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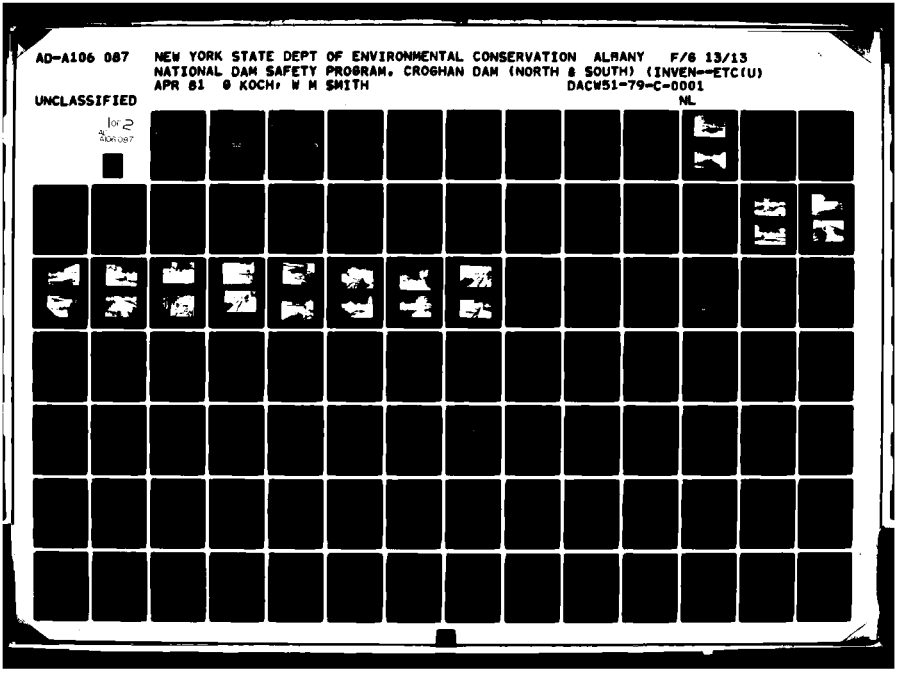

BLACK RIVER BASIN

CROGHAN DAM (NORTH & SOUTH)

LEWIS COUNTY, NEW YORK

INVENTORY NO. N.Y. 694

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(10) George K. Hall
W. T. Smith, Jr.

N. Y.

(6) National Dam Safety Program.
Croghan Dam (North & South)
(Inventory Number 694), Black River
Basin, Lewis County, New York.
Phase I Inspection Report.

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NEW YORK DISTRICT CORPS OF ENGINEERS

MARCH, 1981

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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.

A visual inspection of this dam and the engineering analyses performed revealed that there are a number of structural deficiencies on this structure.

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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 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CROGHAN DAM (NORTH AND SOUTH)
I.D. NO. NY 694
112A-340 BLACK RIVER BASIN
LEWIS COUNTY, NEW YORK

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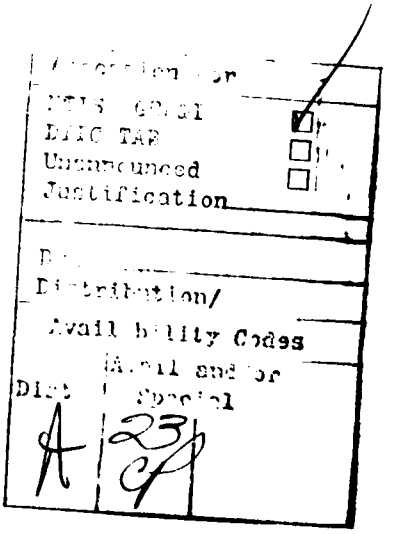


PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Croghan Dam (North and South) (I.D. No. NY 694)
State Located:	New York
County:	Lewis
Watershed:	Black River Basin
Stream:	Beaver River
Date of Inspection:	October 15, 1980

ASSESSMENT

A visual inspection of this dam and the engineering analyses performed revealed that there are a number of structural deficiencies on this structure.

The structural stability analyses indicate that the factors of safety against both overturning and sliding are less than desireable. When the dam is subjected to severe loading conditions (ice load, flood flows), the safety factors fall to critical levels. Further investigation of the stability is needed including subsurface investigations and concrete coring. This information should then be incorporated into a detailed stability evaluation. Appropriate modifications to the dam should then be made.

It is recommended that within 6 months of the date of notification of the owner these investigations should be commenced, within 18 months, necessary modifications to improve the stability of the structure should be completed.

The hydrologic/hydraulic analysis performed indicates that the spillway does not have sufficient capacity to discharge the peak outflow from one-half the Probable Maximum Flood (PMF). However, a high tailwater condition could be expected for this storm event and a dam failure would not significantly increase the hazard to loss of life from that which would exist just before an overtopping induced failure. Therefore, the spillway capacity for this structure has been rated as inadequate.

A number of other deficiencies were noted on this structure. These deficiencies should be corrected within 18 months of the date of notification of the owner. Among the required actions are the following:

1. Repair tilting pier at right end of log sluice;
2. Replace missing concrete on walls supporting intake structures;
3. Repair deteriorated concrete on all spillways;
4. Repair scoured concrete at base of pier on right end of log sluice;
5. Repaired spalled concrete on the retaining wall adjacent stoplog structure # 1;

6. Investigate seepage through the left abutment wall adjacent stoplog structure #2 ;

7. Remove brush and trees growing on both sides of wall connecting the two spillways ;

8. Repair the leaking low-level outlet at the spillway #3;

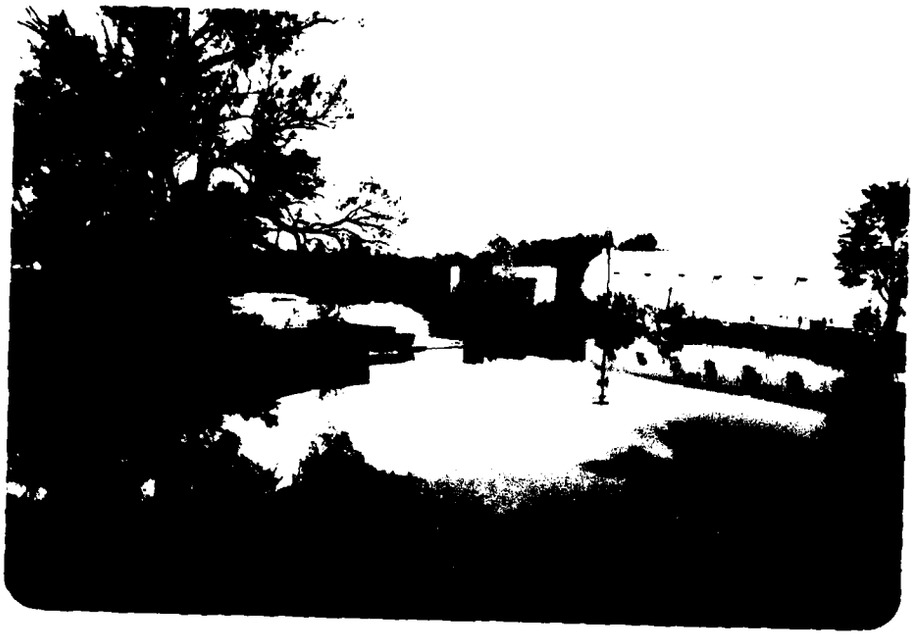
9. Develop an emergency action plan for notification of downstream residents.

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

Approved By:

Col. W.M. Smith Jr.
New York District Engineer

Date: 23 APR 1981



OVERVIEW PHOTO
CROGHAN DAM (NORTH)
I.D. No. NY 694

OVERVIEW PHOTO
CROGHAN DAM (SOUTH)
I.D. No. NY 694

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CROGHAN DAM (NORTH AND SOUTH)
I.D. NO. NY 694
112A-340 BLACK RIVER BASIN
LEWIS COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

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

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Croghan Dam is a run-of-river concrete gravity dam on the Beaver River. An island divides the river into two segments in the vicinity of the dam. There are two main segments of the dam, one crossing each portion of the river. A retaining wall extends across the island connecting the two segments.

The north segment of the dam is 180 feet long and 11.5 feet high. This segment of the dam is predominantly an overflow spillway section. There are intake structures on both ends of the segment and a log sluice near the center. The intake structures originally led to flumes providing water power to downstream mills. The flumes no longer exist and the structures now act as spillway sections. Stop logs have been placed in each up to a level slightly below the spillway crest. The log sluice is also no longer used and stop logs have been placed across the upstream end.

The south segment of the dam is 120 feet long and 9.5 feet high. The spillway forms the entire center section of this segment. There is an intake structure for a flume leading to the one remaining water powered mill at this site. A trash rack extends across the entrance to this structure. At the left end of this segment are the remains of an intake structure for a saw mill flume. Stop logs have also been placed across this intake structure. There is a 4.5 foot wide by 5 foot high opening at the base of the spillway near the center of this section that serves as a low level outlet. Stop logs closed off this outlet.

The retaining wall which connects the two segments is a total of 240 feet long and a maximum of 11 feet high. The base of the wall is masonry and the upper portion is concrete. The area downstream of the wall has been backfilled up to about one foot below the top of the wall along much of its length.

b. Location

This dam is located on the Beaver River in the Village of Croghan. It is adjacent Resha Road which is just off County Route 10.

c. Size Classification

The dam is 11.5 feet high and has a storage capacity of approximately 500 acre feet. Therefore, the dam is in the small size category as defined by the "Recommended Guidelines for Safety Inspection of Dams".

d. Hazard Classification

The dam is classified as "high" hazard due to 3 homes plus a lumber yard on the island immediately downstream of the dam.

e. Ownership

There are multiple owners of this dam. A listing of Hudson River-Black River Regulating District assessments dated June 30, 1980 indicated the owners of the parcels of land which include the dam are as follows:

Parcel Number	Portion of Dam in Parcel	Owner
38	Left end of southern dam	Vaughn Zehr
39	Right end of southern dam up to bridge on island	Croghan Island Mill Lumber Co.
40 & 41	Remainder of dam from bridge on island to right end of northern dam	Beaverite Products Corp.

f. Purpose of Dam

The dam was constructed to provide water power to four mills at this site. Only the Croghan Island Mill Lumber Company still uses the water for power. Beaverite Products Corp uses the impoundment as a water supply for their fire-fighting sprinkler system.

g. Design and Construction History

This dam was constructed in 1918 to replace a former log crib structure. The dam was designed by James P. Brownell, Civil Engineer, of Carthage, New York. The contract for construction was awarded to Mr. H. J. Wright of Watertown, New York.

h. Normal Operation

There are no prescribed operating procedures for this structure.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	293	
b. Discharge at Dam (cfs)		
Spillways Water Surface at Elevation	105	4308
Normal Flow-Water Surface at Elevation	100	300

c. Elevation (Plan Datum)

Top of Dam	105
Spillway Crest	100
Base of Log Sluice	90.5

d. Reservoir Storage Capacity (acre feet)

Top of Dam	797
Spillway Crest	482

e. Dam

Type-Concrete dam with 2 main sections and a retaining wall connecting the two segments.

Dam Length (ft)	500

f. Spillway

Type: Two concrete gravity spillway sections; northern section 80 feet long, southern section 100 feet long.

Four flume intake structures and a log sluice also act as spillway. All have stop logs across openings up to elevation slightly below spillway crest. Total length of these sections is about 70 feet.

g. Reservoir Drain

Type-Low-level outlet at downstream toe of southern spillway section, 4.5 foot wide by 5 foot high; plugged by stop logs.
Control-Stop logs plug the opening.

h. Appurtenant Structures

Croghan Island Mill-water powered saw mill adjacent stop log structure # 3. Intake structure at spillway with trash rack for debris protection. Flume leading to mill constructed of timber.

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. Geology

The Croghan Dam is located in the Western Adirondack Hills section of the Adirondack Highlands physiographic province of New York State. The Beaver River, on which this dam is located, is one of a number of streams which flow down from the higher parts of the mountains into the Black River. The bedrock in these highlands is sedimentary with large intrusions of igneous rocks. The original rock has been metamorphosed by heat, pressure, folding and faulting. The design report indicates that the rock in the vicinity of the dam is gneiss which is unstratified although it does show a faint line of cleavage in a plane running approximately north and south. Occasional seams of mica-schist are found within the rock mass. A review of the "Brittle Structures Map of the State of New York" indicated that there are no faults in the immediate vicinity of the dam.

Surficial soils in the area consist of a relatively thin layer of glacial drift from the Wisconsin glaciation.

b. Subsurface Investigations

No records of any subsurface investigations performed in the vicinity of this structure could be located.

2.2 DESIGN RECORDS

An engineer's report and a set of plans prepared in May, 1918 by James P. Brownell, Civil Engineer of Carthage, New York was available. This report contained hydrologic, hydraulic and structural stability information used in the design of this dam.

2.3 CONSTRUCTION RECORDS

The engineer's report stated that the dam was to be constructed by Mr. H.J. Wright of Watertown, New York. Some other construction records such as a report on the testing of materials to be used in the concrete on the dam were also available.

2.4 OPERATION RECORDS

No operation records were available for this structure.

2.5 EVALUATION OF DATA

Information used for the preparation of this report was obtained from the Department of Environmental Conservation files. The information available appeared to be reasonably accurate although there were certain details which were not shown on the plans.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of the Croghan Dam was conducted on October 15, 1980. The weather was partly cloudy and the temperature was in the mid-fifties. The water level at the time of the inspection was just below the spillway crest.

b. North Segment of Dam

There was concrete deterioration and removal in a number of areas on this segment of the dam. The most serious problem areas were as follows:

a. The pier at the right end of the log sluice had tilted away from the dam (Photos 1 & 2). There was a void up to 2 feet wide between the pier and the dam.

b. The wall supporting the left side of the stop log structure #1 was practically nonexistent (photos 3 & 4). The concrete had been completely removed on the lower portion of the intake structure.

c. There has been extensive concrete removal on the wall supporting the right end of the stop log structure # 2 (photos 5 & 6). This wall was also being supported by reinforcing rods with complete removal of concrete in a section about two feet high in the middle of the wall.

In addition to these three areas, there was less serious concrete deterioration in several other areas. There was a void on the downstream slope of the spillway #1 along the first construction joint from the right hand end (photo 7). The concrete at the base of the pier at the right end of the log sluice was scoured, partially undermining the pier (photo #8). Finally, the concrete retaining wall at the right end of the segment was spalling and cracked (photo 9).

The remainder of this segment appeared to be in satisfactory condition. Except for the one void noted above, the spillway section was in good condition. The trash rack in front of stop log structure #1 was free of debris and well maintained.

Another deficiency noted was seepage emerging from the left wall adjacent stop log structure #2. The water was flowing through the rocks which formed the foundation for the old mill at this end of the segment (photo #10).

c. South Segment of Dam

Deteriorated concrete was the prime deficiency on this segment. A number of cracks and voids in the concrete were noted on the main spillway, section #3. There was leakage through several of the cracks (photo 11). Concrete on the intake of stop log structure #3 was deteriorated with reinforcing rod exposed and leakage through the left wall (photo 12). The intake of stop log structure #4 is in poor condition. There was significant concrete removal on the right wall at both the upstream and downstream ends (photos 13 & 14). Broken concrete slabs had been dumped beyond the left end of this structure to act as fill material in this area (photo 15).

The low-level outlet at the base of spillway #3 was blocked with stop logs but there was substantial leakage through the opening (photo 11). No other means of controlling flow through this outlet could be located.

d. Retaining Wall

The masonry and concrete wall which extends between the two segments of the dam was in satisfactory condition. The left end of the wall was entirely concrete and showed no signs of deterioration (photo 16). The right end of the wall was concrete over a masonry base. There was brush growing on both sides of the wall and two trees were growing just downstream (photo 17). One area of the wall had apparently failed and been repaired with new concrete (photo 18).

e. Appurtenant Structures-Croghan Island Mill

The mill and timber crib flume structure was in satisfactory condition. There was some leakage at the base of the flume near the point where it tied into the concrete stop log structure #3 (photos 19 & 20).

3.2 EVALUATION OF OBSERVATIONS

Visual observations revealed several deficiencies on this structure. The following items were noted:

1. The pier at the right end of the log sluice had tilted away from the dam.
2. Walls supporting the stoplog structures on either end of both spillway segments were seriously deteriorated.
3. There was concrete deterioration on both spillway segments, with the south segment having the most serious problems.
4. Concrete at the base of the pier at the right end of the log sluice was scoured.
5. The concrete retaining wall adjacent stop log structure #1 was spalling and cracked.
6. There was seepage through the left abutment wall adjacent stop log structure #2.
7. There was brush growing on both sides of the wall which connects the two segments of the dam.
8. The low-level outlet consisting of stop logs, at the base of spillway #3 was leaking.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no prescribed operating procedures for this dam.

4.2 MAINTENANCE OF DAM

There is no established maintenance plan for the dam.

4.3 WARNING SYSTEM IN EFFECT

No apparent warning system for evacuation of downstream residents is present.

4.4 EVALUATION

The operation and maintenance procedures on this dam are not satisfactory. The deficiences noted in section 3 indicate that increased maintenance efforts are needed.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

The watershed contributing drainage to the dam site was determined from information for the stream gage located on the Beaver River approximately one-half mile downstream from the dam and from the USGS 7.5 minute quadrangle maps for Croghan and Belfort, New York.

The drainage area of over 293 square miles encompasses portions of the central and western slopes of the Adirondack Mountains. The rugged terrain has steep forested slopes and mountain peaks that rise to elevations at or above 2500 msl. The ground elevation adjacent the dam is at 825 msl. The Beaver River main stem originates some 50 miles upstream of the dam. Major tributaries to the Beaver River are the creeks named Murmur, Balsam, Fish, Alder, Moshier, and Birch plus Shingle Shanty Brook and Harrington Brook. Numerous lakes exist within the watershed, primarily in the upper half of the basin. The largest lakes are the Stillwater Reservoir, Lake Lila, and Nehasane Lake. In addition to these lakes, impoundments created by eight hydroelectric power dams on the Beaver River between this dam and the Stillwater Reservoir Dam further regulate flows in the river.

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 using the "Clark Unit Hydrograph" method and then reservoir routs and channel routs the hydrograph using the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the Probable Maximum Flood (PMF), in accordance with the Recommended Guidelines of the U.S. Army Corps of Engineers.

5.3 SPILLWAY CAPACITY

This run-of-river dam has two primary concrete gravity spillway sections which are separated by a concrete and masonry wall over 220 feet long. The right spillway located in the Beaver River main channel is comprised of a log sluice, three ungated overflow weirs, and two stop log structures. The left spillway located on a side channel from the river is comprised of a single ungated overflow weir flanked by two stop log structures. All spillway structures were analyzed for weir flow using a discharge coefficient, C, of 3.2.

Computed discharges for all site facilities are as follows:

Elevation above Spillway # 1	Water Level @:	DISCHARGES Spillway Left	Spillway Right	Total (cfs)
0	Base Flow	10	282	292
3.3	Top of 3 Stoplog Structures	1943	2254	4197
3.6	Top of Left Spillway Left Abutment Wall	2235	2325	4560
4.8	Top of Dam	2955	3076	6031

The flood analysis performed for this dam indicates that the spillway does not have sufficient capacity for discharging one-half the PMF. For this storm event, the peak inflow and peak outflow is 36,129 cfs. The PMF peak inflow and peak outflow is 73,351 cfs. The total discharge capacity of the spillways for a water surface at the top-of-dam is 6031 cfs.

5.4 RESERVOIR CAPACITY

The reservoir at normal pool impounded by this dam lies primarily within the limits of the existing Beaver River channel; extending approximately 2.7 miles upstream to the High Falls Dam. The normal water surface is at or near the crest of spillway #1 (elev. 825). The impounded capacity for this elevation is 482 acre-feet. Surcharge storage capacity to the top-of-dam (elev. 829.8) adds 315 acre-feet for a total storage capacity of 797 acre-feet.

5.5 FLOODS OF RECORD

The maximum known flood on the Beaver River occurred on May 21, 1969 when the nearby downstream USGS gage recorded a maximum discharge of 5100 cfs. For this flow, the computed water surface rises to approximately elevation 829.2.

5.6 OVERTOPPING POTENTIAL

The highway bridge immediately upstream of the dam has not been overtopped within the past twenty years according to a local resident. The bottom flange of this steel bridge is at or near elevation 827.3.

Analysis using the PMF and one-half PMF storm events indicates that the dam does not have sufficient spillway capacity. The computed depths of overtopping for these two events are 15.84 feet and 8.49 feet respectively. All storm events exceeding 8% of the PMF will result in the dam being overtopped.

5.7 EVALUATION

The spillway does not have sufficient capacity to discharge the peak outflow from one-half the PMF. For this storm event, a high tailwater condition would most likely occur, resulting in flooding of the downstream hazard areas. Dam failure would not significantly increase the hazard to loss of life downstream from that which would exist just before an overtopping induced failure. Therefore, the spillway capacity for this structure has been assessed as inadequate.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations revealed that there are a number of structural problems with this dam. The most serious deficiency was that one end of the log sluice structure was tilting downstream. It appeared to have separated from the dam, however, water flowing over the stop logs prevented a close inspection. There was a void up to 2 feet wide between the pier and the dam.

The other structural problems were the result of concrete deterioration. The worst deterioration was on the stop log structures at either end of both segments. There was complete removal of the concrete on two portions of two of the structures. The reinforcing rods were all that was supporting these portions. Concrete deterioration and leakage through several construction joints on the spillway sections was also noted.

b. Data Review and Stability Evaluation

Included in the 1918 Engineer's Report were the results of a stability analysis performed for the design of this dam. However, this analysis assumed no ice load and only 50% uplift pressure. The "Recommended Guidelines for the Safety Inspection of Dams" suggest an ice load of 5000 pounds per linear foot and full uplift pressure. Therefore, a separate stability analysis was performed for this report, based on the maximum spillway section shown on the plans.

The results of the analyses (see Appendix D) performed are as follows:

CASE	OVERTURNING SAFETY FACTOR	RESULTANT IN MIDDLE THIRD	SLIDING SAFETY FACTOR
a. Normal conditions; water surface at spillway crest	1.83	YES	1.14
b. Same as case a. plus ice load of 5,000 #/ft.	0.96	NO	0.57
c. Flood flows; water surface at top of dam	1.39	NO	0.68
d. 1/2 PMF flow; water surface 8.5 feet over top of dam	0.97	NO	0.39
e. Normal conditions with seismic coefficient of 0.10.	1.76	YES	0.83

The analyses indicates that the stability of this dam is deficient. The safety factor against sliding is below the recommended value even for a normal condition. For severe loading conditions, such as ice loading or flood flows, the analyses indicates that the dam is unstable.

Further investigations are required to better assess the stability of the structure. Subsurface explorations, to obtain data concerning the foundation bedrock and concrete cores are required. Stability analyses should then be performed using this data. Based on the results of these analyses, required modifications to the structure should be made.

c. Seismic Stability

This dam is located in Seismic Zone 2. Due to the location, a seismic stability analysis was performed in accordance with Corps of Engineers' Guidelines. The seismic analysis was performed for normal conditions with the water level at the spillway crest. The safety factors shown in the table on the previous page indicates the structure is unstable when subjected to earthquake loading.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I inspection of the Croghan Dam revealed a number of structural problems for this dam. Deteriorated and cracked concrete has resulted in a tilting pier on the log sluice, stop log structures which are supported only by reinforcing rods, and several leaks through the spillway section. Stability analyses indicate that the structure is unstable when subjected to severe loading conditions.

The spillway capacity is inadequate for the peak outflow from one-half the PMF. However, since downstream flooding could be expected prior to an overtopping induced failure, the spillway capacity is not considered to be seriously inadequate.

b. Adequacy of Information

The engineer's report and construction plans which were available for the preparation of this report were fairly complete and appeared to be reasonably accurate.

c. Need for Additional Investigations

Further investigation of the structural stability of this dam is required. The studies should include subsurface and structure investigations to obtain information about the condition of the structure and its foundation. This data should then be incorporated into a detailed stability evaluation.

d. Urgency

Investigations of the structural stability should be commenced within 6 months. Remedial measures deemed necessary both as a result of these investigations and to correct the other deficiencies should be completed within 18 months.

7.2 RECOMMENDED MEASURES

1. Modify the structure as necessary based on the stability analyses.
2. Repair the tilting pier at the right end of the log sluice.
3. Replace missing concrete on walls supporting the stop log structures on either end of both dam segments.
4. Repair deteriorated concrete on all spillway segments.
5. Repair scoured concrete at base of the pier at the right end of log sluice.
6. Repair spalled concrete on the retaining wall adjacent stoplog structure #1.
7. Investigate seepage through the left abutment wall adjacent to stop log structure #2.

8. Remove brush and trees growing on both sides of the wall which connects the two segments of the dam.

9. Repair the leaking low-level outlet at the base of the spillway # 3.

10. Develop an emergency action plan for the notification and evacuation of downstream residents.

APPENDIX A

PHOTOGRAPHS

Photo 1 Tilting Pier of Log Sluice on North Segment of Dam.

Photo 2 Tilting Pier at Right End of Log Sluice

Photo 3 Deteriorated Concrete and Exposed Re-bar at Right End of North Segment

Photo 4 Leakage Through Sidewall on Intake Structure at Right End of North Segment

Photo 5 Intake Structure at Left End of North Segment
Note Structure Being Supported by Re-bar.

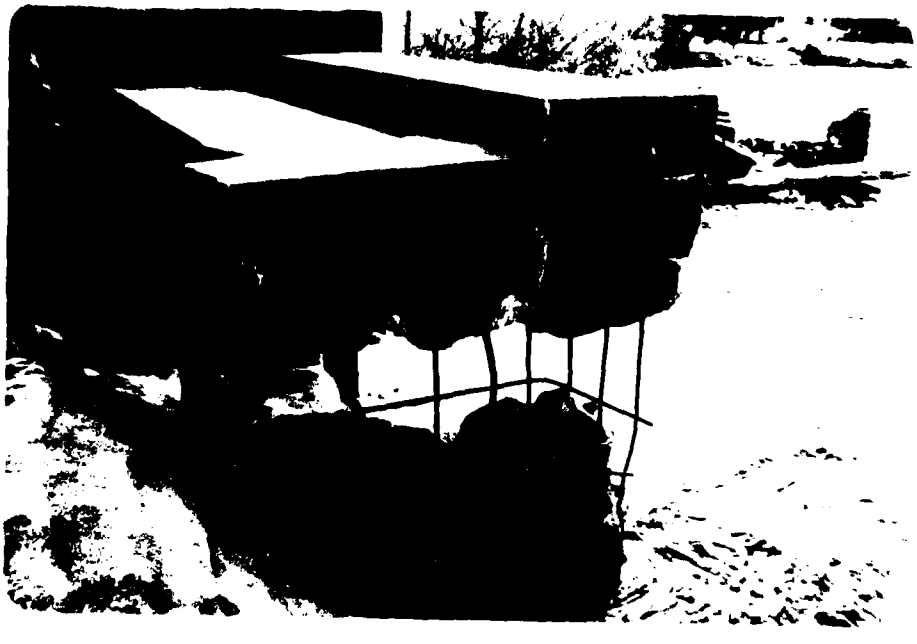

Photo 6 Deteriorated Concrete on Intake Structure at Left end of North Segment

Photo 7 - Deteriorated Concrete and Void along Construction joint on North Segment

Photo 8-Scoured Concrete at Base of Left Pier to Log Sluice on North Segment

Photo 9-Spalled and Deteriorated Concrete
at Right End of North Segment

Photo 10 Seepage Emerging From Left
Abutment of North Segment

Photo 11-South Spillway Segment-Note Crack and Seepage near Crest and Leakage through Center Stop Log Orifice

Photo 12 Deteriorated Concrete and Leakage Through Intake Structure at Right End of South Segment

Photo 13 Deteriorated Concrete on Intake Structure at Left End of South Dam

Photo 14 Downstream View of Intake Structure at Left End of South Dam

Photo 15 Broken Concrete Dumped Beyond
Left End of South Segment

Photo 16 Wall which Connects North
and South Segments of the Dam

Photo 17 Wall Which Connects Two Segments
Note Brush Growing on Both Sides of Wall

Photo 18 Wall Connecting Two Segments; Note Trees Growing
Downstream of Wall

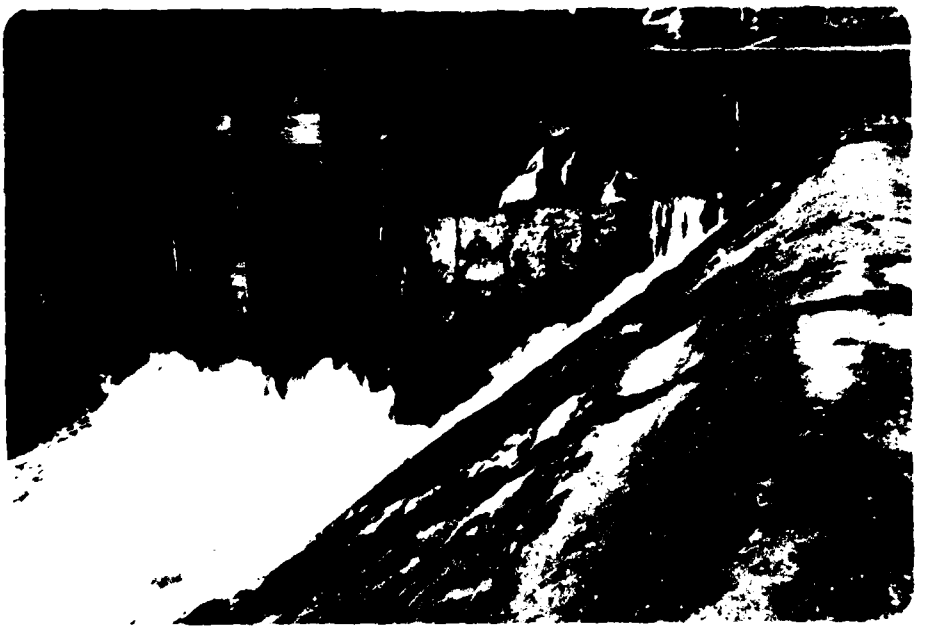

Photo 19 - Flume Leading to Remaining Operating Mill on South Dam

Photo 20 Leakage at Base of Flume Structure Leading to Lumber Mill

APPENDIX B

VISUAL INSPECTION CHECKLIST

93-15-3(9/80)

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam CROGHAN DAM - NORTH & SOUTH

Fed. I.D. # 694 DEC Dam No. 112A-340

River Basin BLACK RIVER

Location: Town CROGHAN County LEWIS

Stream Name BEAVER RIVER

Tributary of

Latitude (N) 43° 53.8' Longitude (W) 75° 23.5'

Type of Dam CONCRETE GRAVITY

Hazard Category C

Date(s) of Inspection 10/15/80

Weather Conditions 55° PARTLY CLOUDY

Reservoir Level at Time of Inspection AT SPILLCREST

b. Inspection Personnel R. WARRENDER W. LYNICK

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

MR. ELMER GOLDEN

BEAVERITE PROD. CO.
CROGHAN, N.Y. 13327
(315) 346-6011

CROGHAN ISLAND MILL LUMBER CO.
BRIDGE STREET
CROGHAN, N.Y. 13327
(315) 346-1115

d. History:

Date Constructed 1918 Date(s) Reconstructed

Designer JAMES P. BROWNELL, CARTHAGE, N.Y.

Constructed By H.J. WRIGHT, WATERTOWN, N.Y.

Owner MULTIPLE OWNERSHIP

SECTION 2 WAS ELIMINATED SINCE THERE WAS NO EMBANKMENT SECTION ON THIS STRUCTURE.

3) Drainage System

a. Description of System NONE

b. Condition of System

c. Discharge from Drainage System

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

STAFF GAGE AT NORTH ABUTMENT WALL NEAR BEAVERITE PRODUCTS

93-15-3(9/80)

5) Reservoir

a. Slopes MAIN CHANNEL OF BEAVER RIVER

b. Sedimentation NO PROBLEMS EVIDENT

c. Unusual Conditions Which Affect Dam HIGHWAY BRIDGE UPSTREAM OF DAM COULD INHIBIT FLOWS TO DAM

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) 3 HOUSES PLUS LUMBER YARD ON ISLAND

b. Seepage, Unusual Growth NONE

c. Evidence of Movement Beyond Toe of Dam NONE

d. Condition of Downstream Channel ROCK BED

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

2 MAIN SPILLWAY SEGMENTS EACH WITH STOP LOG INTAKE STRUCTURES AT EITHER END

a. General DETERIORATED CONCRETE THROUGH OUT - MINOR CRACKS AND SEEPAGE THROUGH THE CONSTRUCTION JOINTS ON BOTH SPILLWAY SECTIONS - PROVISIONS FOR FLASH BOARDS ~~LOGS~~ ON SPILLWAY SECTION

b. Condition of NORTH [redacted] Spillway CONSISTS OF LOG SLUICE, 2 INTAKE STRUCTURES, & MAIN SPILLWAY SECTION

LOG SLUICE - RIGHT END IS TILTED & REMOVED FROM DAM - OPENED A VOID UP TO 2 FEET DEEP, LEFT END INTACT ALTHOUGH THERE IS SCOUR AT BASE

RIGHT INTAKE STRUCTURE - CONCRETE SERIOUSLY DETERIORATED - REBAR IS ALL THAT SUPPORTS LEFT END OF WALL - LEAKAGE THROUGH WALL AT LEFT END

LEFT INTAKE STRUCTURE - REBAR IS ALL THAT IS LEFT ON LOWER PORTION OF WALL OVERALL DETERIORATION AS WELL.

c. Condition of ~~Auxiliary~~ South Spillway CONSISTS OF 2 INTAKE STRUCTURES & MAIN SPILLWAY RIGHT INTAKE STRUCTURE - (TO LUMBER MILL) - SOME DETERIORATED CONCRETE ON SPILLWAY SIDE PERMITTING LEAKAGE THROUGH CONCRETE - SOME EXPOSED REBAR LEFT INTAKE STRUCTURE - SERIOUSLY DETERIORATED CONCRETE - SOME SCOURING ON END NEAR SPILLWAY - REBAR EXPOSED ON DOWNSTREAM END

d. Condition of Discharge Conveyance Channel SATISFACTORY

8) Reservoir Drain/Outlet ON SOUTH SPILLWAY SECTION

Type: Pipe _____ Conduit _____ Other STOPLOG ORIFICE AT BASE OF SPILLWAY

Material: Concrete _____ Metal _____ Other _____

Size: 4.5' WIDE x 5' HIGH Length _____

Invert Elevations: Entrance _____ Exit _____

Physical Condition (Describe): Unobservable _____

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate _____ Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable _____ Other _____

Present Condition (Describe): LEAKING THROUGH STOP LOGS

9) Structural

a. Concrete Surfaces DETERIORATED THROUGHOUT - MORE DETERIORATION ON INTAKE STRUCTURES THAN ON MAIN SPILLWAY SECTIONS SPALLING ON RETAINING WALL AT RIGHT END OF NORTH DAM

b. Structural Cracking SOME CRACKS ON SOUTH SPILLWAY SECTION NEAR CREST-LEAKAGE THROUGH THESE CRACKS

c. Movement - Horizontal & Vertical Alignment (Settlement)

d. Junctions with Abutments or Embankments OKAY

e. Drains - Foundation, Joint, Face NONE

f. Water Passages, Conduits, Sluices SERIOUS CONCRETE DETERIORATION ON ALL OF THE STOPLOGGED INTAKE STRUCTURES

g. Seepage or Leakage SOME NOTED COMING THROUGH STONES AT BASE OF LEFT ABUTMENT OF NORTH SEGMENT OF THE DAM.

h. Joints - Construction, etc. SEPARATION & DETERIORATION ALONG SEVERAL OF CONSTRUCTION JOINTS

i. Foundation OKAY

j. Abutments

k. Control Gates NONE

l. Approach & Outlet Channels OKAY

m. Energy Dissipators (Plunge Pool, etc.) NONE

n. Intake Structures DETERIORATED CONCRETE WITH REBAR EXPOSED ON ALL STRUCTURES

o. Stability

p. Miscellaneous - WALL BETWEEN SPILLWAY SEGMENTS - CONCRETE PATCHED IN SPOTS BUT IN GOOD CONDITION - SOME BRUSH GROWING ON EITHER SIDE OF WALL - TWO TREES DOWNSTREAM OF WALL - RIGHT UP AGAINST IT.

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition

CROGHAN ISLAND MILL - FLUME CONSTRUCTED OF TIMBERS LEADING FROM RIGHT INTAKE STRUCTURE AT SOUTH DAM TO MILL - SOME LEAKAGE NOTED AT BASE OF TIMBERS CRIB

11) Operation Procedures (Lake Level Regulation):

APPENDIX C

HYDROLOGIC/HYDRAULIC ENGINEERING DATA AND COMPUTATIONS

CROGHAN DAM
NY-694

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	(RELATIVE) Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	4.8		797
2) Design High Water (Max. Design Pool)	N/A		
3) Auxiliary Spillway Crest	N/A		
4) Pool Level with Flashboards	N/A		
5) Service Spillway Crest	0.0		482

DISCHARGES

	Volume (cfs)
1) Average Daily (≈ BASE FLOW)	±300
2) Spillway @ Maximum High Water (SPILLWAY 1,2,3)	~~6031~~ 4308
3) Spillway @ Design High Water	N/A
4) Spillway @ Auxiliary Spillway Crest Elevation	N/A
5) Low Level Outlet	N/A
6) Total (of all facilities) @ Maximum High Water	6031
7) Maximum Known Flood	± 5100
8) At Time of Inspection	±300

CREST: (RELATIVE) ELEVATION: 4.8

Type: CONCRETE AND/OR CONCRETE-MASONRY WALL

Width: VARIES 2' – 3' Length: ≈ 300'

Spillover 2 SPILLWAY SECTIONS SEPARATED BY WALL

Location EITHER END OF DAM ; WALL SEPARATES THE SPILLWAYS

SPILLWAY:

LEFT		RIGHT	
SPILLWAY #3		SPILLWAY #2	SPILLWAY #1
0.2	(RELATIVE) Elevation	0.0	0.0
OVERFLOW WEIR	Type	OVERFLOW WEIR w/ CENTER PIER	OVERFLOW WEIR
2'+	Width	2'+	2'+
	Type of Control		
✓	Uncontrolled	✓	✓
	Controlled:		
N/A	Type (Flashboards; gate)	N/A	N/A
—	Number	—	—
107'	[redacted]/Length	26.5'	46.5'
CONCRETE	Invert Material	CONCRETE	CONCRETE
	Anticipated Length of operating service		
N/A	Chute Length	N/A	N/A
N/A	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	N/A	N/A

ADDITIONAL DISCHARGE FACILITIES

a) 2 STOPLOG STRUCTURES: w/ 14' WEIR LENGTHS (EACH)

ONE EACH SIDE OF SPILLWAY #3

a) 2 STOPLOG STRUCTURES: w/ 16' & 14' WEIR LENGTHS

ONE ON EITHER END OF THIS SPILLWAY

b) LOG SLUICE 33.5' LONG BETWEEN SPILLWAY #1 & SPILLWAY #2

HYDROMETEROLOGICAL GAGES: [HUDSON RIVER- BLACK RIVER REGULATING DISTRICT]

Type : STAFF GAGE — USGS #04258000 WATER-STAGE RECORDER

Location: ON RIGHT ABUTMENT WALL 150' UPSTREAM OF STOPLOG STRUCT.#1 — ± 1/2 MILE DOWNSTREAM OF DAM SITE; ON BEAVER RIVER

Records:

Date - UNKNOWN — 9/1930 TO PRESENT

Max. Reading - UNKNOWN — 5/21/1969 → 5100 cfs

FLOOD WATER CONTROL SYSTEM:

Warning System: N/A

Method of Controlled Releases (mechanisms):

NONE APPARENT; STOPLOG REMOVAL IS POSSIBLE SPILLWAY #3 LOW-LEVEL OPENING

DRAINAGE AREA: 293.1 SQ MI. OR 187,584 ACRES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: UNDEVELOPED ; OPEN FIELDS & FORESTS

Terrain - Relief: STEEP SLOPES ; ADIRONDACK MTNS.

Surface - Soil: VERY STONY

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

N/A

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

N/A

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

NONE APPARENT

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

Location: N/A

Elevation:

Reservoir:

Length @ Maximum Pool 2.7 (Miles)

Length of Shoreline (@ Spillway Crest) (Miles)

BEAVER RIVER FLOWS REGULATED BY STILLWATER RESERVOIR DAM AND 8 OTHER HYDRO-POWER DAMS LOCATED BETWEEN CROGHAN DAM & STILLWATER RESERVOIR

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB		SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	NY-694 DEC # 340 BLACK	1/		
SUBJECT			COMPUTED BY	DATE
WATERSHED PARAMETERS			WCL	12/12/80

USGS GAGE #04258000 — BEAVER RIVER @ CROGHAN

DRAINAGE AREA = 294 SQ MI.

DEDUCT = 0.9 SQ MI.

PLANIMETERED AREA: (UPSTREAM OF GAGE)

QUAD NAME	AREA (IN^2)
CROGHAN	4.11
BELFORT	2.12
	6.23 IN^2 = 572 ACRES

CROGHAN DAM — DRAINAGE AREA

USE → 293.1 SQ MI.

1.0 IN^2 = 91.827 ACRES

DRAINAGE AREA TO STILLWATER RESV. DAM:

USGS GAGE #04256500 — @ DAM DA = 172 SQ MI.

PHASE I INSP. REPORT FOR STILLWATER 9/78 NY-316 RESV. DAM DA = 178 SQ MI. ← USE

DRAINAGE AREA BETWEEN 2 DAMS = 115.1 SQ MI.

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB		SHEET NO.	CHECKED BY	DATE
CROGHAN DAM NY-694		2/		
SUBJECT			COMPUTED BY	DATE
WATERSHED PARAMETERS			WCL	12/12/80

CLARK HYDROGRAPH PARAMETERS:

REF: BLACK RIVER BASIN STUDY — CE-BUFFALO DIST. 6/74

$\text{LOG}(TC) = 1.2874 + 0.2035 \text{ LOG}(DA) - 0.7675 \text{ LOG}(S) + 0.2707 \text{ LOG}(L)$

$\text{LOG}(TC+R) = 1.5449 - 0.31 \text{ LOG}(DA) - 0.5991 \text{ LOG}(S) + 0.8787 \text{ LOG}(L)$

$L = 22.46$ MILES [BEAVER RIVER MAIN STEM TO STILLWATER RESV.]

$DA = 115.1$ SQ MI.

$S = 36.95$ FT/MI. $= \frac{1640 - 810}{22.46}$

$\text{LOG}(TC) = 1.2874 + 0.4194 - 1.2031 + 0.3658 = 0.8695$

$TC = 7.40$ HRS

$\text{LOG}(TC+R) = 1.5449 - 0.6389 - 0.9392 + 1.1875 = 1.1543$

$TC + R = 14.27 \longrightarrow R = 6.87$

SOIL INFILTRATION RATES:

REF: SOILS OF NEW YORK LANDSCAPES 8/77 ED. (MAP)

SOIL SYMBOL	NAME	SCS GROUP	SUBBASIN LOCATION ST. R.	CROGHAN	
Ds	CHARLTON	B		✓	
	PAXTON	C		✓	
	ESSEX	C		✓	
Kd	ADAMS	A		✓	
	COLTON	A		✓	
Fs 1	BECKET	C	✓	✓	
	BERKSHIRE	B	✓	✓	
	POTSDAM	B	✓	✓	
			VERY STONY		
INITIAL LOSS = 1.0 INS. (BOTH)	RATE: (INS/HR)		0.2	0.1	← USE

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Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM NY-694	3/		
SUBJECT		**COMPUTED BY**	**DATE**
WATERSHED PARAMETERS		WCL	12/12/80

BASE FLOW:

REF: USGS/NYS DEC - BULL. # 74 (1979):

GAGE ON BEAVER RIVER NEAR CROGHAN : DA ≈ 290 ± SQ MI.

7 READINGS (9/5/20 TO 7/10/21) AVE = 337 cfs → 1.16 csm

BASE FLOW = 1 csm ← USE

RAINFALL — PMP

REF: NWS - HRR #33 (4/1956) :

INDEX PMP = 18.5" FOR 200 SQ MI - 24 HR (ZONE #1)

ADJUSTMENT FOR DA & DURATION:

DURATION → HRS	6	12	24	48
% OF INDEX	69	84	95	101
PRECIP. AMT. =	12.76	15.54	17.58	18.68

IMPERVIOUS AREAS WITHIN SUBBASINS: (FROM USGS MAPS)

STILLWATER RESV. SUBBASIN : DA = 178 SQ MI

STILLWATER RESV	=	10.5 SQ MI.
NEHASANE LAKE	=	0.68
LAKE LILA	=	2.07
SALMON LAKE	=	0.49
		13.74 SQ MI

} 7.7% → 0.077

```
**************************
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
**************************
```

PMF ROUTING-CREST EL 1679.3
STILLWATER RESERVOIR DAM
O'BRIEN + GENE - JUSTIN + COUPINEY DIV

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
44	2	0	1	0	0	0	0	2	0

JOPER NWT
5 0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= .10 .20 .30 .40 .50 .60 .70 .80 1.00

****

SUB-AREA RUNOFF COMPUTATION

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	178.00	0.00	0.00	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
6	0.00	0.00	0.00

PRECIP PATTERN

.40 .80 2.00 8.50 2.60 .40

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 10.80 CP= .63 NTA= 0

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.31 AND R= 4.90 INTERVALS

UNIT HYDROGRAPH 30 END-OF-PERIOD ORDINATES, LAG= 10.74 HOURS, CP= .63 VOL= 1.00

475.	1710.	3402.	5043.	6283.	6702.	6170.	5107.	4161.	3390.
2762.	2250.	1833.	1493.	1217.	991.	807.	658.	536.	437.
356.	290.	236.	192.	157.	128.	104.	85.	69.	56.

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
2 0	80	50	285

AC-FT		30167.	74604.	94611.		94611.			

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 9

228.	1058.	3147.	9717.	22754.	34632.	56340.	69174.	72336.	67828.
57319.	47633.	38885.	31679.	25939.	21076.	17130.	13956.	11370.	9263.
7546.	6144.	5009.	4081.	3324.	2709.	2206.	1798.	1466.	1193.
963.	752.	547.	141.	27.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	72336.	69446.	45843.	18153.	653844.
INCHES		3.63	9.58	11.39	11.39
AC-FT		34454.	90376.	108136.	108136.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 9

285.	1323.	3934.	12147.	28442.	49614.	70425.	85217.	90420.	84795.
72399.	59622.	48606.	39599.	32261.	26283.	21412.	17445.	14212.	11574.
9433.	7545.	6261.	5101.	4155.	3385.	2758.	2247.	1831.	1491.
1188.	940.	683.	176.	34.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	90420.	86807.	57304.	22704.	817356.
INCHES		4.54	11.98	14.24	14.24
AC-FT		43057.	113720.	135170.	135170.

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

HYDROGRAPH ROUTING

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

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	1

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

STORAGE=	0.	14103.	23110.	45519.	63002.	81640.	101434.	122382.	0.	0.
OUTFLOW=	0.	5750.	12939.	22216.	33193.	54116.	83380.	118440.	0.	0.

STATION 2, PLAN 1, RTIO 1

28.	32.	47.	96.	223.	463.	824.	1279.	1768.	2225.
2593.	2954.	3321.	3112.	3143.	3123.	3041.	3005.	2913.	2807.
2693.	2573.	2450.	2327.	2206.	2095.	1970.	1858.	1750.	1647.
1548.	1454.	1364.	1278.	1195.	1117.	1044.	976.	912.	853.
797.	745.	696.	651.	609.	569.	532.	497.		

STOP

78.	78.	115.	236.	545.	1134.	2019.	3132.	4331.	5449.
6350.	6991.	7400.	7622.	7633.	7566.	7545.	7363.	7136.	6876.
6545.	6331.	6002.	5701.	5432.	5110.	4826.	4551.	4286.	4033.
3791.	3561.	3341.	3130.	2927.	2736.	2558.	2391.	2235.	2089.
1952.	1825.	1706.	1595.	1490.	1393.	1302.	1217.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3143.	3128.	2910.	1961.	75042.
INCHES		.16	.61	1.23	1.31
AC-FT		1552.	5776.	11675.	12410.

O'BRIEN&GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
STILLWATER RESERVOIR DAM	7	RCH	6/19/78	

Checked DBC

STAGE - STORAGE

Surface area @ Spillway Crest = 6720 Ac (Elev 1679.3)

Surface area @ Elev 1700 = 12698 Ac

Assume area varies linearly with stage

∴ 5977.6 / 20.7 = 288.8 Ac/Ft

$A = 288.8d + 6720$ d=0 @ 1679.3

$S = 144.4\,d^2 + 6720d$ (above Spillway Crest)

From Water Resources Data for NY

Sta	Ac	Inc Stor (Ac-Ft)	Accum Stor (Ac-Ft)	(Ac-Ft) Accum Storage
1658		13866	13.866	
1660		14982	18,848	
1665		16001	34.849	
1670		20959	55.808	
1675		25826	81.634	
1680		31222	112 856	0 @ 1679.3
1681.3	7298		122,502	14018
1683.3	7875		137,675	29190
1685.3	8453		154,002	45518
1687.3	9030		171,487	63002
1689.3	9608		190,125	81640
1691.3	10186		209,919	101434

O'BRIEN&GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
STILLWATER RESERVOIR DAM	6	RCH	6/16/78	

ELEV — DISCHARGE (cfs)

Elev	Qgates	Qspillways	Qovertopping	Qtotal
1679.3	0*	0	0	0
1681.3	1864	3896	0	5760
1683.3	1918	11020	0	12938
1685.3	1971	20245	0	22216
1687.3	2024	31169	0	33193
1689.3	2071	43560	8485	54116
1691.3	2119	57261	24000	83380

* Assume gates are opened at the beginning of PMF

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	4/		
SUBJECT		**COMPUTED BY**	**DATE**
STORAGE CAPACITY		WCL	12/15/80

RESERVOIR STORAGE VOLUME :

REF: 7.5 MIN USGS QUAD - CROGHAN :

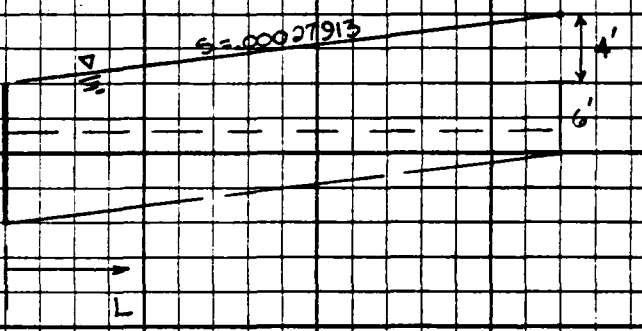
L ≈ 14330' UPSTREAM TO HIGH FALLS DAM (TAILWATER)

RIVER WIDTH (AVE.) ≈ 200'

Δ ELEV ≈ 4' = (829 - 825) FOR WATER SURFACE SLOPE

CHANNEL BOTTOM SLOPE ≈ WATER SURFACE SLOPE

$$S = 0.00027913 = \frac{4}{14330}$$



VOL = 1/3 A h h = 4'

L = 14330'

A = L x 200' = 2866000 FT² = 65.794 ACRES

VOL = 87.7 A-F h : 0-4' ABOVE BOTTOM (H = -6)

ΔVOL = 65.8 A-F/FT DEPTH h = 4' - 10'

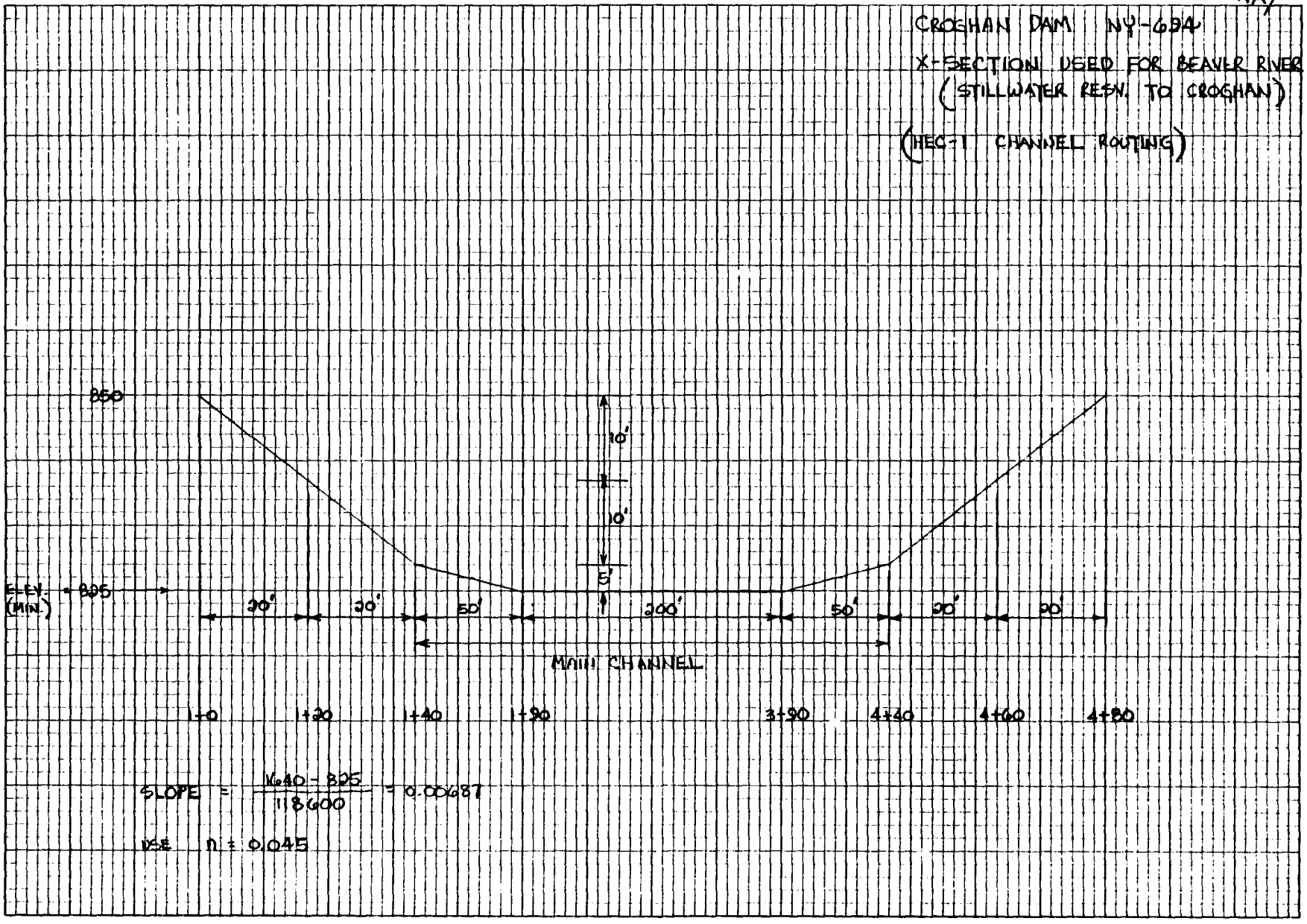
FOR 10' DAM : VOL = 482 A-F @ CREST OF SPILLWAY #1 (H = 0)

4.8 x 65.8 = +315 ⟶ 797 A-F (H = 4.8)

CROGHAN DAM NY-694

X-SECTION USED FOR BEAVER RIVER
(STILLWATER RESV. TO CROGHAN)

(HEC-1 CHANNEL ROUTING)



$$\text{SLOPE} = \frac{\text{K}_{0+40} - 835}{118600} = 0.00687$$

USE $n = 0.045$

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	5/		
SUBJECT		**COMPUTED BY**	**DATE**
BASE FLOW - DISCHARGES		WCL	12/16/80

BASE FLOW Q = 293 cfs (SHT 3/)

@ TIME OF INSPECTION = SITE DISCHARGE ≈ BASE FLOW

FLOW OCCURRING THRU FOUR STOPLOG STRUCTURES + LOG SLUICE

$Q = CLH^{3/2}$ USE C = 3.2

STRUCTURE →	STOPLOG #1	STOPLOG #2	STOPLOG #3	STOPLOG #4	LOG SLUICE	
L =	16	14	14	14	29	
DIST. BELOW CREST OF SPILLWAY #1 = H = (MEASURED)	0.35	0.75	0.05	0.05	1.9±	TOTAL
$Q = CLH^{3/2}$ (cfs)	10.6	29.1	5	5	243	292.7

∴ USE THE ABOVE H VALUES TO SET THE RESPECTIVE CREST ELEVATIONS

AT TIME OF INSPECTION WATER SURFACE WAS AT CREST OF PRIMARY SPILLWAYS (1 & 2)

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	6/		
SUBJECT		**COMPUTED BY**	**DATE**
SPILLWAY DISCHARGES		WCL	12/17/80

$Q = CLH^{3/2}$

SPILLWAY #1

$L = L' + 2(NK_p + K_a)H$

$L' = 46.5'$ $C = 3.2$ $N = 0$ $K_a = 0.2$

ABUTMENT CONTRACTION FOR H = 0 TO 3.3'

NO ABUTMENT CONTRACTION FOR H = 3.3' & ABOVE

$L = 46.5 - 0.4H$

SPILLWAY #2

$L = L' - 2(NK_p + K_a)H$

$L' = 24'$ $N = 1$ $K_p = 0.2$ $K_a = 0.2$

ABUTMENT & PIER CONTRACTION FOR H = 0 TO 3.3'

NO CONTRACTION FOR H = 3.3' & ABOVE

$L = 24 - 0.4H$

(ASSUME USGS 825.0) ELEVATION	C = 3.2 (cfs) Q	L	CREST = 0 H	L	C = 3.2 (cfs) Q			
→		46.5	0	24				
	13	46.42	0.2	23.91	6			
	52	46.3	0.5	23.78	26			
	147	46.1	1	23.56	75			
	269	45.9	1.5	23.34	137			
	413	45.7	2	23.12	209			
	575	45.5	2.5	22.90	289			
	753	45.3	3	22.68	377			
	866	45.18	3.3	22.55	432			
879 = 13 +	866	46.5 (L)	0.2 (ΔH)	3.5	0.2 (ΔH)	26.5 (L)	432	+ 7 = 439
890 24 +			0.3	3.6	0.3			+ 13 = 445
953 87 +			0.7	4	0.7			+ 49 = 481
1061 195 +			1.2	4.5	1.2			+ 111 = 543
1139 = 273 +	866	46.5	1.5	4.8	1.5	26.5	432	+ 155 = 587

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	7/		
SUBJECT		**COMPUTED BY**	**DATE**
SPILLWAY DISCHARGES		WCL	12/17/80

SPILLWAY #3

$Q = CLH^{3/2}$

$L = L' - 2(NK_p + K_a)H$

$L' = 107'$ $N = 0$ $K_a = 0.2$

$L = 107 - 0.4H$

2-ABUTMENT CONTRACTIONS H = 0.2 TO 3.3

1-ABUTMENT CONTRACTION H = 3.3 TO 3.6

NO ABUTMENT CONTRACTION H = 3.6 & ABOVE

(SPILLWAYS 1 & 2 ELEVATION CREST = 0)

C = 3.2 (cfs)

(ASSUMED) USGS	Q	L	ΔH	H	L	Q
825.0 →	—	107		0	29	243
	—	107		0.2	28.92	243 + 8 = 251
	56	106.88	0.3	0.5	28.8	+ 32 = 275
	244	106.68	0.8	1	28.6	+ 91 = 334
	505	106.48	1.3	1.5	28.4	+ 166 = 409
	821	106.28	1.8	2	28.2	+ 255 = 498
	1184	106.08	2.3	2.5	28	+ 354 = 597
	1587	105.88	2.8	3	27.8	+ 462 = 705
	1847	105.76	3.1	3.3	27.68	243 + 530 = 773
		(L = 107 - 0.2H)			ΔH L	
	2039	106.34	3.3	3.5	0.2 33.5	9 + = 782
	2132	106.32	3.4	3.6	0.3	17 + = 790
2218 = 86 +		107	ΔH 0.4	4	0.7	62 + = 835
2424 = 292 +		107	0.9	4.5	1.2	140 + = 913
2582 = 450 +	2132	107	1.2	4.8	1.5 33.5	196 + 773 = 969

LOG SLUICE

$L = L' - 2(NK_p + K_a)H$

$L' = 29'$ $N = 0$ $K_a = 0.2$

$L = 29 - 0.4H$

2 ABUTMENT CONTRACTIONS H TO 3.3

NO ABUTMENT CONTRACTION H ABOVE 3.3

INITIAL FLOW = 243 cfs (SHT 5/)

C = 3.2 (cfs)

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CROGHAN DAM	8/		
SUBJECT		**COMPUTED BY**	**DATE**
SPILLWAY DISCHARGES		WCL	12/17/80

STOPLOG STRUCTURES

	#1 (@ RT. SPILLWAY)	#2 (@ RT. SPILLWAY)	#3 (@ LEFT SPILLWAY)	#4 (@ LEFT SPILLWAY)	WALL @ LEFT SPILLWAY
(SHT 5/) BASE FLOW=	10.6	29.1	5	5	
@ H = 0 SPILLCREST #1 ℄ D — REF. ELEV.	Q = CLH^3/2		w/ C = 3.2		
L →	16'	14'	14'	14'	
ADDITIONAL WEIR FLOW FOR H = 1.0	H = 1.35	H = 1.75	H = 1.05	H = 1.05	
Q (cfs)	80	103	48	48	
ORIFICE FLOW OCCURS BETWEEN			REF. H = 1.0 ℄ 1	H = 3.3	{ NOT INCLUDED
OVERTOPPING FLOW, Q = CLH^3/2					
C →	2.7	2.7	2.7	2.7	WALL 2.7
L →	24'	16'	16'	19'	37'

H	ΔH	Q	ΔH	Q	ΔH	Q	ΔH	Q	ΔH	Q
3.3	—		—		—		—		—	
3.5	0.2	5	0.2	3	0.2	3	—		—	
3.6	0.3	10	0.3	7	0.3	7	—	—	—	—
4	0.7	37	0.7	25	0.7	25	0.4	12	0.4	25
4.5	1.2	85	1.2	56	1.2	56	0.9	43	0.9	85
4.8	1.5	119	1.5	79	1.5	79	1.2	67	1.2	131

TOP-OF-DAM = TOP OF CONNECTING CONCRETE WALL

L = 206.5' C = 3.2

21-12

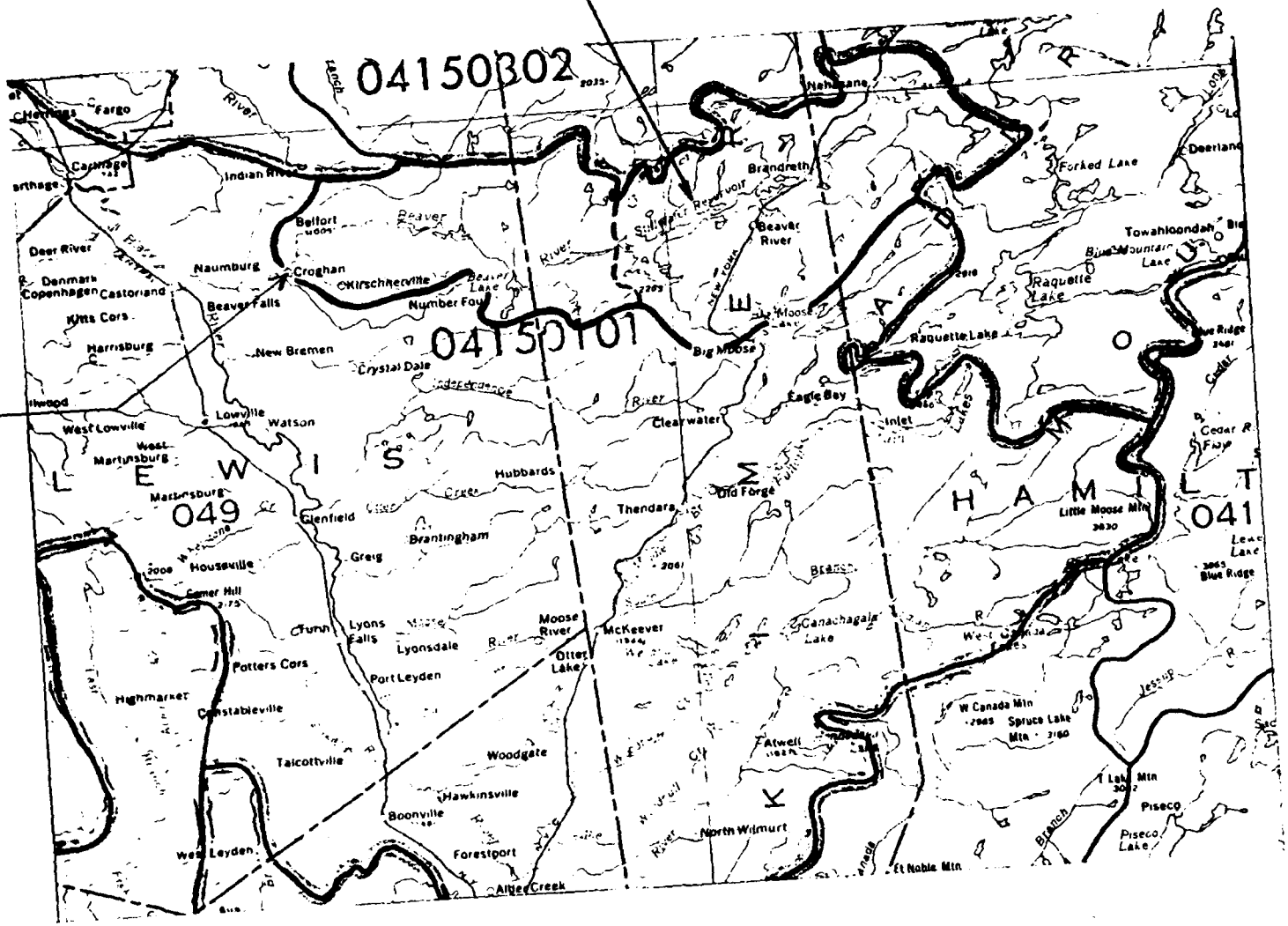
SUMMARY OF DISCHARGES

CROGHAN DAM
NY - 694

Elev.	H	Stoplog #1	Spillway #1	Log Sluice	Spillway #2	Stoplog #2	Stoplog #3	Spillway #3	Stoplog #4	Wall	TOTAL (cfs)
USGS 825.0	0	10	Crest	243	Crest	29	5	----	5	----	292
	0.2	24	13	251	6	43	13	Crest	13		363
	0.5	45	52	275	26	66	26	56	26		572
	1	80	147	334	75	103	48	244	48		1079
	1.5	↑	269	409	137	↑	↑	505	↑		1599
	2		413	498	209			821			2220
	2.5		575	597	289			1184			2924
	3	↓	753	705	377	↓	↓	1587			3701
	3.3	80	866	773	432	103	48	1847			4197
	3.5	85	879	782	439	106	51	2039	↓	↓	4429
	3.6	90	890	790	445	110	55	2132	48	Top	4560
	4	117	953	835	481	128	73	2218	60	25	4890
	4.5	165	1061	913	543	159	104	2424	91	85	5545
	4.8	199	1139	969	587	182	127	2582	115	131	6031

STILLWATER RESERVOIR
SUBBASIN

DAM
SITE



DRAINAGE AREA MAP - CROGHAN DAM NY - 694

04256500 STILLWATER RESERVOIR NEAR BEAVER RIVER, NY

LOCATION.--Lat 43°53'50", long 75°03'05", Herkimer County, Hydrologic Unit 04150101, in gatehouse at Stillwater Dam on Beaver River, 2.5 mi (4.0 km) upstream from Moshier Creek, and 7.5 mi (12.1 km) west of Beaver River Post Office.

DRAINAGE AREA.--172 mi² (445 km²).

PERIOD OF RECORD.--May 1908 to current year. Prior to February 1925, monthend contents only, published in WSP 1307. February 1925 to September 1937, published in WSP 824.

GAGE.--Nonrecording gage read once daily and prior to reservoir gate changes. Datum of gage is National Geodetic Vertical Datum, adjustment of 1912.

REMARKS.--Reservoir originally formed about 1885; enlarged at various times and in 1924 enlarged to a usable capacity of 4,623 mil ft³ (131 hm³) between elevations 1,650.3 ft (503.01 m) and 1,679.3 ft (511.85 m) (top of 24-inch flashboards in place throughout year). Elevation of gate sill of lowest outlet, 1,642.3 ft (500.57 m). Capacity below elevation 1,650.3 ft (503.01 m), 90 mil ft³ (2.55 hm³), is included in records presented herein, but is not ordinarily available for release. Reservoir is used to regulate flow of Beaver and Black Rivers for flood control, power development, and general public welfare.

EXTREMES FOR PERIOD OF RECORD.--Maximum observed elevation, 1,680.08 ft (512.088 m) May 20, 1969, contents, 4,939 mil ft³ (140 hm³); minimum observed since first filling, 1,644.80 ft (501.335 m) Mar. 25-27, 1949, contents, 8 mil ft³ (0.227 hm³).

EXTREMES FOR CURRENT YEAR.--Maximum observed elevation, 1,679.33 ft (511.866 m) May 2, contents, 4,722 mil ft³ (134 hm³); minimum observed, 1,659.69 ft (505.880 m) Mar. 5, contents, 786 mil ft³ (22.3 hm³).

Capacity table, current year (elevation, in feet, and contents, in millions of cubic feet)

1,658.0	604	1,670.0	2,431
1,660.0	821	1,675.0	3,556
1,665.0	1,518	1,680.0	4,916

ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979
INSTANTANEOUS OBSERVATIONS AT 0800

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1666.22	1665.52	1664.16	1664.81	1666.93	1660.90	1671.44	1679.23	1677.63	1674.68	1670.49	1667.36
2	1666.16	1665.43	1664.05	1665.34	1666.84	1660.55	1672.08	1679.33	1677.54	1674.62	1670.34	1667.42
3	1665.95	1665.37	1664.10	1665.97	1666.72	1660.18	1672.83	1679.31	1677.45	1674.54	1670.34	1667.61
4	1665.74	1665.38	1664.19	1666.38	1666.59	1659.83	1673.52	1679.30	1677.35	1674.44	1670.22	1667.67
5	1665.52	1665.44	1664.15	1666.61	1666.50	1659.69	1674.03	1679.30	1677.24	1674.36	1670.05	1667.62
6	1665.38	1665.50	1664.10	1666.66	1666.39	1660.54	1674.43	1679.25	1677.13	1674.26	1669.87	1667.60
7	1665.17	1665.41	1664.04	1667.05	1666.26	1661.61	1674.80	1679.03	1677.02	1674.17	1669.69	1668.26
8	1665.25	1665.31	1663.99	1667.28	1666.14	1662.45	1675.09	1678.78	1676.88	1674.06	1669.49	1668.65
9	1665.33	1665.18	1664.11	1667.31	1666.03	1663.02	1675.23	1678.82	1676.78	1673.96	1669.32	1668.90
10	1665.23	1665.07	1664.40	1667.33	1665.84	1663.44	1675.57	1678.86	1676.66	1673.85	1669.14	1668.98
11	1665.07	1664.95	1664.56	1667.31	1665.64	1663.78	1675.59	1678.84	1676.53	1673.75	1669.01	1668.97
12	1664.87	1665.00	1664.55	1667.29	1665.44	1664.08	1675.59	1678.82	1676.42	1673.65	1668.85	1668.95
13	1664.66	1665.03	1664.52	1667.25	1665.24	1664.32	1675.58	1678.80	1676.36	1673.55	1668.66	1668.90
14	1664.61	1664.90	1664.55	1667.42	1665.01	1664.62	1675.63	1678.80	1676.28	1673.45	1668.46	1668.86
15	1665.08	1664.78	1664.53	1667.67	1664.79	1664.77	1675.80	1678.76	1676.19	1673.33	1668.27	1669.31
16	1665.41	1664.69	1664.46	1667.73	1664.59	1664.88	1675.92	1678.68	1676.11	1673.23	1668.13	1669.65
17	1665.37	1664.57	1664.57	1667.73	1664.34	1664.95	1676.03	1678.63	1676.03	1673.14	1668.00	1669.80
18	1665.29	1664.46	1664.73	1667.70	1664.13	1664.95	1676.18	1678.56	1675.93	1672.96	1667.87	1669.81
19	1665.16	1664.67	1664.67	1667.65	1663.90	1664.91	1676.39	1678.48	1675.85	1672.77	1667.77	1669.89
20	1665.06	1664.83	1664.59	1667.57	1663.67	1664.87	1676.58	1678.39	1675.77	1672.59	1667.67	1669.88
21	1665.02	1664.75	1664.57	1667.55	1663.44	1664.83	1676.79	1678.29	1675.67	1672.40	1667.57	1669.93
22	1665.13	1664.67	1664.55	1667.55	1663.24	1664.87	1677.04	1678.20	1675.57	1672.20	1667.44	1669.99
23	1665.19	1664.55	1664.50	1667.55	1662.89	1665.01	1677.33	1678.11	1675.43	1672.03	1667.31	1670.10
24	1665.09	1664.49	1664.59	1667.51	1662.57	1665.52	1677.65	1678.01	1675.36	1671.83	1667.18	1670.11
25	1665.00	1664.44	1664.76	1667.48	1662.22	1666.87	1677.95	1677.95	1675.26	1671.65	1667.14	1670.05
26	1664.90	1664.50	1664.90	1667.43	1661.94	1668.06	1678.21	1677.87	1675.17	1671.45	1667.24	1669.98
27	1665.01	1664.57	1664.85	1667.36	1661.61	1668.76	1678.42	1677.82	1675.04	1671.33	1667.36	1669.91
28	1665.22	1664.47	1664.78	1667.28	1661.25	1669.23	1678.93	1677.78	1674.95	1671.16	1667.36	1669.83
29	1665.44	1664.38	1664.69	1667.22	---	1669.63	1679.10	1677.73	1674.86	1670.95	1667.34	1669.82
30	1665.59	1664.27	1664.60	1667.14	---	1670.00	1679.11	1677.64	1674.77	1670.78	1667.39	1669.92
31	1665.56	---	1664.67	1667.04	---	1670.52	---	1677.66	---	1670.58	1667.40	---
MEAN	1665.28	1664.89	1664.67	1667.13	1664.65	1664.57	1675.96	1678.55	1676.17	1672.96	1668.46	1669.12
MAX	1666.22	1665.52	1664.90	1667.73	1666.93	1670.52	1679.11	1679.33	1677.63	1674.68	1670.49	1670.11
MIN	1664.61	1664.27	1663.99	1664.81	1661.25	1659.69	1671.44	1677.64	1674.77	1670.58	1667.14	1667.36
†	1605	1392	1480	2035	946	2662	4681	4244	3484	2538	1925	2413
‡	-43.3	-82.2	+32.9	+207	-450	+641	+779	-163	-293	-353	-229	+188

CAL YR 1978 MEAN 1669.38 MAX 1678.91 MIN 1658.87 ‡ -79.1
WTR YR 1979 MEAN 1669.37 MAX 1679.33 MIN 1659.69 ‡ +21.9

† Contents, in millions of cubic feet, at 2400 hours on last day of month by interpolation.
‡ Change in contents, equivalent in cubic feet per second.

04258000 BEAVER RIVER AT CROGHAN, NY

LOCATION.--Lat 43°53'50", long 75°24'16", Lewis County, Hydrologic Unit 04150101, on left bank 1,200 ft (366 m) upstream from Black Creek, and 0.5 mi (0.8 km) west of Croghan.

DRAINAGE AREA.--294 mi^2 (761 km^2).

PERIOD OF RECORD.--September 1930 to current year.

REVISED RECORDS.--WSP 759: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 806.20 ft (245.730 m) National Geodetic Vertical Datum of 1929.

REMARKS.--Records good. Flow regulated by Stillwater Reservoir (see station 04256500). Between Stillwater Dam and this station, flow is further regulated by several powerplant ponds. Diurnal fluctuation at low and medium flow.

AVERAGE DISCHARGE.--49 years, 593 ft^3/s (16.79 m^3/s).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,100 ft^3/s (144 m^3/s) May 21, 1969, gage height, 6.98 ft (2.128 m); minimum, 11 ft^3/s (0.31 m^3/s) Jan. 22, 29, Feb. 4, 1967, gage height, 0.63 ft (0.192 m); minimum daily, 22 ft^3/s (0.62 m^3/s) July 18, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,110 ft^3/s (59.8 m^3/s) Apr. 28, gage height, 4.73 ft (1.442 m); minimum, 61 ft^3/s (1.73 m^3/s) Jan. 1, gage height, 1.19 ft (0.363 m); minimum daily, 108 ft^3/s (3.06 m^3/s) Dec. 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	300	714	480	250	899	772	1010	1380	899	238	500	318
2	286	596	520	906	720	865	955	1320	886	272	684	300
3	341	432	333	1030	552	872	1010	1070	838	303	515	266
4	422	289	369	1200	418	927	992	1130	636	373	475	470
5	480	253	465	1130	558	1310	1210	1100	665	515	391	413
6	510	253	436	1250	1130	1370	1170	1090	690	500	382	579
7	436	607	432	1300	942	1190	1110	1470	765	293	515	596
8	422	613	460	1110	772	999	1040	1540	727	247	624	427
9	446	515	485	636	678	970	955	1160	684	364	552	307
10	505	526	505	845	907	999	906	999	475	352	568	373
11	490	322	531	752	953	984	920	879	785	318	568	423
12	579	293	558	927	1010	920	941	811	702	341	325	329
13	541	293	490	541	721	607	825	408	838	391	360	413
14	505	352	547	391	720	648	778	665	563	344	470	325
15	427	505	531	927	700	955	752	671	422	318	624	504
16	714	404	480	1310	680	913	852	702	451	436	671	746
17	602	289	422	1260	720	852	948	765	356	413	432	575
18	791	373	418	1140	620	785	865	852	505	520	303	476
19	660	341	665	1070	740	831	778	838	422	526	250	485
20	739	377	552	621	740	906	765	811	436	515	460	515
21	772	386	500	708	859	934	708	798	422	465	485	536
22	382	369	510	929	906	948	714	798	404	480	373	340
23	470	360	427	1030	825	906	798	714	247	455	369	256
24	441	455	344	977	759	408	886	798	241	547	413	462
25	337	382	108	941	739	1150	886	733	364	648	303	386
26	275	352	404	899	727	1680	886	714	386	607	250	314
27	526	413	515	927	746	1500	1380	865	373	585	495	408
28	232	422	495	850	798	1090	1990	684	386	432	500	465
29	480	510	495	816	---	1020	1880	879	382	272	460	460
30	590	404	446	906	---	970	1710	920	250	505	541	322
31	739	---	253	899	---	999	---	920	---	590	485	---
TOTAL	15440	12400	14176	28478	21539	30280	30620	28484	16200	13165	14313	12789
MEAN	498	413	457	919	769	977	1021	919	540	425	462	426
MAX	791	714	665	1310	1130	1680	1990	1540	899	648	684	746
MIN	232	253	108	250	418	408	708	408	241	238	250	256

CAL YR 1978 TOTAL 259277 MEAN 710 MAX 2350 MIN 33
WTR YR 1979 TOTAL 237884 MEAN 652 MAX 1990 MIN 108

Table 2.--(Continued)

Station number	Station name	Latitude	Longitude	Co. code[1/]	Drainage area (mi²)	Date	Discharge[2/] (ft³/s)
04257950	Balsam Creek near Belfort.....	43 57 08	75 20 24	049	10.1	12- 7 66	14.5
						12-14-66	*9.77
						5-25-67	*8.47
						8-16-67	*5.43
						8-28-74	*6.6
04257960	Murmur Creek near Croghan.....	43 54 32	75 22 15	049	17.8	6- 6-67	*5.16
						5- 1-68	30.3
	Beaver River near Croghan.....	43 53 34	75 23 58	049		9- 5-20	143
						10-14-20	585
						11-20-20	362
						1-27-21	484
						5-14-21	268
						7- 9-21	423
						7-10-21	99
04258005	Black Creek at Croghan.....	43 53 27	75 23 52	049	22.4	6- 6-67	*12.6
						9- 6-67	*8.91
						5- 1-68	38.8
	Black River at Castorland.....	42 53 39	75 30 18	049	1,626	7-15-52	2,540
						7-17-52	1,610
						7-22-52	1,940
						7-29-52	1,290
						8- 6-52	1,360
						8-12-52	1,450
						4-26-55	7,340
						8-17-55	1,670
04258070	Swiss Creek near Naumburg.....	43 56 13	75 30 28	049	14.7	10- 6-66	*.99
						12-14-66	47.6
						5-25-67	*18.4
						6- 6-67	*1.58
						10- 5-67	*2.21
						8-28-74	*.53
04258080	Deer River, East Branch, near Parkers.....	43 42 58	75 41 25	049		7-26-67	*1.73
04258082	Deer River tributary, East Branch, near Parkers.....	43 43 01	75 41 14	049		7-26-67	*.71
04258085	Edick Creek at Parkers.....	43 43 56	75 40 18	049		7-26-67	*.89
04258088	Edick Creek at Rector.....	43 44 50	75 41 25	049		7-26-67	*1.92
04258090	Mulligan Creek at Parkers.....	43 43 58	75 41 06	049		7-26-67	*1.75
04258092	Mulligan Creek at Rector.....	43 44 45	75 41 27	049		7-26-67	*1.85
04258095	Edick Creek tributary near Rector.....	43 44 20	75 42 04	049		7-26-67	*.15
04258097	Edick Creek near Rector.....	43 44 15	75 42 25	049		7-26-67	*5.02
04258100	Deer River, East Branch, near Liberty Corners.....	43 44 30	75 43 12	049		7-26-67	*11.0
04258110	Luther Creek near Parkers.....	43 42 44	75 42 10	049		7-26-67	T
04258112	Luther Creek near Hooker.....	43 43 36	75 43 06	049		7-26-67	*1.16
04258114	Luther Creek near Liberty Corners.....	43 44 49	75 44 22	049		7-26-67	*1.55
04258125	Deer River, West Branch, near Hooker.....	43 42 29	75 44 00	049		7-26-67	*2.31

```
**********                                                    **********
FLOOD HYDROGRAPH PACKAGE (HEC-1)                              NEW YORK STATE
DAM SAFETY VERSION      JULY 1978                             DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********                                                    **********
    1                A   NY-694    CROGHAN DAM                          BLACK RIVER BASIN
    2                A             DEC - 540 BLACK  --  BEAVER RIVER    LEWIS COUNTY
    3                A             SUBBASINS                            CLARK UH
    4                B     96       2       0       0       0       0       0       0       0       0
    5                B1    5
    6                J     1        8       1
    7                J1  0.05    0.06    0.07    0.08    0.09    0.10    0.50       1
    8                K     0   STIBSN                                       1
    9                K1            STILLWATER RESV DAM SUBBASIN - DIRECT INPUT OF CLARK UH - INFLOW
   10                M     1       -1     178            293.1                                   1
   11                P            18.5      69      84      95     101
   12                T                                                     1     0.2             0.077
   13                U    30
   14                U1  475     1730    3402    5083    6283    5702    6170    5107    4161    3390
   15                U1 2762     2250    1833    1493    1217     991     807     658     536     437
   16                U1  356      290     236     192     157     128     104      85      69      56
   17                X   178      178       1
   18                K     1   STIDAM                                       1
   19                K1            STILLWATER RESV DAM - ROUTED OUTFLOW
   20                Y                                     1       1
   21                Y1    1                                                -1679.3      -1
   22                Y41679.3  1681.3  1683.3  1685.3  1687.3  1669.3  1691.3
   23                Y5    0    5760   12938   22216   33193   45631   59380
   24                $S 81634  112856  122502  137675  154302  171487  190125  209919
   25                $E  1675    1680  1681.3  1683.3  1685.3  1687.3  1689.3  1691.3
   26                $$1679.3
   27                $D1687.3       3     1.5    1000
   28                K     1   RIVER                                        1
   29                K1            CHANNEL ROUTING OF HYDROGRAPH TO DAM - BEAVER RIVER
   30                Y                                     1       1
   31                Y1    4
```

```
Y6 0.045   0.045   0.045    825     150  118630 0.00687
Y7   100     850     120     840     140     830     190     825     390     825
Y7   440     830     460     840     480     850
K      0  CROBSN                                      1
K1            CROGHAN DAM SUBBASIN - INFLOW HYDROGRAPH
M      1       0   115.1           293.1                             1
P             18.5      69      84      95     101
T                                                    1     0.1
V    7.4    6.87
X    292     292       1
K      2  CRODAM                                      1
K1            COMBINED HYDROGRAPHS AT DAM
K      1  CRODAM                                      1
K1            ROUTED OUTFLOW - CROGHAN DAM - SPILLCREST ELEV 825
Y                                    1       1
Y1     1                                           -825      -1
Y4   825   825.2   825.5     826   826.5     827   827.5     828   828.3   828.5
Y4 828.6     829   829.5   829.8
Y5   292     303     572    1079    1599    2220    2924    3701    4197    4429
Y5  4560    4890    5545    6031
$S   482     797
$F   825   829.8
$$   825
$D 829.8     3.2     1.5   206.5
K     99
A
A
A
A
A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	STIBSN
ROUTE HYDROGRAPH TO	STIDAM
ROUTE HYDROGRAPH TO	RIVER
RUNOFF HYDROGRAPH AT	CRUBSN
COMBINE 2 HYDROGRAPHS AT	CRODAM
ROUTE HYDROGRAPH TO	CRODAM
END OF NETWORK	

RUN DATE 12/22/80

KY-094 CROGHAN DAM
DEC - 340 BLACK -- BEAVER RIVER
SUBBASINS

BLACK RIVER BASIN
LEWIS COUNTY
CLARK UH

JOB SPECIFICATION

NC	ITHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
96	2	0	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 RTIO= 8 LRTIO= 1
RTICS= 0.05 0.06 0.07 0.08 0.09 0.10 0.50 1.00

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

SUB-AREA RUNOFF COMPUTATION

STILLWATER RESV DAM SUBBASIN - DIRECT INPLT OF CLARK UH - INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
STIBSN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	178.00	0.	293.10	0.	0.	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.	18.50	69.00	84.00	95.00	101.00	0.	0.

TRSPC COMPUTED BY THE PROGRAM IS 0.690

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.	0.	1.00	0.	0.	1.00	1.00	0.20	0.	0.08

GIVEN UNIT GRAPH, NUHGO= 30

475.	1730.	3402.	5083.	6283.	5702.	6170.	5107.	4161.	3390.
2762.	2250.	1833.	1493.	1217.	991.	807.	658.	536.	437.
356.	290.	236.	192.	157.	128.	104.	85.	69.	56.

UNIT GRAPH TOTALS 56160. CFS OR 0.98 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 178.00 QRCSN= 176.00 RTIOR= 1.00

END-OF-PERIOD FLOW

0 MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	2.00	1	0.02	0.00	0.01	179.	1.05	2.00	49	0.	0.	0.	643.
1.01	4.00	2	0.02	0.00	0.01	181.	1.05	4.00	50	0.	0.	0.	298.
1.01	6.00	3	0.02	0.00	0.01	185.	1.05	6.00	51	0.	0.	0.	184.
1.01	8.00	4	0.05	0.00	0.05	192.	1.05	8.00	52	0.	0.	0.	181.
1.01	10.00	5	0.05	0.00	0.05	204.	1.05	10.00	53	0.	0.	0.	180.
1.01	12.00	6	0.05	0.00	0.05	220.	1.05	12.00	54	0.	0.	0.	178.
1.01	14.00	7	0.19	0.01	0.17	247.	1.05	14.00	55	0.	0.	0.	178.
1.01	16.00	8	0.38	0.03	0.35	296.	1.05	16.00	56	0.	0.	0.	178.
1.01	18.00	9	0.15	0.01	0.14	370.	1.05	18.00	57	0.	0.	0.	178.
1.01	20.00	10	0.02	0.00	0.02	459.	1.05	20.00	58	0.	0.	0.	178.
1.01	22.00	11	0.02	0.00	0.02	541.	1.05	22.00	59	0.	0.	0.	178.
1.02	0.	12	0.02	0.00	0.02	584.	1.06	0.	60	0.	0.	0.	178.

1.01	14.00	7	0.19	0.01	0.17	247.	1.05	14.00	55	0.	0.	0.	178.
1.01	16.00	8	0.36	0.03	0.33	256.	1.05	16.00	56	0.	0.	0.	178.
1.01	18.00	9	0.15	0.01	0.14	370.	1.05	18.00	57	0.	0.	0.	178.
1.01	20.00	10	0.02	0.00	0.02	459.	1.05	20.00	58	0.	0.	0.	178.
1.01	22.00	11	0.02	0.00	0.02	541.	1.05	22.00	59	0.	0.	0.	178.
1.02	0.	12	0.02	0.00	0.02	594.	1.06	0.	60	0.	0.	0.	178.
1.02	2.00	13	0.24	0.02	0.22	592.	1.06	2.00	61	0.	0.	0.	178.
1.02	4.00	14	0.24	0.02	0.22	613.	1.06	4.00	62	0.	0.	0.	178.
1.02	6.00	15	0.24	0.02	0.22	632.	1.06	6.00	63	0.	0.	0.	178.
1.02	8.00	16	0.82	0.45	0.37	877.	1.06	8.00	64	0.	0.	0.	178.
1.02	10.00	17	0.82	0.45	0.37	1697.	1.06	10.00	65	0.	0.	0.	178.
1.02	12.00	18	0.82	0.45	0.37	3242.	1.06	12.00	66	0.	0.	0.	178.
1.02	14.00	19	2.95	2.58	0.37	6546.	1.06	14.00	67	0.	0.	0.	178.
1.02	16.00	20	6.02	5.65	0.37	14490.	1.06	16.00	68	0.	0.	0.	178.
1.02	18.00	21	2.39	2.02	0.37	27855.	1.06	18.00	69	0.	0.	0.	178.
1.02	20.00	22	0.36	0.03	0.33	44616.	1.06	20.00	70	0.	0.	0.	178.
1.02	22.00	23	0.36	0.03	0.33	60046.	1.06	22.00	71	0.	0.	0.	178.
1.03	0.	24	0.36	0.03	0.33	68064.	1.07	0.	72	0.	0.	0.	178.
1.03	2.00	25	0.	0.	0.	67236.	1.07	2.00	73	0.	0.	0.	178.
1.03	4.00	26	0.	0.	0.	64991.	1.07	4.00	74	0.	0.	0.	178.
1.03	6.00	27	0.	0.	0.	56651.	1.07	6.00	75	0.	0.	0.	178.
1.03	8.00	28	0.	0.	0.	46469.	1.07	8.00	76	0.	0.	0.	178.
1.03	10.00	29	0.	0.	0.	37953.	1.07	10.00	77	0.	0.	0.	178.
1.03	12.00	30	0.	0.	0.	30959.	1.07	12.00	78	0.	0.	0.	178.
1.03	14.00	31	0.	0.	0.	25289.	1.07	14.00	79	0.	0.	0.	178.
1.03	16.00	32	0.	0.	0.	20634.	1.07	16.00	80	0.	0.	0.	178.
1.03	18.00	33	0.	0.	0.	16843.	1.07	18.00	81	0.	0.	0.	178.
1.03	20.00	34	0.	0.	0.	13757.	1.07	20.00	82	0.	0.	0.	178.
1.03	22.00	35	0.	0.	0.	11236.	1.07	22.00	83	0.	0.	0.	178.
1.04	0.	36	0.	0.	0.	9187.	1.08	0.	84	0.	0.	0.	178.
1.04	2.00	37	0.	0.	0.	7519.	1.08	2.00	85	0.	0.	0.	178.
1.04	4.00	38	0.	0.	0.	6159.	1.08	4.00	86	0.	0.	0.	178.
1.04	6.00	39	0.	0.	0.	5051.	1.08	6.00	87	0.	0.	0.	178.
1.04	8.00	40	0.	0.	0.	4149.	1.08	8.00	88	0.	0.	0.	178.
1.04	10.00	41	0.	0.	0.	3412.	1.08	10.00	89	0.	0.	0.	178.
1.04	12.00	42	0.	0.	0.	2811.	1.08	12.00	90	0.	0.	0.	178.
1.04	14.00	43	0.	0.	0.	2322.	1.08	14.00	91	0.	0.	0.	178.
1.04	16.00	44	0.	0.	0.	1926.	1.08	16.00	92	0.	0.	0.	178.
1.04	18.00	45	0.	0.	0.	1602.	1.08	18.00	93	0.	0.	0.	178.
1.04	20.00	46	0.	0.	0.	1317.	1.08	20.00	94	0.	0.	0.	178.
1.04	22.00	47	0.	0.	0.	1085.	1.08	22.00	95	0.	0.	0.	178.
1.05	0.	48	0.	0.	0.	895.	1.09	0.	96	0.	0.	0.	178.

SUM	16.63	11.83	4.80	681563.
	(422.)	(301.)	(122.)	(19299.71)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	68064.	65939.	45644.	18578.	681384.
CMS	1927.	1867.	1293.	526.	19295.
INCHES		3.45	9.54	11.65	11.87
MM		87.53	242.35	295.92	301.49
AC-FT		32697.	90534.	110544.	112625.
THOUS CU M		40331.	111672.	136354.	138921.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIO 1

9.	9.	9.	10.	10.	11.	12.	15.	18.	23.
27.	29.	30.	31.	32.	44.	85.	162.	327.	724.
1393.	2231.	3002.	3403.	3362.	3250.	2833.	2323.	1898.	1550.
1264.	1032.	842.	688.	562.	459.	376.	308.	253.	207.
171.	141.	116.	94.	80.	66.	54.	45.	32.	15.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.

11.	11.	11.	11.	11.	11.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4084.	3956.	2739.	1115.	40883.
CMS	116.	112.	78.	32.	1158.
INCHES		0.21	0.57	0.70	0.71
MM		5.25	14.54	17.76	18.09
AC-FT		1962.	5432.	6633.	6758.
THOUS CU M		2420.	6700.	8181.	8335.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIO 3

12.	13.	13.	13.	14.	15.	17.	21.	26.	32.
38.	41.	41.	43.	44.	61.	115.	227.	458.	1014.
1950.	3123.	4203.	4764.	4766.	4549.	3966.	3253.	2657.	2170.
1770.	1444.	1179.	963.	787.	643.	526.	431.	354.	290.
239.	197.	163.	135.	112.	92.	76.	63.	45.	21.
13.	13.	13.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4764.	4616.	3195.	1300.	47697.
CMS	135.	131.	90.	37.	1351.
INCHES		0.24	0.67	0.82	0.83
MM		6.13	16.96	20.71	21.10
AC-FT		2289.	6337.	7738.	7884.
THOUS CU M		2823.	7817.	9545.	9725.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIO 4

14.	14.	15.	15.	16.	18.	20.	24.	30.	37.
43.	47.	47.	49.	51.	70.	136.	259.	524.	1159.
2228.	3569.	4804.	5445.	5379.	5199.	4532.	3718.	3036.	2480.
2023.	1651.	1347.	1101.	899.	735.	602.	493.	404.	332.
273.	225.	186.	154.	128.	105.	87.	72.	51.	24.
15.	15.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5445.	5275.	3652.	1486.	54511.
CMS	154.	149.	103.	42.	1544.
INCHES		0.28	0.76	0.93	0.95
MM		7.00	19.39	23.67	24.12
AC-FT		2616.	7243.	8844.	9010.
THOUS CU M		3227.	8934.	10908.	11114.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIO 5

16.	16.	17.	17.	18.	20.	22.	27.	33.	41.
49.	53.	53.	55.	57.	79.	153.	292.	589.	1304.
2507.	4015.	5404.	6126.	6051.	5849.	5099.	4182.	3416.	2790.
2274.	1857.	1516.	1238.	1011.	827.	677.	554.	455.	373.
307.	253.	209.	173.	144.	119.	98.	81.	58.	27.
17.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
16.	16.	16.	16.	16.	16.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIC 6

13.	13.	13.	17.	21.	22.	25.	30.	37.	46.
54.	58.	59.	61.	63.	58.	170.	324.	655.	1445.
2785.	4462.	6005.	6806.	6724.	6499.	5665.	4647.	3795.	3100.
2529.	2063.	1684.	1374.	1124.	919.	752.	616.	505.	415.
341.	281.	232.	193.	160.	132.	109.	90.	64.	30.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	18.	18.	18.	18.	18.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6806.	6594.	4564.	1858.	68138.
CMS	193.	187.	129.	53.	1929.
INCHES		0.34	0.95	1.17	1.19
MM		8.75	24.24	29.69	30.15
AC-FT		3270.	9053.	11054.	11263.
THOLS CU M		4033.	11167.	13635.	13892.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIC 7

89.	90.	92.	96.	102.	110.	124.	148.	185.	230.
270.	292.	296.	307.	316.	439.	848.	1621.	3273.	7245.
13927.	22308.	30023.	34032.	33613.	32496.	28326.	23235.	18977.	15499.
12644.	10317.	8421.	6873.	5619.	4593.	3760.	3079.	2526.	2074.
1706.	1405.	1161.	963.	801.	668.	543.	444.	321.	149.
92.	91.	90.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	34032.	32970.	22822.	9288.	340692.
CMS	964.	934.	646.	263.	9647.
INCHES		1.72	4.77	5.83	5.93
MM		43.76	121.18	147.96	150.75
AC-FT		16349.	45267.	55272.	56313.
THOLS CU M		20166.	55836.	68177.	69461.

HYDROGRAPH AT STASTIBSN FOR PLAN 1, RTIC 8

179.	181.	185.	192.	204.	220.	247.	296.	370.	459.
541.	584.	592.	613.	632.	877.	1697.	3242.	6546.	14490.
27855.	44616.	60046.	68064.	67235.	64991.	56651.	46469.	37953.	30995.
25289.	20634.	16843.	13757.	11233.	9187.	7519.	6159.	5051.	4145.
3412.	2811.	2322.	1926.	1602.	1317.	1085.	895.	643.	298.
184.	181.	180.	178.	178.	178.	178.	178.	178.	178.
178.	178.	178.	178.	178.	178.	178.	178.	178.	178.
178.	178.	178.	178.	178.	178.	178.	178.	178.	178.
178.	178.	178.	178.	178.	178.	178.	178.	178.	178.
178.	178.	178.	178.	178.	178.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	68064.	65939.	45644.	18578.	681384.
CMS	1927.	1867.	1293.	526.	19295.
INCHES		3.45	9.54	11.65	11.87
MM		87.53	242.35	295.92	301.49
AC-FT		32697.	90534.	110544.	112625.
THOLS CU M		40331.	111672.	136354.	138921.

	87.33	242.35	295.92	301.49
C-FT	32607.	90534.	110544.	112623.
TOTAL CUM	40331.	111672.	136354.	139921.

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HYDROGRAPH ROUTING

STILLWATER RESV DAM - ROUTED OUTFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
STIDAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.	0.	0.	-1679.	-1

STAGE	1679.30	1681.30	1683.30	1685.30	1687.30	1689.30	1691.30
FLOW	0.	5760.00	12936.00	22216.00	33193.00	45631.00	59380.00
CAPACITY=	81634.	112856.	122502.	137675.	154002.	171487.	190125.	209919.
ELEVATION=	1675.	1680.	1681.	1683.	1685.	1687.	1689.	1691.

CREL	SPWID	COOW	EXPW	ELEVL	CCOL	CAREA	EXPL
1679.3	0.	0.	0.	0.	0.	0.	0.

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1687.3	3.0	1.5	1000.

STATION STIDAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	1.	2.	2.	3.	4.	4.	5.	6.	7.
9.	10.	11.	12.	14.	16.	19.	27.	43.	78.
150.	271.	443.	644.	845.	1026.	1172.	1274.	1335.	1363.
1366.	1350.	1320.	1280.	1233.	1180.	1125.	1068.	1011.	954.
899.	845.	793.	743.	695.	650.	607.	566.	528.	491.
456.	423.	393.	365.	339.	315.	292.	272.	253.	235.
218.	203.	189.	176.	163.	152.	142.	132.	123.	115.
107.	100.	93.	87.	81.	76.	71.	66.	62.	58.
55.	51.	48.	45.	43.	40.	38.	36.	34.	32.
30.	29.	27.	26.	25.	24.				

STORAGE

108486.	108488.	108489.	108490.	108491.	108493.	108494.	108495.	108497.	108500.
108503.	108508.	108509.	108512.	108515.	108519.	108526.	108543.	108578.	108654.
108810.	109073.	109445.	109882.	110311.	110710.	111027.	111247.	111379.	111440.
111447.	111413.	111348.	111261.	111159.	111044.	110924.	110801.	110677.	110554.
110434.	110316.	110203.	110095.	109992.	109893.	109800.	109712.	109629.	109549.
109473.	109403.	109337.	109276.	109220.	109168.	109119.	109074.	109032.	108994.
108958.	108925.	108894.	108866.	108839.	108815.	108792.	108771.	108751.	108733.
108717.	108701.	108687.	108673.	108661.	108649.	108639.	108629.	108620.	108611.
108604.	108596.	108590.	108583.	108577.	108572.	108567.	108563.	108558.	108554.
108551.	108547.	108544.	108541.	108538.	108536.				

STAGE

1679.3 1679.3 1679.3 1679.3 1679.3 1679.3

PEAK OUTFLOW IS 1917. AT TIME 62.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1917.	1904.	1760.	1157.	47516.
CMS	54.	54.	50.	33.	1346.
INCHES		0.10	0.37	0.73	0.83
MM		2.53	9.34	18.43	21.02
AC-FT		944.	3491.	6886.	7854.
THOUS CU M		1165.	4306.	8494.	9688.

STATION STIDAM, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	2.	3.	4.	5.	6.	7.	8.	9.	11.
13.	15.	18.	20.	22.	25.	31.	43.	69.	125.
240.	434.	710.	1034.	1355.	1644.	1881.	2041.	2124.	2164.
2169.	2148.	2108.	2053.	1983.	1899.	1811.	1720.	1629.	1538.
1448.	1362.	1278.	1198.	1121.	1048.	979.	914.	852.	793.
736.	684.	635.	590.	548.	509.	473.	439.	408.	379.
353.	328.	305.	284.	264.	246.	229.	213.	199.	185.
173.	161.	150.	140.	131.	123.	115.	107.	101.	94.
88.	83.	78.	73.	69.	65.	61.	58.	55.	52.
49.	46.	44.	42.	40.	38.				

STORAGE

108487.	108469.	108491.	108493.	108495.	108497.	108499.	108502.	108505.	108508.
108513.	108518.	108523.	108528.	108533.	108539.	108551.	108578.	108633.	108756.
109005.	109426.	110024.	110727.	111424.	112050.	112563.	112921.	113135.	113236.
113250.	113197.	113093.	112951.	112784.	112603.	112412.	112214.	112016.	111819.
111625.	111437.	111256.	111082.	110913.	110758.	110606.	110466.	110332.	110204.
110081.	109958.	109842.	109764.	109673.	109588.	109510.	109437.	109370.	109308.
109250.	109196.	109146.	109100.	109058.	109018.	108981.	108947.	108916.	108887.
108859.	108834.	108811.	108789.	108769.	108751.	108734.	108718.	108703.	108689.
108676.	108665.	108654.	108644.	108634.	108626.	108618.	108610.	108603.	108597.
108591.	108586.	108580.	108576.	108571.	108567.				

STAGE

1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.4	1679.5	1679.5	1679.7	1679.8	1679.9	1680.0	1680.0	1680.0	1680.1
1680.1	1680.0	1680.0	1680.0	1680.0	1680.0	1679.9	1679.9	1679.9	1679.8
1679.8	1679.8	1679.7	1679.7	1679.7	1679.7	1679.6	1679.6	1679.6	1679.6
1679.6	1679.5	1679.5	1679.5	1679.5	1679.5	1679.5	1679.5	1679.4	1679.4
1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.4
1679.4	1679.4	1679.4	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.3	1679.3	1679.3	1679.3	1679.3	1679.3				

PEAK OUTFLOW IS 2169. AT TIME 62.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2169.	2156.	2005.	1323.	54335.
CMS	61.	61.	57.	37.	1539.
INCHES		0.11	0.42	0.83	0.95
MM		2.86	10.65	21.07	24.04
AC-FT		1069.	3977.	7870.	8981.
THOUS CU M		1319.	4906.	9708.	11078.

STATION STIDAM, PLAN 1, RATIO 5

1679.3 1679.3 1679.3 1679.3 1679.3 1679.3

PEAK OUTFLOW IS 2651. AT TIME 62.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2651.	2633.	2461.	1647.	
CMS	75.	75.	70.	47.	67810.
INCHES		0.14	0.51	1.03	1920.
MM		3.49	13.07	26.24	1.18
AC-FT		1306.	4881.	9802.	30.00
THOUS CU M		1610.	6021.	12090.	11208.
					13825.

STATION STIDAM, PLAN 1, RATIO 7

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

7.	13.	18.	24.	29.	35.	41.	48.	57.	68.
81.	96.	110.	124.	138.	155.	191.	267.	427.	782.
1502.	2613.	4078.	5826.	7933.	9824.	11373.	12457.	13141.	13508.
13559.	13372.	13013.	12597.	12120.	11592.	11034.	10461.	9885.	9314.
8756.	8214.	7692.	7193.	6713.	6268.	5841.	5455.	5177.	4870.
4575.	4297.	4035.	3790.	3560.	3344.	3142.	2952.	2774.	2607.
2451.	2304.	2166.	2037.	1894.	1765.	1642.	1530.	1426.	1329.
1239.	1156.	1079.	1007.	940.	878.	821.	768.	718.	672.
630.	590.	554.	520.	489.	459.	432.	407.	384.	363.
343.	324.	307.	291.	276.	262.				

STORAGE

108499.	108512.	108525.	108537.	108549.	108561.	108574.	108589.	108608.	108632.
108661.	108692.	108724.	108754.	108784.	108822.	108859.	109065.	109410.	110180.
111741.	114395.	118167.	122643.	127096.	131093.	134367.	136650.	138031.	139678.
138767.	136439.	137807.	136955.	135945.	134830.	133650.	132439.	131221.	130015.
128834.	127685.	126586.	125532.	124523.	123575.	122674.	121819.	121001.	120210.
119450.	118732.	118058.	117426.	116834.	116278.	115756.	115268.	114809.	114375.
113976.	113597.	113243.	112910.	112600.	112312.	112045.	111802.	111576.	111367.
111172.	110991.	110824.	110668.	110523.	110389.	110265.	110149.	110042.	109943.
109851.	109765.	109686.	109612.	109544.	109481.	109422.	109368.	109318.	109271.
109228.	109187.	109150.	109116.	109084.	109054.				

STAGE

1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.3	1679.3	1679.3	1679.3	1679.3	1679.4	1679.4	1679.4	1679.4	1679.6
1679.8	1680.2	1680.7	1681.3	1681.9	1682.4	1682.9	1683.2	1683.3	1683.4
1683.4	1683.4	1683.3	1683.2	1683.1	1682.9	1682.8	1682.6	1682.4	1682.3
1682.1	1682.0	1681.8	1681.7	1681.6	1681.4	1681.3	1681.2	1681.1	1681.0
1680.9	1680.8	1680.7	1680.6	1680.5	1680.5	1680.4	1680.3	1680.3	1680.2
1680.2	1680.1	1680.1	1680.0	1680.0	1679.9	1679.9	1679.8	1679.8	1679.8
1679.7	1679.7	1679.7	1679.6	1679.6	1679.6	1679.6	1679.6	1679.5	1679.5
1679.5	1679.5	1679.5	1679.5	1679.5	1679.5	1679.5	1679.4	1679.4	1679.4
1679.4	1679.4	1679.4	1679.4	1679.4	1679.4				

PEAK OUTFLOW IS 13559. AT TIME 62.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13559.	13441.	12326.	8079.	
CMS	384.	381.	349.	229.	337536.
INCHES		0.70	2.58	5.07	9559.
MM		17.84	65.45	128.69	5.88
AC-FT		6665.	24448.	48072.	149.35
THOUS CU M		8221.	30156.	59296.	55791.
					68817.

STATION STIDAM, PLAN 1, RATIO 8

PEAK OUTFLOW IS 13559. AT TIME 72.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13559.	13441.	12326.	8079.	337536.
CMS	384.	381.	349.	229.	9558.
INCHES		0.70	2.58	5.07	5.88
MM		17.84	65.45	128.69	149.35
AC-FT		6665.	24448.	48072.	55791.
THOUS CU M		8221.	30156.	59296.	68817.

STATION STIDAM, PLAN 1, RATIO 8

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

13.	25.	37.	48.	59.	70.	82.	96.	113.	135.
162.	191.	220.	248.	276.	311.	382.	534.	855.	1564.
2952.	4620.	6320.	12514.	17379.	21751.	25559.	28124.	29514.	30003.
29820.	29144.	28118.	26853.	25437.	23935.	22399.	20986.	19606.	18260.
16961.	15718.	14538.	13425.	12469.	11640.	10855.	10112.	9409.	8737.
8097.	7502.	6951.	6441.	5970.	5573.	5238.	4924.	4629.	4352.
4093.	3850.	3621.	3407.	3207.	3018.	2842.	2676.	2521.	2375.
2239.	2111.	1987.	1854.	1731.	1619.	1515.	1418.	1329.	1245.
1168.	1096.	1030.	968.	910.	857.	808.	762.	719.	680.
643.	610.	578.	549.	522.	497.				

STORAGE

108513.	108540.	108565.	108589.	108613.	108637.	108663.	108693.	108730.	108778.
108836.	108900.	108963.	109023.	109063.	109158.	109313.	109644.	110338.	111877.
115011.	120357.	127913.	136773.	145490.	153184.	159327.	163413.	165626.	166405.
166114.	165037.	163402.	161338.	159133.	156740.	154292.	151837.	149409.	147040.
144754.	142568.	140491.	138531.	136683.	134932.	133271.	131702.	130216.	128794.
127443.	126164.	125019.	123942.	122945.	122021.	121158.	120348.	119588.	118876.
118207.	117580.	116992.	116441.	115924.	115439.	114984.	114557.	114157.	113782.
113430.	113100.	112792.	112504.	112237.	111995.	111770.	111560.	111366.	111185.
111019.	110862.	110717.	110583.	110459.	110343.	110236.	110137.	110045.	109959.
109880.	109807.	109738.	109675.	109615.	109562.				

STAGE

1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3	1679.3
1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.4	1679.5	1679.6	1679.8
1680.3	1681.0	1682.0	1683.2	1684.3	1685.2	1685.9	1686.4	1686.6	1686.7
1686.7	1686.6	1686.4	1686.1	1685.9	1685.6	1685.3	1685.0	1684.7	1684.4
1684.2	1683.9	1683.6	1683.4	1683.2	1682.9	1682.7	1682.5	1682.3	1682.1
1682.0	1681.8	1681.6	1681.5	1681.4	1681.2	1681.1	1681.0	1680.9	1680.8
1680.7	1680.6	1680.6	1680.5	1680.4	1680.3	1680.3	1680.2	1680.2	1680.1
1680.1	1680.0	1680.0	1679.9	1679.9	1679.9	1679.8	1679.8	1679.8	1679.7
1679.7	1679.7	1679.7	1679.6	1679.6	1679.6	1679.6	1679.6	1679.5	1679.5
1679.5	1679.5	1679.5	1679.5	1679.5	1679.5				

PEAK OUTFLOW IS 30003. AT TIME 60.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	30003.	29717.	26689.	16452.	675260.
CMS	850.	841.	756.	466.	19121.
INCHES		1.55	5.58	10.32	11.76
MM		39.45	141.71	262.07	298.78
AC-FT		14736.	52937.	97897.	111613.
THOUS CU M		18176.	65297.	120755.	137673.

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[illegible] IN [illegible], AT TIME [illegible] HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	30003.	29717.	26639.	16452.	675260.
CMS	850.	841.	756.	466.	19121.
INCHES		1.55	5.53	10.32	11.76
MM		39.45	141.71	262.07	298.78
AC-FT		14736.	52937.	97897.	111613.
THOUS CU M		18176.	65297.	120755.	137673.

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HYDROGRAPH ROUTING

CHANNEL ROUTING OF HYDROGRAPH TC DAM - BEAVER RIVER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
RIVER	1	0	0	0	C	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	C	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
4	0	0	0.	0.	0.	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELEVT	ELMAX	RLNTH	SEL
0.0450	0.0450	0.0450	825.0	850.0	118600.	0.00687

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

100.00 850.00 120.00 840.00 140.00 830.00 190.00 825.00 390.00 825.00
440.00 830.00 460.00 840.00 480.00 850.00

STORAGE	0.	763.63	1621.54	2573.72	3618.67	4706.61	5813.41	6939.06	8083.56	9246.93
	10429.14	11630.21	12850.14	14086.92	15346.55	16623.05	17918.39	19232.59	20565.65	21917.56
OUTFLOW	0.	887.74	2893.20	5847.51	9826.67	15169.22	21429.83	28566.10	36546.36	45346.24
	54946.63	65332.26	76490.80	88412.21	101088.28	114512.29	128678.74	143583.15	159221.92	175592.17
STAGE	825.00	826.32	827.63	828.95	830.26	831.58	832.89	834.21	835.53	836.84
	838.16	839.47	840.79	842.11	843.42	844.74	846.05	847.37	848.68	850.00
FLOW	0.	887.74	2893.20	5847.51	9826.67	15169.22	21429.83	28566.10	36546.36	45346.24
	54946.63	65332.26	76490.80	88412.21	101088.28	114512.29	128678.74	143583.15	159221.92	175592.17

STATION RIVER, PLAN 1, RTIC 1

OUTFLOW

0.	0.	0.	0.	1.	1.	1.	2.	2.	3.
4.	4.	5.	6.	7.	8.	10.	11.	13.	16.
22.	33.	54.	93.	155.	244.	362.	507.	685.	913.
1218.	1314.	1345.	1346.	1329.	1297.	1256.	1208.	1156.	1101.
1045.	988.	936.	896.	874.	851.	821.	784.	745.	703.
661.	620.	580.	541.	505.	470.	437.	406.	378.	351.
326.	303.	281.	261.	243.	226.	210.	195.	182.	169.
157.	147.	136.	127.	118.	110.	103.	96.	90.	84.
78.	73.	69.	64.	60.	56.	53.	50.	47.	44.
41.	39.	37.	35.	33.	31.				

MAXIMUM STORAGE = 298.

MAXIMUM STAGE IS 827.0

STATION RIVER, PLAN 1, RTIC 4

OUTFLOW

0.	0.	0.	1.	1.	2.	2.	3.	4.	5.
6.	7.	8.	10.	11.	13.	15.	18.	21.	25.
34.	52.	87.	141.	248.	402.	647.	1083.	1623.	1881.
2027.	2107.	2142.	2142.	2113.	2074.	2014.	1941.	1859.	1772.
1682.	1592.	1502.	1415.	1329.	1247.	1169.	1094.	1023.	957.
906.	877.	853.	821.	782.	739.	694.	650.	606.	565.
526.	489.	454.	422.	393.	365.	340.	316.	294.	273.
254.	237.	221.	205.	192.	179.	167.	155.	145.	135.
127.	118.	111.	104.	97.	91.	85.	80.	75.	71.
67.	63.	59.	56.	53.	50.				

STOR

0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	2.	2.	2.	3.	3.	4.	4.	5.
7.	11.	19.	32.	53.	87.	139.	212.	270.	297.
313.	321.	325.	325.	322.	316.	311.	304.	295.	285.
276.	266.	257.	247.	238.	229.	221.	213.	205.	198.
193.	189.	184.	177.	168.	159.	149.	140.	130.	121.
113.	105.	98.	91.	84.	79.	73.	68.	63.	59.
55.	51.	47.	44.	41.	38.	36.	33.	31.	29.
27.	25.	24.	22.	21.	20.	18.	17.	16.	15.
14.	14.	13.	12.	11.	11.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.1	825.1	825.1	825.2	825.4	825.6	826.0	826.4	826.8	827.0
827.1	827.1	827.1	827.1	827.1	827.1	827.1	827.0	827.0	826.9
826.8	826.8	826.7	826.7	826.6	826.6	826.5	826.5	826.4	826.4
826.3	826.4	826.3	826.2	826.2	826.1	826.0	826.0	825.9	825.8
825.8	825.7	825.7	825.6	825.6	825.5	825.5	825.5	825.4	825.4
825.4	825.4	825.3	825.3	825.3	825.3	825.2	825.2	825.2	825.2
825.2	825.2	825.2	825.2	825.1	825.1	825.1	825.1	825.1	825.1
825.1	825.1	825.1	825.1	825.1	825.1				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2142.	2132.	1978.	1303.	5410.
CMS	61.	60.	56.	37.	1532.
INCHES		0.11	0.41	0.82	0.94
MM		2.83	10.50	20.75	23.94
AC-FT		1057.	3922.	7753.	8942.
THOUS CU M		1304.	4838.	9563.	11030.

MAXIMUM STORAGE = 325.

MAXIMUM STAGE IS 827.1

STATION RIVER, PLAN 1, RTIC 5

OUTFLOW

0.	0.	0.	1.	1.	2.	3.	3.	4.	5.
6.	8.	9.	11.	13.	15.	17.	20.	23.	29.
39.	59.	97.	167.	281.	465.	783.	1391.	1851.	2101.
2252.	2339.	2377.	2380.	2354.	2308.	2246.	2173.	2090.	1999.
1902.	1802.	1701.	1602.	1506.	1413.	1324.	1239.	1158.	1082.
1009.	945.	896.	872.	845.	810.	769.	725.	681.	636.
594.	553.	515.	479.	445.	414.	385.	358.	333.	310.

MAXIMUM STORAGE = 376.

MAXIMUM STAGE IS 827.5

STATION RIVER, PLAN 1, RTIC 7

OUTFLOW

0.	0.	2.	3.	5.	10.	14.	19.	24.	29.
35.	42.	51.	60.	71.	83.	95.	110.	129.	159.
215.	337.	679.	1844.	3662.	6253.	8641.	10702.	12216.	12957.
13387.	13528.	13402.	13097.	12689.	12225.	11713.	11163.	10594.	10033.
9565.	9084.	8539.	8003.	7492.	7003.	6538.	6109.	5759.	5473.
5167.	4861.	4569.	4291.	4030.	3785.	3555.	3340.	3139.	2958.
2822.	2692.	2544.	2396.	2253.	2115.	1979.	1847.	1721.	1602.
1493.	1391.	1297.	1210.	1121.	1053.	984.	925.	886.	867.
839.	805.	767.	726.	685.	645.	606.	569.	535.	503.
473.	445.	419.	395.	373.	352.				

STOR

0.	0.	0.	1.	1.	2.	3.	4.	5.	6.
8.	9.	11.	13.	15.	18.	21.	24.	28.	34.
46.	72.	146.	293.	483.	670.	827.	949.	1026.	1064.
1086.	1093.	1087.	1071.	1050.	1027.	1001.	973.	944.	915.
887.	856.	820.	785.	751.	719.	689.	661.	636.	613.
589.	564.	540.	518.	497.	477.	459.	441.	425.	411.
398.	384.	368.	352.	337.	322.	308.	294.	280.	267.
254.	245.	235.	225.	217.	209.	201.	195.	191.	186.
180.	173.	165.	156.	147.	139.	130.	122.	115.	108.
102.	96.	90.	85.	81.	76.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.1	825.1	825.1	825.1	825.1	825.1	825.1	825.2	825.2	825.2
825.3	825.5	826.0	826.9	828.1	829.1	829.9	830.5	830.9	831.0
831.1	831.2	831.1	831.1	831.0	830.9	830.7	830.6	830.5	830.3
830.2	830.0	829.8	829.7	829.5	829.3	829.2	829.0	828.9	828.8
828.6	828.5	828.4	828.3	828.1	828.0	827.9	827.8	827.7	827.7
827.6	827.5	827.4	827.3	827.2	827.1	827.0	826.9	826.9	826.8
826.7	826.6	826.6	826.5	826.5	826.4	826.4	826.3	826.3	826.3
826.2	826.2	826.1	826.1	826.0	826.0	825.9	825.8	825.8	825.7
825.7	825.7	825.6	825.6	825.6	825.5				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13528.	13391.	12278.	8033.	335901.
CMS	383.	379.	348.	227.	9512.
INCHES		0.70	2.57	5.04	5.85
MM		17.77	65.19	127.96	148.63
AC-FT		6640.	24353.	47802.	55521.
THOLS CU M		8190.	30039.	58962.	68484.

MAXIMUM STORAGE = 1093.

MAXIMUM STAGE IS 831.2

STATION RIVER, PLAN 1, RTIC 8

OUTFLOW

0.	1.	3.	7.	12.	19.	28.	37.	47.	58.
71.	85.	101.	120.	141.	165.	191.	220.	258.	318.
449.	856.	2482.	5586.	10537.	16536.	21574.	25544.	28110.	29557.
29977.	29713.	29006.	28011.	26790.	25363.	23863.	22350.	20992.	19717.

CMS	313.	379.	340.	227.	9512.
INCHES		0.73	2.57	5.04	5.45
MM		17.77	65.19	127.98	140.63
AC-FT		6640.	24353.	47802.	55521.
THOUS CU M		8190.	30039.	58962.	68484.

MAXIMUM STORAGE = 1093.

MAXIMUM STAGE IS 831.2

STATION RIVER, PLAN 1, RTIO 8

OUTFLOW

0.	1.	3.	7.	12.	19.	28.	37.	47.	58.
71.	85.	101.	120.	141.	165.	191.	220.	258.	318.
449.	856.	2402.	5585.	10537.	16536.	21574.	25544.	28110.	29557.
29977.	29713.	29006.	28011.	26790.	25363.	23863.	22350.	20992.	19717.
18365.	17054.	15818.	14725.	13713.	12708.	11829.	11041.	10294.	9667.
9119.	8487.	7861.	7283.	6749.	6260.	5849.	5546.	5230.	4918.
4623.	4347.	4088.	3845.	3617.	3403.	3203.	3019.	2869.	2750.
2610.	2465.	2325.	2190.	2060.	1932.	1808.	1691.	1582.	1480.
1386.	1299.	1218.	1142.	1072.	1008.	949.	904.	879.	859.
832.	800.	765.	728.	692.	657.				

STOR

0.	0.	1.	1.	3.	4.	6.	8.	10.	13.
15.	18.	22.	26.	30.	36.	41.	47.	55.	68.
95.	134.	361.	622.	941.	1237.	1459.	1616.	1717.	1770.
1785.	1776.	1751.	1713.	1665.	1608.	1549.	1490.	1434.	1378.
1318.	1260.	1205.	1154.	1102.	1051.	1007.	966.	928.	894.
858.	817.	776.	738.	703.	671.	644.	619.	594.	569.
545.	523.	502.	482.	464.	446.	430.	416.	403.	390.
375.	360.	345.	330.	318.	303.	289.	277.	265.	254.
244.	235.	226.	218.	211.	204.	197.	193.	189.	185.
179.	172.	164.	157.	149.	141.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.1	825.1	825.1
825.1	825.1	825.1	825.2	825.2	825.2	825.3	825.3	825.4	825.5
825.7	826.3	827.4	828.8	830.4	831.9	832.9	833.7	834.1	834.4
834.4	834.4	834.3	834.1	833.9	833.6	833.3	833.1	832.8	832.5
832.3	832.0	831.7	831.5	831.2	831.0	830.8	830.6	830.4	830.2
830.0	829.8	829.6	829.4	829.2	829.1	828.9	828.8	828.7	828.5
828.4	828.3	828.2	828.1	828.0	827.9	827.8	827.7	827.6	827.5
827.4	827.4	827.3	827.2	827.1	827.0	826.9	826.8	826.8	826.7
826.6	826.6	826.5	826.5	826.4	826.4	826.4	826.3	826.3	826.3
826.2	826.2	826.1	826.1	826.0	826.0				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	29977.	29657.	26631.	16403.	672189.
CMS	849.	840.	754.	464.	19034.
INCHES		1.55	5.57	10.29	11.71
MM		39.37	141.40	261.28	297.42
AC-FT		14706.	52822.	97602.	111106.
THOUS CU M		18140.	65155.	120391.	137047.

MAXIMUM STORAGE = 1785.

MAXIMUM STAGE IS 834.4

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	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	29977.	29657.	26631.	16403.	672189.
CMS	849.	840.	754.	464.	19034.
INCHES		1.55	5.57	10.29	11.71
MM		39.37	141.40	261.28	297.42
AC-FT		14706.	52822.	97602.	111106.
THOUS CU M		18140.	65155.	120391.	137047.

MAXIMUM STORAGE = 1785.

MAXIMUM STAGE IS 834.4

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SUB-AREA RUNOFF COMPUTATION

CROGHAN DAM SUBBASIN - INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CROBSN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	115.10	0.	293.10	0.	0.	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.	18.50	69.00	84.00	95.00	101.00	0.	0.

TRSPC COMPUTED BY THE PROGRAM IS 0.990

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.	0.	1.00	0.	0.	1.00	1.00	0.10	0.	0.

UNIT HYDROGRAPH DATA

TC= 7.40 R= 6.87 NTA= 0

RECESSION DATA

STRTQ= 292.00 QRCSN= 292.00 RTIOR= 1.00

UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG= 6.38 HOURS, CP= 0.56 VOL= 1.00

937. 3338. 5720. 6344. 5281. 3939. 2938. 2191. 1634. 1219.
909. 678. 506. 377. 281. 210. 157. 117. 87. 65.
48.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	2.00	1	0.02	0.	0.02	292.	1.05	2.00	49	0.	0.	0.	292.
1.01	4.00	2	0.02	0.	0.02	292.	1.05	4.00	50	0.	0.	0.	292.
1.01	6.00	3	0.02	0.	0.02	292.	1.05	6.00	51	0.	0.	0.	292.
1.01	8.00	4	0.05	0.	0.05	292.	1.05	8.00	52	0.	0.	0.	292.
1.01	10.00	5	0.05	0.	0.05	292.	1.05	10.00	53	0.	0.	0.	292.
1.01	12.00	6	0.05	0.	0.05	292.	1.05	12.00	54	0.	0.	0.	292.
1.01	14.00	7	0.19	0.	0.19	292.	1.05	14.00	55	0.	0.	0.	292.
1.01	16.00	8	0.31	0.	0.38	292.	1.05	16.00	56	0.	0.	0.	292.
1.01	18.00	9	0.15	0.	0.15	292.	1.05	18.00	57	0.	0.	0.	292.
1.01	20.00	10	0.02	0.	0.02	292.	1.05	20.00	58	0.	0.	0.	292.
1.01	22.00	11	0.02	0.	0.02	292.	1.05	22.00	59	0.	0.	0.	292.
1.02	0.	12	0.02	0.	0.02	292.	1.06	0.	60	0.	0.	0.	292.
1.02	2.00	13	0.24	0.04	0.20	329.	1.06	2.00	61	0.	0.	0.	292.
1.02	4.00	14	0.24	0.04	0.20	463.	1.06	4.00	62	0.	0.	0.	292.
1.02	6.00	15	0.24	0.04	0.20	695.	1.06	6.00	63	0.	0.	0.	292.
1.02	8.00	16	0.82	0.62	0.20	1502.	1.06	8.00	64	0.	0.	0.	292.

1.01	2.00	1	0.02	0.	0.02	292.	1.05	2.00	49	0.	0.	0.	292.
1.01	4.00	2	0.02	0.	0.02	292.	1.05	4.00	50	0.	0.	0.	292.
1.01	6.00	3	0.02	0.	0.02	292.	1.05	6.00	51	0.	0.	0.	292.
1.01	8.00	4	0.05	0.	0.05	292.	1.05	8.00	52	0.	0.	0.	292.
1.01	10.00	5	0.05	0.	0.05	292.	1.05	10.00	53	0.	0.	0.	292.
1.01	12.00	6	0.05	0.	0.05	292.	1.05	12.00	54	0.	0.	0.	292.
1.01	14.00	7	0.19	0.	0.19	292.	1.05	14.00	55	0.	0.	0.	292.
1.01	16.00	8	0.38	0.	0.38	292.	1.05	16.00	56	0.	0.	0.	292.
1.01	18.00	9	0.15	0.	0.15	292.	1.05	18.00	57	0.	0.	0.	292.
1.01	20.00	10	0.02	0.	0.02	292.	1.05	20.00	58	0.	0.	0.	292.
1.01	22.00	11	0.02	0.	0.02	292.	1.05	22.00	59	0.	0.	0.	292.
1.02	0.	12	0.02	0.	0.02	292.	1.06	0.	60	0.	0.	0.	292.
1.02	2.00	13	0.24	0.04	0.20	329.	1.06	2.00	61	0.	0.	0.	292.
1.02	4.00	14	0.24	0.04	0.20	463.	1.06	4.00	62	0.	0.	0.	292.
1.02	6.00	15	0.24	0.04	0.20	695.	1.06	6.00	63	0.	0.	0.	292.
1.02	8.00	16	0.82	0.62	0.20	1502.	1.06	8.00	64	0.	0.	0.	292.
1.02	10.00	17	0.82	0.62	0.20	3666.	1.06	10.00	65	0.	0.	0.	292.
1.02	12.00	18	0.82	0.62	0.20	7160.	1.06	12.00	66	0.	0.	0.	292.
1.02	14.00	19	2.95	2.75	0.20	12972.	1.06	14.00	67	0.	0.	0.	292.
1.02	16.00	20	6.02	5.82	0.20	26125.	1.06	16.00	68	0.	0.	0.	292.
1.02	18.00	21	2.39	2.19	0.20	47587.	1.06	18.00	69	0.	0.	0.	292.
1.02	20.00	22	0.36	0.16	0.20	66300.	1.06	20.00	70	0.	0.	0.	292.
1.02	22.00	23	0.36	0.16	0.20	70772.	1.06	22.00	71	0.	0.	0.	292.
1.03	0.	24	0.36	0.16	0.20	61702.	1.07	0.	72	0.	0.	0.	292.
1.03	2.00	25	0.	0.	0.	48585.	1.07	2.00	73	0.	0.	0.	292.
1.03	4.00	26	0.	0.	0.	37263.	1.07	4.00	74	0.	0.	0.	292.
1.03	6.00	27	0.	0.	0.	28294.	1.07	6.00	75	0.	0.	0.	292.
1.03	8.00	28	0.	0.	0.	21267.	1.07	8.00	76	0.	0.	0.	292.
1.03	10.00	29	0.	0.	0.	15936.	1.07	10.00	77	0.	0.	0.	292.
1.03	12.00	30	0.	0.	0.	11961.	1.07	12.00	78	0.	0.	0.	292.
1.03	14.00	31	0.	0.	0.	8995.	1.07	14.00	79	0.	0.	0.	292.
1.03	16.00	32	0.	0.	0.	6784.	1.07	16.00	80	0.	0.	0.	292.
1.03	18.00	33	0.	0.	0.	5134.	1.07	18.00	81	0.	0.	0.	292.
1.03	20.00	34	0.	0.	0.	3902.	1.07	20.00	82	0.	0.	0.	292.
1.03	22.00	35	0.	0.	0.	2953.	1.07	22.00	83	0.	0.	0.	292.
1.04	0.	36	0.	0.	0.	2298.	1.08	0.	84	0.	0.	0.	292.
1.04	2.00	37	0.	0.	0.	1765.	1.08	2.00	85	0.	0.	0.	292.
1.04	4.00	38	0.	0.	0.	1368.	1.08	4.00	86	0.	0.	0.	292.
1.04	6.00	39	0.	0.	0.	1072.	1.08	6.00	87	0.	0.	0.	292.
1.04	8.00	40	0.	0.	0.	775.	1.08	8.00	88	0.	0.	0.	292.
1.04	10.00	41	0.	0.	0.	442.	1.08	10.00	89	0.	0.	0.	292.
1.04	12.00	42	0.	0.	0.	325.	1.08	12.00	90	0.	0.	0.	292.
1.04	14.00	43	0.	0.	0.	310.	1.08	14.00	91	0.	0.	0.	292.
1.04	16.00	44	0.	0.	0.	300.	1.08	16.00	92	0.	0.	0.	292.
1.04	18.00	45	0.	0.	0.	292.	1.08	18.00	93	0.	0.	0.	292.
1.04	20.00	46	0.	0.	0.	292.	1.08	20.00	94	0.	0.	0.	292.
1.04	22.00	47	0.	0.	0.	292.	1.08	22.00	95	0.	0.	0.	292.
1.05	0.	48	0.	0.	0.	292.	1.09	0.	96	0.	0.	0.	292.
									SUM	16.63	13.24	3.39	517640.
										(422.)	(336.)	(86.)	(14657.93)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	70772.	63892.	37225.	13892.	517347.
CMS	2004.	1809.	1054.	393.	14650.
INCHES		5.16	12.03	13.47	13.94
MM		131.16	305.66	342.22	354.01
AC-FT		31682.	73834.	82664.	85512.
THOUS CU M		39079.	91073.	101965.	105477.

HYDROGRAPH AT STACPOBSN FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4954.	4472.	2606.	972.	36214.
CMS	140.	127.	74.	28.	1025.
INCHES		0.36	0.84	0.94	0.98
MM		9.18	21.40	23.96	24.78
AC-FT		2218.	5168.	5787.	5986.
THOUS CU M		2736.	6375.	7138.	7383.

HYDROGRAPH AT STACROSSN FOR PLAN 1, RTIO 4

23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	23.	26.	37.	56.	120.	293.	973.	1038.	2090.
3801.	5304.	5662.	4936.	3887.	2981.	2263.	1701.	1275.	957.
720.	543.	411.	312.	239.	184.	141.	109.	86.	62.
35.	26.	25.	24.	23.	23.	23.	23.	23.	23.
23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	23.	23.	23.	23.	23.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5662.	5111.	2978.	1111.	41388.
CMS	160.	145.	84.	31.	1172.
INCHES		0.41	0.96	1.08	1.11
MM		10.49	24.45	27.38	28.32
AC-FT		2535.	5907.	6613.	6841.
THOUS CU M		3126.	7286.	8157.	8438.

HYDROGRAPH AT STACROSSN FOR PLAN 1, RTIO 5

26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	30.	42.	63.	135.	330.	644.	1167.	2351.
4276.	5967.	6370.	5553.	4373.	3354.	2546.	1914.	1434.	1076.
810.	611.	462.	351.	268.	207.	159.	123.	97.	70.
40.	29.	28.	27.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
26.	26.	26.	26.	26.	26.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6370.	5750.	3350.	1250.	46561.
CMS	180.	163.	95.	35.	1318.
INCHES		0.46	1.08	1.21	1.25
MM		11.80	27.51	30.80	31.86
AC-FT		2851.	6645.	7440.	7696.
THOUS CU M		3517.	8197.	9177.	9493.

HYDROGRAPH AT STACROSSN FOR PLAN 1, RTIO 6

29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	33.	46.	70.	150.	367.	716.	1297.	2612.
4751.	6630.	7077.	6170.	4859.	3726.	2829.	2127.	1594.	1196.
900.	678.	513.	390.	298.	230.	177.	137.	107.	77.
44.	32.	31.	30.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.				

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME

HYDROGRAPH AT STACROBSN FOR PLAN 1, RTIO 6

29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	33.	46.	71.	150.	367.	716.	1297.	2612.
4751.	6630.	7077.	6170.	4853.	3726.	2825.	2127.	1594.	1196.
900.	678.	513.	390.	293.	230.	177.	137.	107.	77.
44.	32.	31.	30.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7077.	6389.	3722.	1389.	51735.
CMS	200.	181.	105.	39.	1465.
INCHES		0.52	1.20	1.35	1.39
MM		13.12	30.57	34.22	35.40
AC-FT		3168.	7383.	8266.	8551.
THOUS CU M		3908.	9107.	10196.	10548.

HYDROGRAPH AT STACROBSN FOR PLAN 1, RTIO 7

146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
146.	146.	164.	231.	348.	751.	1833.	3580.	6486.	13062.
23754.	33150.	35386.	30851.	24293.	18631.	14147.	10633.	7968.	5980.
4498.	3392.	2567.	1951.	1492.	1149.	883.	684.	536.	387.
221.	162.	155.	150.	146.	146.	146.	146.	146.	146.
146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
146.	146.	146.	146.	146.	146.	146.	146.	146.	146.
146.	146.	146.	146.	146.	146.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	35386.	31946.	18612.	6946.	258674.
CMS	1002.	905.	527.	197.	7325.
INCHES		2.58	6.02	6.74	6.97
MM		65.58	152.83	171.11	177.00
AC-FT		15841.	36917.	41332.	42796.
THOUS CU M		19540.	45536.	50982.	52739.

HYDROGRAPH AT STACROBSN FOR PLAN 1, RTIO 8

292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	329.	463.	693.	1502.	3666.	7160.	12972.	26125.
47507.	66300.	70772.	61702.	48585.	37263.	28294.	21267.	15936.	11961.
8995.	6784.	5134.	3902.	2983.	2298.	1765.	1368.	1072.	775.
442.	325.	310.	300.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	70772.	63892.	37225.	13892.	517347.
CMS	2004.	1809.	1054.	393.	14650.
INCHES		5.16	12.03	13.47	13.94
MM		131.16	305.66	342.22	354.01
AC-FT		31682.	73834.	82664.	85512.
THOUS CU M		39079.	91073.	101965.	105477.

COMBINE HYDROGRAPHS

COMBINED HYDROGRAPHS AT DAM

	ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	CRODAM	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIO 1

15.	15.	15.	15.	15.	16.	16.	16.	17.	18.
18.	19.	22.	29.	42.	83.	193.	369.	662.	1322.
2397.	3346.	3593.	3178.	2584.	2107.	1776.	1570.	1482.	1511.
1667.	1653.	1602.	1541.	1477.	1412.	1344.	1276.	1209.	1139.
1067.	1005.	951.	911.	889.	866.	835.	799.	759.	718.
676.	635.	594.	556.	519.	484.	452.	421.	392.	365.
341.	317.	296.	276.	251.	240.	225.	210.	196.	184.
172.	161.	151.	142.	133.	125.	118.	111.	104.	98.
93.	88.	83.	79.	75.	71.	68.	64.	61.	59.
56.	54.	51.	49.	47.	46.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3593.	3245.	2225.	1418.	59546.
CMS	102.	92.	63.	40.	1686.
INCHES		0.10	0.28	0.54	0.63
MM		2.62	7.17	13.71	16.00
AC-FT		1609.	4413.	6436.	9842.
THOLS CU M		1985.	5444.	10406.	12140.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIO 2

18.	18.	18.	18.	18.	19.	19.	20.	20.	21.
22.	23.	26.	35.	50.	100.	231.	443.	794.	1587.
2876.	4017.	4311.	3813.	3101.	2530.	2138.	1916.	1889.	2072.
2055.	1996.	1926.	1851.	1774.	1696.	1614.	1533.	1453.	1369.
1282.	1207.	1139.	1073.	1009.	953.	911.	889.	864.	831.
793.	751.	708.	664.	622.	581.	542.	506.	471.	439.
410.	382.	356.	332.	310.	289.	270.	253.	236.	221.
207.	194.	182.	170.	160.	150.	141.	133.	125.	118.
112.	106.	100.	95.	90.	85.	81.	77.	74.	70.
67.	64.	62.	59.	57.	55.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4311.	3894.	2709.	1703.	71524.
CMS	122.	110.	77.	48.	2025.
INCHES		0.12	0.34	0.65	0.76
MM		3.14	8.74	16.47	19.22
AC-FT		1931.	5373.	10132.	11822.
THOLS CU M		2382.	6628.	12498.	14582.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIO 3

20.	21.	21.	21.	21.	22.	22.	23.	24.	25.
25.	26.	30.	41.	59.	117.	270.	517.	926.	1851.
3356.	4687.	5030.	4449.	3618.	2953.	2512.	2311.	2441.	2468.
2409.	2332.	2249.	2162.	2072.	1980.	1886.	1791.	1697.	1600.
1499.	1411.	1332.	1254.	1179.	1108.	1039.	976.	926.	898.
875.	844.	806.	764.	720.	675.	632.	590.	551.	514.
479.	447.	417.	389.	363.	339.	316.	296.	276.	259.
242.	227.	213.	199.	187.	176.	165.	156.	147.	138.
131.	124.	117.	111.	105.	100.	95.	90.	86.	82.
79.	75.	72.	69.	67.	64.				

131.	124.	117.	111.	105.	100.	95.	91.	86.	82.
79.	75.	72.	69.	67.	64.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5030.	4544.	3194.	1988.	83527.
CMS	142.	129.	90.	56.	2365.
INCHES		0.14	0.41	0.76	0.88
MM		3.66	10.30	19.24	22.44
AC-FT		2253.	6335.	11832.	13806.
THOUS CU M		2779.	7813.	14595.	17030.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIC 4

23.	23.	24.	24.	24.	25.	26.	26.	27.	28.
29.	30.	34.	47.	67.	133.	309.	590.	1058.	2115.
3835.	5356.	5748.	5084.	4135.	3395.	2910.	2765.	2898.	2838.
2747.	2650.	2552.	2454.	2356.	2258.	2155.	2051.	1945.	1834.
1717.	1618.	1527.	1439.	1353.	1271.	1192.	1117.	1046.	980.
929.	900.	877.	844.	805.	762.	718.	673.	630.	588.
549.	512.	478.	446.	416.	389.	363.	339.	317.	297.
278.	260.	244.	229.	215.	202.	190.	179.	168.	159.
150.	142.	134.	127.	120.	114.	109.	104.	99.	94.
90.	86.	83.	79.	76.	74.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5748.	5193.	3675.	2273.	95468.
CMS	163.	147.	104.	64.	2704.
INCHES		0.16	0.47	0.87	1.01
MM		4.19	11.85	21.99	25.66
AC-FT		2575.	7290.	13526.	15783.
THOUS CU M		3176.	8992.	16684.	19468.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIC 5

26.	26.	27.	27.	27.	28.	29.	30.	31.	32.
33.	34.	39.	52.	75.	150.	347.	664.	1191.	2380.
4314.	6026.	6467.	5720.	4653.	3818.	3329.	3305.	3285.	3178.
3062.	2949.	2839.	2731.	2623.	2515.	2405.	2296.	2187.	2069.
1942.	1831.	1729.	1629.	1532.	1439.	1350.	1265.	1185.	1108.
1036.	971.	923.	898.	871.	836.	795.	752.	707.	663.
620.	579.	541.	505.	471.	440.	411.	384.	359.	336.
315.	295.	276.	259.	243.	229.	215.	202.	191.	180.
170.	160.	152.	144.	136.	129.	123.	117.	112.	107.
102.	98.	94.	90.	86.	83.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6467.	5842.	4152.	2557.	107378.
CMS	183.	165.	118.	72.	3041.
INCHES		0.19	0.53	0.97	1.14
MM		4.71	13.39	24.74	28.85
AC-FT		2897.	8235.	15217.	17749.
THOUS CU M		3573.	10158.	18769.	21892.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIC 6

29.	29.	30.	30.	30.	31.	32.	33.	34.	35.
36.	38.	43.	58.	84.	167.	386.	738.	1323.	2644.
4704.	6695.	7186.	6356.	5172.	4254.	3705.	3806.	3663.	3512.
3375.	3249.	3128.	3009.	2893.	2772.	2651.	2532.	2414.	2290.
2158.	2042.	1932.	1822.	1714.	1610.	1511.	1416.	1326.	1240.
1159.	1081.	1009.	949.	912.	890.	859.	821.	778.	734.
689.	645.	604.	564.	527.	492.	460.	430.	402.	374.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIC 7

142.	146.	148.	149.	152.	156.	160.	165.	170.	175.
181.	188.	215.	291.	418.	834.	1928.	3690.	6615.	13221.
23969.	33447.	36065.	32695.	28155.	24885.	22788.	21335.	20184.	16937.
17885.	16920.	15969.	15048.	14181.	13374.	12595.	11547.	11130.	10420.
9784.	9247.	8694.	8153.	7633.	7149.	6684.	6254.	5905.	5615.
5313.	5047.	4715.	4437.	4176.	3931.	3701.	3486.	3285.	3104.
2968.	2838.	2690.	2542.	2399.	2261.	2125.	1993.	1867.	1746.
1639.	1537.	1443.	1356.	1274.	1199.	1130.	1071.	1032.	1013.
985.	951.	913.	872.	831.	791.	752.	715.	681.	649.
619.	591.	565.	541.	519.	498.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	36065.	33194.	24621.	14331.	544575.
CMS	1021.	940.	697.	406.	16836.
INCHES		1.05	3.13	5.46	6.29
MM		26.76	79.39	138.64	159.77
AC-FT		16460.	48836.	85278.	98277.
THOLS CU M		20309.	60236.	105188.	121223.

SUM OF 2 HYDROGRAPHS AT CRODAM PLAN 1 RTIC 8

292.	293.	295.	299.	304.	311.	320.	329.	339.	350.
363.	377.	430.	583.	835.	1667.	3857.	7380.	13230.	26443.
47956.	67155.	73255.	67287.	59123.	53798.	49867.	46811.	44046.	41517.
38973.	36497.	34140.	31913.	29773.	27661.	25629.	23727.	22064.	20491.
18806.	17379.	16128.	15024.	14005.	13000.	12121.	11333.	10586.	9959.
9411.	8779.	8153.	7575.	7041.	6552.	6141.	5838.	5522.	5210.
4915.	4639.	4380.	4137.	3909.	3695.	3495.	3311.	3161.	3042.
2902.	2757.	2617.	2482.	2352.	2224.	2100.	1983.	1874.	1772.
1678.	1591.	1510.	1434.	1364.	1300.	1241.	1186.	1171.	1151.
1124.	1092.	1057.	1020.	984.	949.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	73255.	67694.	51772.	29264.	1189536.
CMS	2074.	1923.	1466.	829.	33684.
INCHES		2.15	6.57	11.15	12.56
MM		54.73	166.94	283.09	319.64
AC-FT		33666.	102687.	174135.	196618.
THOLS CU M		41527.	126663.	214792.	242524.

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

HYDROGRAPH ROUTING

ROUTED OUTFLOW - CROGHAN DAM - SPILLCREST ELEV 825

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CRODAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.	0.	0.	-825.	-1

STAGE	825.00	825.20	825.50	826.00	826.50	827.00	827.50	828.00	828.30	828.50
	828.60	829.00	829.50	829.80						

ROUTED OUTFLOW - CROGHAN DAM - SPILLCREST ELEV 825

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CRODAM	1	0	0	0	C	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	C	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0. 0.		C.	-825.	-1

STAGE	825.00	825.20	825.50	826.00	826.50	827.00	827.50	828.00	828.30	828.50
	828.60	829.00	829.50	829.60						
FLOW	292.00	363.00	572.00	1079.00	1599.00	2220.00	2924.00	3701.00	4197.00	4429.00
	4560.00	4690.00	5545.00	6031.00						

CAPACITY= 482. 797.

ELEVATION= 825. 830.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
825.0	0.	0.	0.	0.	0.	0.	0.

DAM DATA

TOPEL	COQD	EXPD	CAREA
829.8	3.2	1.5	207.

STATION CRODAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	464.	1034.
1998.	3112.	3586.	3320.	2745.	2234.	1877.	1628.	1510.	1495.
1602.	1673.	1617.	1565.	1502.	1437.	1370.	1302.	1235.	1167.
1095.	1028.	972.	926.	897.	875.	848.	814.	775.	734.
692.	651.	610.	571.	540.	504.	470.	438.	409.	381.
358.	340.	319.	299.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.				

STORAGE

482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.	482.	482.	505.	545.
602.	654.	674.	668.	633.	614.	595.	582.	575.	574.
581.	584.	581.	578.	574.	570.	566.	562.	557.	553.
549.	544.	541.	538.	536.	534.	533.	530.	528.	525.
523.	520.	517.	515.	512.	508.	505.	502.	499.	497.
494.	491.	487.	485.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.3	826.0
826.8	827.6	827.9	827.8	827.4	827.0	826.7	826.5	826.4	826.4
826.5	826.6	826.5	826.5	826.4	826.3	826.3	826.2	826.1	826.1
826.0	826.0	825.9	825.8	825.8	825.8	825.8	825.7	825.7	825.7
825.6	825.6	825.5	825.5	825.5	825.4	825.4	825.3	825.3	825.2

AC-FT	2270.	6311.	11831.	15167.
THOUS CU M	2807.	7784.	14594.	18708.

STATION CRODAM, PLAN 1, RATIC 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	403.	842.	1691.
3321.	4886.	5728.	5327.	4507.	3539.	3020.	2796.	2854.	2872.
2771.	2679.	2580.	2482.	2384.	2286.	2187.	2085.	1979.	1870.
1755.	1649.	1559.	1473.	1385.	1302.	1222.	1146.	1073.	1006.
949.	911.	886.	857.	821.	779.	735.	690.	647.	604.
566.	533.	497.	464.	433.	404.	378.	356.	339.	319.
299.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.				

STORAGE

482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.	482.	459.	532.	565.
663.	744.	785.	766.	716.	672.	650.	640.	643.	644.
639.	635.	630.	625.	621.	616.	611.	606.	601.	595.
589.	583.	578.	572.	567.	562.	557.	552.	547.	543.
539.	537.	535.	533.	531.	528.	525.	522.	520.	517.
514.	511.	508.	506.	502.	499.	497.	494.	491.	487.
483.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	482.	482.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.3	825.8	826.6
827.8	829.0	829.6	829.8	828.6	827.9	827.6	827.4	827.5	827.5
827.4	827.3	827.3	827.2	827.1	827.0	827.0	826.9	826.8	826.7
826.6	826.5	826.5	826.4	826.3	826.2	826.1	826.1	826.0	825.9
825.9	825.8	825.8	825.8	825.7	825.7	825.7	825.6	825.6	825.5
825.5	825.4	825.4	825.3	825.3	825.3	825.2	825.2	825.1	825.1
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0				

PEAK OUTFLO. IS 5728. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5728.	5250.	3661.	2273.	103096.
CMS	162.	149.	104.	64.	2919.
INCHES		0.17	0.46	0.87	1.09
MM		4.23	11.60	21.99	27.70
AC-FT		2603.	7261.	13528.	17041.
THOUS CU M		3211.	8956.	16687.	21019.

STATION CRODAM, PLAN 1, RATIC 5

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	292.	292.	292.	455.	962.	1917.
3761.	5469.	6536.	5913.	4982.	4132.	3384.	3295.	3295.	3211.
3090.	2978.	2869.	2762.	2653.	2545.	2436.	2327.	2218.	2108.
1983.	1865.	1761.							

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	825.0	825.0	825.0	826.0	826.0
828.3	827.0	830.4	830.0	829.5	828.6	828.1	828.0	828.0	827.9
827.5	827.7	827.7	827.5	827.5	827.4	827.3	827.2	827.2	827.1
827.0	826.9	826.8	826.7	826.6	826.5	826.4	826.4	826.3	826.2
826.1	826.0	826.0	825.9	825.8	825.8	825.8	825.8	825.7	825.7
825.6	825.6	825.5	825.5	825.5	825.4	825.4	825.3	825.3	825.2
825.2	825.2	825.1	825.1	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.0	825.0				

PEAK OUTFLOW IS 7339. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7339.	6540.	4605.	2842.	125787.
CMS	208.	185.	130.	80.	3562.
INCHES		0.21	0.58	1.08	1.33
MM		5.27	14.85	27.49	33.80
AC-FT		3243.	9133.	16910.	20791.
THOUS CU M		4000.	11265.	20858.	25646.

STATION CRODAM, PLAN 1, RATIO 7

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

292.	292.	292.	292.	292.	292.	292.	292.	292.	292.
292.	292.	292.	292.	331.	594.	1481.	3142.	5640.	12155.
22677.	32834.	36129.	33161.	28543.	25151.	22959.	21469.	20296.	19084.
17978.	17035.	16071.	15156.	14279.	13470.	12691.	11941.	11222.	10516.
9867.	9319.	8778.	8233.	7719.	7228.	6765.	6334.	5978.	5688.
5401.	5101.	4818.	4571.	4253.	3991.	3755.	3541.	3335.	3149.
3000.	2873.	2734.	2583.	2439.	2300.	2166.	2036.	1907.	1786.
1673.	1571.	1479.	1389.	1305.	1228.	1156.	1093.	1047.	1020.
997.	985.	928.	888.	847.	806.	767.	730.	694.	661.
630.	602.	575.	554.	532.	510.				

STORAGE

482.	482.	482.	482.	482.	482.	482.	482.	482.	482.
482.	482.	482.	482.	489.	516.	573.	655.	781.	950.
1145.	1305.	1354.	1310.	1240.	1186.	1150.	1124.	1104.	1083.
1063.	1046.	1028.	1010.	993.	977.	961.	945.	930.	915.
900.	887.	874.	861.	847.	834.	821.	808.	795.	783.
770.	755.	739.	719.	702.	690.	681.	672.	663.	656.
649.	644.	637.	630.	623.	617.	610.	604.	597.	590.
584.	579.	573.	567.	562.	557.	553.	549.	546.	544.
542.	540.	538.	535.	533.	530.	527.	525.	523.	521.
519.	517.	515.	513.	511.	509.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0
825.0	825.0	825.0	825.0	825.1	825.5	826.4	827.6	829.6	832.1
835.1	837.5	838.3	837.6	836.5	835.7	835.2	834.8	834.5	834.2
833.9	833.6	833.3	833.0	832.8	832.5	832.3	832.1	831.8	831.6
831.4	831.2	831.0	830.8	830.6	830.4	830.2	830.0	829.8	829.6
829.4	829.2	828.9	828.6	828.3	828.2	828.0	827.9	827.8	827.6
827.5	827.5	827.4	827.3	827.2	827.1	827.0	826.9	826.7	826.7
826.6	826.5	826.4	826.3	826.2	826.1	826.1	826.0	826.0	825.9
825.9	825.9	825.9	825.8	825.8	825.7	825.7	825.7	825.6	825.6
825.6	825.5	825.5	825.5	825.4	825.4				

PEAK OUTFLOW IS 36129, AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	36129.	33326.	24573.	14321.	595987.
CMS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PEAK OUTFLOW IS 36129. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	36129.	33326.	24573.	14321.	555987.
CMS	1023.	944.	696.	406.	15876.
INCHES		1.06	3.12	5.45	6.31
MM		26.87	79.24	138.54	160.15
AC-FT		16525.	48740.	85217.	98510.
THOUS CU M		20384.	60120.	105114.	121511.

STATION CROD4M, PLAN 1, RATIO 8

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

292.	292.	293.	295.	299.	308.	311.	318.	328.	339.
350.	362.	400.	499.	721.	1319.	3105.	6288.	12495.	24533.
46027.	65592.	73351.	67968.	59675.	54103.	50182.	47008.	44295.	41702.
39212.	36694.	34356.	32104.	29975.	27858.	25824.	23910.	22223.	20657.
19994.	17514.	16271.	15141.	14127.	13121.	12223.	11433.	10683.	10037.
9486.	8878.	8243.	7666.	7128.	6638.	6217.	5904.	5603.	5304.
5004.	4752.	4493.	4212.	3959.	3747.	3545.	3357.	3197.	3071.
2940.	2799.	2656.	2520.	2389.	2260.	2139.	2020.	1908.	1804.
1708.	1619.	1540.	1463.	1391.	1324.	1264.	1213.	1180.	1159.
1135.	1105.	1071.	1035.	999.	963.				

STORAGE

482.	482.	482.	483.	483.	484.	485.	487.	489.	491.
493.	495.	499.	508.	524.	563.	654.	866.	957.	1176.
1493.	1748.	1837.	1772.	1670.	1600.	1548.	1506.	1469.	1433.
1398.	1362.	1329.	1294.	1262.	1229.	1197.	1165.	1137.	1110.
1081.	1054.	1031.	1010.	990.	970.	951.	935.	918.	904.
891.	877.	861.	846.	831.	817.	804.	792.	780.	765.
750.	734.	715.	699.	689.	681.	672.	664.	658.	652.
647.	640.	634.	627.	621.	615.	609.	603.	597.	591.
586.	581.	577.	572.	567.	563.	559.	556.	554.	553.
551.	549.	547.	548.	542.	540.				

STAGE

825.0	825.0	825.0	825.0	825.0	825.0	825.1	825.1	825.1	825.1
825.2	825.2	825.3	825.4	825.6	826.2	827.6	829.9	832.2	835.6
840.4	844.3	845.6	844.7	843.1	842.0	841.2	840.6	840.0	839.5
839.0	838.4	837.9	837.4	836.9	836.4	835.9	835.4	835.0	834.6
834.1	833.7	833.4	833.0	832.7	832.4	832.2	831.9	831.6	831.4
831.2	831.0	830.8	830.5	830.3	830.1	829.9	829.7	829.5	829.3
829.1	828.8	828.5	828.3	828.2	828.0	827.9	827.8	827.7	827.6
827.5	827.4	827.3	827.2	827.1	827.0	826.9	826.8	826.7	826.7
826.6	826.5	826.4	826.4	826.3	826.2	826.2	826.1	826.1	826.1
826.1	826.0	826.0	826.0	825.9	825.9				

PEAK OUTFLOW IS 73351. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	73351.	68051.	51698.	29258.	1189184.
CMS	2077.	1927.	1464.	828.	33674.
INCHES		2.16	6.56	11.14	12.58
MM		54.86	166.70	283.03	319.55
AC-FT		33744.	102541.	174095.	196559.
THOUS CU M		41623.	126483.	214743.	242452.

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FORMULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.05	RATIO 2 0.06	RATIO 3 0.07	RATIO 4 0.08	RATIO 5 0.09	RATIO 6 0.10	RATIO 7 0.50	RATIO 8 1.00
HYDROGRAPH AT	STIASN	178.00	1	3403.	4084.	4764.	5445.	6126.	6806.	34032.	68064.
		(********)		(96.37)(	115.64)(	134.91)(	154.19)(	173.46)(	192.73)(	963.67)(	1927.35)(
ROUTED TO	STIDAM	178.00	1	1366.	1641.	1917.	2169.	2409.	2651.	13559.	30003.
		(********)		(38.68)(	46.47)(	54.27)(	61.42)(	68.21)(	75.06)(	383.94)(	849.58)(
ROUTED TO	RIVER	178.00	1	1346.	1618.	1890.	2142.	2380.	2619.	13528.	29977.
		(********)		(38.12)(	45.81)(	53.52)(	60.66)(	67.36)(	74.16)(	383.07)(	848.86)(
HYDROGRAPH AT	CRDSN	115.10	1	3539.	4246.	4954.	5662.	6370.	7077.	35386.	70772.
		(********)		(100.20)(	120.24)(	140.28)(	160.32)(	180.36)(	200.41)(	1002.03)(	2004.05)(
2 COMBINED	CRDDAM	293.10	1	3593.	4311.	5030.	5748.	6467.	7186.	36065.	73255.
		(********)		(101.74)(	122.08)(	142.43)(	162.78)(	183.12)(	203.47)(	1021.26)(	2074.35)(
ROUTED TO	CRDDAM	293.10	1	3586.	4293.	4900.	5728.	6536.	7339.	36129.	73351.
		(********)		(101.55)(	121.56)(	138.74)(	162.20)(	185.08)(	207.82)(	1023.07)(	2077.08)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

[STILLWATER RESV. DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1679.30	1679.30	1687.30
STORAGE	108485.	108485.	171487.
OUTFLOW	0.	0.	33193.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.05	1679.77	0.	111447.	13e6.	0.	62.00	0.
0.06	1679.87	0.	112043.	1641.	0.	62.00	0.
0.07	1679.97	0.	112640.	1917.	0.	62.00	0.
0.08	1680.05	0.	113250.	2169.	0.	62.00	0.
0.09	1680.14	0.	113868.	2409.	0.	62.00	0.
0.10	1680.22	0.	114492.	2651.	0.	62.00	0.
0.50	1683.43	0.	133767.	13559.	0.	62.00	0.
1.00	1686.72	0.	166405.	30003.	0.	60.00	0.

PLAN 1 STATION RIVER

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.05	1346.	826.6	60.00
0.06	1618.	826.8	66.00
0.07	1890.	827.0	66.00
0.08	2142.	827.1	60.00
0.09	2380.	827.3	68.00
0.10	2619.	827.5	68.00
0.50	13528.	831.2	64.00
1.00	29977.	834.4	62.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	825.00	825.00	829.80
STORAGE	482.	482.	797.
OUTFLOW	292.	292.	6031.

CROGHAN DAM

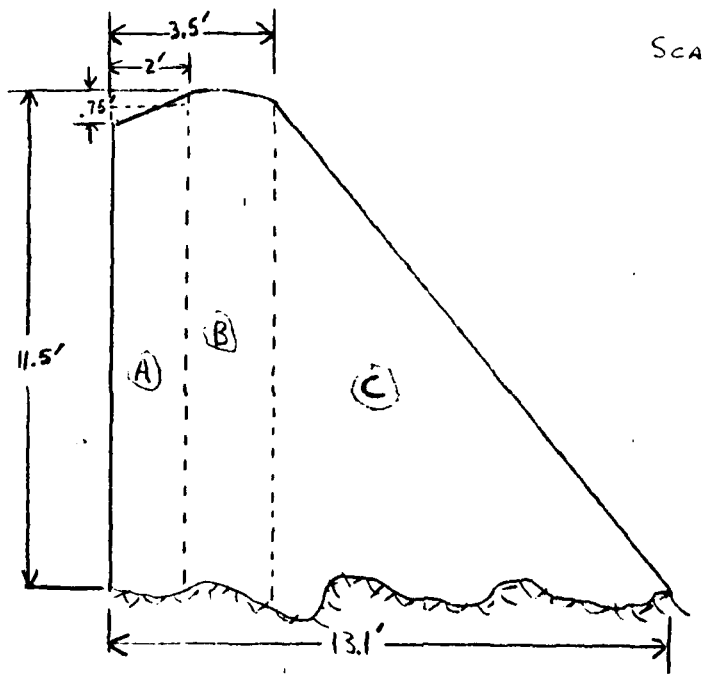
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.05	827.92	0.	674.	3586.	0.	46.00	0.
0.06	828.38	0.	704.	4293.	0.	46.00	0.
0.07	829.01	0.	745.	4900.	0.	46.00	0.
0.08	829.61	0.	785.	5726.	0.	46.00	0.
0.09	830.06	0.26	814.	6534.	2.00	46.00	0.
0.10	830.41	0.61	837.	7359.	6.00	46.00	0.
0.50	836.29	6.49	1354.	36129.	58.00	46.00	0.
1.00	845.64	15.84	1837.	73351.	80.00	46.00	0.

APPENDIX D

STABILITY COMPUTATIONS

CROSS SECTION OF CROGHAN DAM - SPILLWAY SECTION - TAKEN FROM PLANS PREPARED BY JAMES P. BROWNELL

SCALE 1/4" = 1'

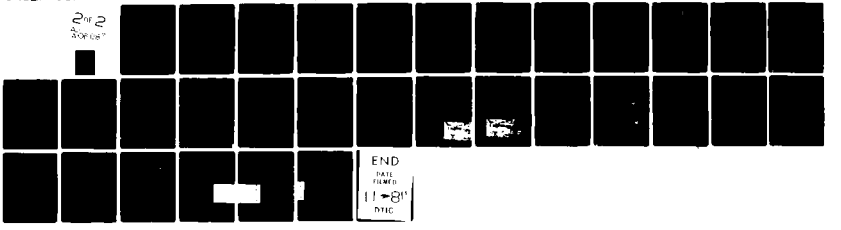


SECTION	AREA	DISTANCE TO CENTROID
A	$(11.12)(2) = 22.2\ ft^2$	12.1'
B	$(11.5)(1.5) = 17.2\ ft^2$	8.8'
C	$\frac{1}{2}(11.5)(9.6) = 55.2\ ft^2$	6.4'

AD-A106 087 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CROGHAN DAM (NORTH & SOUTH) (INVEN--ETC(U)
APR 81 B KOCH, W M SMITH DACW51-79-C-0001

UNCLASSIFIED NL

2 OF 2



ANALYSIS CONDITIONS

1. Normal conditions; water surface at spillway crest.
2. Water surface at spillway crest plus ice load of 5,000 pounds per linear foot.
3. 1/2 PMF flow; water surface 8.5 feet over top of dam.
4. Flood flows; water surface at top of dam.
5. Normal conditions with seismic coefficient of 0.10.

STABILITY ANALYSIS PROGRAM - WORK SHEET

INPUT ENTRY		ANALYSIS CONDITION 1	2	3	4	5
Unit Weight of Dam (K/ft^3)	0	0.15				
Area of Segment No. 1 (ft^2)	1	22.2				
Distance from Center of Gravity of Segment No. 1 to Downstream Toe (ft)	2	12.1				
Area of Segment No. 2 (ft^2)	3	17.2				
Distance from Center of Gravity of Segment No. 2 to Downstream Toe (ft)	4	8.8				
Area of Segment No. 3 (ft^2)	5	55.2				
Distance from Center of Gravity of Segment No. 3 to Downstream Toe (ft)	6	6.4				
Base Width of Dam (Total) (ft)	7	13.1				
Height of Dam (ft)	8	11.5				
Ice Loading (K/L ft.)	9		5.0			
Coefficient of Sliding	10	0.65				
Unit Weight of Soil (K/ft^3) (deduct 18)	11	.055				
Active Soil Coefficient - Ka	12	0.33				
Passive Soil Coefficient - Kp	13	3.0				
Height of Water over Top of Dam or Spillway (ft)	14			13.29	4.8	
Height of Soil for Active Pressure (ft)	15	10				
Height of Soil for Passive Pressure (ft)	16					
Height of Water in Tailrace Channel (ft)	17	2				
Weight of Water (K/ft^3)	18	.0625				
Area of Segment No. 4 (ft^2)	19					
Distance from Center of Gravity of Segment No. 4 to Downstream Toe (ft)	20					
Height of Ice Load or Active Water (ft) (does not include 14)	46	11.5				
Seismic Coefficient (g)	50					.10
RESULTS OF ANALYSIS						
Factor of Safety vs. Overturning		1.83	.96	.97	1.39	1.76
Distance From Toe to Resultant		6.06	-.57	-.28	3.77	5.8
Factor of Safety vs. Sliding		1.14	.57	.39	.68	.83

APPENDIX E

REFERENCES

APPENDIX E
REFERENCES

1. M.G. Cline and R.L. Marshall, Soils of New York Landscapes - Information Bulletin 119, New York State College of Agriculture and Life Sciences, Cornell University August, 1977.

2. B.B. Eissler, Low-Flow Frequency Analysis of Streams in New York - Bulletin 74, U.S. Geological Survey, 1979.

3. H.W. King and E.F. Brater, Handbook of Hydraulics, 5th Edition, McGraw-Hill, 1963.

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6. Black River Basin, New York; Hydrology and Economic Analysis for Flood Control of proposed Reservoirs at Hawkinsville, Forestport and Nelson Lake; June, 1974.

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7. Stillwater Reservoir Dam - Phase I Inspection Report, National Dam Safety Program, O'Brien and Gere Engineers, Inc. July, 1978.

8. U.S. Department of Agriculture, Soil Conservation Service; National Engineering Handbook; Section 4 - Hydrology, August 1972.

9. Hydrometerological Report No. 33:
Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours, April, 1956.

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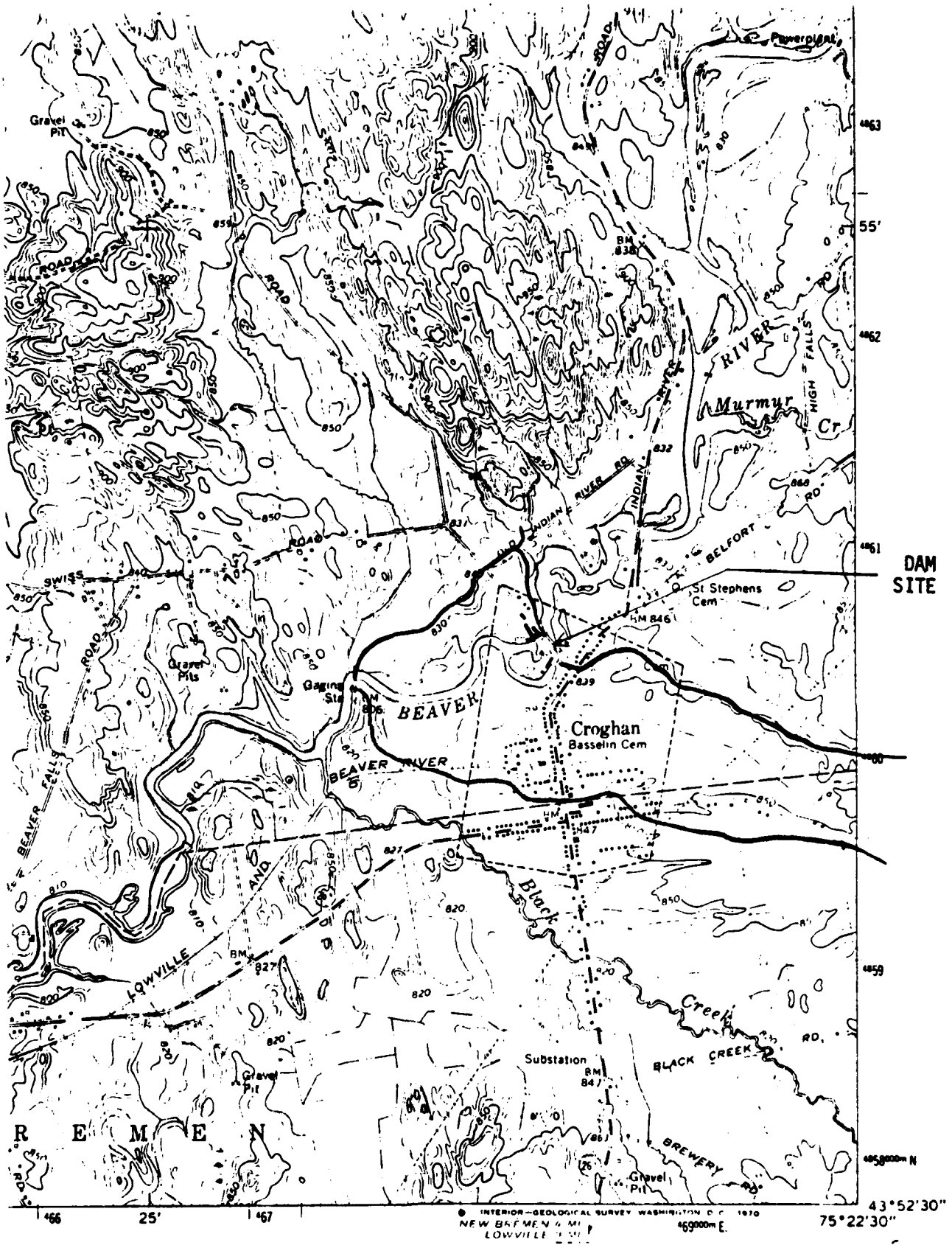
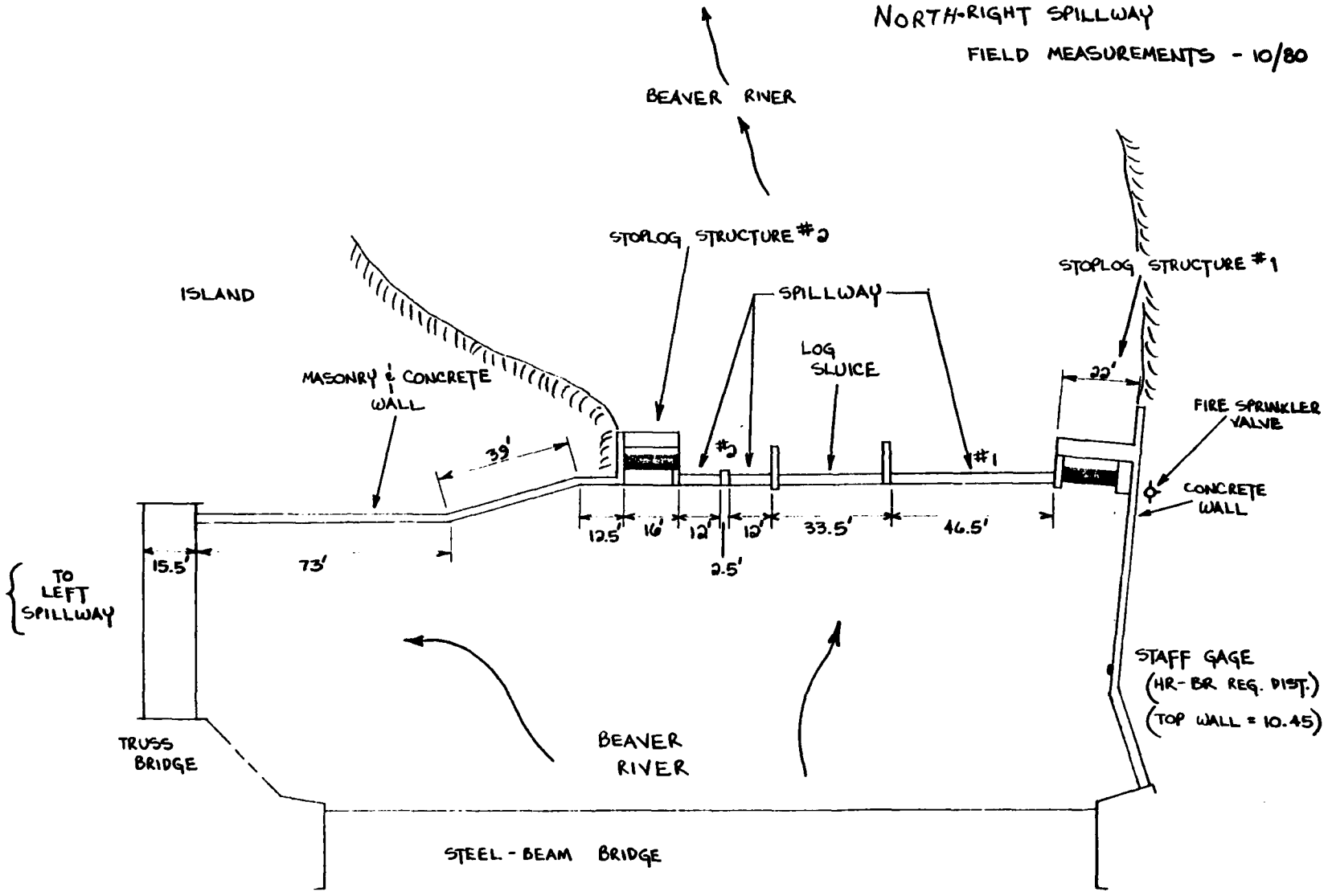
APPENDIX F

DRAWINGS

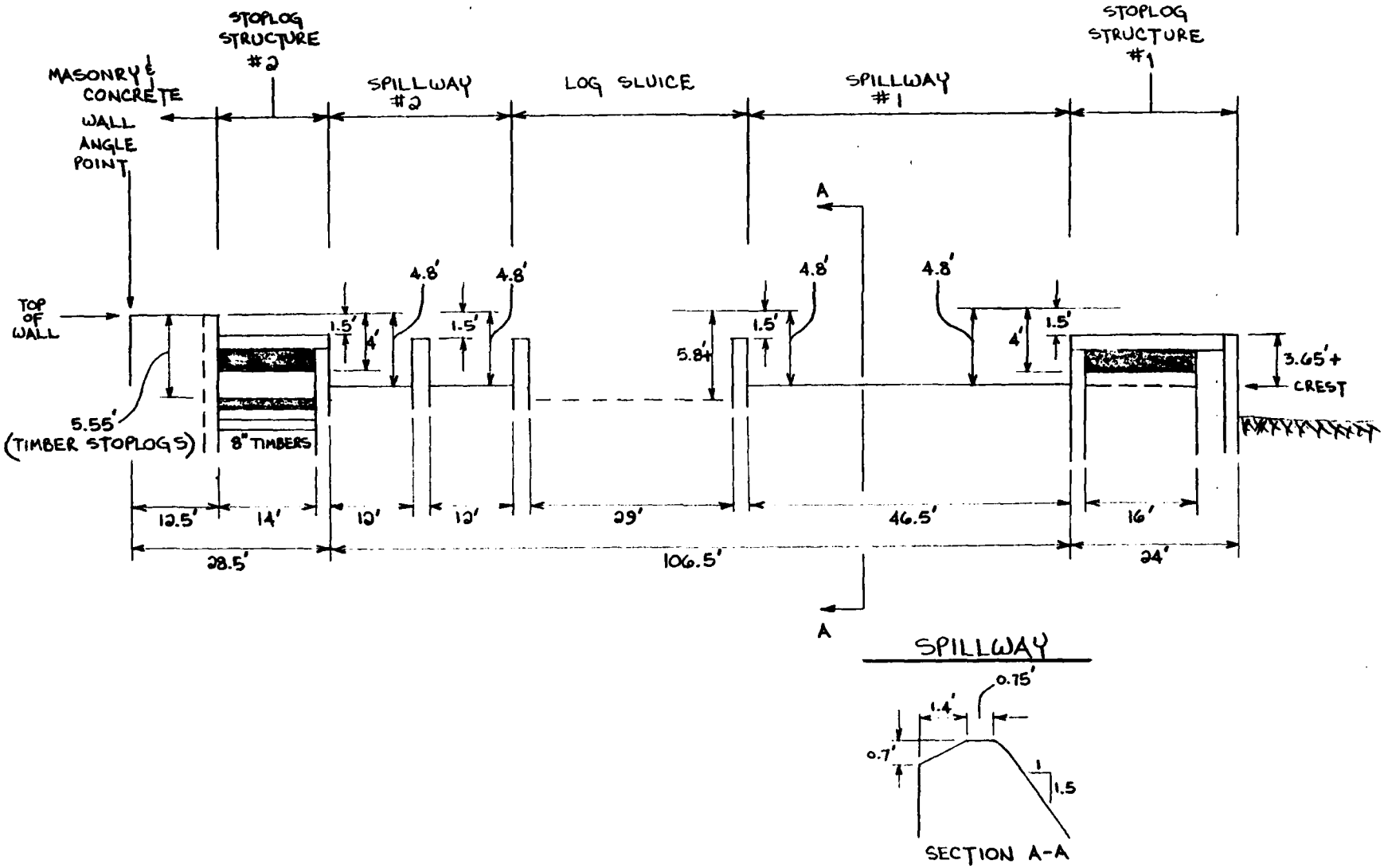


VICINITY MAP
CROGHAN DAM
NY-694

PLAN OF CROGHAN DAM NY-694
NORTH-RIGHT SPILLWAY
FIELD MEASUREMENTS - 10/80



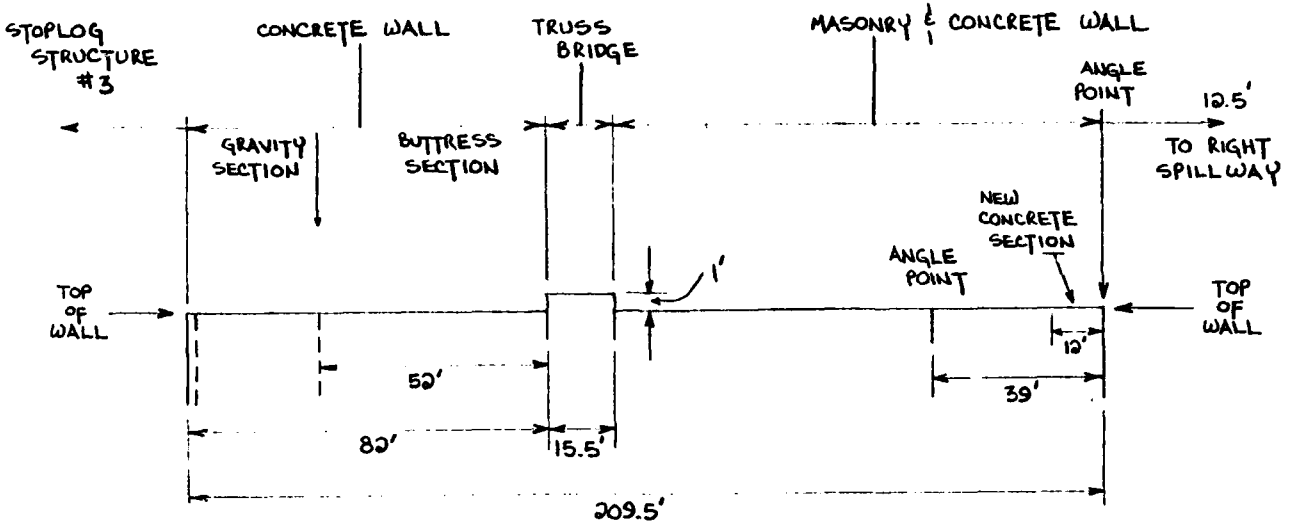
ELEVATION - CROGHAN DAM NY-694
NORTH - RIGHT SPILLWAY
FIELD MEASUREMENTS - 10/80



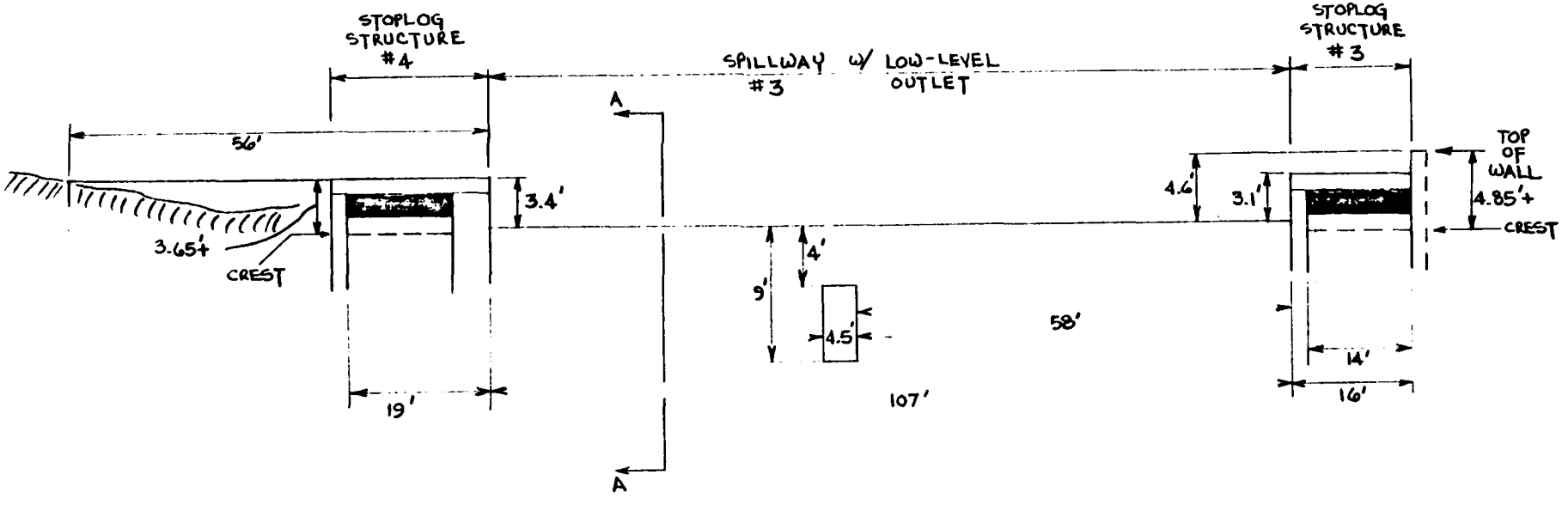
SPILLWAY

SECTION A-A

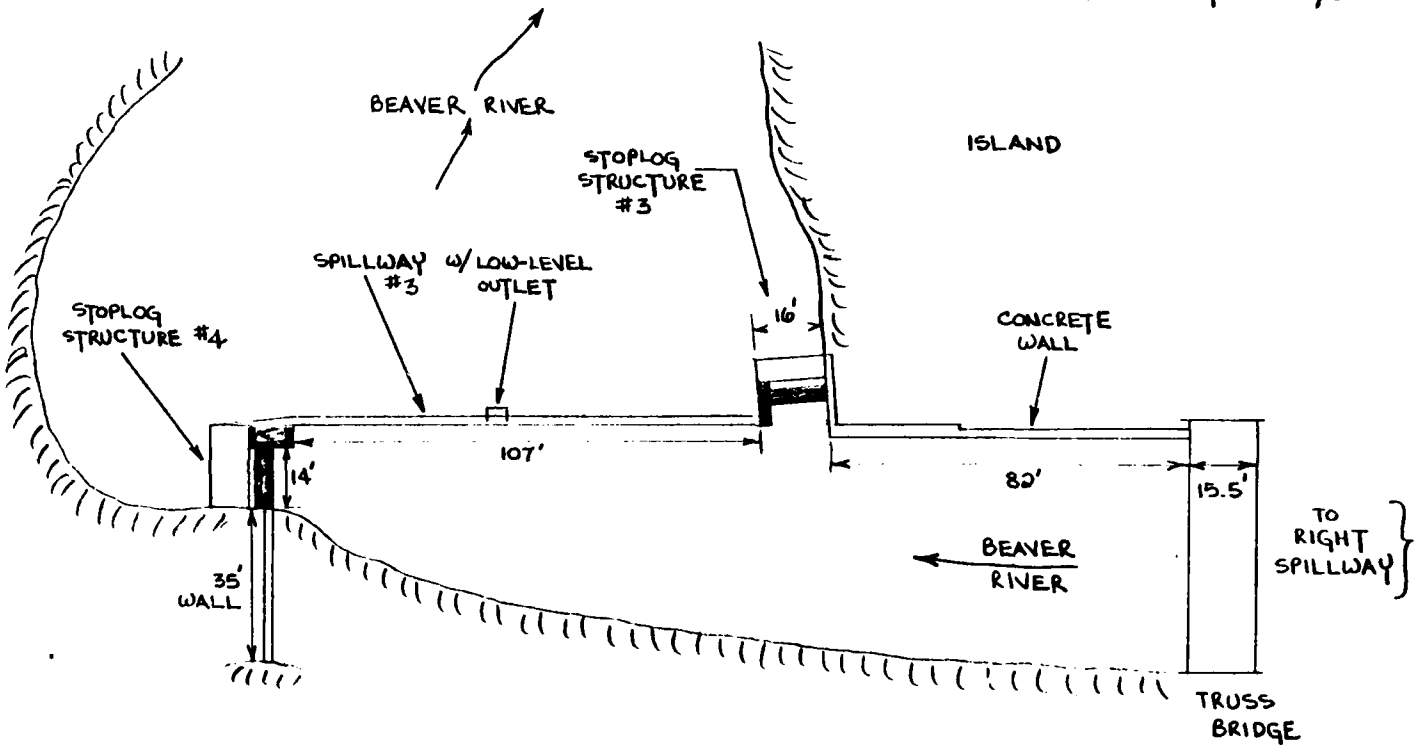
ELEVATION - CROGHAN DAM NY-694
WALLED SECTION - BETWEEN SPILLWAYS
FIELD MEASUREMENTS - 10/80

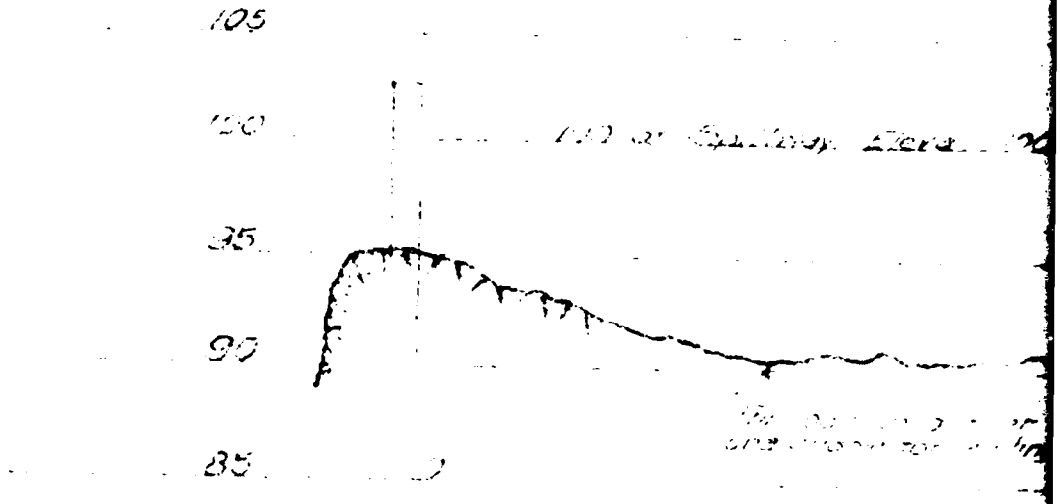


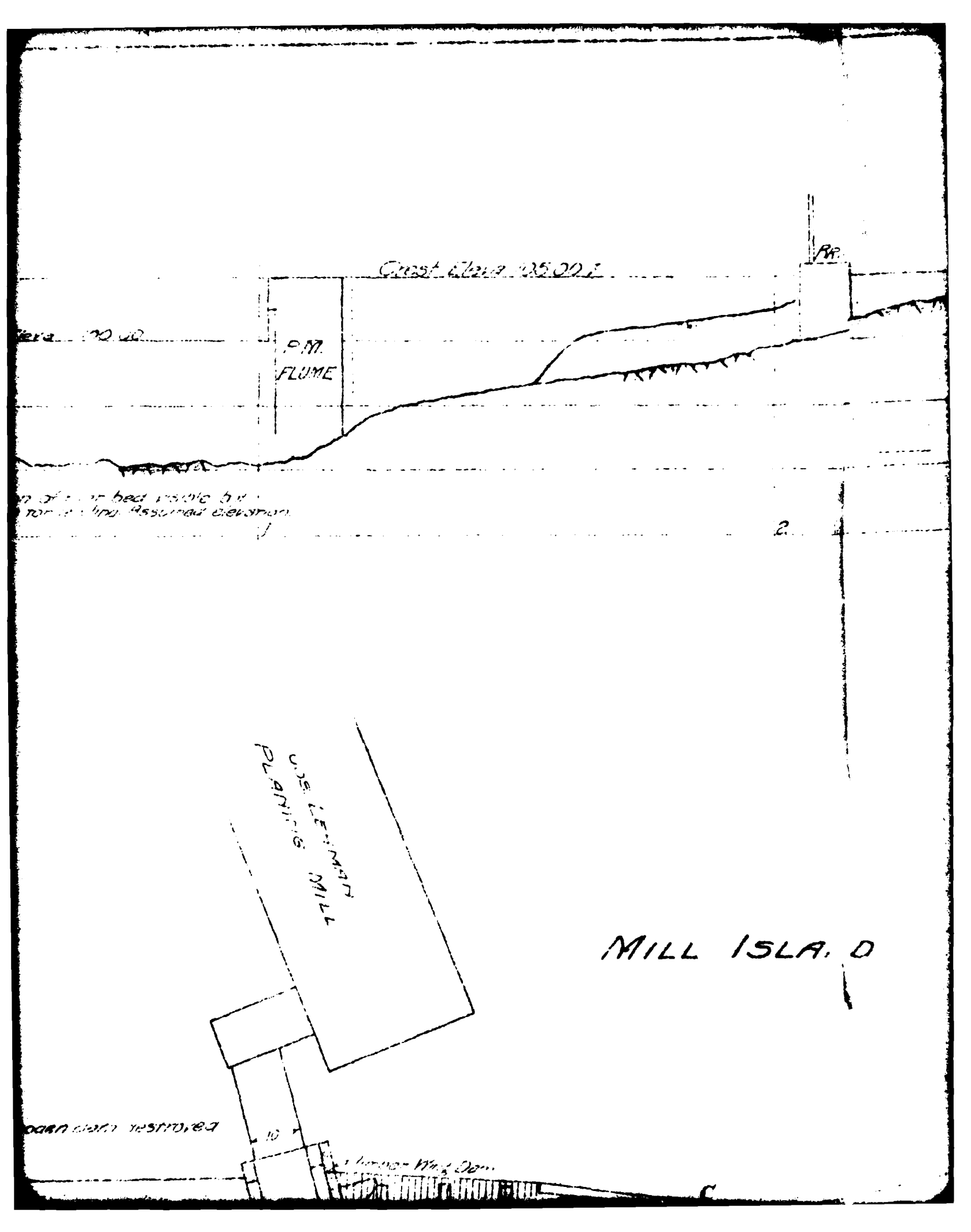
ELEVATION - CROGHAN DAM · NY-694
SOUTH - LEFT SPILLWAY
FIELD MEASUREMENTS - 10/80

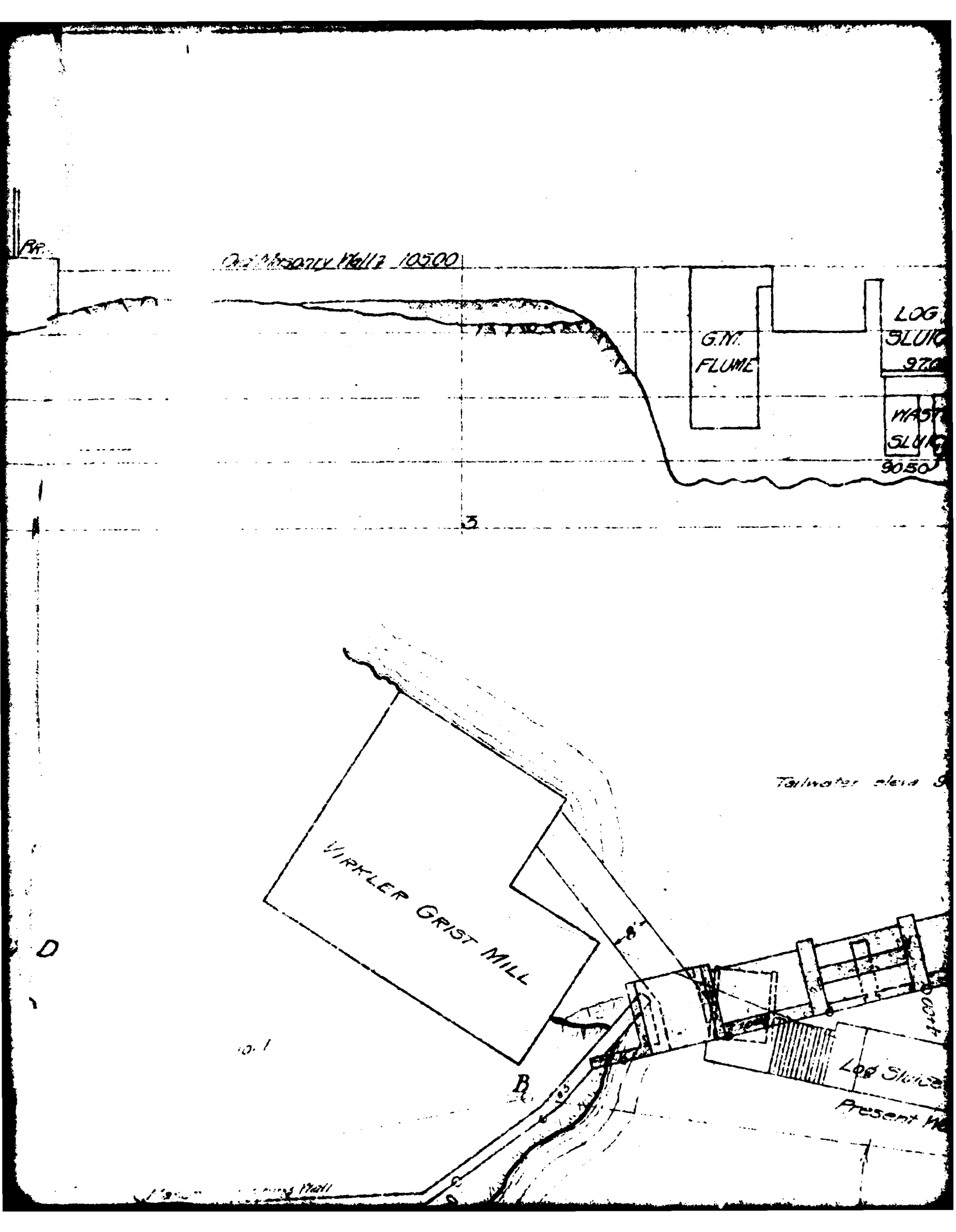


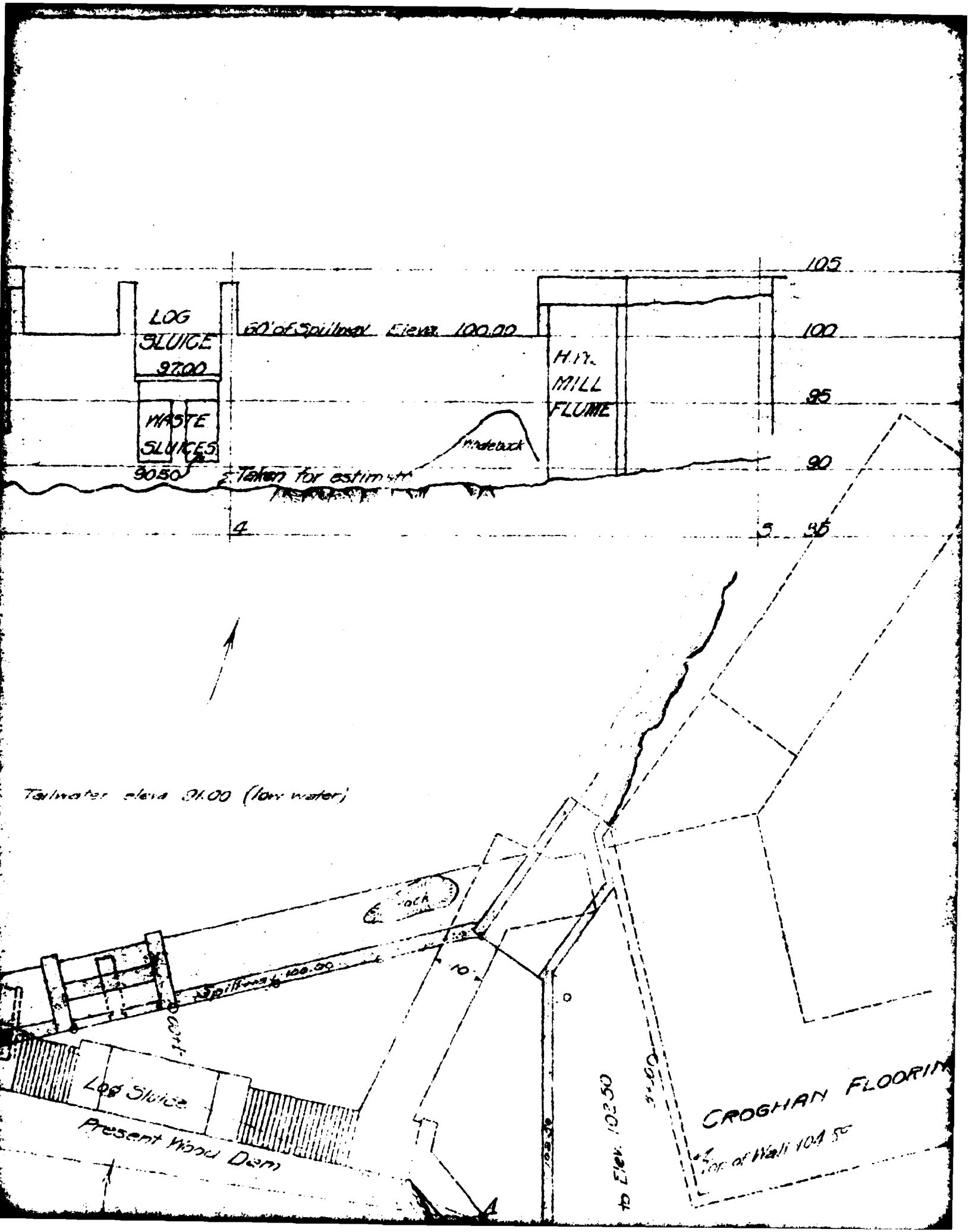
PLAN of CROGHAN DAM NY-694
SOUTH - LEFT SPILLWAY
FIELD MEASUREMENTS - 10/80

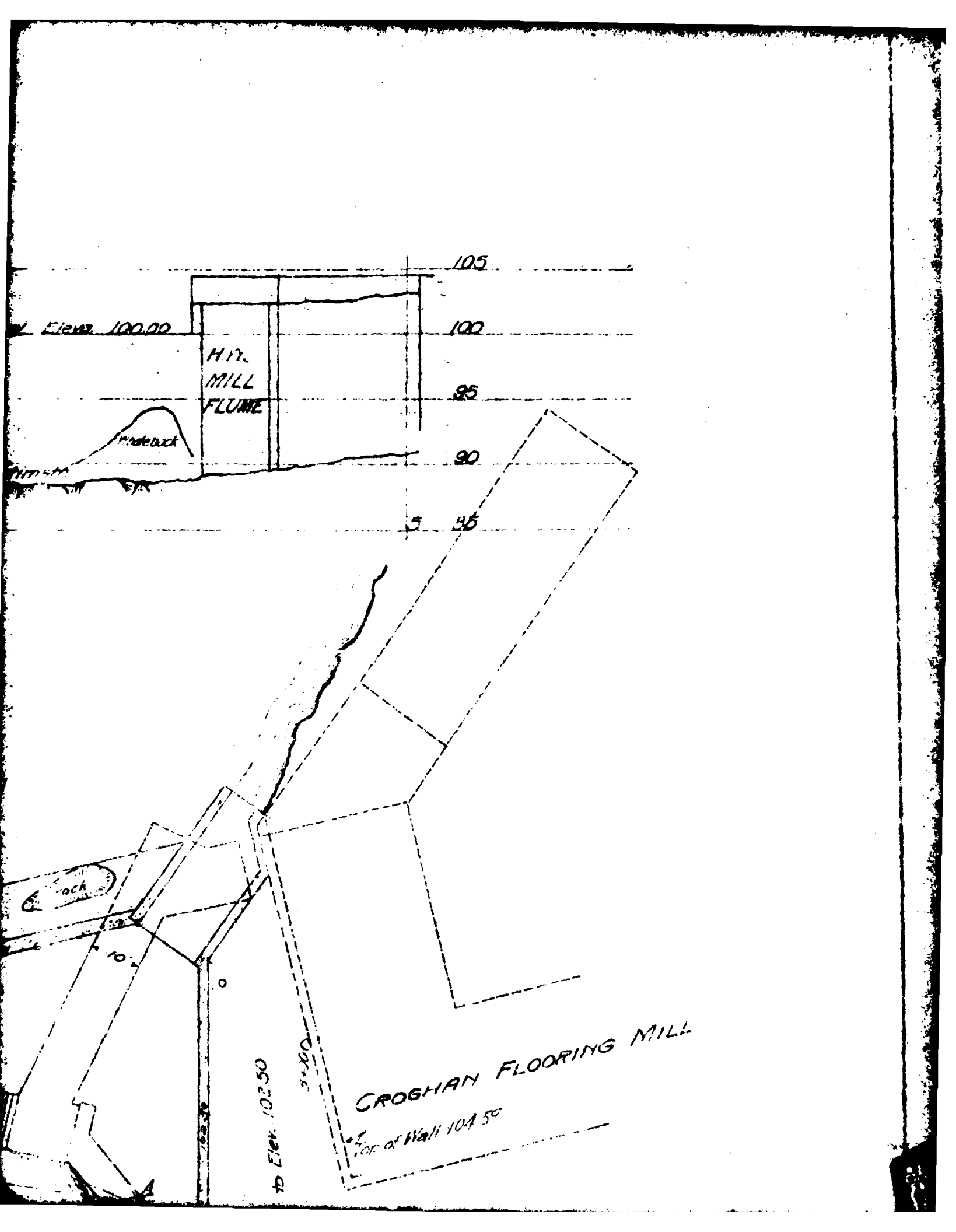


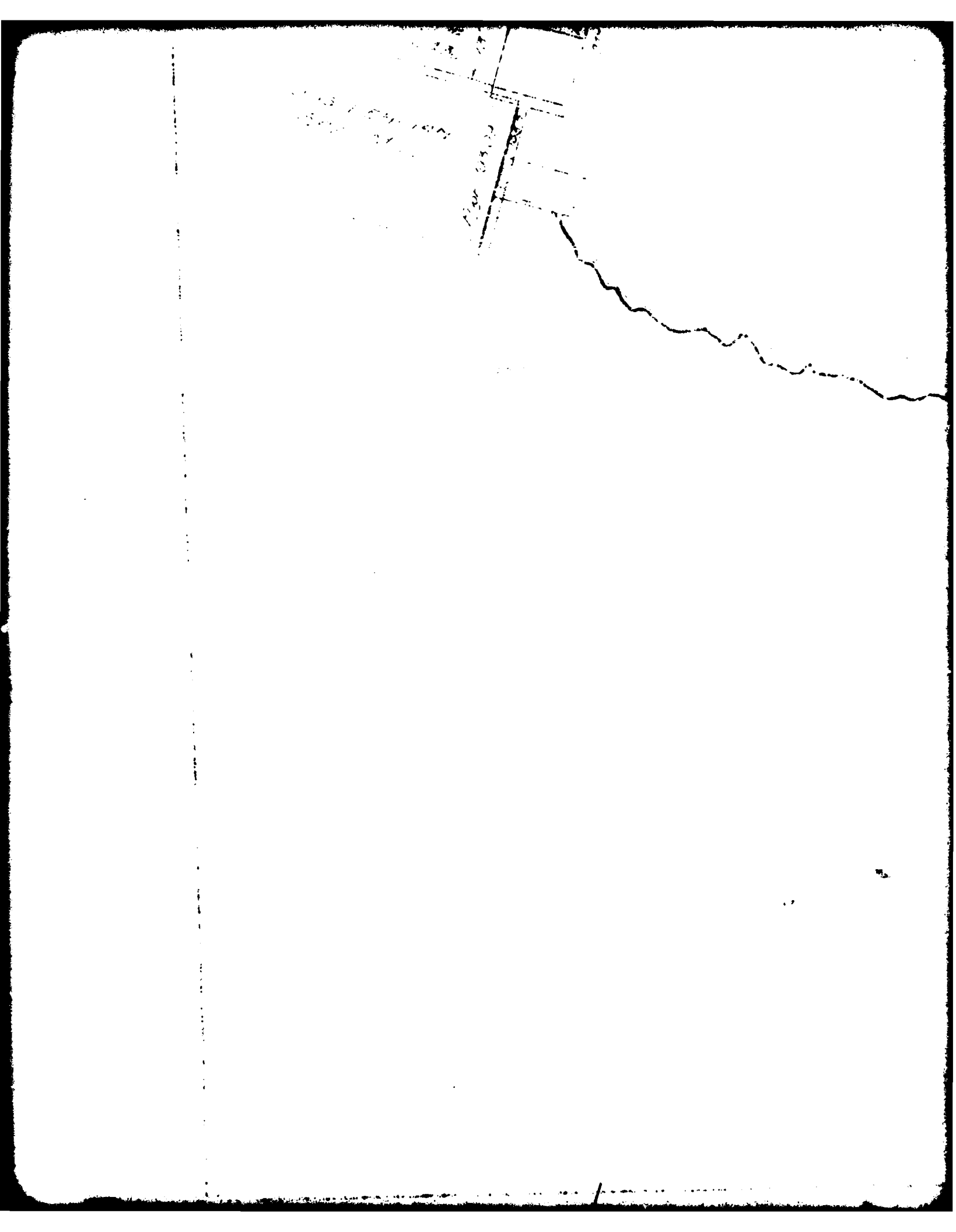

105
100
95
90
85


RR.
P.M.
FLUME
2.
MILL ISLAND


RR.
G.N. FLUME
LOG SLUI
WAST
SLUI
9050
3
VIRKLER GRIST MILL
Tailwater elev
D
B
Log Sluice
Present

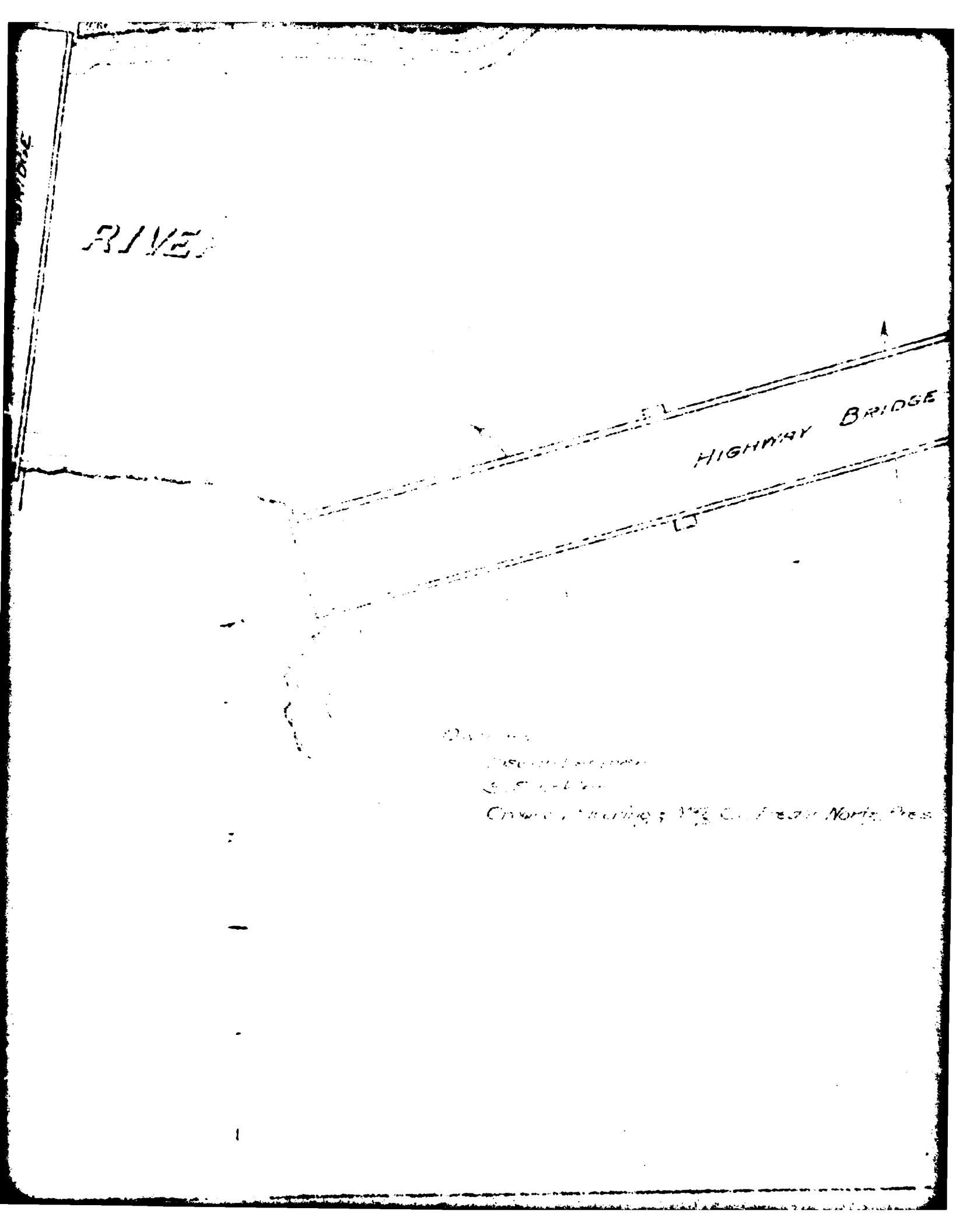

LOG SLUICE 97.00
WASTE SLUICES
90.50
60' of Spillway Elevs. 100.00
Estimated
H.P. MILL FLUME
105
100
95
90
85
4
5
Tailwater elevs 91.00 (low water)
Spillway to 100.00
Log Sluice
Present Wood Dam
CROGHAN FLOORING
Top of Wall 104.50
to Elev. 102.50

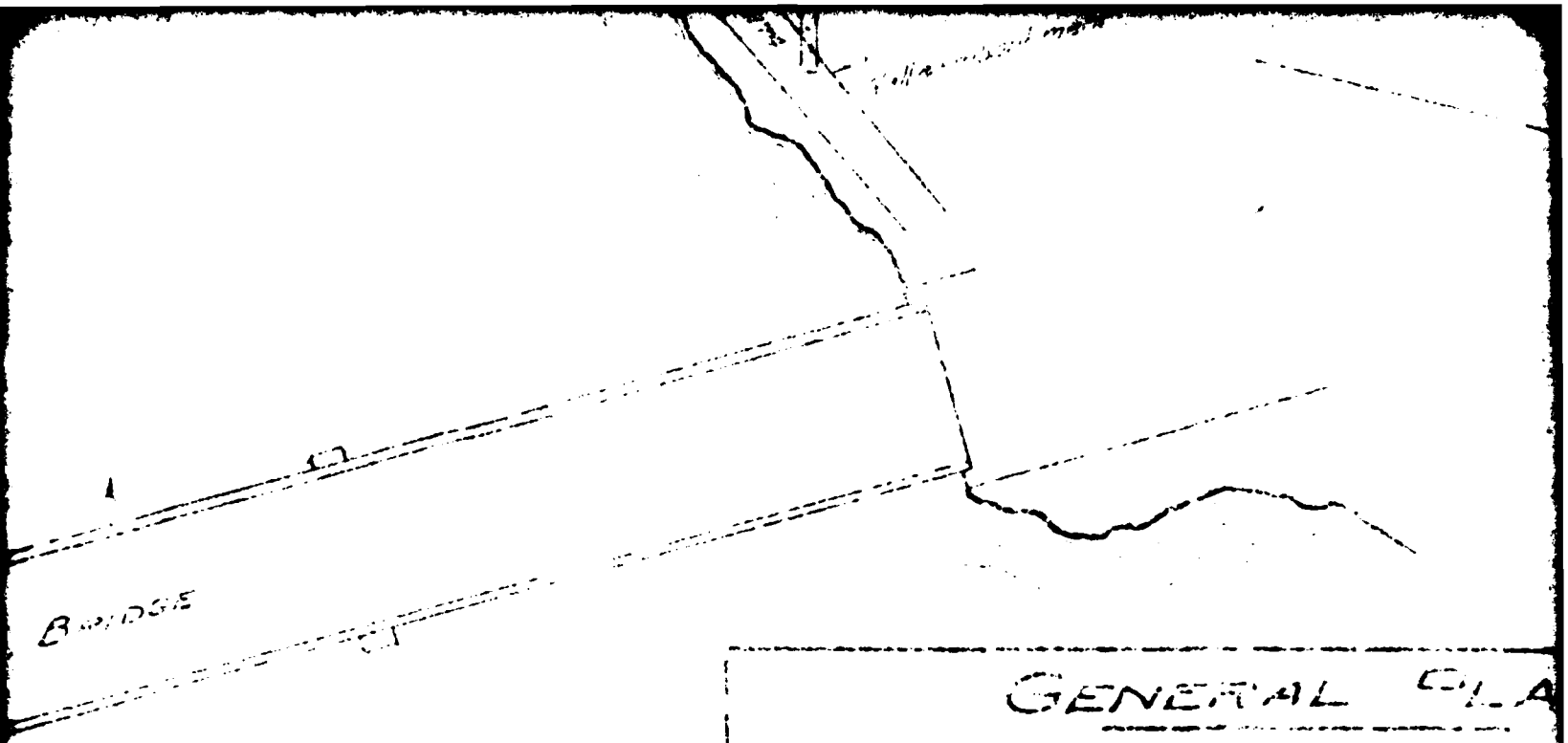

105
Elevn. 100.00
100
H.P.
MILL
FLUME
95
Headgate
90
85
6' Lock
10'
to Elev. 102.50
3'x6'
CROGHAN FLOORING MILL
Top of Wall 104.50



BEAVER

Bench Mark Elevation 100.00
(Approx 520 mm elevation)


RIVE
HIGHWAY BRIDGE

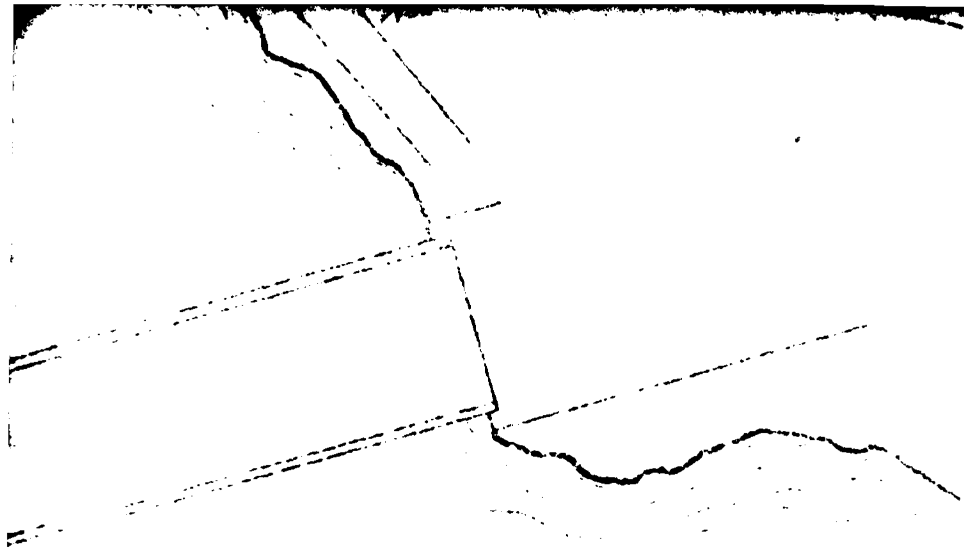


GENERAL PLA

PROPOSED NEW DA
BEAVER RIVER
CROGHAN, NY

Town of Croghan, County of Lew... S

Scales As Indicated & Vertical	Drawing No. 7216	
Date 10.19.8		



GENERAL PLAN

PROPOSED NEW DAM ON THE BEAVER RIVER
AT CROGHAN, N.Y.

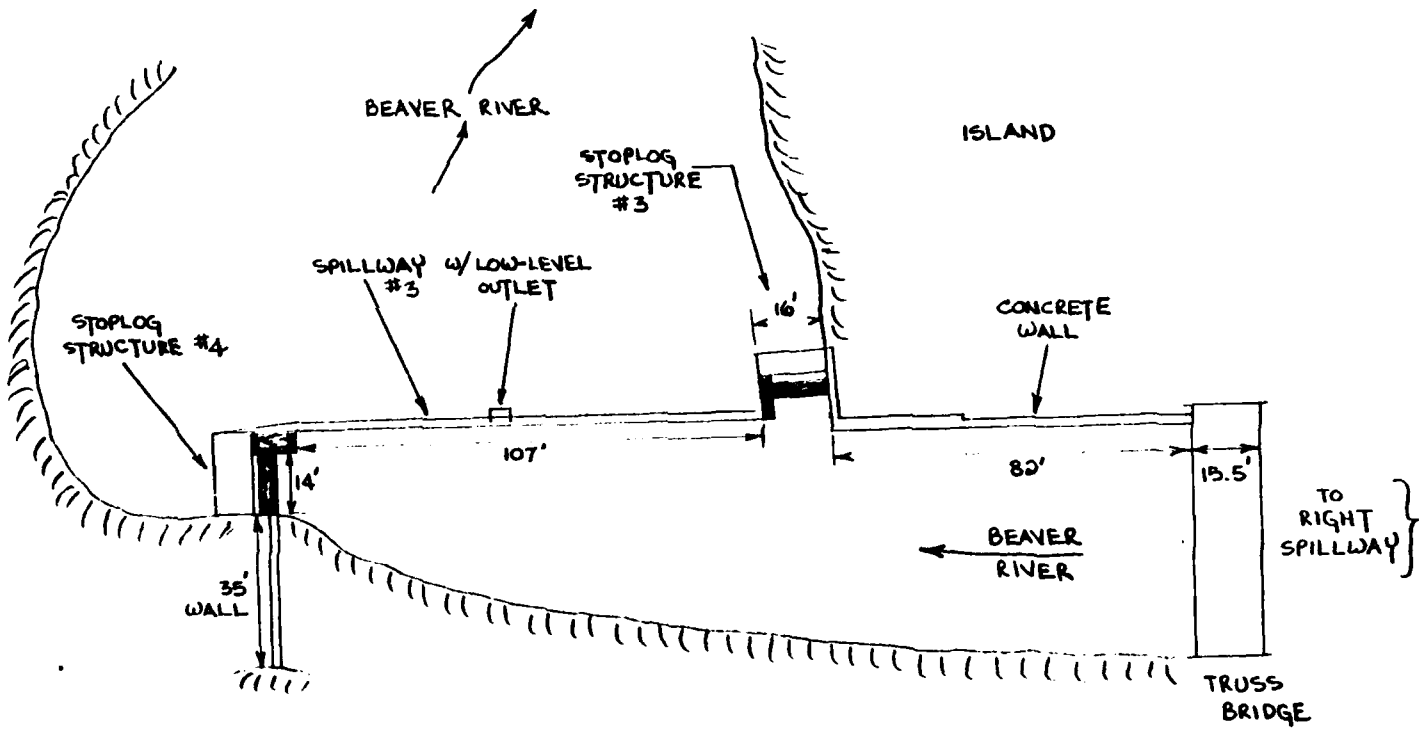
Town of Croghan, County of Lewis, State of New York

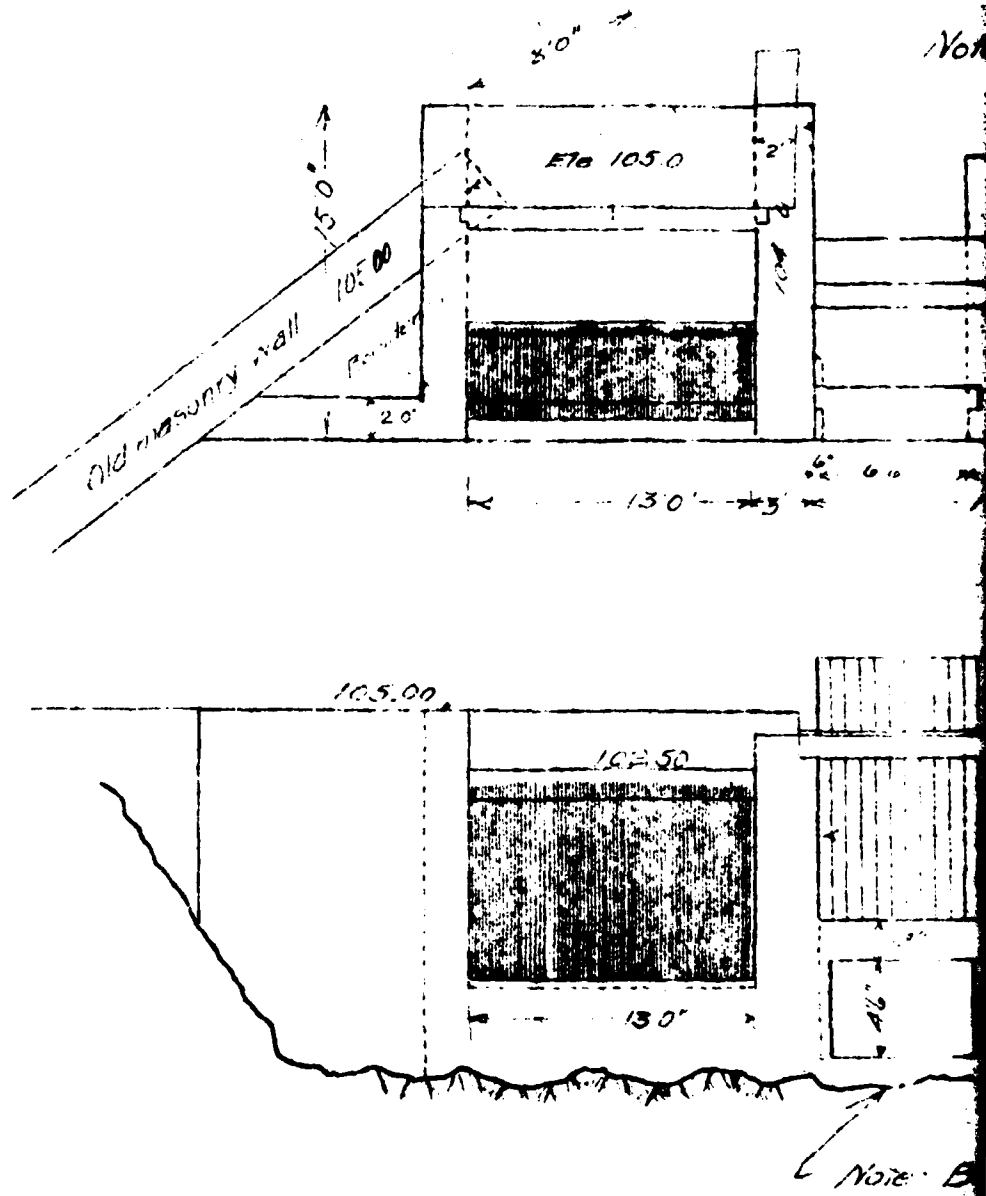
Scales ... Horizontal ... Vertical ... 19, 1918	Drawing No. 7216 ...	James ... Brown ... Engineer ...

PLAN OF CROGHAN DAM NY-694

SOUTH - LEFT SPILLWAY

FIELD MEASUREMENTS - 10/80

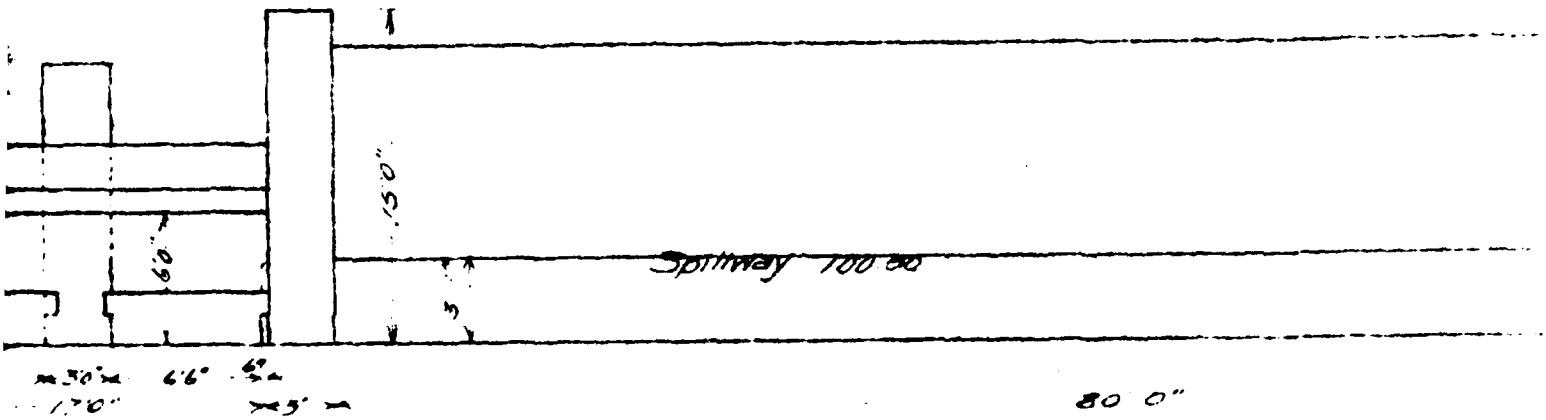


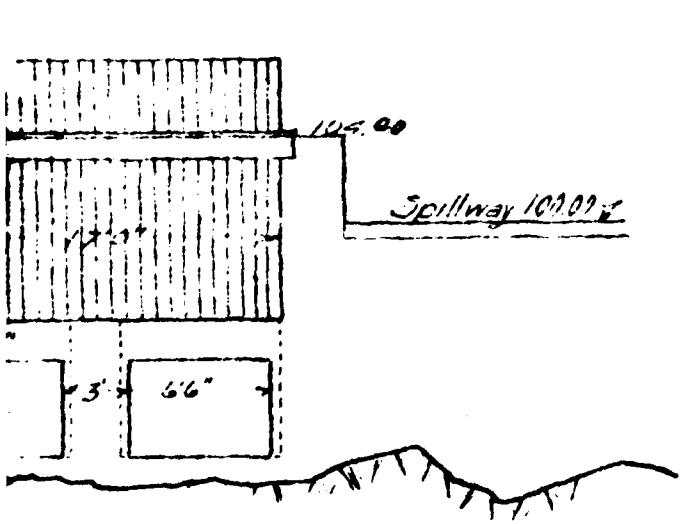


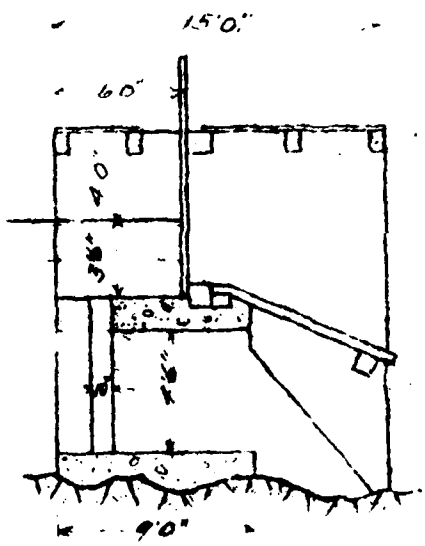
GRIST MILL BUI

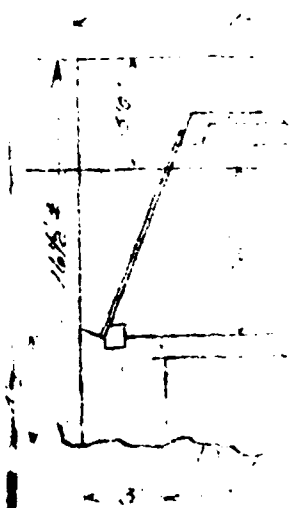
NORTH DAM

Note Change location of Log Sluice toward center – adjacent to J. P. Lewis Co.



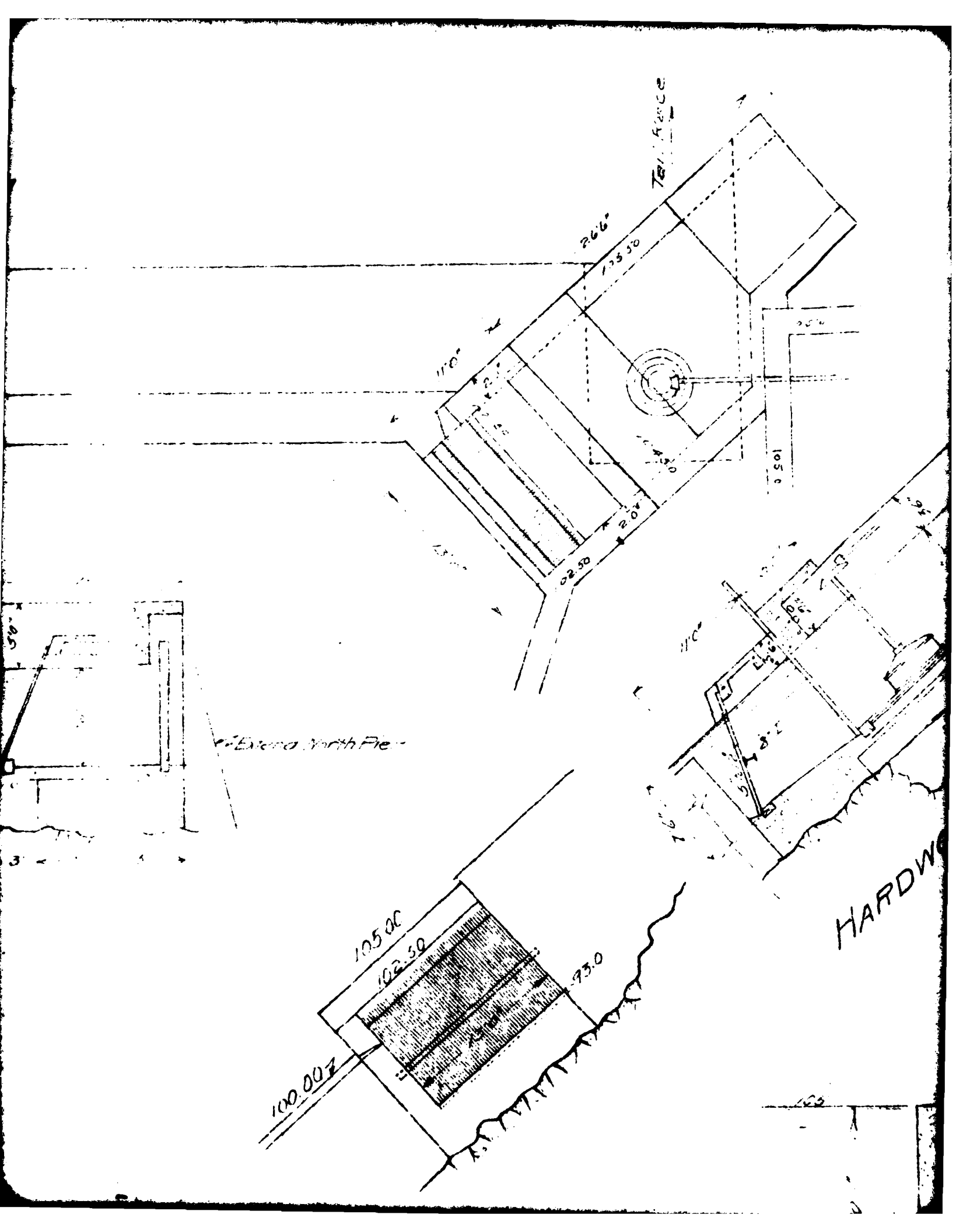






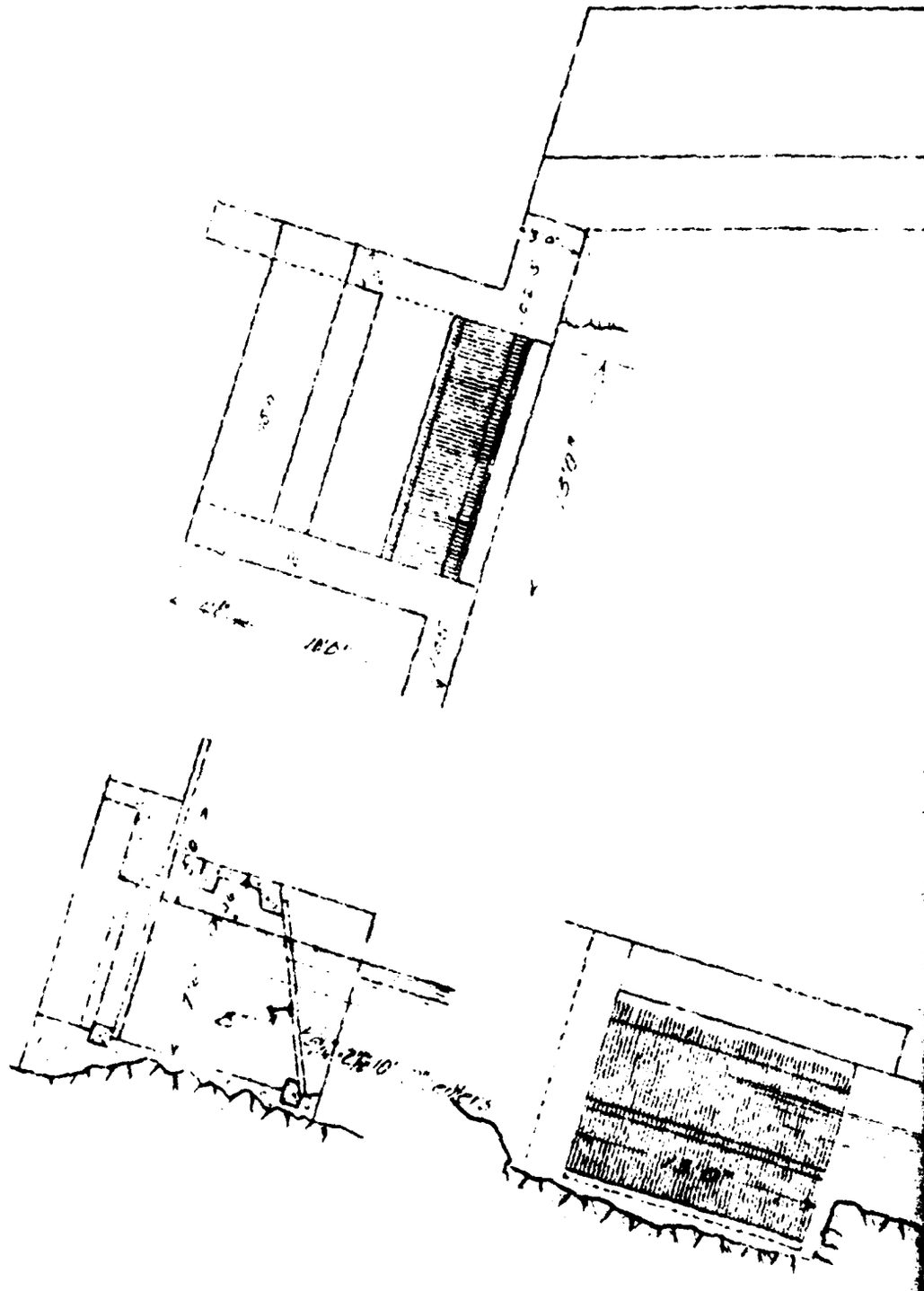
: Bed rock very uneven. Taken as elevation 885 for estimate, this chan[illegible]

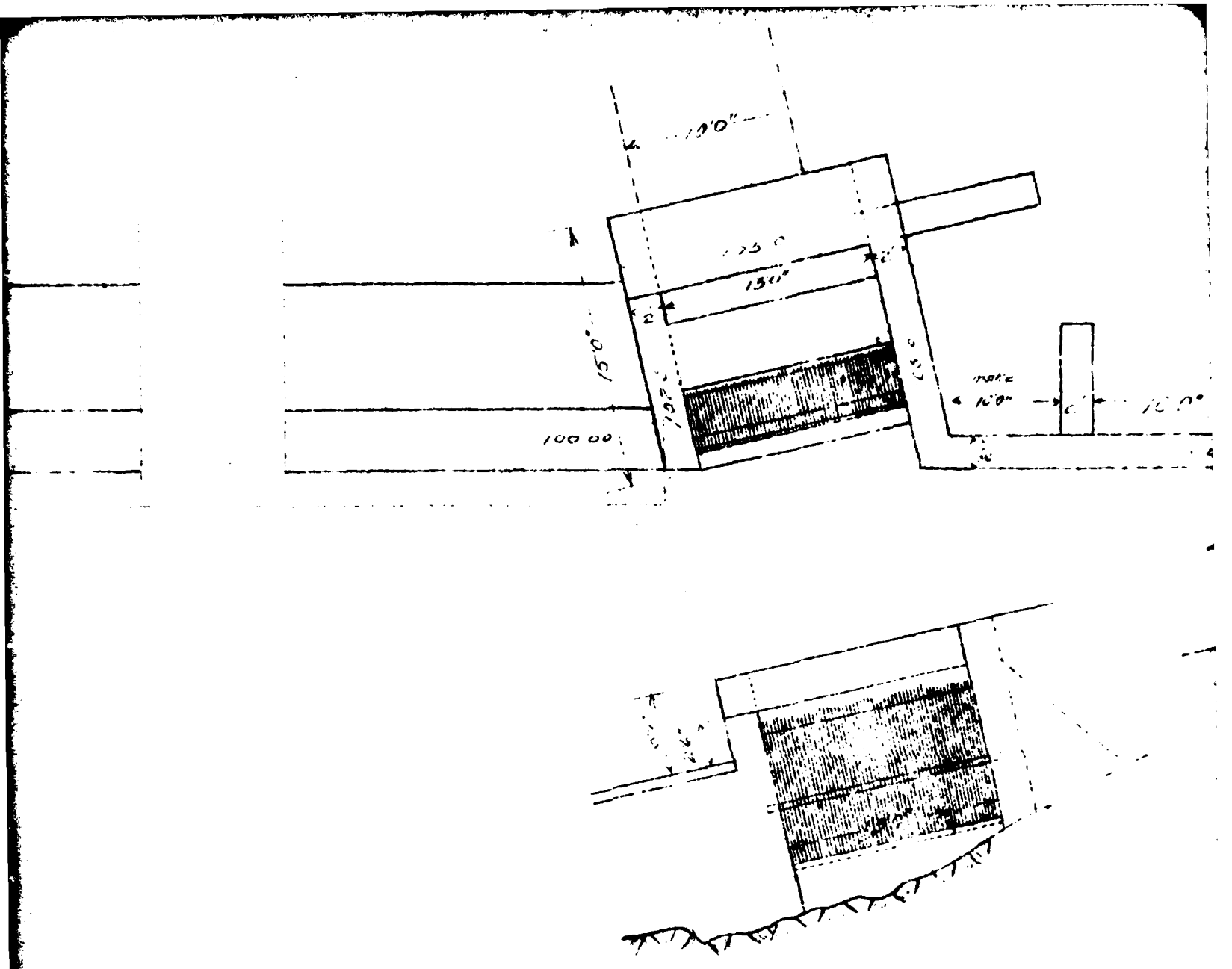
'ULKHEAD & LOG SLUICE

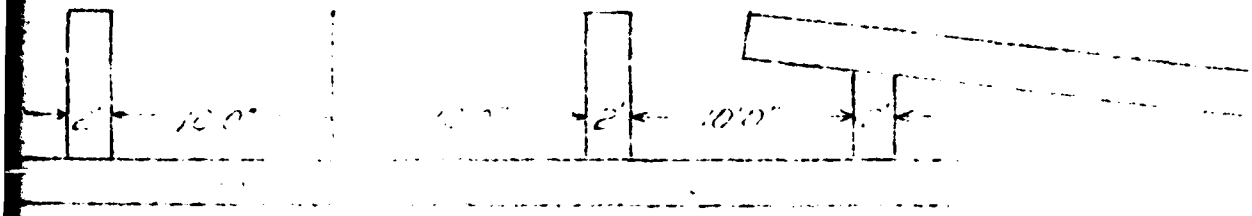

266'
175.50
110'
105.0
2.0'
102.50
110'
105.00
102.50
100.00'
93.0
HARDW

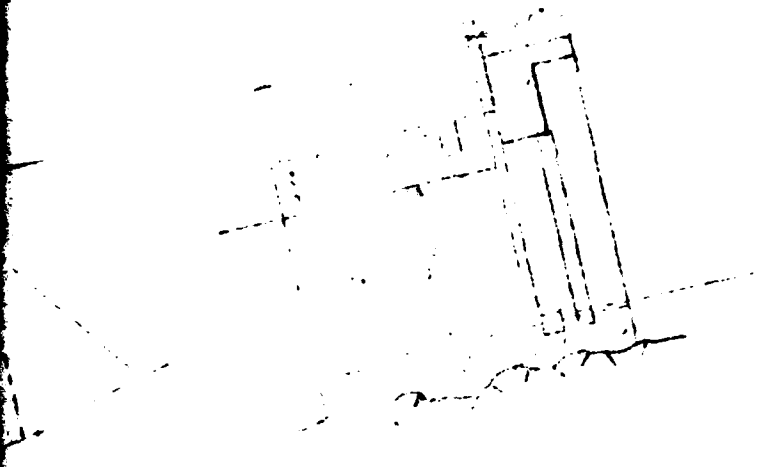

HARDWOOD MILL BULKHEAD


MILL BULKHEAD




10'0"
15'0"
100 00
10'0"

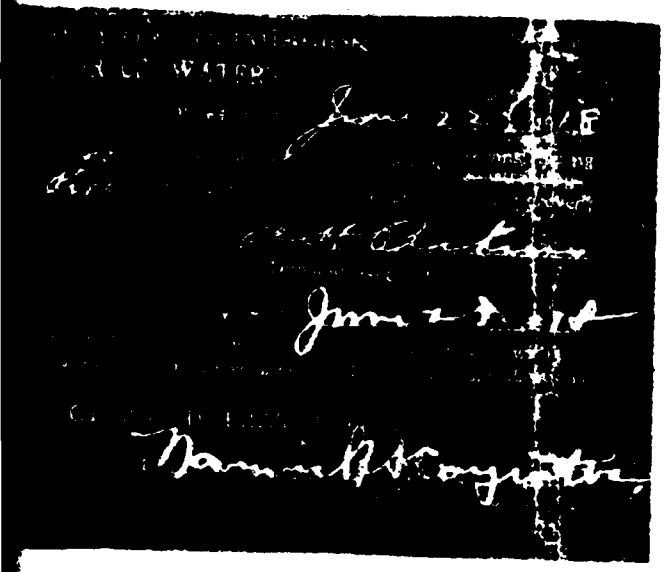




326

MAXIMUM SECTION
WING DAM

MAXIMUM SECTI
SPILLWAY



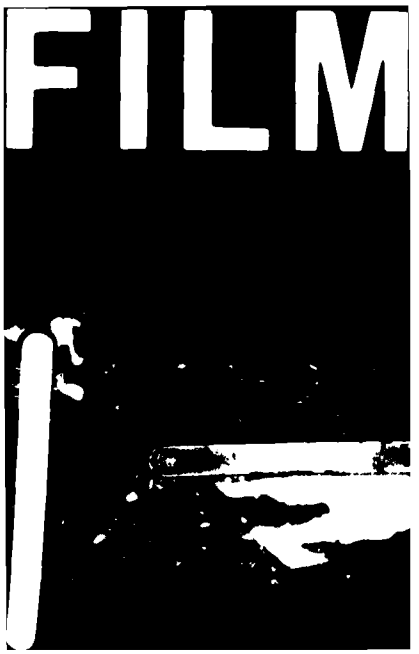
PLANS OF BULKHEADS & LOG
PROPOSED NEW CONCRET
CROGHAN, N.Y.
TOWN OF CROGHAN, COUNTY OF LEWIS, STA
ACROSS THE BEAVER R

Scales 1/8" and 1/4" per foot	Drawing No. 7217	
Date: May 10, 1918	File	

MAXIMUM SECTION
SPILLWAY

PLANS OF BULKHEADS & LOG SLUICE
PROPOSED NEW CONCRETE DAM
CROGHAN, N.Y.
TOWN OF CROGHAN, COUNTY OF LEWIS, STATE OF NEW YORK
ACROSS THE BEAVER RIVER

Scales: [illegible] one foot Date: May 10, 1918	Drawing No. 7217 File [illegible]	James [illegible] Engineer Carthage, N.Y.


FILM