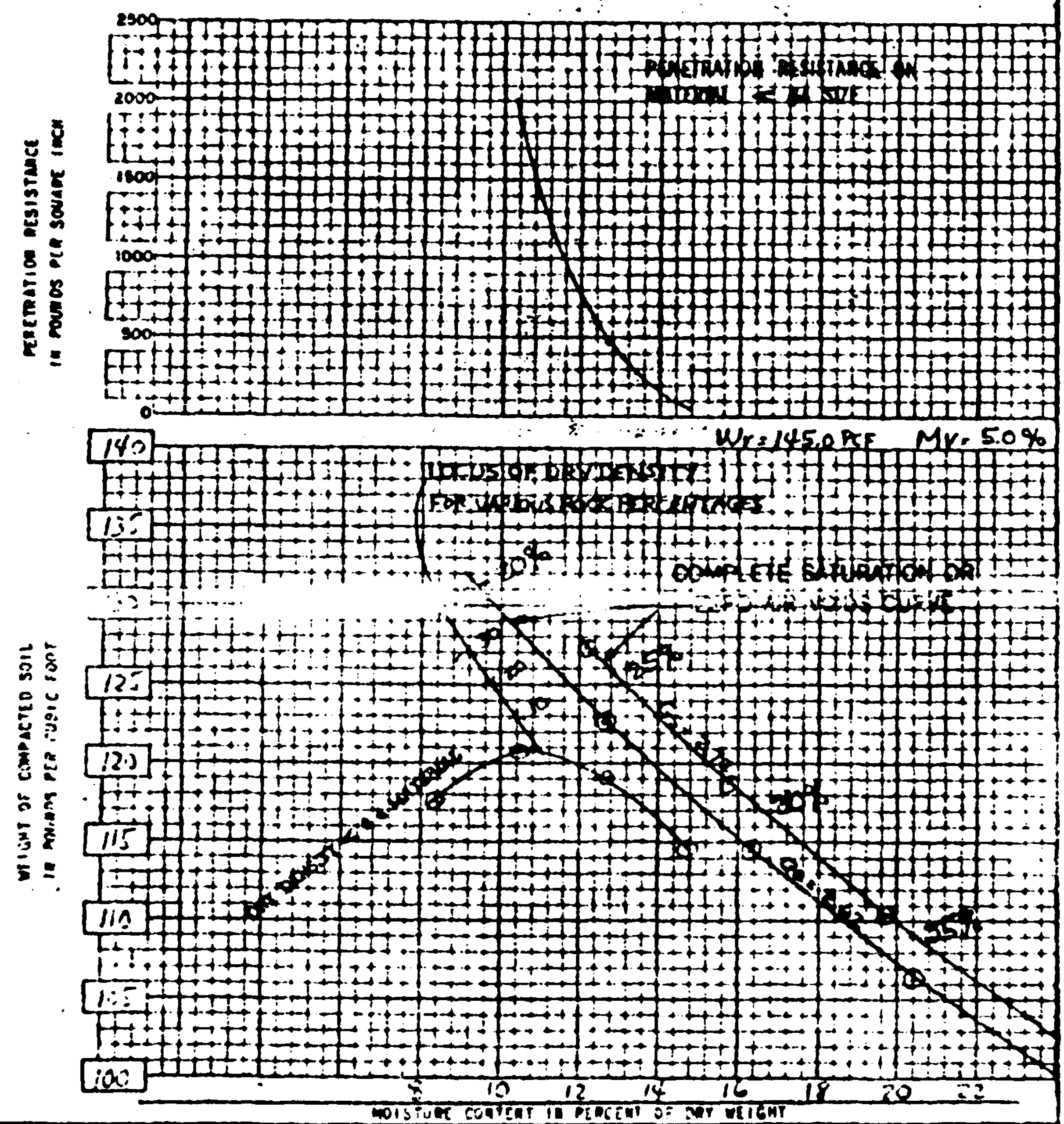
SCS-26

COMPACTION AND PENETRATION RESISTANCE REPORT

Date ____________ Sample No.: Field 216.1 Lab 62W332

Project I-S-416 SPEEP #4 Location NEW YORK

Sample Location and Depth EM SFWY DEPTH 1-2'



TYPE OF TEST	TEST PROCEDURE	
[X] Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification GM
[ ] Modified AASHO	Drop 12 Inches	Material compacted represents 62 percent of the sample and passed #4 sieve
[ ] Other ________	Lifts 3	(Sp. Gr.) Gs = [illegible]
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 3 of 4

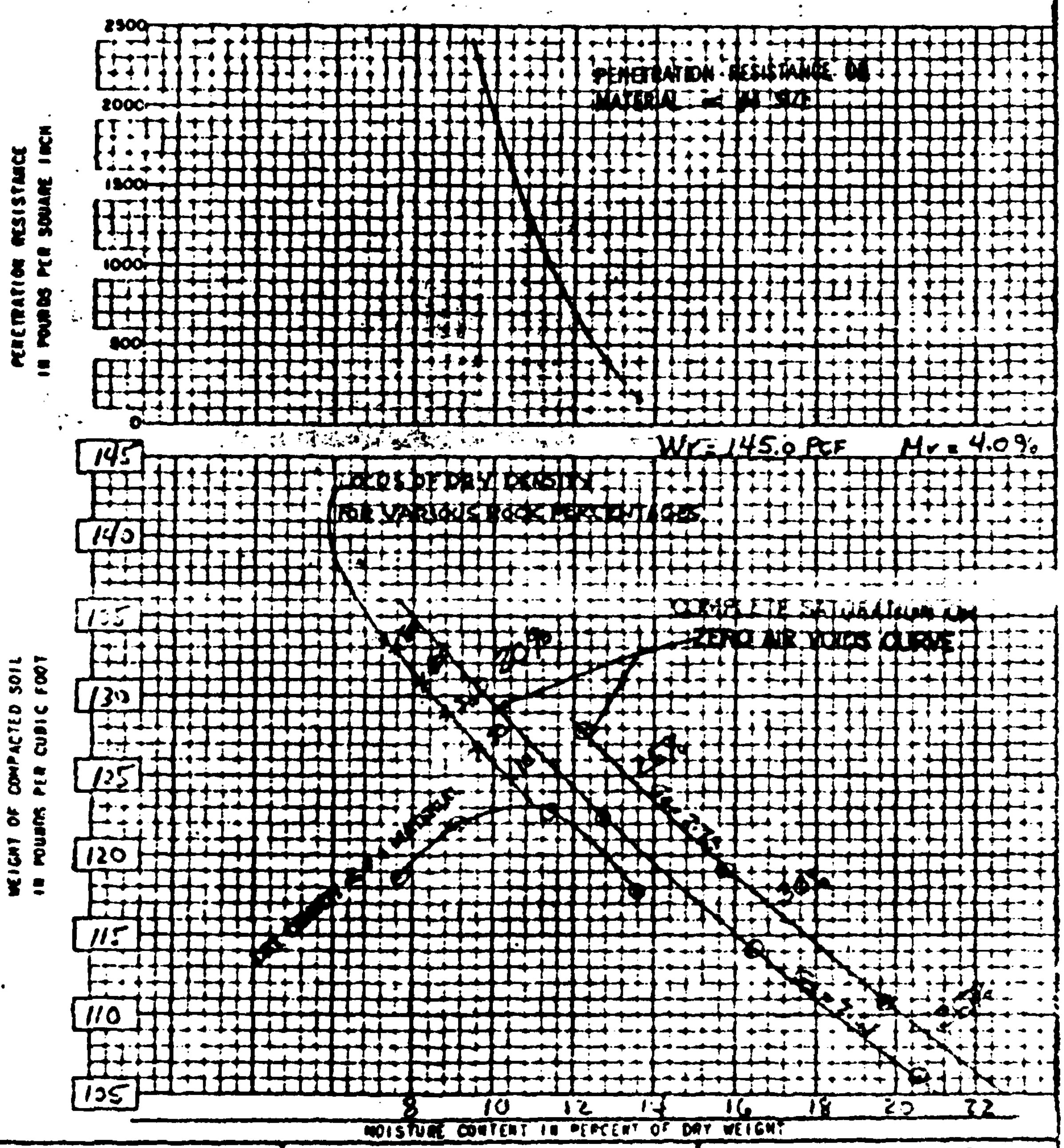
59-24

COMPACTION AND PENETRATION RESISTANCE REPORT

Date ______ Sample No.: Field 103.1 Lab 62W 333

Project ISCHUA CREEK #4 Location NEW YORK

Sample Location and Depth BORROW DEPTH 1-10'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification GC-GM
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 50 percent of the sample and passed #4 sieve
☐ Other ______	Lifts 3	(Sp. Gr.) Gs = [illegible]
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 4 of 4

FORM SCS-351
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State [illegible] Project [illegible] Site #1

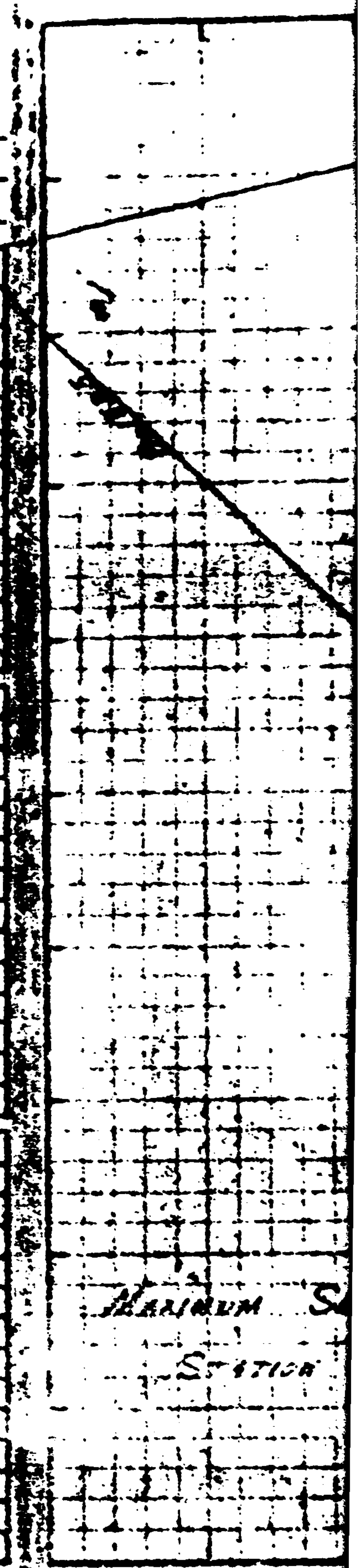
Date 8-5-[illegible] Analysis Made By [illegible] Checked By [illegible]

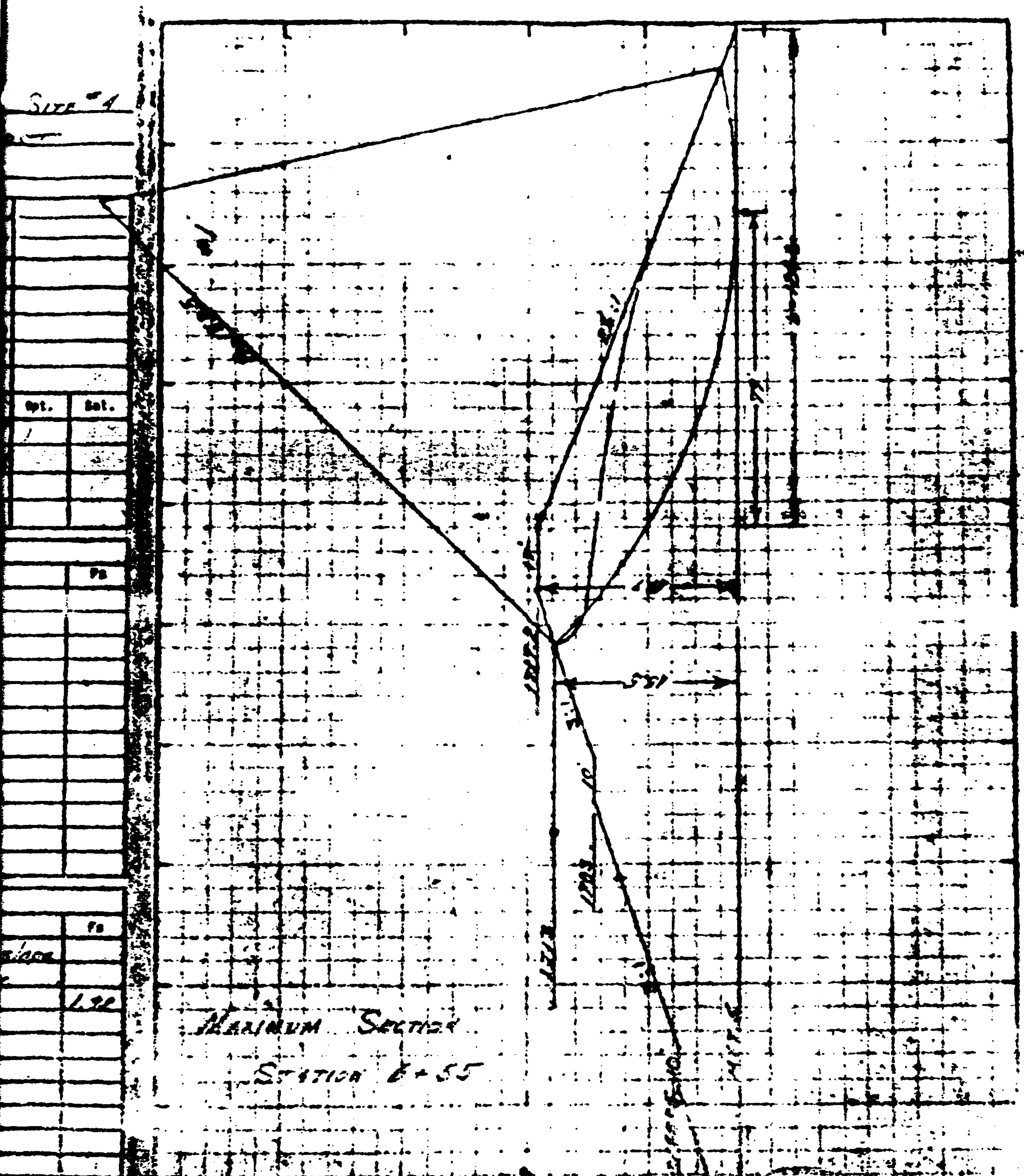
Method of Analysis [illegible] Circle

Location of Material					[illegible] 23 [illegible]		Emb [illegible] 60GM			
Sample No.					[illegible]		62W 353			
γ_d					121.3		125.1			
γ_m					133.5		135.0			
γ_s					138.0		136.5			
γ_b					75.5		76.0			
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ						26.5		25°		
Tan ϕ						[illegible]49		[illegible]		
K										
C						[illegible]		750		

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs

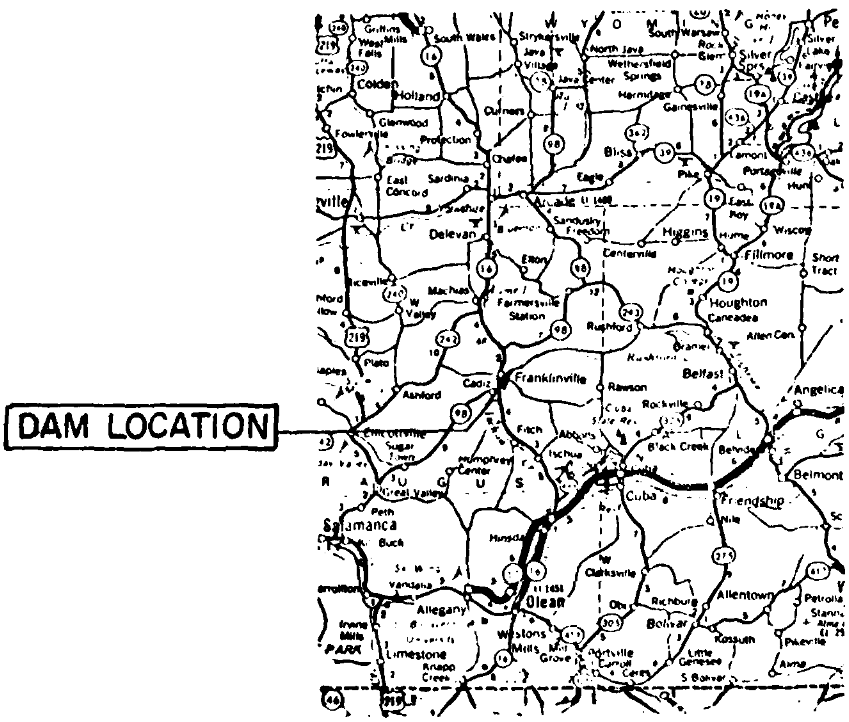
DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
1	[illegible]	[illegible]	
		[illegible] only	
		[illegible]	1.[illegible]




Site #4
Maximum Section
Station 6+55

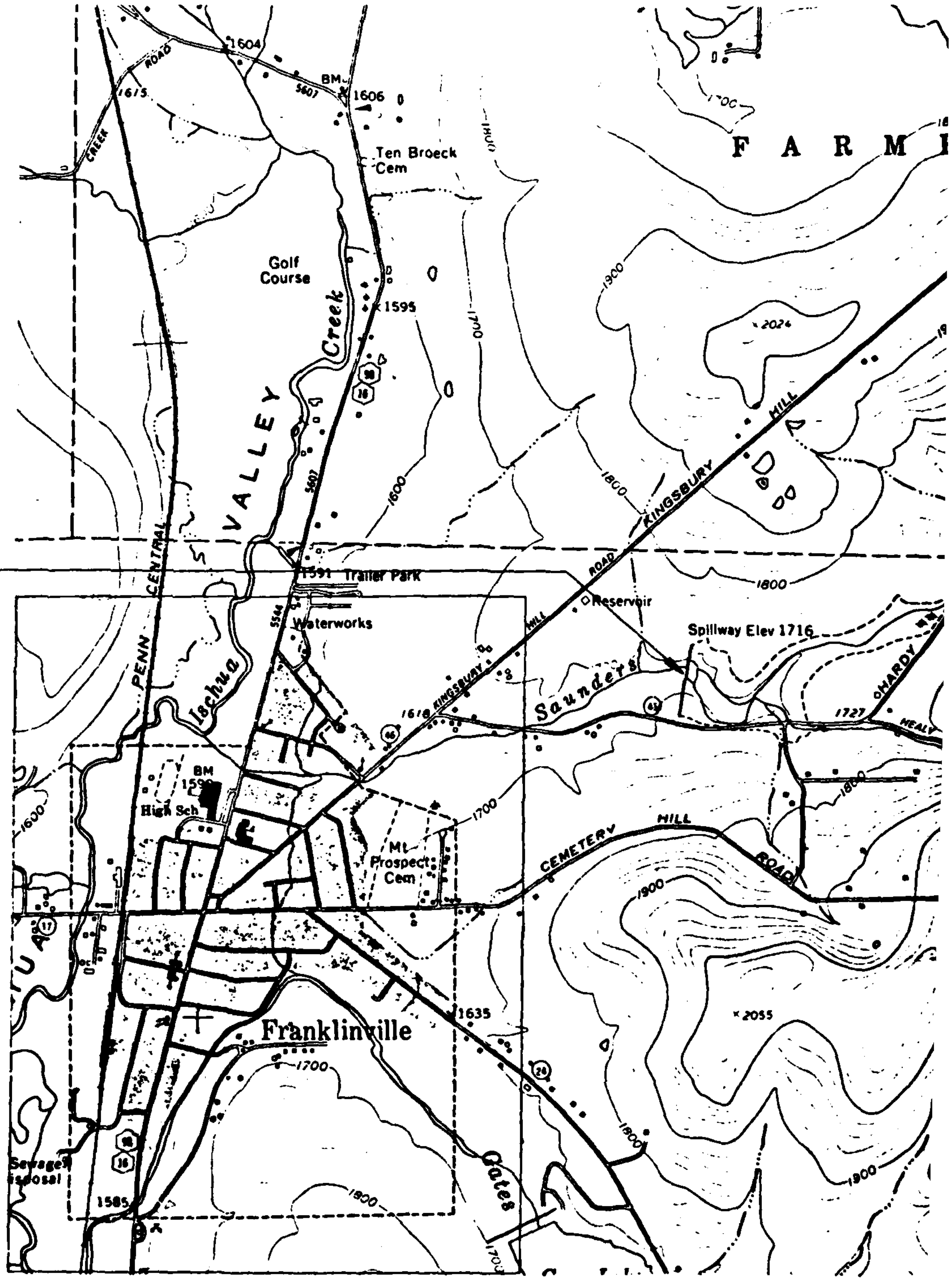
APPENDIX F

AS-BUILT DRAWINGS

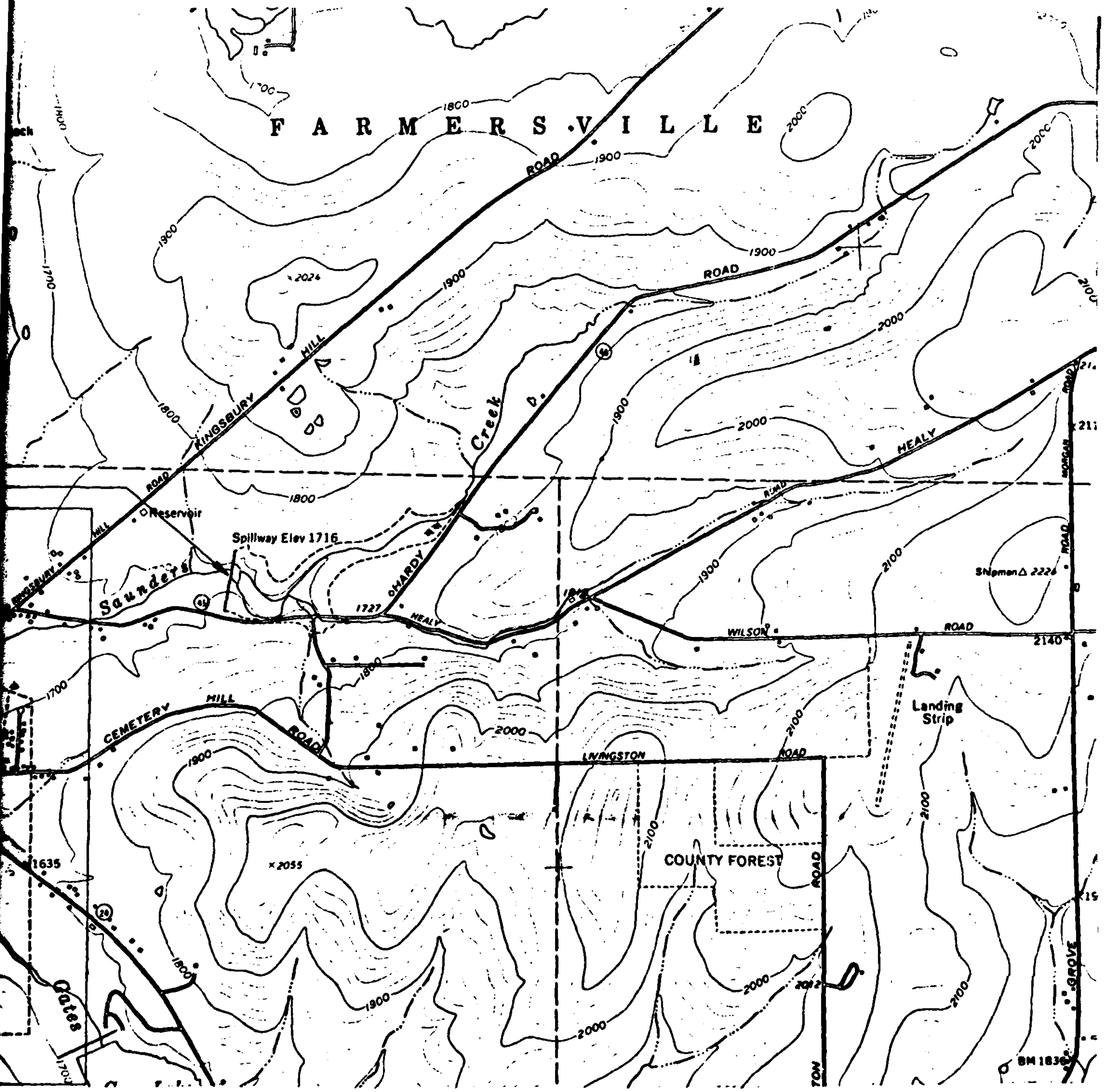


VICINITY MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I.D. NO. N.Y. 626

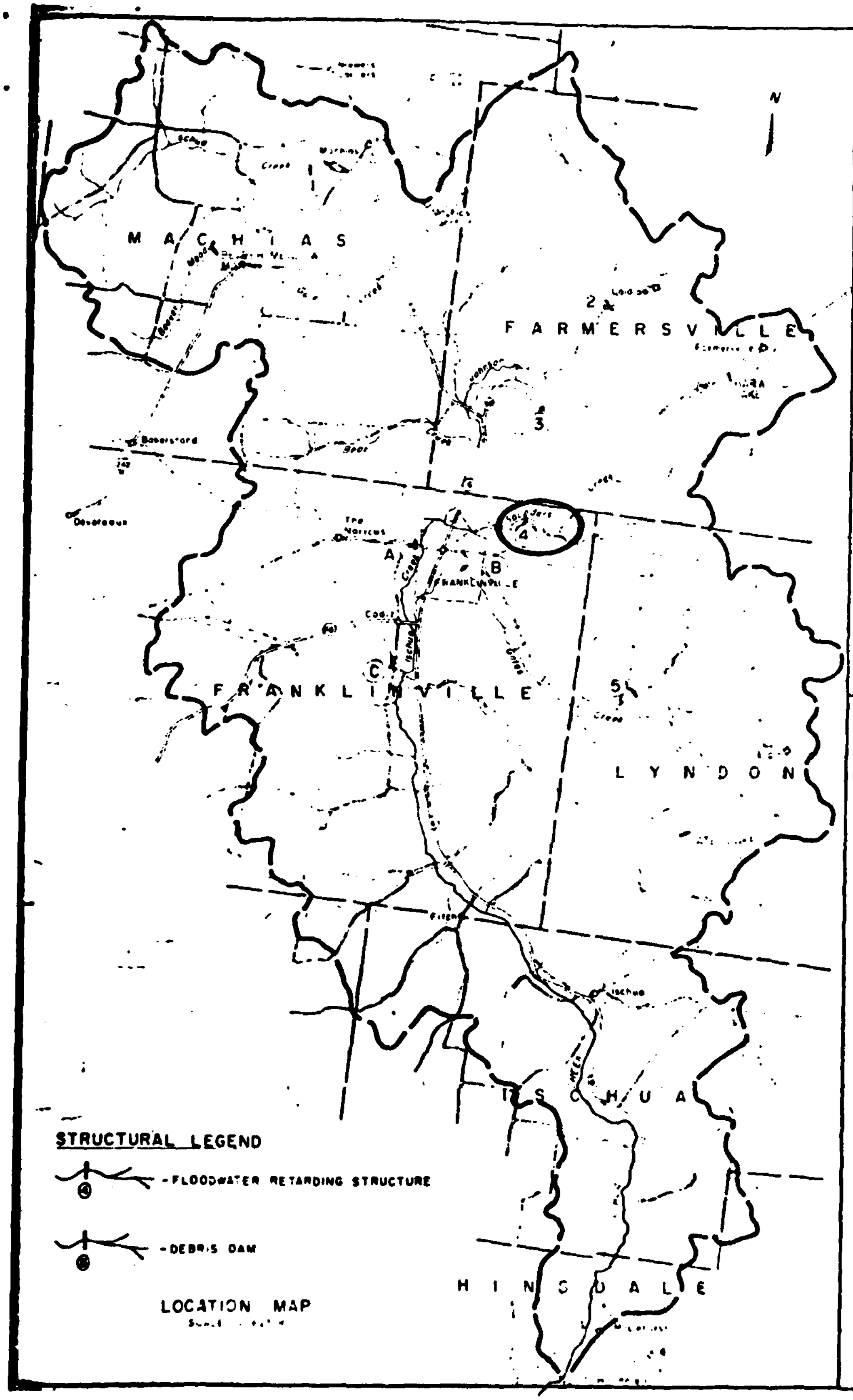
DAM LOCATION



TOPOGRAPHI
ISCHUA CREEK WATER
SITE 4
I.D. NO. N.Y.



TOPOGRAPHIC MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I.D. NO. N.Y. 626



ISCHUA C

FLOO

Flood St

DRAINAGE

TOTAL STO

WATER SU

HEIGHT OF

VOLUME O

BUILT UN

ISC

SHEET 1 COVER SHEET

SHEET 2 PLAN OF STO

SHEET 3 PLAN OF DAM

SHEET 4 PROFILE OF D

SHEET 5 PROFILES

SHEET 6 SEEPAGE DRA

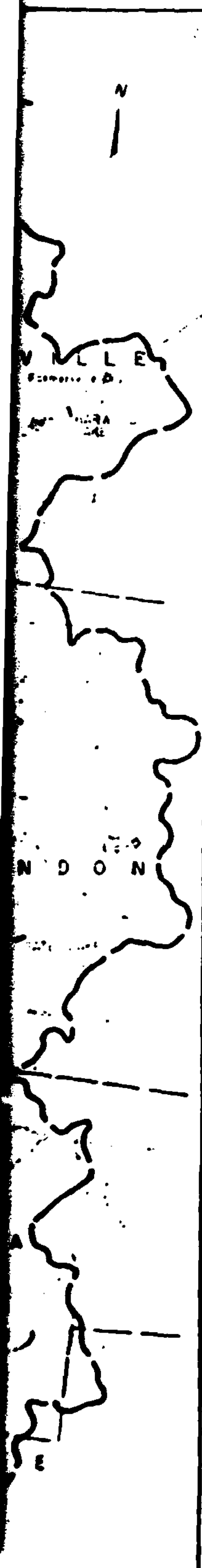
SHEET 7 PLAN-PROFIL

SHEET 8 RISER DETAIL

SHEET 9 CRADLE - COL

SHEET 10 TRASH RACK

SHEET 11 FENCE DETAI



ISCHUA CREEK WATERSHED PROJECT

FLOODWATER RETARDING DAM NO. 4

Flood storage	658	AF
DRAINAGE AREA	2624.	Acres
TOTAL STORAGE	689.	Acre ft.
WATER SURFACE AREA		Acres
HEIGHT OF DAM	51.	Feet
VOLUME OF FILL	102,600.	Cubic Yards

BUILT UNDER THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

by

ISCHUA CREEK SMALL WATERSHED DISTRICT

with the assistance of

SOIL CONSERVATION SERVICE

of the

U S DEPARTMENT OF AGRICULTURE

AS BUILT PLAN

AS BUILT

ISCHUA CREEK WATERSHED PROJECT

NEW YORK

COVER SHEET

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

NY-5

LEGEND

- MONITORING WELL (?)
- BM
- POWER LINE
- FENCE LINE (EXISTING TO REMAIN)
- FENCE LINE (EXISTING TO BE REMOVED)
- FENCING TO BE INSTALLED
- STREAM
- CONTOUR LINE
- ROAD
- SEDIMENT POOL ELEV. 1682.5
- DESIGN HIGH WATER ELEV. 1715.9

CURVE #2 INFORMATION

Δ :
D :
R :
L :
T :
E :
M :
L.C. :

CURVE #3 INFORMATION

Δ : 90°00'
D : 4° 44'
R : 15.00'
L : 23.56'
T : 155.00'
E : 56.97'
M : 19.56'
L.C. : 173.42'

GENERAL NOTES:

1. ALL COMPACTED FILL SHALL BE ... OR AS DIRECTED BY THE ENGINEER
2. AREA UNDER THE DAM, BORROW AREA, SEDIMENT POOL & EMERGENCY SPILLWAY TO BE CLEARED & GRUBBED 3 ACRES (...)
3. TOPSOIL REMOVED & STOCKPILED DURING STRIPPING OPERATIONS UNDER THE DAM, BORROW AREA & EMERGENCY SPILLWAY SHALL BE SPREAD ON THE FILL, EMERGENCY SPILLWAY & BORROW AREAS AS DIRECTED BY THE ENGINEER

SOIL DATA FOR BORROW AREAS

(DATE OF GEOLOGICAL INVESTIGATION — MAY '81
UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION
NOT BY LABORATORY ANALYSIS)

TP-101 ELEV. 1745.0
TOPSOIL
1.0' SM OR ML - SILT, SAND & GRAVELY, DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
9.0' FRACTURED BEDROCK SEEPAGE
10.0' SANDSTONE

TP-102 ELEV. 1737.0
TOPSOIL
1.0' ML OR SM - SILTY - SAND & GRAVELY DENSE - MOIST
GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
8.0'

TP-103 ELEV. 1718.0
TOPSOIL
ML OR SM - SILT - SAND & GRAVELY DENSE - MOIST
3.0'
GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST WET @ BOTTOM
11.0'

TP-104 ELEV. 1740.0
TOPSOIL
1.0' ML OR SM - SILT - SAND & GRAVELY - DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
8.0' SAME AS ABOVE VERY STONY - (...)
9.0'

TP-105 ELEV. 1746.0
TOPSOIL
ML OR SM - SILT - SAND & GRAVELY - DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
9.0'

TP-107 ELEV. 1749.0
TOPSOIL
3.0' ML OR SM - SILT - SAND & GRAVELY - DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
6.5'

TP-108 ELEV. 1739.0
TOPSOIL
1.0' ML OR SM - SILT - SAND & GRAVELY - DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
9.0'

TP-109 ELEV. 1727.0
TOPSOIL
1.0' ML OR SM - SILT - SAND & GRAVELY DENSE - MOIST
5.0' GM - GRAVEL - SILT FINES MEDIUM BROWN - MOIST
7.0'

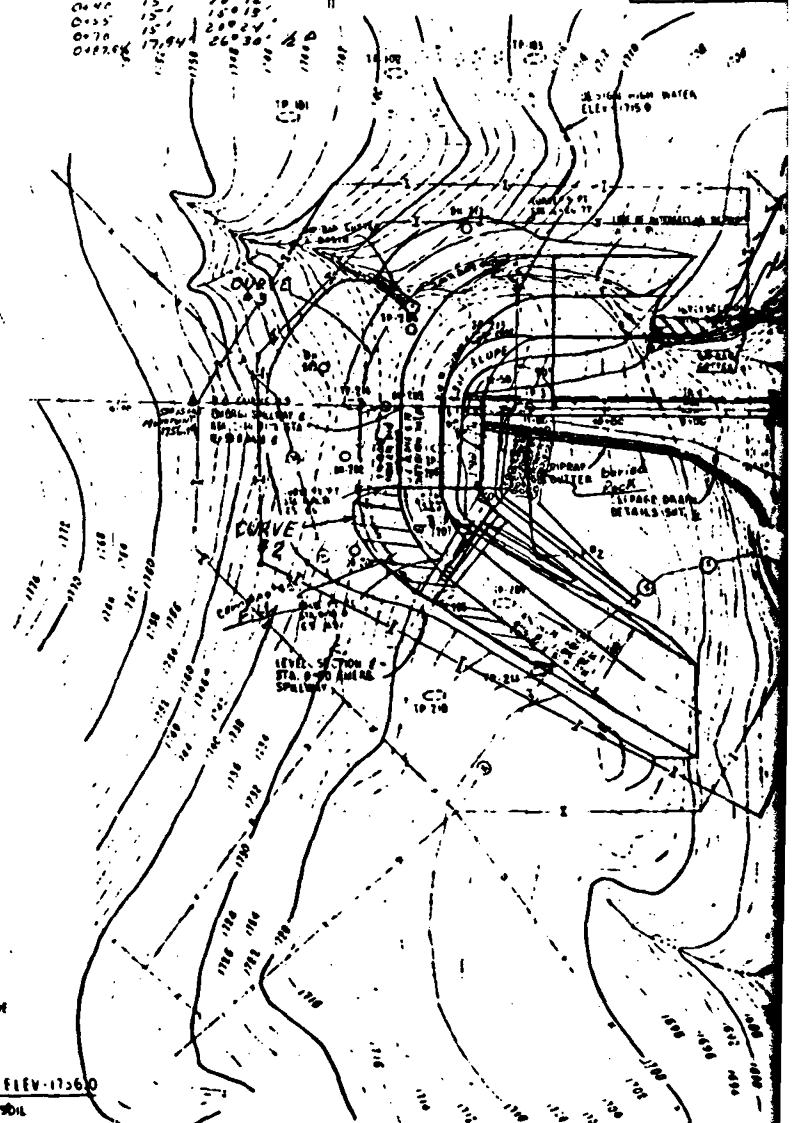
TP-206 ELEV. 1718.0
TOPSOIL
1.0 SM - SILTY SAND & SILT - SCATTERED GRAVEL - LIGHT BROWN - DRY
4.0 GM - GRAVEL FLAGGY - SAND & SILT FINES - DARK BROWN - DENSE
7.0 GM - GRAVEL - NOT AS COARSE AS ABOVE
8.0

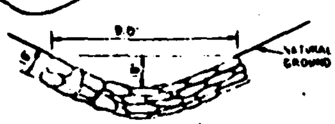
TP-207 ELEV. 1716.0
TOPSOIL
GM - GRAVEL - FLAGGY - SAND & SILT FINES - DARK BROWN - DENSE
6.0' GM - SLIGHTLY COARSER THAN 1-6 ABOVE
8.0'

TP-209 ELEV. 1713.0
TOPSOIL
1.0' GM - GRAVEL - FLAGGY - SAND & SILT FINES - DARK BROWN - DENSE
6.0' GM - SLIGHTLY COARSER THAN 1-6 ABOVE
9.0'

TP-211 ELEV. 1711.0
TOPSOIL
1.0 GM - GRAVEL - FLAGGY - SAND & SILT FINES - DARK BROWN - DENSE
6.0 GM - SLIGHTLY COARSER THAN 1-6 ABOVE SATURATED
8.0

TP-214 ELEV. 1736.0
TOPSOIL
1.0' ML - SILT - DENSE - MOIST SEEPAGE @ BOTTOM
4.0' GM - GRAVEL - SAND & SILT FINES - MEDIUM BROWN - VERY DENSE (TILL - MOIST)
10.0'

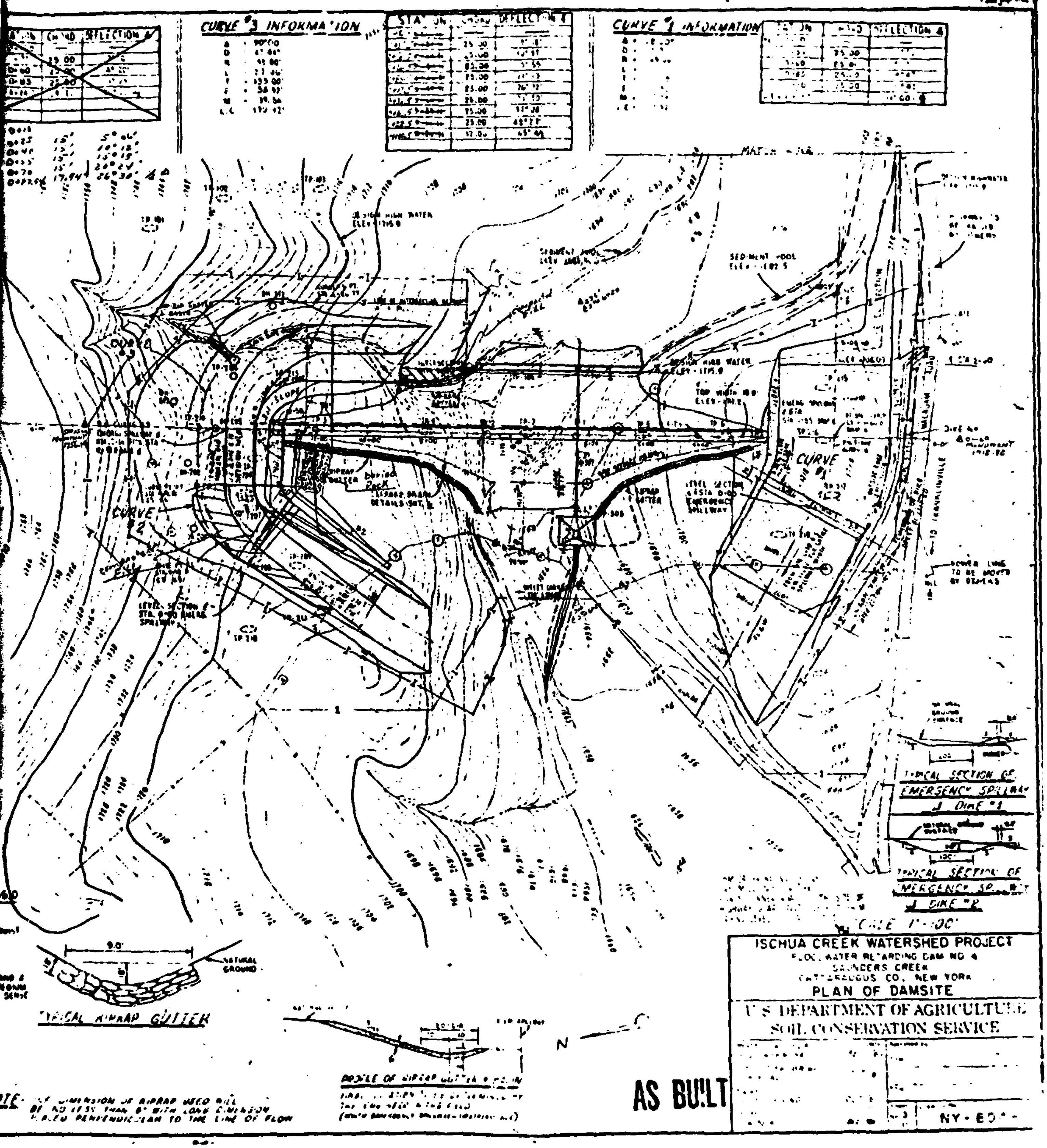


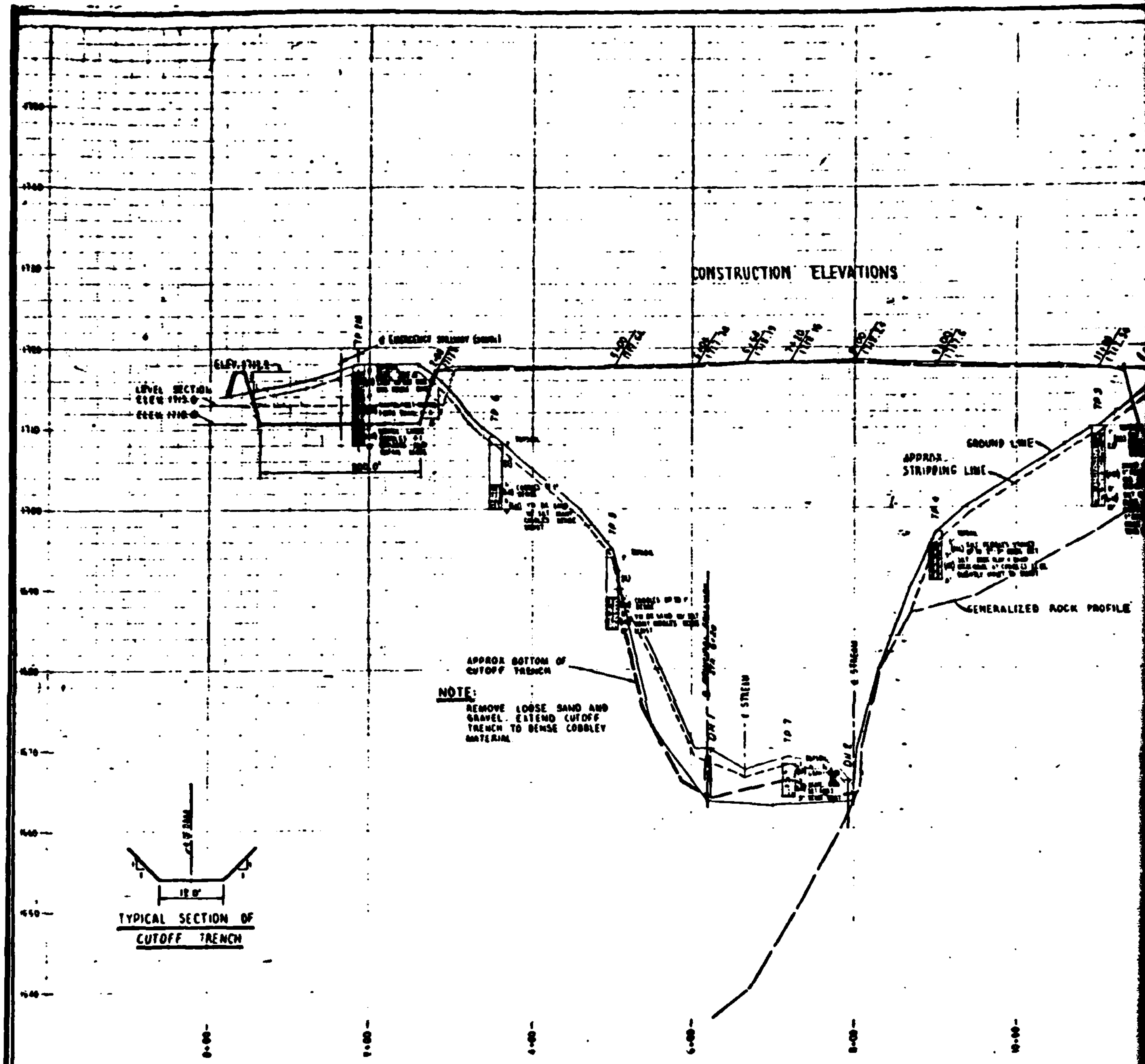


TYPICAL RIPRAP GUTTER

PROFILE OF RIPRAP GUTTER

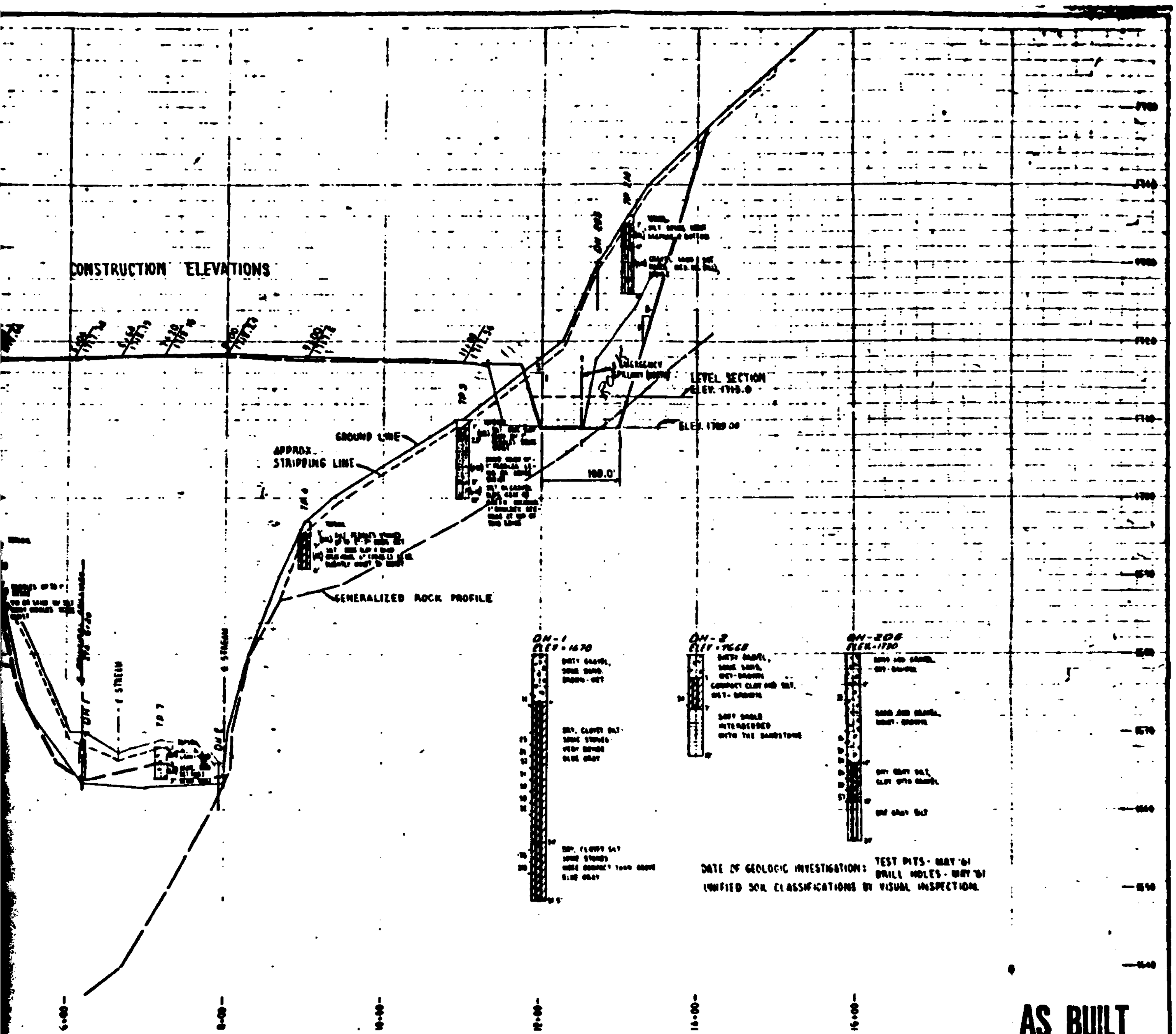
NOTE: THE DIMENSION OF RIPRAP USED WILL BE NO LESS THAN 8" WITH LONG DIMENSION PLACED PERPENDICULAR TO THE LINE OF FLOW


CURVE #3 INFORMATION
CURVE #1 INFORMATION
MATCH LINE
DESIGN HIGH WATER
SEDIMENT POOL
CURVE #1
CURVE #2
CURVE #3
RIPRAP GUTTER
EMERGENCY SPILLWAY
TYPICAL SECTION OF EMERGENCY SPILLWAY & DIKE #1
TYPICAL SECTION OF EMERGENCY SPILLWAY & DIKE #2
TYPICAL RIPRAP GUTTER
NATURAL GROUND
PROFILE OF RIPRAP GUTTER
N
AS BUILT
ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 4
SAUNDERS CREEK
CATTARAUGUS CO., NEW YORK
PLAN OF DAMSITE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



PROFILE ALONG ℄ OF DAM (LOOKING DOWNSTREAM)

SCALE: HORIZ. 1" = 80.0'
VERT. 1" = 8.0'



OFILE ALONG ℄ OF DAM (LOOKING DOWNSTREAM)

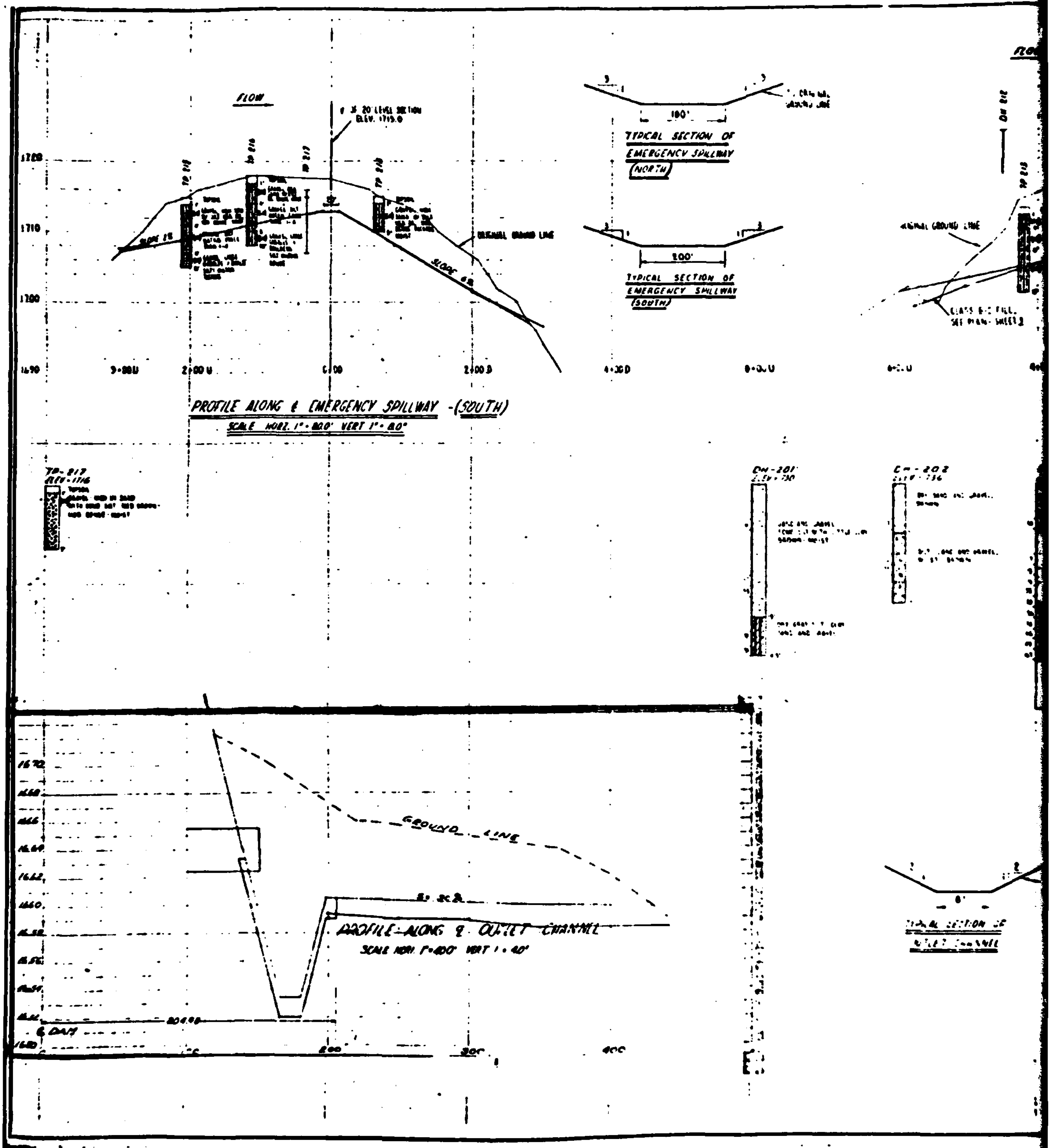
SCALE: HORIZ. 1" = 80.0' VERT. 1" = 8.0'

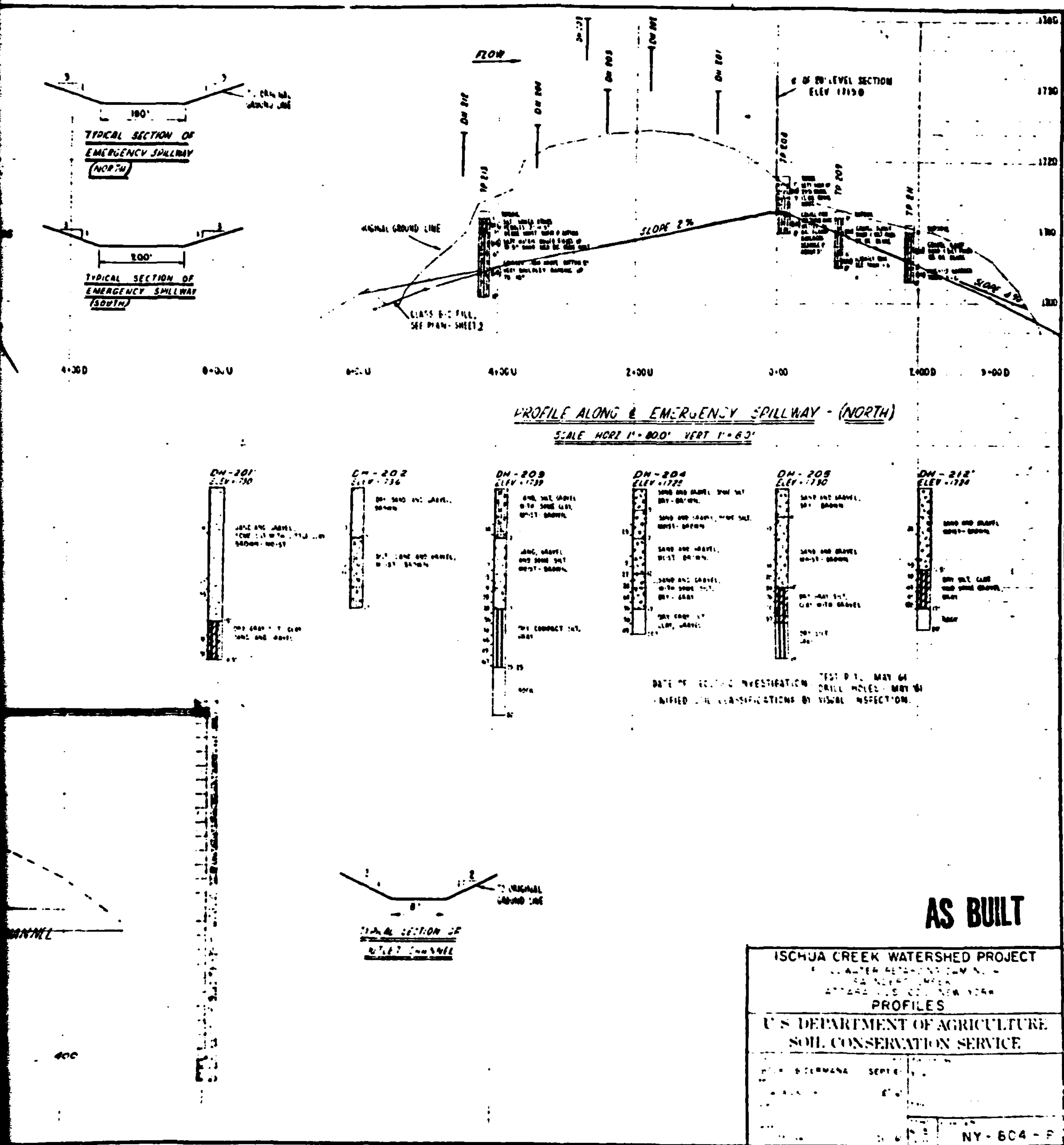
ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 4
SAUNDERS CREEK
CATTARAUGUS CO., NEW YORK
PROFILE OF DAM

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

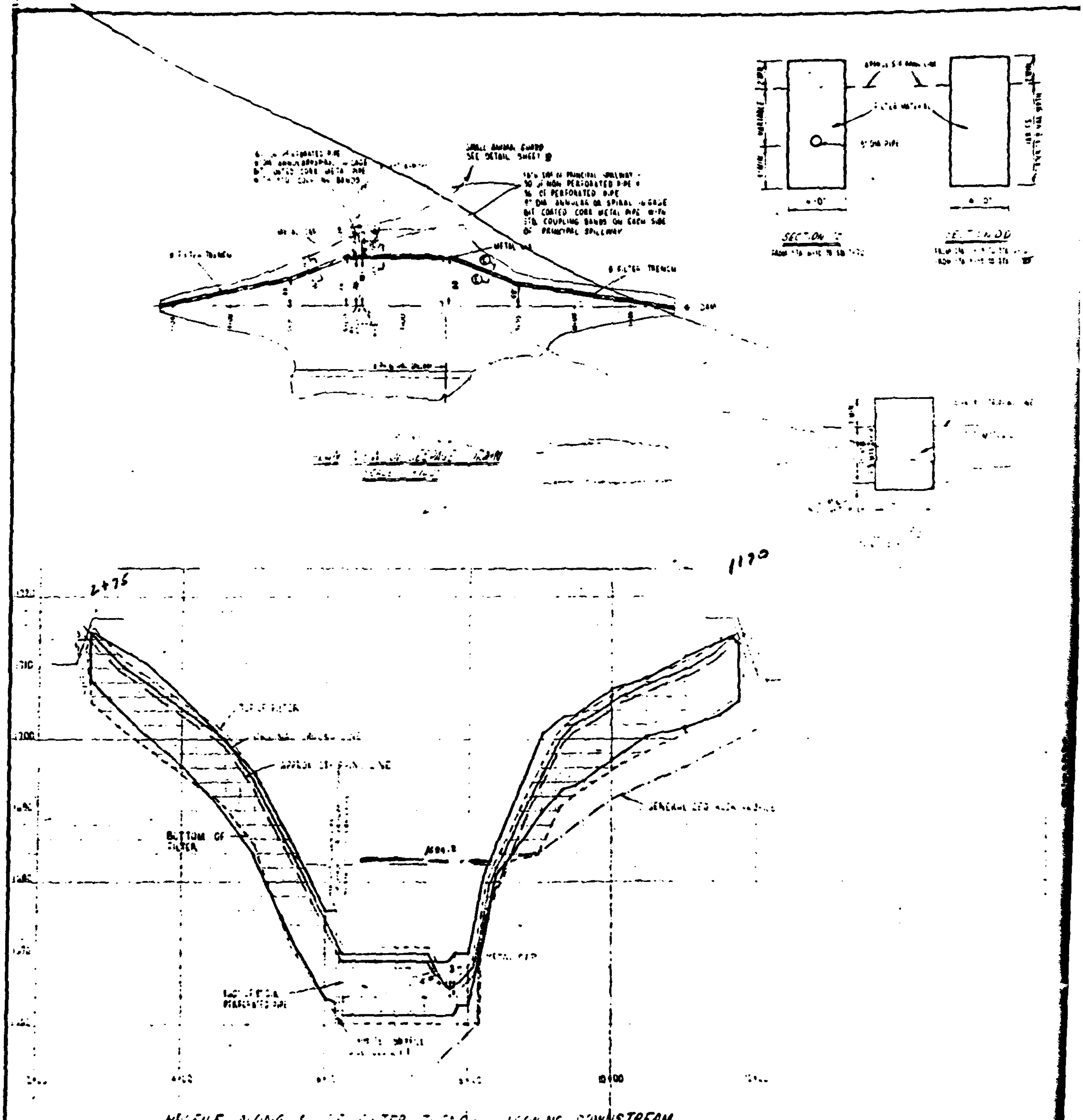
L. BECK - D. GERMANA	SEPT 61	
H. T. BROWNING	OCT 61	
		NY-804-F

12

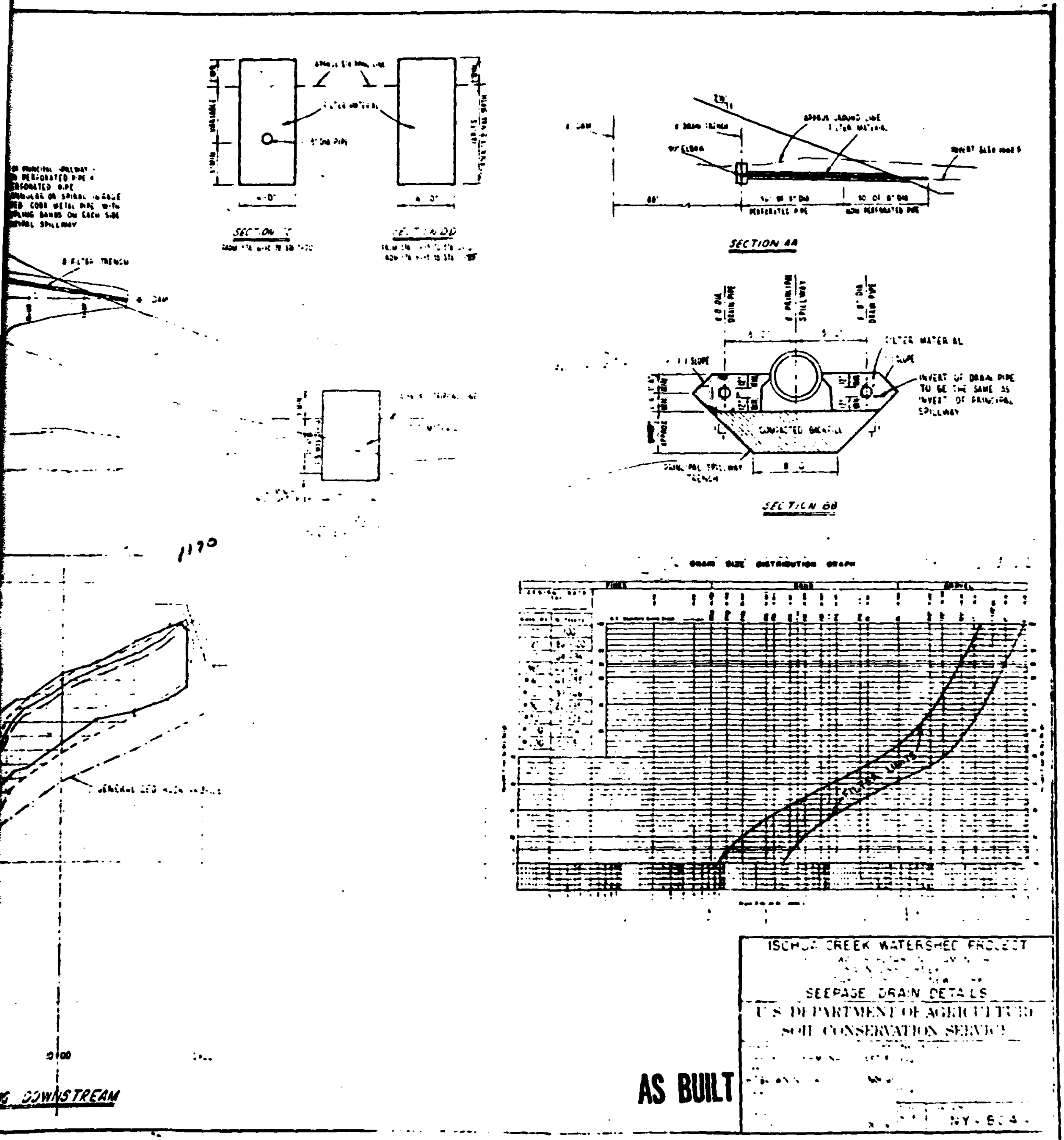

FLOW
1720
1710
1700
1690
SLOPE 6%
ORIGINAL GROUND LINE
PROFILE ALONG ℄ EMERGENCY SPILLWAY -(SOUTH)
TYPICAL SECTION OF EMERGENCY SPILLWAY (NORTH)
100'
TYPICAL SECTION OF EMERGENCY SPILLWAY (SOUTH)
200'
TP-217
GROUND LINE
PROFILE ALONG ℄ OUTLET CHANNEL
℄ DAM


FLOW
TYPICAL SECTION OF EMERGENCY SPILLWAY (NORTH)
190'
TYPICAL SECTION OF EMERGENCY SPILLWAY (SOUTH)
200'
ORIGINAL GROUND LINE
SLOPE 2%
SLOPE 4%
PROFILE ALONG ℄ EMERGENCY SPILLWAY - (NORTH)
DH-201
DH-202
DH-203
DH-204
DH-205
DH-212
TYPICAL SECTION OF INLET CHANNEL
AS BUILT
ISCHUA CREEK WATERSHED PROJECT
PROFILES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NY-604-P

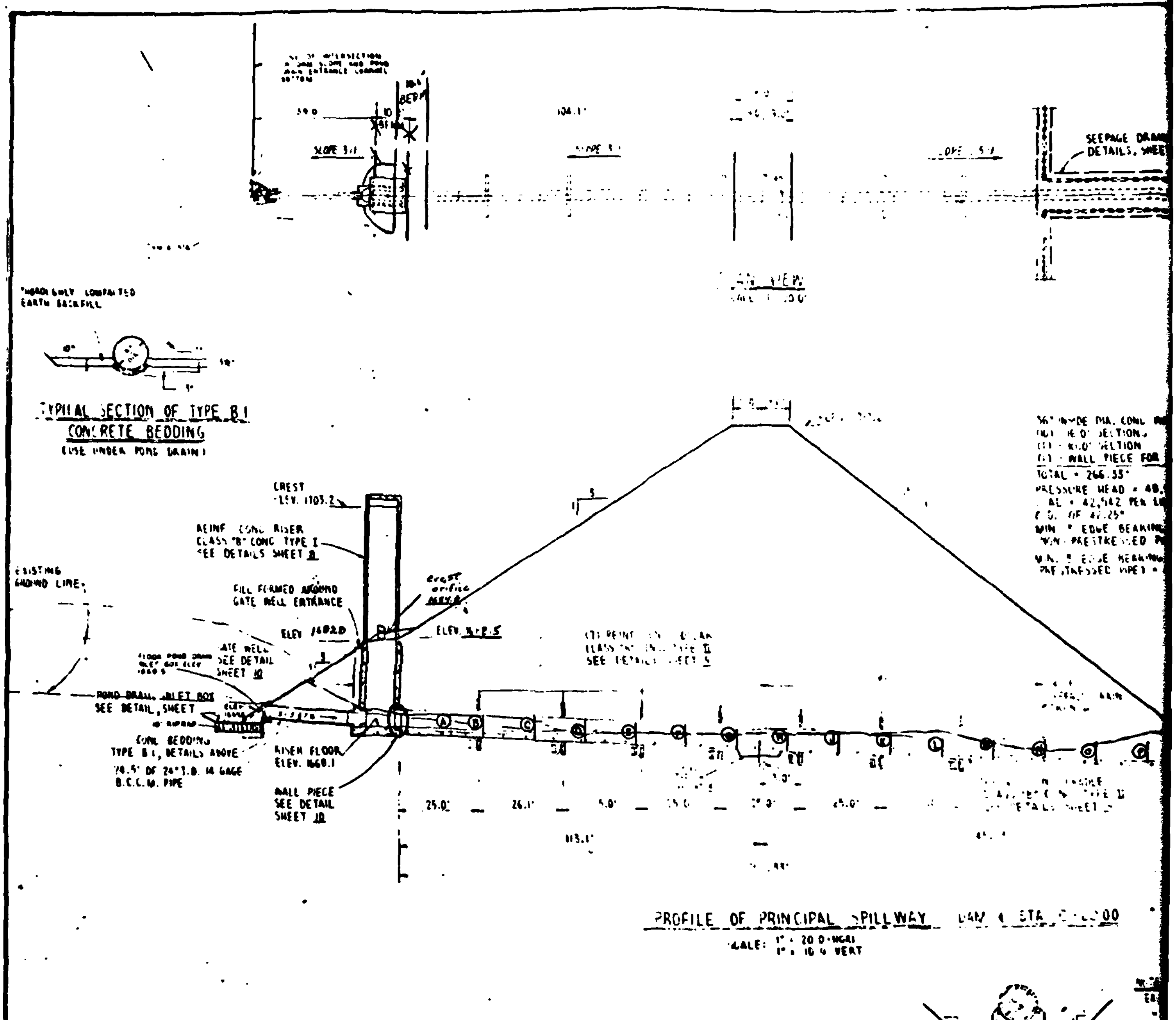
2



PROFILE ALONG ⊈ OF FILTER TRENCH – LOOKING DOWNSTREAM


SECTION AA
FILTER MATERIAL
INVERT OF DRAIN PIPE TO BE THE SAME AS INVERT OF PRINCIPAL SPILLWAY
COMPACTED BACKFILL
PRINCIPAL SPILLWAY TRENCH
SECTION BB
GRAIN SIZE DISTRIBUTION GRAPH
1170
DOWNSTREAM
ISCHUA CREEK WATERSHED PROJECT
SEEPAGE DRAIN DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AS BUILT

2



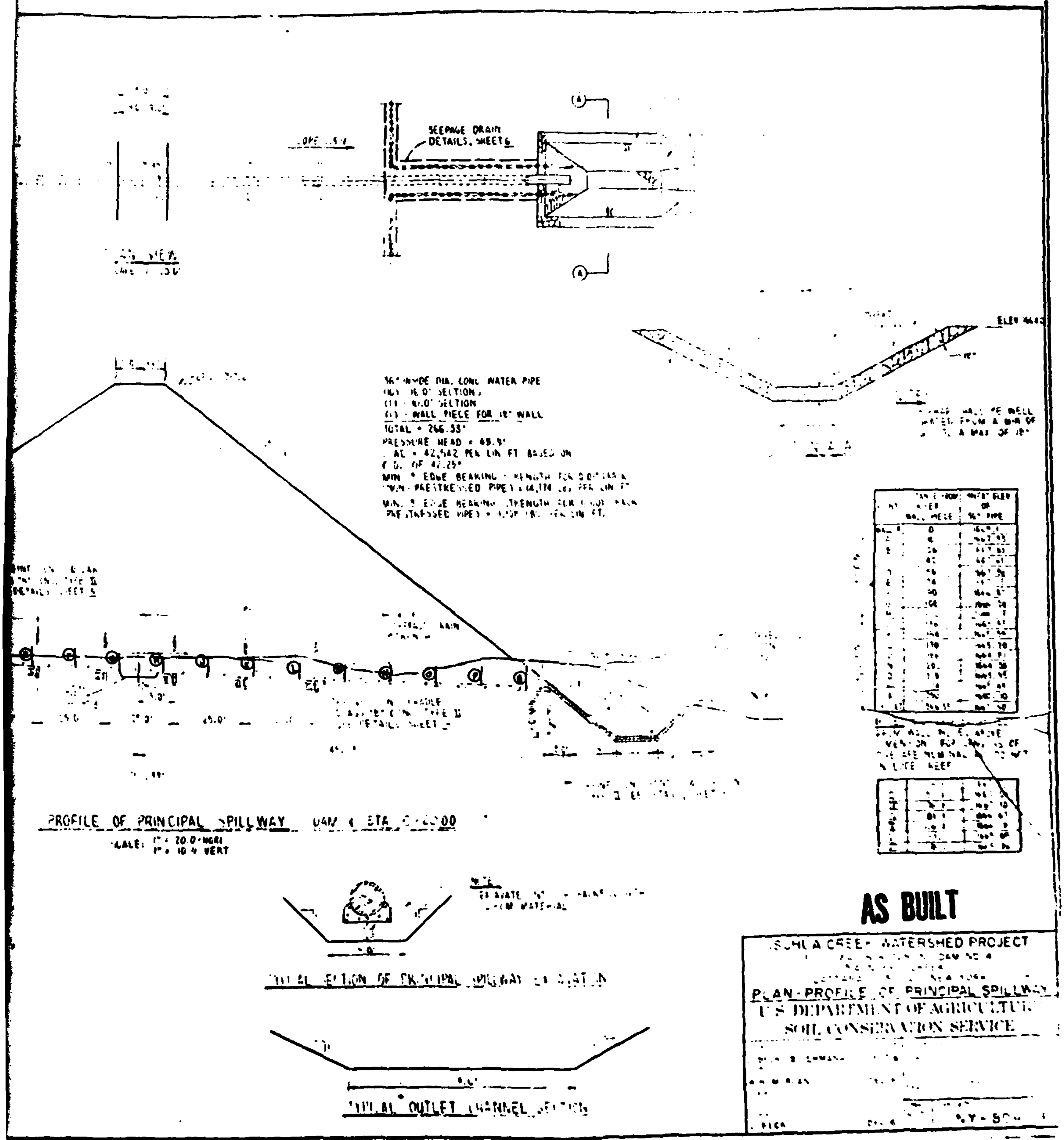
SOIL DATA FOR BORROW AREAS

DATE OF GEOLOGICAL INVESTIGATION - MAY 1961
UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION, NOT BY LABORATORY ANALYSIS.

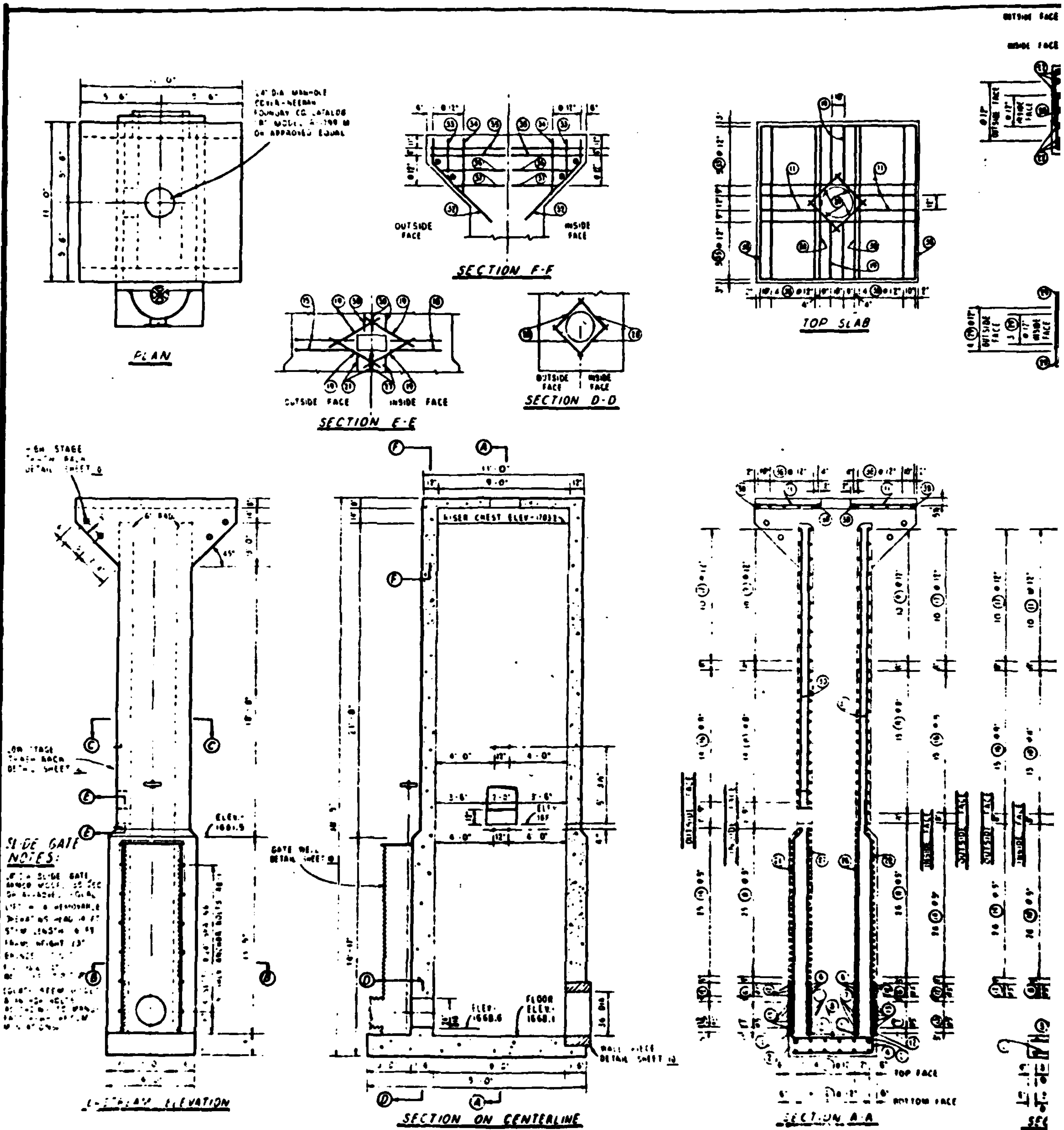
DH-2 ELEV. 1668.0

- DIRTY GRAVEL, SOME SAND, WET
- COMPACT CLAY AND SILT WET
- 1.0' SOFT SHALE INTERBEDDED WITH THE SANDSTONE

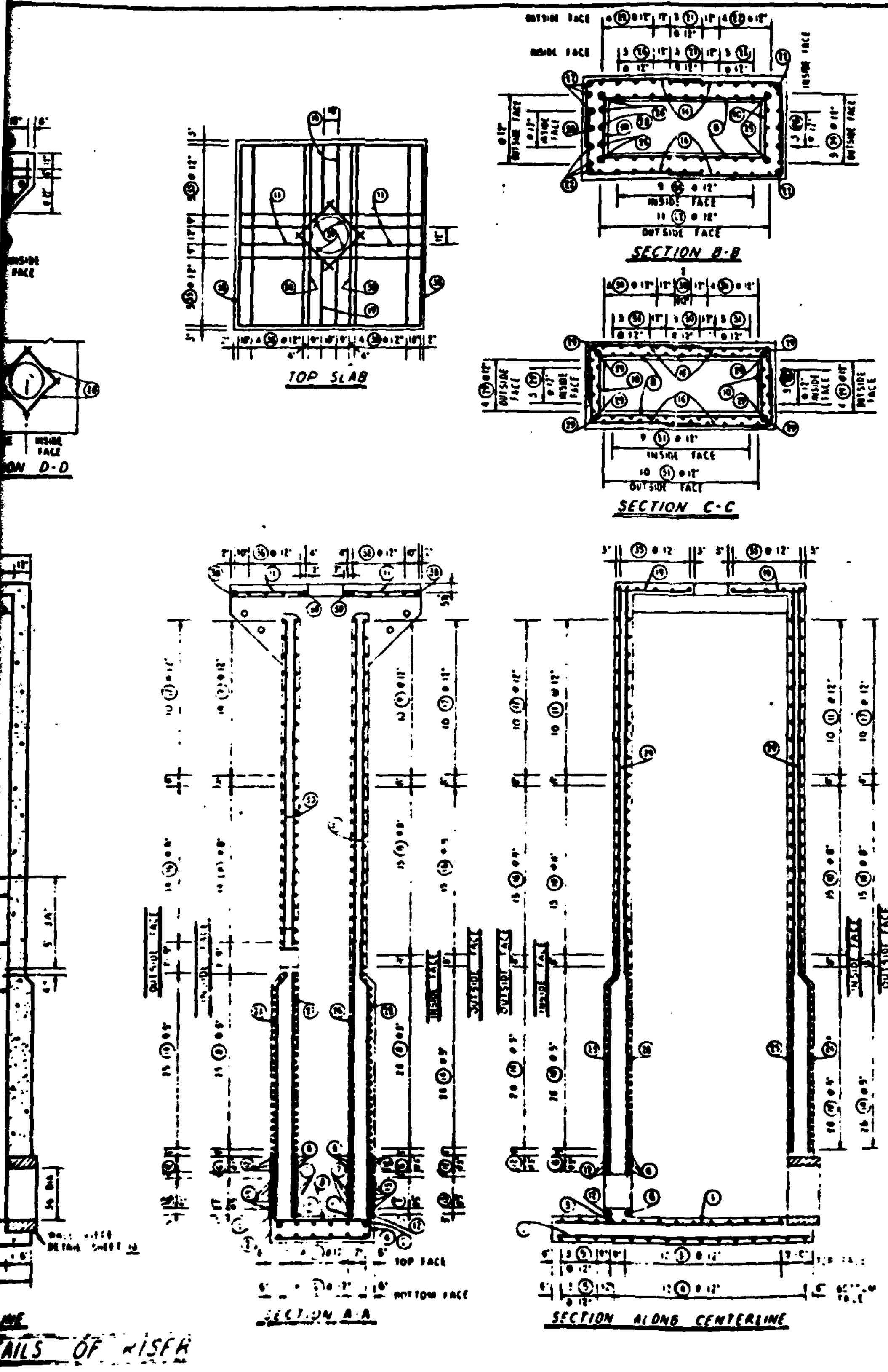
TP-304 ELEV


SEEPAGE DRAIN DETAILS, SHEET 6
TOTAL = 266.33'
PRESSURE HEAD = 48.9'
PROFILE OF PRINCIPAL SPILLWAY
AS BUILT
WATERSHED PROJECT
PLAN - PROFILE OF PRINCIPAL SPILLWAY
SOIL CONSERVATION SERVICE
OUTLET CHANNEL

12

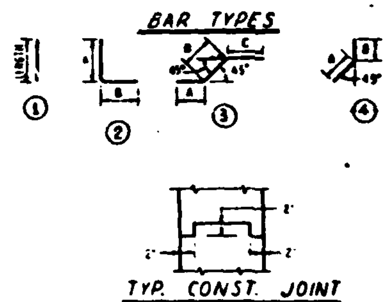


STRUCTURAL & STEEL DETAILS OF RISER



STEEL SCHEDULE

MARK	LOCATION	NUM	SIZE	LENGTH	TYPE	A	B	C	WGT.
1	FLOOR	6	5	13-0	1				81
2	"	8	5	14-6	1				[illegible]
3	"	11	5	7-6	2	5-6	2-1		86
4	"	12	5	8-2	2	5-6	2-8		98
5	"	6	5	9-6	1				33
6	WALL	6	6	11-9	2	9-0	2-9		[illegible]
7	"	16	6	9-6	2	9-0	0-9		[illegible]
8	"	60	6	10-0	1				[illegible]
9	"	77	5	10-0	1				800.00
10	"	82	6	4-3	1				[illegible]
11	WALL - TOP SLAB	24	5	4-3	1				[illegible]
12	WALL	6	6	15-3	2	11-6	3-9		[illegible]
13	"	10	6	13-1	2	11-6	1-7		[illegible]
14	"	102	6	10-6	2	6-9	3-9		[illegible]
15	"	6	6	7-9	2	4-0	3-9		[illegible]
16	"	58	6	9-6	2	6-3	3-3		[illegible]
17	"	40	5	9-2	2	6-1	3-1		[illegible]
18	"	4	6	3-9	1				[illegible]
19	ORIFACE - TOP SLAB	12	6	4-0	1				[illegible]
20	WALL	8	6	8-0	1				[illegible]
21	"	3	5	16-5	3	13-9	0-8	0-4	43.15
22	"	27	5	16-2	3	13-5	0-8	2-3	456.50
23	"	1	5	13-5	3	10-6	0-8	2-3	13.42
24	"	9	5	12-7	3	9-8	0-8	2-3	62.92
25	"	5	5	12-6	1				61.50
26	"	19	5	16-0	1				304.00
27	"	3	5	14-0	1				42.00
28	"	1	5	13-3	1				13.25
29	"	22	5	22-6	1				495.00
30	"	5	5	19-3	1				96.25
31	"	33	5	20-9	1				684.75
32	ANTI-VORTEX	8	5	1-3	4	5-6	1-9		68.00
33	" "	8	5	2-9	1				22.00
34	" "	8	5	3-9	1				30.00
35	ANTI-VORTEX - TOP SLAB	18	5	10-6	1				189.00
36	ANTI-VORTEX	4	5	9-6	1				38.00
37	" "	4	5	7-6	1				30.00
38	TOP SLAB	12	6	10-6	1				126.00
39	" "	4	6	3-0	1				12.00



AS BUILT

SCALE ¼" = 1'-0"

ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 4
SAUNDERS CREEK
CATTARAUGUS CO., NEW YORK
RISER DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NY-804-F

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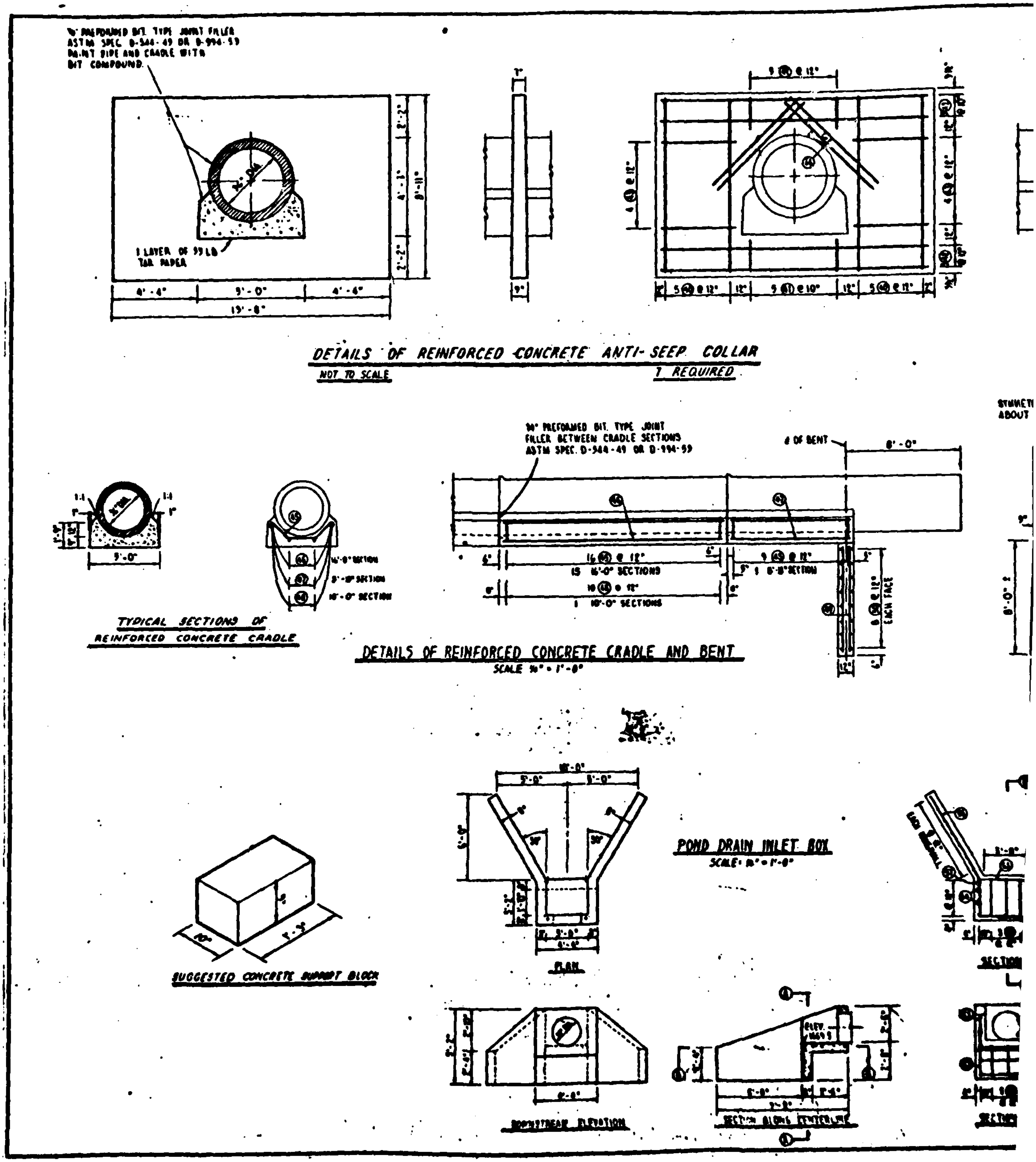
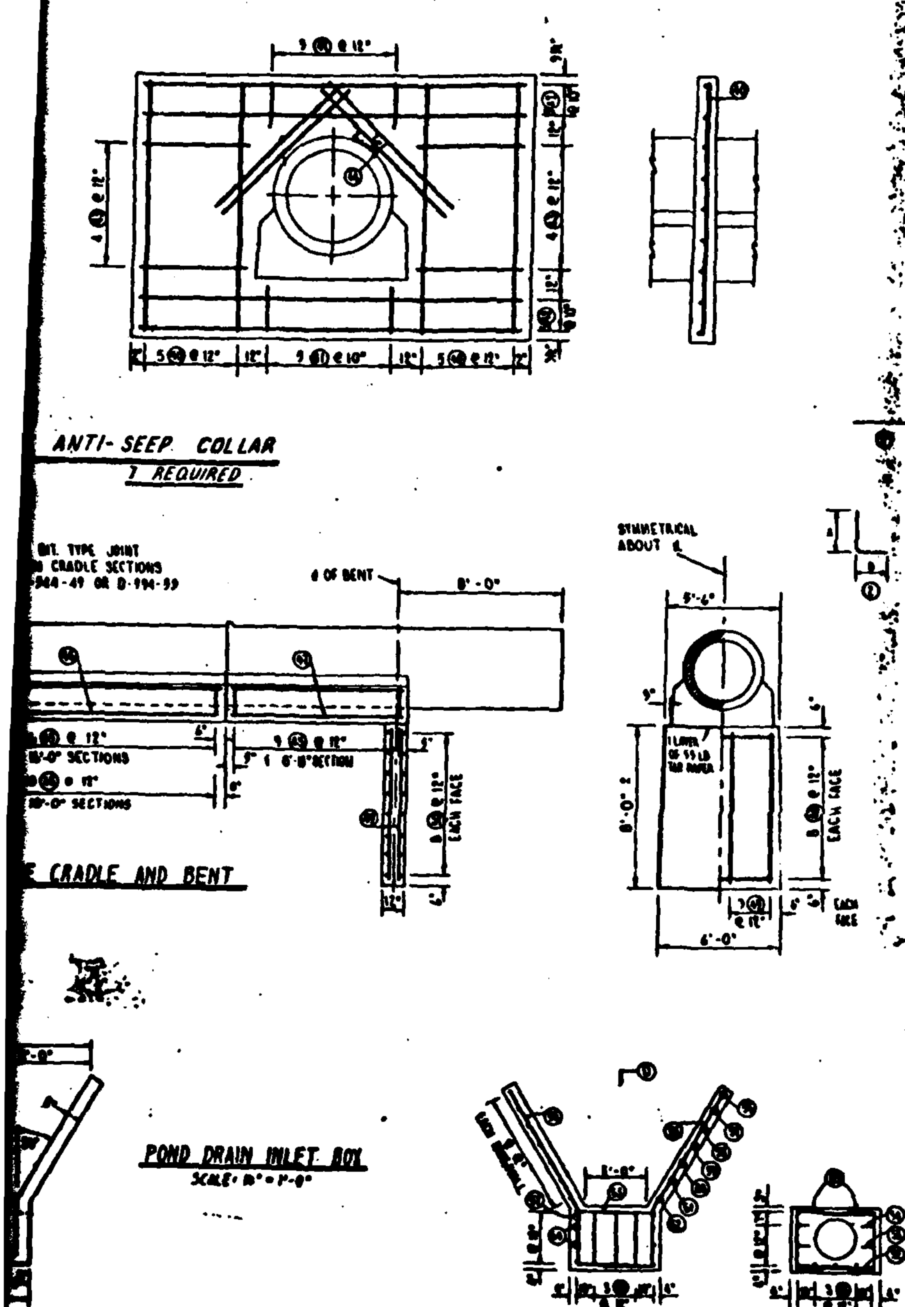
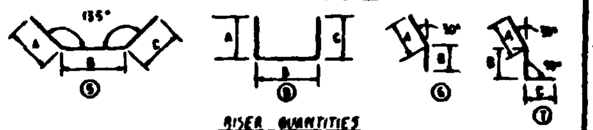


1/2" PREFORMED BIT. TYPE JOINT FILLER ASTM SPEC. D-544-49 OR D-994-59 PAINT PIPE AND CRADLE WITH BIT COMPOUND.
1 LAYER OF 55 LB TAR PAPER
DETAILS OF REINFORCED CONCRETE ANTI-SEEP COLLAR
NOT TO SCALE
1 REQUIRED
1/2" PREFORMED BIT. TYPE JOINT FILLER BETWEEN CRADLE SECTIONS ASTM SPEC. D-544-49 OR D-994-59
TYPICAL SECTIONS OF REINFORCED CONCRETE CRADLE
DETAILS OF REINFORCED CONCRETE CRADLE AND BENT
15 16'-0" SECTIONS
1 10'-0" SECTIONS
EACH FACE
SUGGESTED CONCRETE SUPPORT BLOCK
POND DRAIN INLET BOX
PLAN
DOWNSTREAM ELEVATION
SECTION ALONG CENTERLINE



MARK	LOCATION	NUM.	SIZE	LENGTH	TYPE	A	B	C	TOTAL FT
40	COLLAR	10	4	8-6	1				[illegible]
41	•	10	4	1-9	1				[illegible]
42	•	42	4	13-3	1				[illegible]
43	•	42	4	8-0	1				[illegible]
44	•	18	4	5-6	1				[illegible]
45	CRADLE	139	4	5-8	5	1-6	2-8	1-6	[illegible]
46	•	60	4	15-6	1				[illegible]
47	•	4	4	8-6	1				[illegible]
48	•	4	4	9-6	1				[illegible]
49	BENT	12	5	7-6	1				[illegible]
50	•	16	5	9-3	1				[illegible]
51	INLET BOX	4	4	9-5	6	5-4	2-6		[illegible]
52	•	2	4	11-7	6	5-7	2-6	2-6	[illegible]
53	•	2	4	6-3	7	3-5	2-6	0-6	[illegible]
54	•	2	4	2-8	2	2-6	0-6		[illegible]
55	•	2	4	12-4	7	3-2	2-8	2-6	[illegible]
56	•	2	4	2-0	1				[illegible]
57	•	2	4	2-3	1				[illegible]
58	•	2	4	2-6	1				[illegible]
59	•	2	4	2-9	1				[illegible]
60	•	2	4	3-0	1				[illegible]
61	•	2	4	3-3	1				[illegible]
62	•	2	4	3-6	1				[illegible]
63	•	2	4	4-6	2	2-0	2-6		[illegible]
64	•	4	4	4-9	2	2-3	2-6		[illegible]
65	•	2	4	5-3	8	1-9	2-9	1-3	[illegible]

BAR TYPES



RISER QUANTITIES

STEEL
NO. 5 BARS 3557 LIN FT 3825 LBS.
NO. 6 BARS 3448 LIN FT 5139 LBS.
TOTAL 9004 LBS.

CONCRETE
CLASS "B" TYPE I 55.3 CU. YDS.

CRADLE QUANTITIES

NO. 4 BARS 2291.0 LIN. FT. 1535 LBS. CLASS "B" TYPE II 53.3 CU. YDS.

COLLAR QUANTITIES

NO. 4 BARS 1652.0 LIN FT 1104 LBS. CLASS "B" TYPE II 16.0 CU. YDS.

BENT QUANTITIES

NO. 5 BARS 174.0 LIN. FT 182.0 LBS. CLASS "B" TYPE II 1.7 CU. YDS.

POND DRAIN INLET BOX QUANTITIES

NO. 4 BARS 187.0 LIN FT 125 LBS. CLASS "B" TYPE II 2.2 CU. YDS.

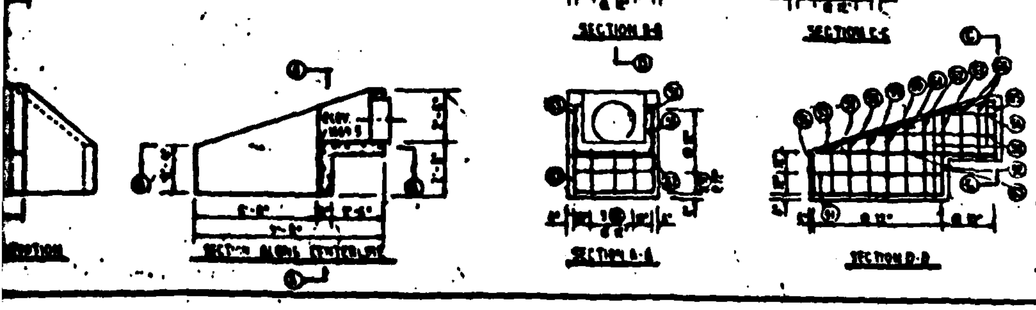
POND DRAIN PIPE BEDDING

GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS "B" AND OF THE TYPE NOTED
2. PORTLAND CEMENT TYPE IA OR TYPE I WITH AN AIR-ENTRAINING ADMIXTURE SHALL BE USED.
3. ALL REINFORCING STEEL TO BE LAPPED A MIN. OF 30 BAR DIA.
4. ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MIN. OF 3" COVER. WHERE FORMS ARE USED BARS SHALL HAVE MIN. OF 2" CLEAR COVER.
5. ALL EXPOSED EDGES OF CONCRETE TO HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

STEEL QUANTITIES FOR SITE
NO. 4 BARS 4135 LIN FT 2764 LBS.
NO. 5 BARS 3841 LIN FT 4007 LBS.
NO. 6 BARS 3448 LIN FT 5139 LBS.
TOTAL STEEL WT. = 11950 LBS

CONCRETE QUANTITIES FOR SITE
CLASS "B" TYPE I 55.3 CU. YDS.
TYPE II 84.1 CU. YDS.
TYPE III 0.0 CU. YDS.



AS BUILT

ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 4
SAUNDERS CREEK
CATTARAUGUS CO., NEW YORK
CRADLE - COLLAR AND BENT DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed: L. BECK - B. GERMANA, SEPT 61
Drawn: W. H. MORGAN, DEC. 61
H. T. BROWNING JR., DEC. 61
Checked: L. BECK, DEC 61
Sheet 9 of 11
Drawing No. NY-804-P

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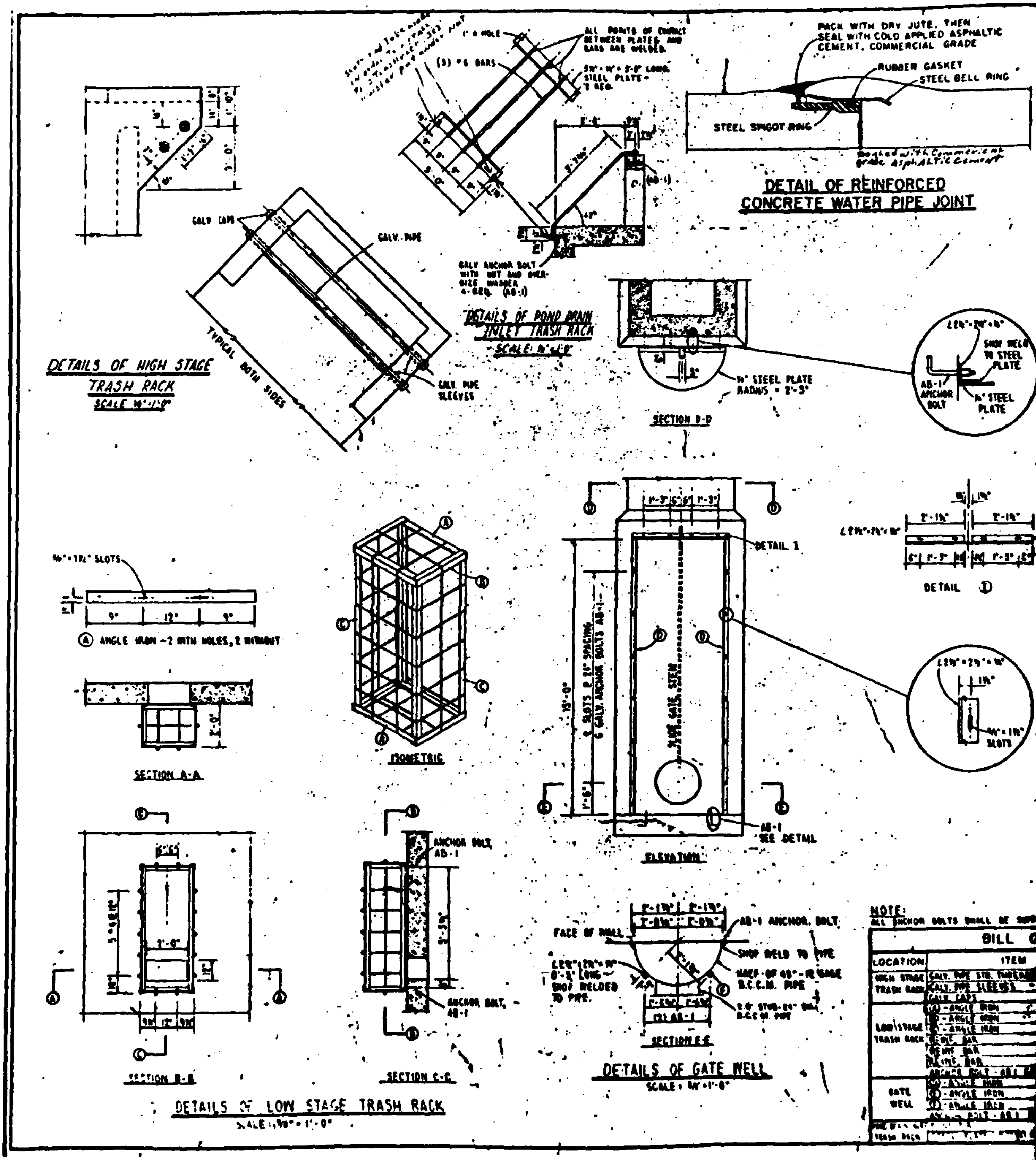
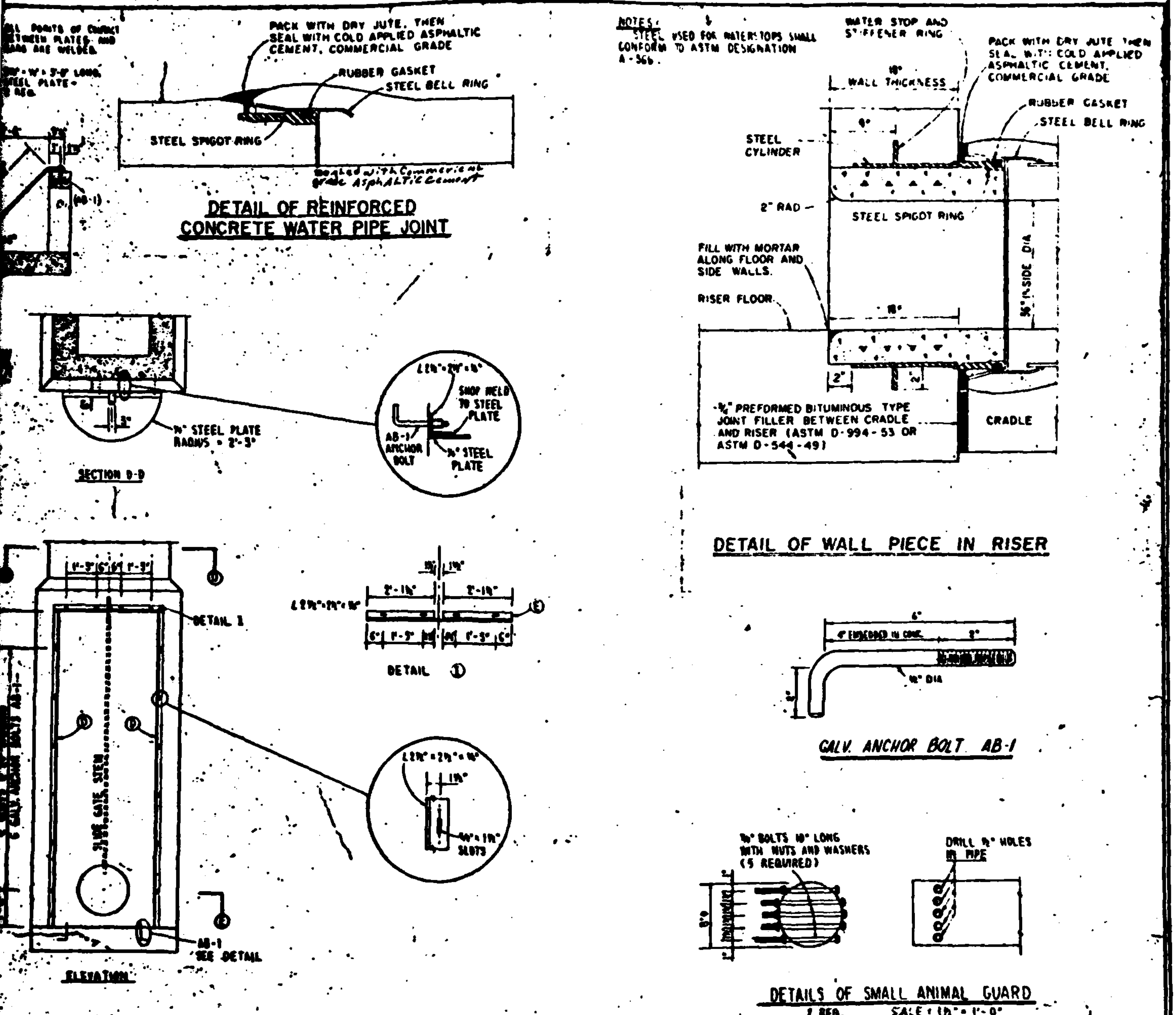
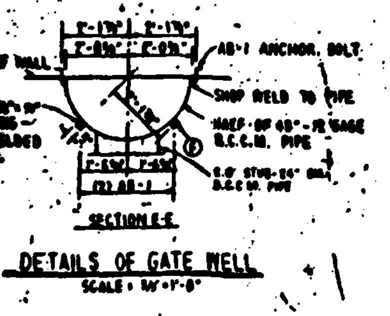

DETAILS OF HIGH STAGE TRASH RACK
SCALE 1/2"=1'-0"
GALV CAPS
GALV. PIPE
TYPICAL BOTH SIDES
GALV. PIPE SLEEVES
ALL POINTS OF CONTACT BETWEEN PLATES AND BARS ARE WELDED.
1" Φ HOLE
(3) #6 BARS
GALV ANCHOR BOLT WITH NUT AND OVER-SIZE WASHER 4-REQ. (AB-1)
DETAILS OF POND DRAIN INLET TRASH RACK
PACK WITH DRY JUTE, THEN SEAL WITH COLD APPLIED ASPHALTIC CEMENT, COMMERCIAL GRADE
RUBBER GASKET
STEEL BELL RING
STEEL SPIGOT RING
Coated with Commercial grade Asphaltic Cement
DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT
1/4" STEEL PLATE RADIUS = 2'-3"
SECTION D-D
SHOP WELD TO STEEL PLATE
AB-1 ANCHOR BOLT
1/4" STEEL PLATE
DETAIL 1
A ANGLE IRON - 2 WITH HOLES, 2 WITHOUT
SECTION A-A
ISOMETRIC
SLIDE GATE STEM
AB-1 SEE DETAIL
ELEVATION
SECTION B-B
ANCHOR BOLT, AB-1
SECTION C-C
DETAILS OF LOW STAGE TRASH RACK
FACE OF WALL
AB-1 ANCHOR BOLT
SHOP WELD TO PIPE
SECTION E-E
DETAILS OF GATE WELL
NOTE:
BILL
LOCATION
ITEM
HIGH STAGE TRASH RACK
LOW STAGE TRASH RACK
GATE WELL





NOTE:
ALL ANCHOR BOLTS SHALL BE SUPPLIED WITH NUTS AND WASHERS.

BILL OF MATERIAL

LOCATION	ITEM	SIZE	LENGTH	QUANTITY
HIGH STAGE TRASH RACK	GALV. PIPE STD. THREADED ENDS	3" DIA.	[illegible]	4
	GALV. PIPE SLEEVES	[illegible] DIA.	1'-0"	[illegible]
	GALV. CAPS	3" DIA.		[illegible]
LOW STAGE TRASH RACK	Ⓐ - ANGLE IRON	[illegible]	[illegible]	4
	Ⓑ - ANGLE IRON	[illegible]	[illegible]	4
	Ⓒ - ANGLE IRON	[illegible]	[illegible]	4
	REINF. BAR	[illegible]	[illegible]	4
	REINF. BAR	[illegible]	[illegible]	[illegible]
	REINF. BAR	[illegible]	[illegible]	[illegible]
	ANCHOR BOLT - AB1 GALV.	[illegible]		4
GATE WELL	Ⓓ - ANGLE IRON	[illegible]	[illegible]	[illegible]
	Ⓔ - ANGLE IRON	[illegible]	[illegible]	[illegible]
	Ⓕ - ANGLE IRON	[illegible]	[illegible]	[illegible]
	ANCHOR BOLT - AB1 GALV.	[illegible] DIA.		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRASH RACK	[illegible]	[illegible]	3'-0"	[illegible]

AS BUILT

ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 4
SAUNDERS CREEK
CATTARAUGUS CO., NEW YORK

TRASH RACK-GATE WELL-MISC. DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DECK - B GERMANA	SEPT 61	
W H MORGAN	NOV 61	
M NIKOLICH	OCT 61	
		NY-804

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