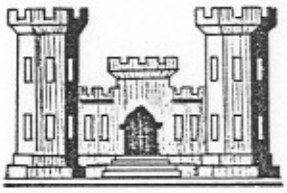
LAKE ONTARIO BASIN

BURT DAM

NIAGARA COUNTY, NEW YORK
INVENTORY No. N.Y. 745

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT, CORPS OF ENGINEERS

AUGUST 1981

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 investigations, 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 aid 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.

TABLE OF CONTENTS

TABLE OF CONTENTS - con't.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Burt Dam
State Located:	New York
County Located:	Niagara
Stream:	Eighteenmile Creek
Basin:	Lake Ontario
Date of Inspection:	May 19, 1981

ASSESSMENT

Examination of available documents and a visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigation and remedial action.

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, spillway discharges occurring during large storm events will cause water surface elevations in the downstream hazard area to rise to flood levels. A dam failure resulting from overtopping would not significantly increase the hazard to loss of life from that which would exist just prior to an overtopping failure. Therefore, the spillway is assessed as inadequate.

Since the structural stability analysis performed by the dam's designer could not be located, an analysis was performed as part of this Phase I Investigation. It indicated that the sliding and overturning factors of safety, for normal operating conditions, are less than the recommended minimum values. In addition, the dam is located in Seismic Zone 3, and there is no record of a suitable seismic analysis being performed. Therefore, an additional investigation by a qualified registered professional engineer to evaluate the normal and seismic stability of the dam is recommended.

The investigation should be completed within 12 months of notification to the owner, and remedial actions resulting from the investigation completed in the subsequent 12 months.

The following remedial measures should be performed within 1 year of notification to owner:

- Replace the missing floor grating on the bridge across the spillway.
- Paint the bridge across the spillway.
- Install hand rails the full length of the dam crest.
- Repair the gate hoist controlling the reservoir drain gate.
- Install fencing at the east abutment and post warning signs at both abutments to discourage treaspassers.
- Clean debris and vegetation from areas atop the downstream face of dam and from both abutments.
- Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks, and from upstream slopes.
- Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.
- Develop and maintain a program of biannual technical inspections.

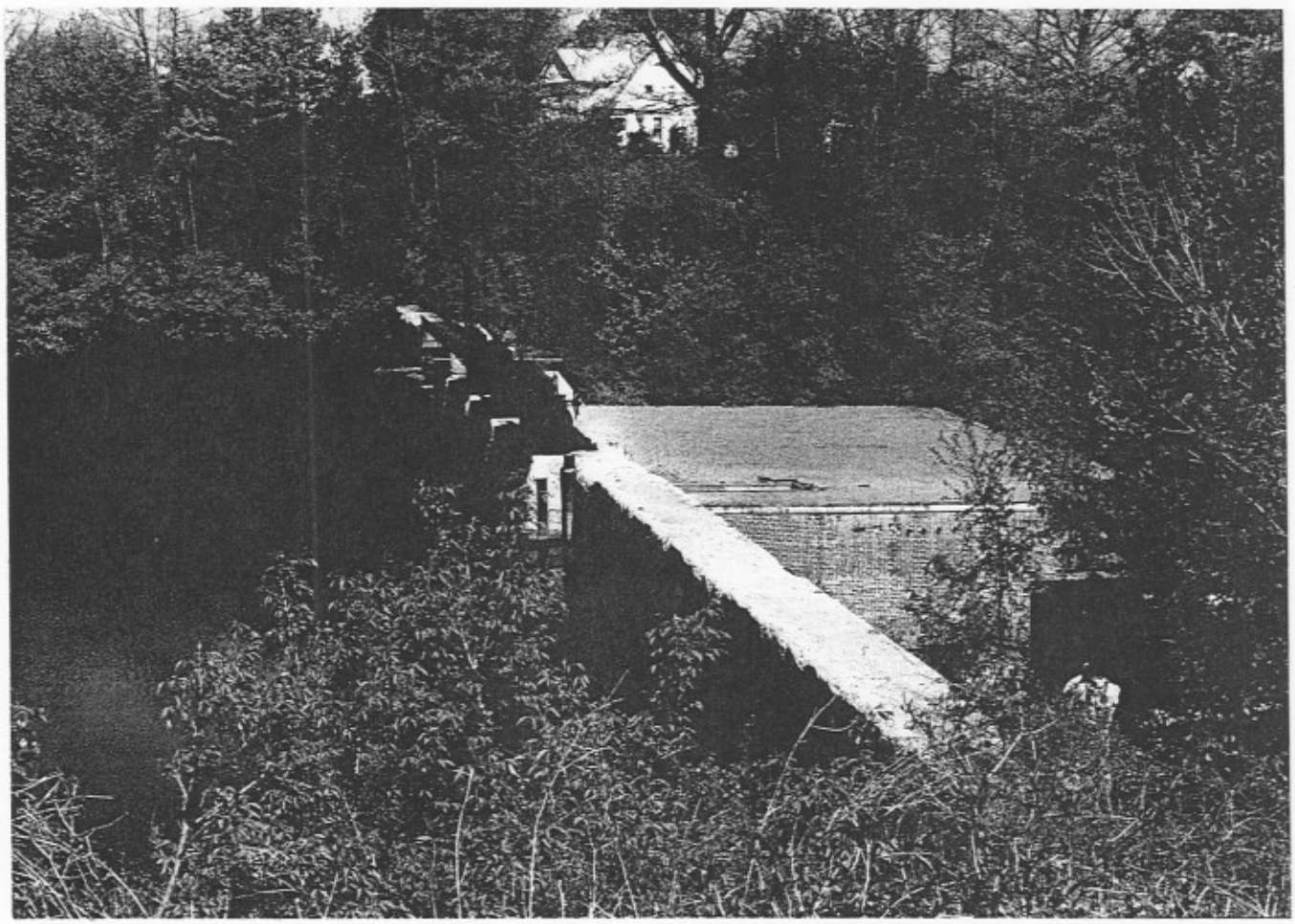
Robert J. Farrell, P.E.
New York No. 55983

Approved by:

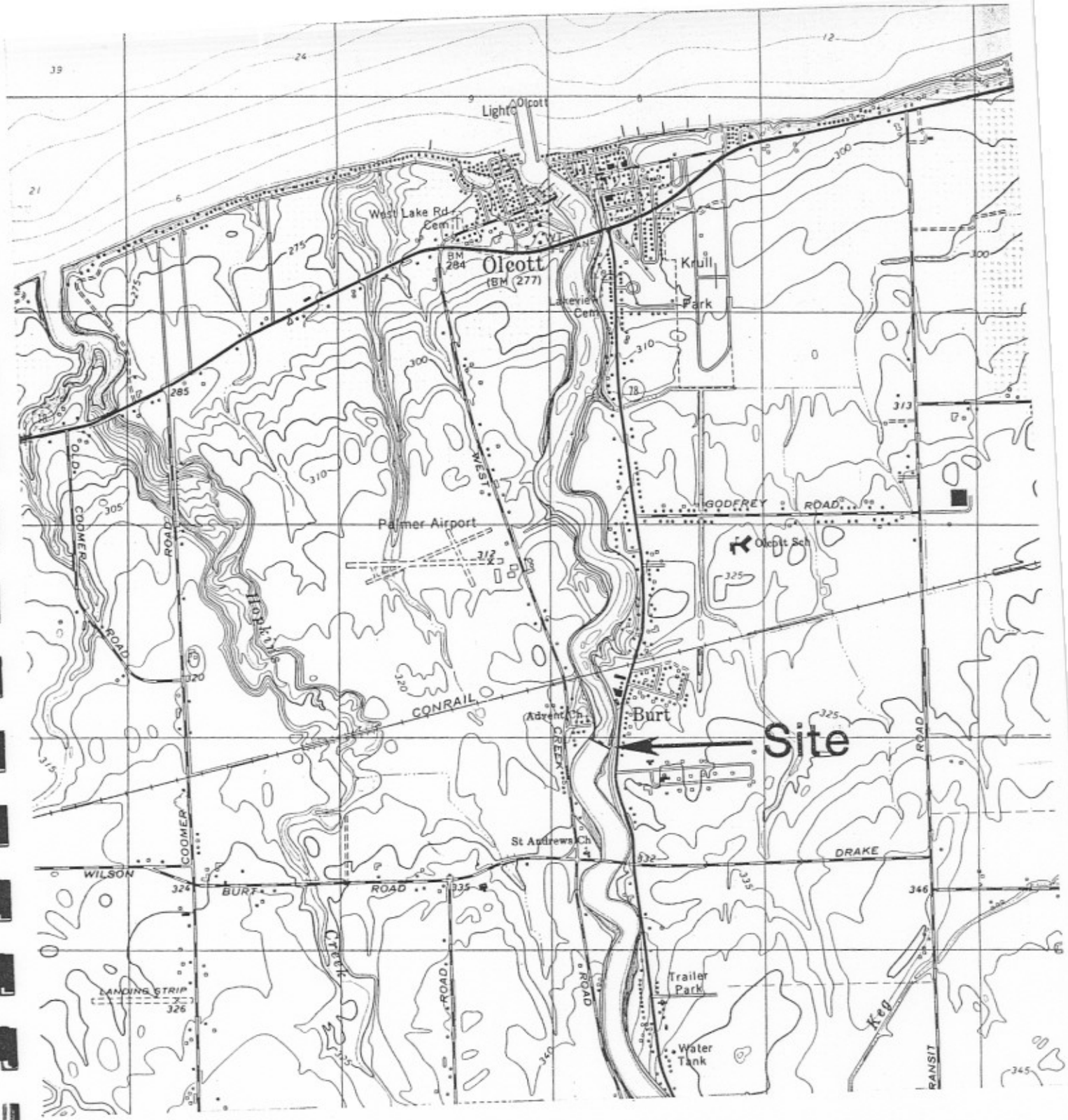
Col. W.M. Smith, Jr.
New York District Engineer

Date: 27 Aug 81

Burt Dam



OVERVIEW



Burt Dam

LOCATION PLAN

Scale: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BURT DAM
I.D. NO. NY 745
D.E.C. NO.15C-272
LAKE ONTARIO BASIN
NIAGARA COUNTY, NEW YORK

SECTION I - 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 fulfill the requirements of the National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.

b. Purpose of Inspection

This inspection was conduted 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 THE PROJECT

a. Description of Dam and Appurtenances

Burt Dam is an unreinforced concrete gravity dam with an ogee spillway located near the west abutment. It is approximately 328 ft. long and has a maximum height of 54.5 ft. The crest width of the dam is 5 ft. The upstream face of the dam is vertical. The downstream face is vertical for the top 7.5 ft. below which the face slopes at approximately 1 ft. vertical to .77 ft. horizontal.

The principal ogee spillway is 75 ft. wide and 7.5 ft. deep. The reservoir drain consists of a 6 ft. conduit running through the east end of the spillway section. It is operated by a vertical lift sluice gate with a gate hoist positioned on the walkway above the spillway.

The dam contains three penstocks. According to the design calculations two measure 9 ft. by 14 ft. while the third is 11 ft. by 18 ft. The penstocks, located near the center of the dam, at one time carried flow to the turbines in the powerhouse on the downstream face of the dam. The flow into the penstocks was controlled by two vertical lift sluice gates per penstock.

b. Location

The dam is located on Eighteenmile Creek approximately 0.2 miles south of Burt, New York. The dam is approximately 1.5 miles south of the intersection of N.Y.S. Route 18 and 78.

c. Size Classification

The dam is 54.5 ft. high and the reservoir has a storage capacity of 2447 acre-ft. The dam is classified as "INTERMEDIATE" in size (40 to 100 ft. in height).

d. Hazard Classification

The hazard classification for this dam is HIGH because of the potential for loss of life and property 2.0 miles downstream in the event of dam failure.

e. Ownership

Burt Dam is owned by the Olcott Harbor Board of Trade, a local association of businessmen. No address or telephone is listed for this organization. An application for converting the dam to power generation is pending with the Federal Energy Regulatory Commission by:

J. W. Company
Jeffery Moon, President
55 Union Place
Manchester, Connecticut 06040
Tele: (207) 775-5401

f. Purpose of Dam

Burt Dam was originally constructed for hydroelectric power generation. It presently serves no useful purpose.

g. Design and Construction History

The dam was designed and constructed by McCarthy Brothers and Ford of Buffalo, New York in 1924. The original owner was Lockport and Newfane Power and Water Supply Co.; it was later sold to Niagara Mohawk Power Co. "As-built" dam drawings were obtained from the New York State Department of Environmental Conservation, Albany, New York.

h. Normal Operating Procedure

No regular procedure of operating the sluice gates at the dam presently exists. Normal flows pass over the ogee spillway.

1.3 PERTINENT DATA

a. Drainage Area	77.4 sq. miles
b. Discharge at Damsite	
Maximum known flood at Damsite	Unknown
Recent maximum discharge (from high water mark)	1867 cfs
Principal Spillway	
Maximum Pool	6116 cfs
Total Spillway Capacity at Maximum Pool Elevation	6116 cfs
c. Elevation (U.S.G.S. Datum)	
Top of Dam	304.5 ft.
Maximum Pool	304.5 ft.
Normal Pool	297.0 ft.
Principal Spillway Crest	297.0 ft.
d. Reservoir	
Length of Normal Pool	1050 ft.
Length of Maximum Pool	1300 ft.
e. Storage	
Normal Pool	1488 acre-ft.
Maximum Pool	2447 acre-ft.
f. Reservoir Surface	
Normal Pool	95 acres
Maximum Pool	149 acres
g. Dam	
Type	Concrete Gravity
Length	328± ft.
Maximum Height	54.5± ft.
Top Width	5 ft.
Side Slopes (V:H)	
Upstream	Vertical
Downstream	Vertical to 1V:0.77H
h. Reservoir Drain	
Type	Conduit
Dimensions	6 ft. x 6 ft.
Closure	Vertical lift sluice gate
Invert Elevation	252 ft.
i. Principal Spillway	
Type	Concrete Ogee
Base Width	75 ft.
Height	7.5 ft.
Side Slopes	Vertical
Location	Near west abutment

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

The stratigraphy in northern Niagara County consists of relatively undeformed flat-lying sedimentary rocks of upper Ordovician age (450-425 million years ago). The bedrock formation is red bedded, massive shales with some interbedded siltstones and silty dolomites of the Queenston Shale Formation. The shale rock is generally moderately soft, and tends to break down rapidly upon exposure. The siltstones and silty dolomites are generally moderately hard and tend to resist weathering. The rock forms a homocline which dips southward to southwestward at approximately 40 feet per mile. Only minor folding and faulting are found in the region with no major or active faults known to exist in the area.

The Village of Olcott and the Burt Dam are in a region classified as Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams.

Glaciations of the area was extensive. During the glacial period (Pleistocene Eopch), spanning about 1.5 million years, the area was over-ridden many times by a thick continental ice sheet moving southward over the region, from Quebec and Ontario, eroding the rock and changing drainage patterns. Soil deposits left by the glacier include lake silt, sand and clayey silts deposited as off-shore deposits of primitive lakes of the Lake Iroquois stage in the Ontario basin.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigations could be located for the dam.

2.3 DESIGN RECORDS

The records available for the project consist of 4 contract drawings which show plans, sections and details of the dam and powerhouse, the original "application for Construction of a Dam", and several sheets of correspondence, some of which discuss the selected design discharge.

2.4 CONSTRUCTION RECORDS

The only construction records available consist of correspondence between the dam's designer and various public agencies.

2.5 OPERATION RECORD

An effort to locate the operation record was unsuccessful.

2.6 EVALUATION OF DATA

The information presented was obtained primarily from NYSDEC files and appears adequate and reliable for Phase I inspection and evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of Burt Dam was made on May 19, 1981. The weather was sunny, and the temperature was in the mid-seventies. The reservoir level at the time of the inspection was at elevation 297.5 MSL, 6 in. above the spillway crest.

b. Foundation

Foundation rock is generally competent and lightly weathered from the left abutment downstream. There is a horizontal clay seam (1/4 in. to 1/2 in. thick) approximately 6 ft. above the tailwater surface. Water exits this seam as a minor weep of approximately 2 GPM for its entire length. Scree covers the slope at the right abutment. Downstream of the dam (150 ft. to 200 ft.) is an outcrop of red, thin to medium bedded shale, which is moderately weathered. Slaking shale has been deposited downslope.

c. Dam

The dam is generally in good condition. However, several deficiencies and areas of deterioration were noted. These include:

1. Significant areas of eroded and spalled concrete were observed along the entire crest of the dam, as well as along both spillway sidewalls. In addition, cracks, significant spalls and effervescent stains were observed on the downstream face of the dam; although it was completely dry at the time of the inspection.

2. The gate hoist controlling the reservoir drain sluice gate is inoperative. The electric motor has been removed, and the electrical wiring has been disconnected and abandonded.

3. The wood stairs at the east abutment are seriously deteriorated.

4. Water seepage was observed along the west side of the west spillway sidewall.

5. Trees and vegetation were observed at both abutments and atop the downstream face of the dam.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate any serious problems which would adversely affect the adequacy of the dam. The following is a summary of the problem areas encountered, in order of importance, with the appropriate recommended action:

1. The missing floor grating on the bridge across the spillway should be replaced. The entire bridge should be painted.

2. Handrails should be installed the full length of the dam crest.

3. The stairs at the east abutment should be repaired or replaced.

4. The gate hoist controlling the reservoir drain sluice gate should be made operational. The gate should be exercised and lubricated annually.

5. The reservoir should be lowered below the spillway crest so that the spillway and downstream toe of the dam can be inspected.

6. Fencing should be installed at the east abutment and warning signs posted at both abutments to discourage trespassers.

7. The concrete cracks and spalls should be monitored.

8. Some debris has collected near the crest of the principal spillway. This debris should be removed on an annual basis.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

No written operation and maintenance procedures exist for the project. The normal operation of the project consists of allowing water to flow over the spillway section of the dam. It appears that the reservoir drain has not been used in many years.

4.2 MAINTENANCE OF DAM

The dam's owner, the Olcott Harbor Board of Trade, practices a policy of deferred maintenance.

4.3 WARNING SYSTEM IN EFFECT

No warning system is in effect or in preparation.

4.4 EVALUATION

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

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Burt Dam is located on Eighteenmile Creek in the Lake Ontario basin, and has a drainage area of 77.4 square miles. The dam is situated approximately 1200 ft. south of Burt, New York in the Town of Newfane. The topography of the watershed is gently northward sloping farmlands, with orchards and woodland.

5.2 DESIGN DATA

Burt Dam was constructed for the purpose of hydroelectric power generation, although power is not currently being generated. According to the application for construction of the dam, dated April 24, 1924, the design flow for the dam was 5,940 cfs (144 cfs/acre). This figure was computed by assuming a peak flow of 64 cfs/sq. mi. over an 85 square mile drainage basin plus 500 cfs overflow from the New York State Barge Canal. The combined discharges from the spillway, penstocks, and sluice gate of 5953 cfs produces a design high water of 302.0 ft. (MSL). The ogee spillway control cross section is 75 ft. wide with a crest elevation of 297.0 ft. (MSL). The dam crest elevation is 304.5 ft. (MSL).

5.3 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and the storage of the reservoir was performed using the Corps of Engineers HEC-1 Dam Safety Version computer model. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method. The drainage area for Burt Dam was divided into three smaller drainage areas: Eighteenmile Creek, East Branch Eighteenmile Creek, and the West Branch Eighteenmile Creek; and routed downstream by means of the Muskingam routing procedure. The three penstocks and the reservoir drain gate are inoperable and were excluded as factors in the hydraulic analysis as were the tailwater effects of Lake Ontario. The Probable Maximum Precipitation (PMP) was 21.8 in. (24 hours 200 sq. miles) from Hydrometerological Report #33 in accordance with the Recommended Guidelines of the Corps of Engineers. The dam is 54.5 ft. high and impounds approximately 2447 acre-ft. at the top of the dam. The dam is classified as a HIGH hazard and INTERMEDIATE in size, according to the Recommended Guidelines of the Corps of Engineers. The spillway design flood is the Probable Maximum Flood (PMF). The floods selected for analysis were 20, 40, 50, 60, 80 and 100% of the PMF flows. The PMF inflow of 65,495 cfs was routed through the reservoir and the peak outflow was determined to be 65,687 cfs. The peak PMF elevation is 316.8 ft. (MSL) or 12.3 ft. above the top of dam. The maximum elevation for one half the PMF is 311.7 ft. (MSL) or 7.2 ft. above the top of the dam. The inflow and outflow for one half the PMF are 32,748 cfs and 32,785 cfs, respectively.

5.4 RESERVOIR CAPACITY

The reservoir capacities at the crest of the spillway and at the top of the dam are 1488 acre-ft. and 2447 acre-ft., respectively. Surcharge storage between the spillway crest and the top of the dam is equivalent to 0.23 in. of runoff from the drainage area.

5.5 EXPERIENCE DATA

There are no flood records for the dam site. However, during the field investigation evidence of recent high water was observed at elevation 300.4 ft. (MSL). This reservoir elevation corresponds to a peak outflow of 1867 cfs.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 6116 cfs which is less than the PMF peak outflow of 65,687 cfs. The dam is overtopped by the PMF, the peak elevation being 12.3 ft. above the top of the dam. The dam is also overtopped by half the PMF, the peak elevation being 7.2 ft. above the top of the dam. The dam will be overtopped by floods greater than 10% of the PMF.

5.7 ANALYSIS OF DOWNSTREAM IMPACTS

During the field investigation, dwellings and highways located downstream of the dam were identified and referenced to the channel invert. The cross section locations used in the downstream channel routing are shown on Page D-2, Appendix D. The impacts of the PMF on dwellings located downstream of the dam are shown in Table 5.1. For the purposes of this analysis, a danger of loss of life was assumed to exist if the computed PMF water surface was above the first floor elevation of a structure. This situation occurs at a substantial number of structures (Locations 7 & 8) as well as some small roads being overtopped at Location 8. The potential danger of loss of life and economic damage is substantial enough to warrant classification as a HIGH hazard dam.

5.8 EVALUATION

The spillway of Burt Dam will safely pass only 10% of the PMF without overtopping. The spillway, therefore, is assessed as inadequate.

ETL 1110-2-234, Section 5, gives the basis for determining whether or not a spillway should be classified as seriously inadequate. The results of this investigation indicates that there would not be a significant increase in the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. This is illustrated by the elevation - discharge relationship shown in Figure 5.1. The increase in flow above elevation 304.5 ft. (MSL) does not appear to be significant, therefore the spillway is assessed as inadequate. Potential problems include:

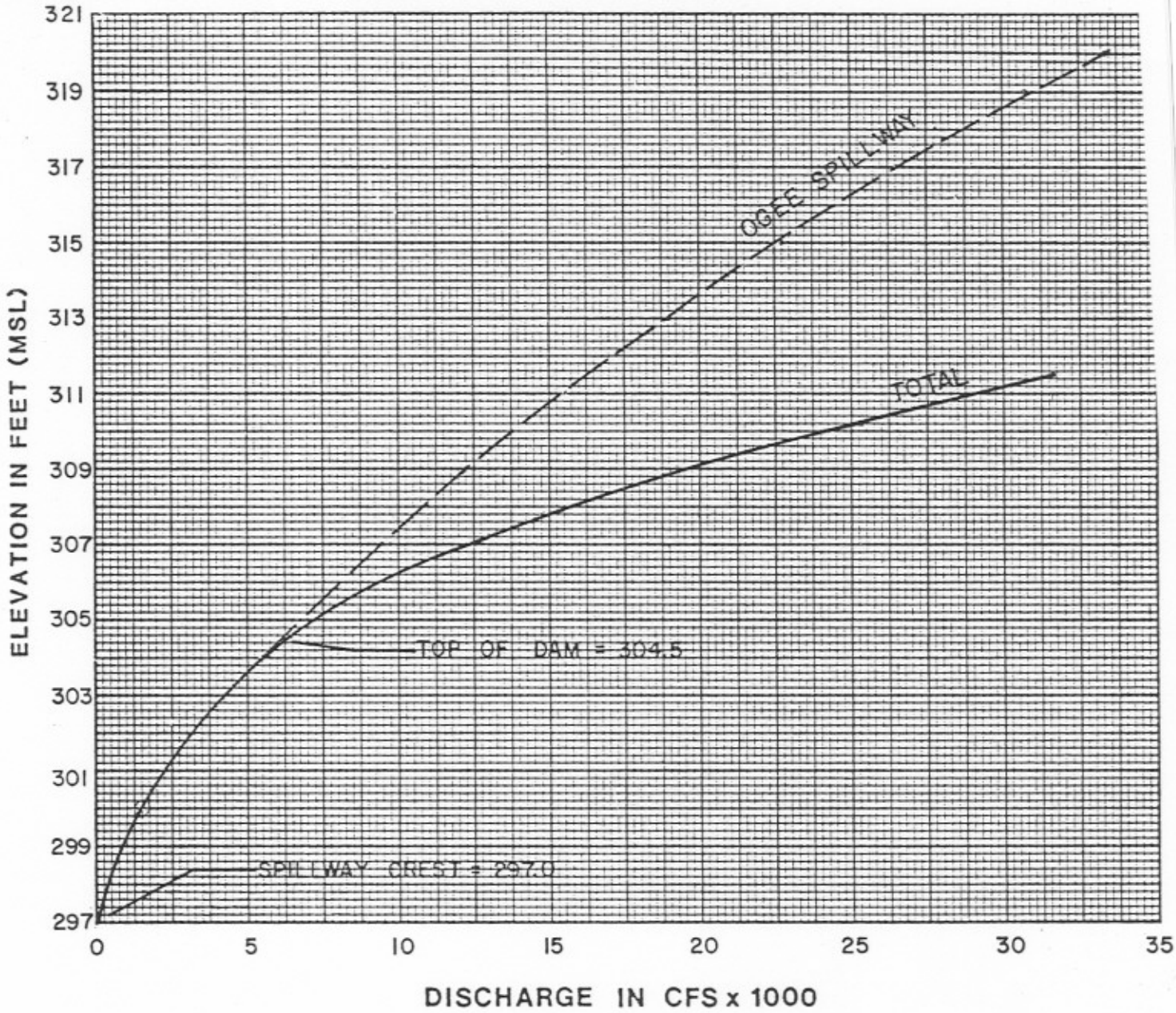
a) The danger of loss of life and economic damage in the harbor area (Locations 7 & 8) downstream of the dam for floods in the 1/2 PMF to PMF range.

TABLE 5.1

SUMMARY OF DOWNSTREAM IMPACTS FOR PMF

Location # (See pg. D-2, Appendix D)	Location	# of Dwellings	Structure Height Above Streambed (1) (ft)	Peak Flow (cfs)	Peak Stage (2) (ft)	Comments
-	At Dam	-	-	65,687	-	-
1	500' d/s of dam	-	-	65,662	34.7	-
2	800' d/s of Loc. 1	-	-	65,647	36.5	-
3	1300' d/s of Loc. 2	-	-	65,609	19.2	-
4	1100' d/s of Loc. 3	-	-	65,605	18.6	-
5	1800' d/s of Loc. 4	-	-	65,582	16.6	-
6	1700' d/s of Loc. 5	-	-	65,604	17.7	-
7	1600' d/s of Loc. 6	1 boathouse	11.5	65,612	16.4	Danger of loss of life
	500' d/s of Loc. 7	1 boathouse	13.0	65,612	15.2	
	"	1 house	17.6	65,612	15.2	
	"	1 house	14.3	65,612	15.2	
	"	1 house	15.7	65,612	15.2	
8	1400' d/s of Loc. 7	50 houses	13.4	65,622	14.0	Danger of loss of life
		1 yacht club	14.4	65,622	14.0	
		1 boat co.	14.9	65,622	14.0	Roads on the west side @ Loc 8 will be overtopped.
		1 commercial	15.1	65,622	14.0	

Notes: (1) Structure height above streambed is the difference in elevation of dwelling's 1st floor & channel invert.
(2) Tailwater effects of Lake Ontario were not considered in the analysis



BURT DAM (N.Y. 745)

RATING CURVE

PHASE I DAM INSPECTION REPORT

DATE: JULY, 1981 | FIGURE 5.1

SECTION 6 - STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

Visual observations did not detect any settlement, displacement, tilting or distress of the dam of appurtenant structures with the reservoir at its present level. There are no adverse conditions which would affect the stability of the dam at the present time.

6.2 DESIGN AND CONSTRUCTION DATA

No information could be located regarding the structural stability of the dam.

6.3 OPERATING RECORD

No operating records could be located for the structure. The sluice gate for draining the reservoir cannot be operated in its present condition.

6.4 POST-CONSTRUCTION CHANGES

There have been no post-construction changes to the dam. However, two of the three turbines have been removed, and the powerhouse has been abandoned.

6.5 SEISMIC STABILITY

The dam is located in Seismic Zone 3 and, in accordance with the recommended Phase I guidelines, a seismic stability analysis is warranted. This should be accomplished by a qualified registered professional engineer and should be made a part of the record for this dam.

6.6 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted for the typical dam cross section. The results of the analysis are as follows:

Case	Description of Loading Conditions
1	Normal Operating Conditions, reservoir at elevation 297.0 MSL, full uplift, no tailwater.
2	Same as Case 1 plus 10 kips/L.F. ice load.
3	Water at 1/2 PMF elevation 311.53 MSL, uplift as in case 1, tailwater at elevation 280.7 MSL

Case	Factor of Safety Overturning	Location of Resultant From Toe	Factor of Safety Sliding
1	1.54	13.8	1.08
2	1.33	9.82	.96
3	.95	-3.10	.62

The location of the middle third of the dam foundation is 13.67 ft. to 27.33 ft. from the toe. A factor of safety of 1.5 for overturning, a resultant location within the middle third of the foundation, and a factor of safety of 3.0 for sliding is considered to be adequate by the Corps of Engineers guidelines. Therefore, it is recommended that an in-depth investigation of the structural stability of the dam be conducted. That investigation should include the following items:

1. The reservoir level should be lowered below the spillway crest elevation to permit an inspection of the ogee spillway and the rock at the toe of the dam.

2. The actual magnitude and distribution of hydrostatic uplift pressures under the dam should be determined by installing and monitoring piezometers.

3. Core samples of the dam and foundation rock should be taken to determine in-situ material properties.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of the Burt Dam did not reveal conditions which constitute an immediate hazard to the human life and property of the downstream residents.

From the available data the total spillway capacity is capable of discharging 10% of the PMF before overtopping of the dam occurs. This spillway is, therefore, judged to be inadequate.

The structural stability analysis performed as part of this investigation indicates the dam has safety factors against overturning and sliding below those recommended by the Corps of Engineers Guidelines.

b. Adequacy of Information

The information reviewed for this Phase I inspection is considered adequate.

c. Need for Additional Investigation

The following investigation is required to be performed by a qualified registered professional engineer:

1. Investigate the normal and seismic stability of the dam and spillway.

d. Urgency

All recommended investigations should be completed within 12 months of notification to owner, and remedial actions resulting from these investigations completed in the subsequent 12 months. The remedial measures or actions listed below should be completed within one year from notification to owner.

7.2 RECOMMENDED REMEDIAL MEASURES

1. Implement those remedial measures or actions resulting from the aforementioned investigation.
2. Replace the missing floor grating on the bridge across the spillway.
3. Paint the bridge across the spillway.

4. Install handrails the full length of the dam crest.

5. Repair the gate hoist controlling the reservoir drain gate.

6. Install fencing at the east abutment and post warning signs at both abutments to discourage trespassers.

7. Clear debris and vegetation from areas atop the downstream face of dam and from both abutments.

8. Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks and from upstream slopes.

9. Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.

10. Develop and maintain a program of biannual technical inspections.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Burt Dam

Fed. I.D. # 745 DEC Dam No. 15C-272

River Basin Lake Ontario

Location: Town Burt County Niagara

Stream Name Eighteenmile Creek

Tributary of

Latitude (N) 43° 18.8' Longitude (W) 78° 43.0'

Type of Dam Concrete Gravity

Hazard Category High

Date(s) of Inspection May 19, 1981

Weather Conditions Sunny, 70°

Reservoir Level at Time of Inspection Elevation 297.5, 6 in. on spillway

b. Inspection Personnel Jim Reynolds, Ray Kampff, Jeff Hardin, Ken Avery, Bob Farrell, Rick Brown

c. Persons Contacted (including Address & Phone No.) Attempted unsuccessfully to contact Olcott Harbor Board of Trade

d. History:

Date Constructed 1924 Date(s) Reconstructed

Designer McCarthy Brothers and Company

Constructed by Same as Designer

Owner Olcott Harbor Board of Trade

) Embankment Not applicable

a. Characteristics

(1) Embankment Material _____

_____

(2) Cutoff Type _____

_____

(3) Impervious Core _____

_____

(4) Internal Drainage System _____

_____

(5) Miscellaneous _____

_____

b. Crest

(1) Vertical Alignment _____

_____

(2) Horizontal Alignment _____

_____

(3) Surface Cracks _____

_____

(4) Miscellaneous _____

_____

c. Upstream Slope

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

(2) Undesirable Growth or Debris, Animal Burrows _____

_____

(3) Sloughing, Subsidence or Depressions _____

_____

_____

(4) Slope Protection

(5) Surface Cracks or Movement at Toe

d. Downstream Slope

(1) Slope (Estimate - V:H)

(2) Undesirable Growth or Debris, Animal Burrows

(3) Sloughing, Subsidence, or Depressions

(4) Surface Cracks or Movement at Toe

(5) Seepage

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

(7) Condition Around Outlet Structure

(8) Seepage Beyond Toe

e. Abutments - Embankment Contact

(1) Erosion at Contact

(2) Seepage Along Contact

4) Drainage System

(a) Description of System None noted

(b) Condition of System

(c) Discharge from Drainage System

5) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piczometers, etc.) None noted

6) Reservoir

a. Slopes Generally good condition

b. Sedimentation Could not be observed

c. Unusual Conditions Which Affect Dam None

7) Area Downstream of Dam

a. Downstream Hazard (No. of homes, highways, etc) Many structures in Olcott, See Table 5.1 for Summary of Downstream Impacts.

b. Seepage, unusual growth Many trees in and along channel

c. Evidence of movement beyond toe of Dam None noted

d. Conditions of Downstream Channel Rock strewn, stable

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

Spillway could not be inspected because of flow over it

a. General Side walls are spalled

b. Condition of Service Spillway Good based on what could be seen

c. Condition of Auxiliary Spillway Not applicable

d. Condition of Discharge Conveyance Channel

8) Reservoir Drain/Outlet

Type: Pipe ____ Conduit ____ Other 6' x 6' penetration thru spillway

Material: Concrete ____ Metal ____ Other ____

Size: 6' x 6' Length Approx 40'

Invert Elevations: Entrance 252 ft. Exit 252 ft.

Physical Condition (Describe): Unobservable X

Material: ____

Joints: ____ Alignment ____

Structural Integrity: ____

Hydraulic Capability: ____

Means of Control: Gate X Valve ____ Uncontrolled ____

Operation: Operable ____ Inoperable X Other ____

Present Condition (Describe): ____

9) Structural

a. Concrete Surfaces Spalling significant on crest, spillway sidewalls and downstream face

b. Structural Cracking Minor

c. Movement - Horizontal & Vertical Alignment (Settlement) None observed

d. Junctions with Abutments or Embankments Could not inspect

e. Drains - Foundation, Joint, Face None

f. Water Passages, Conduits, Sluices Could not inspect reservoir drain water passage

g. Seepage or Leakage Seepage observed along west side of west spillway side wall. May be ground water.

h. Joints - Construction, etc. Effervesance observed along same construction joints. No leakage.

i. Foundation On rock. Could not inspect near dam due to high water.

j. Abutments Covered with earth, trees and vegetation

k. Control Gates Inoperative

l. Approach & Outlet Channels Not applicable

m. Energy Dissipators (Plunge Pool,etc) None

n. Intake Structures Not applicable

o. Stability Good. No problems observed

p. Miscellaneous

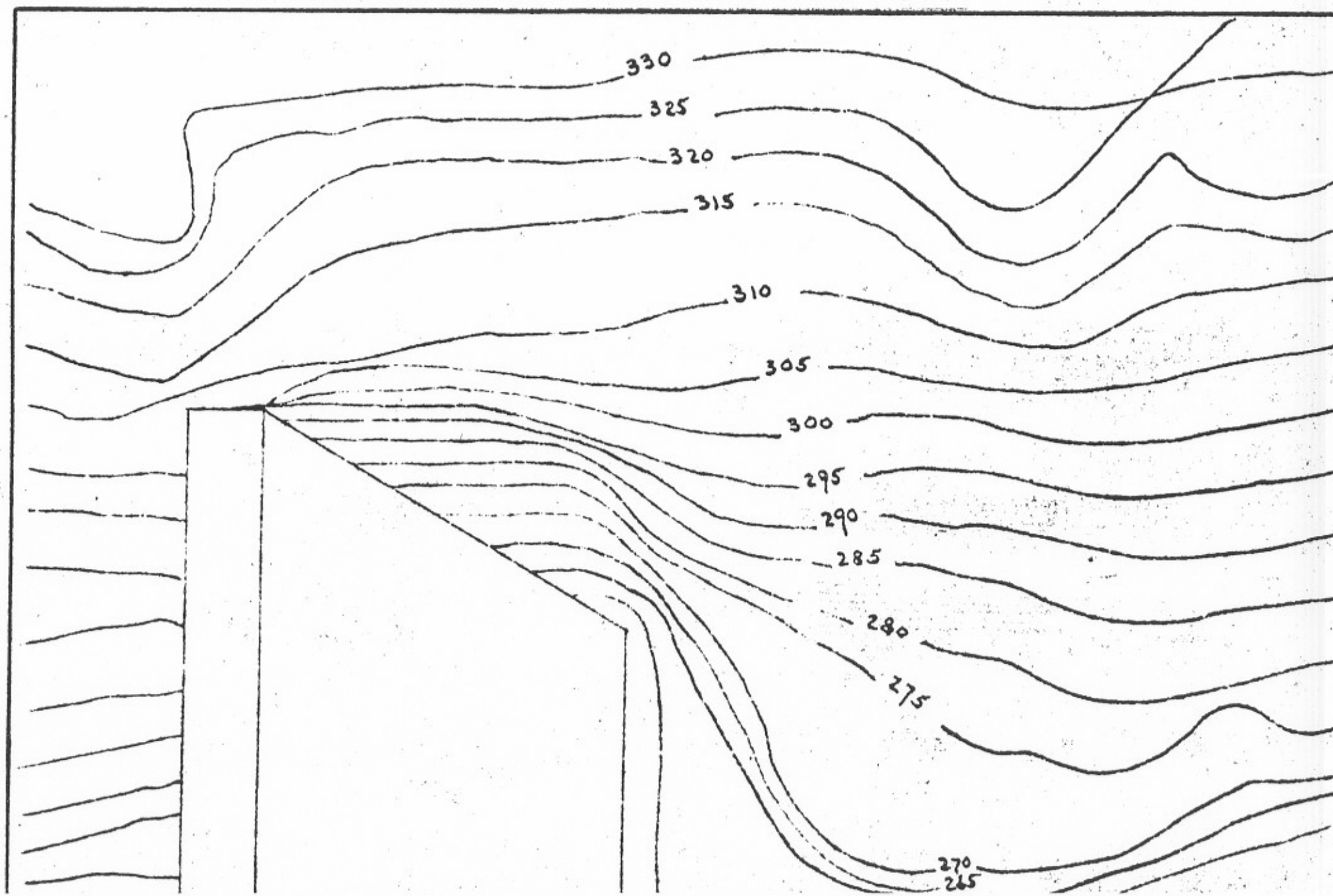
10) Appurtenant Structures (Power House, Lock, Gatchouse, Other)

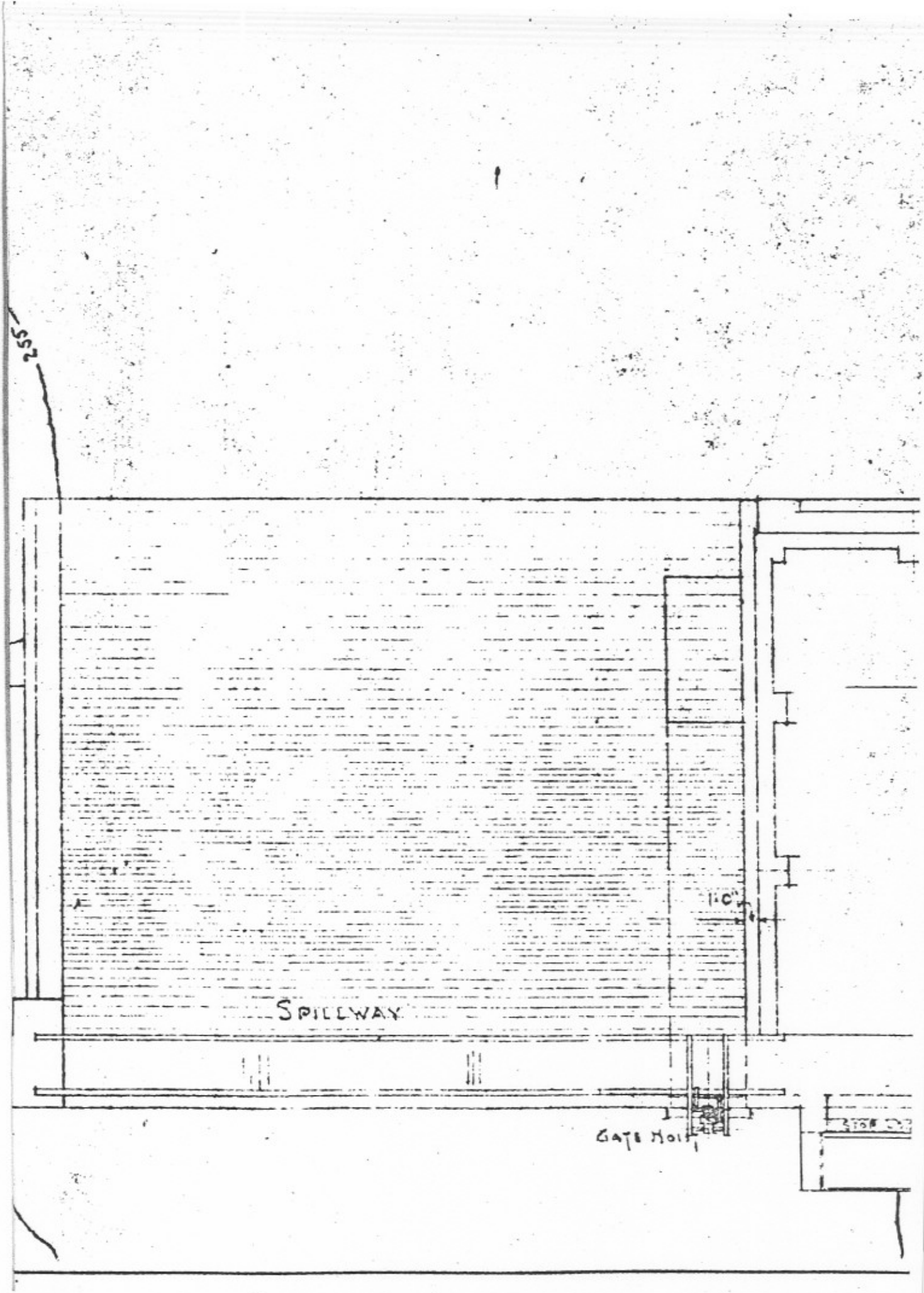
a. Description and Condition Power House abandoned but in good condition

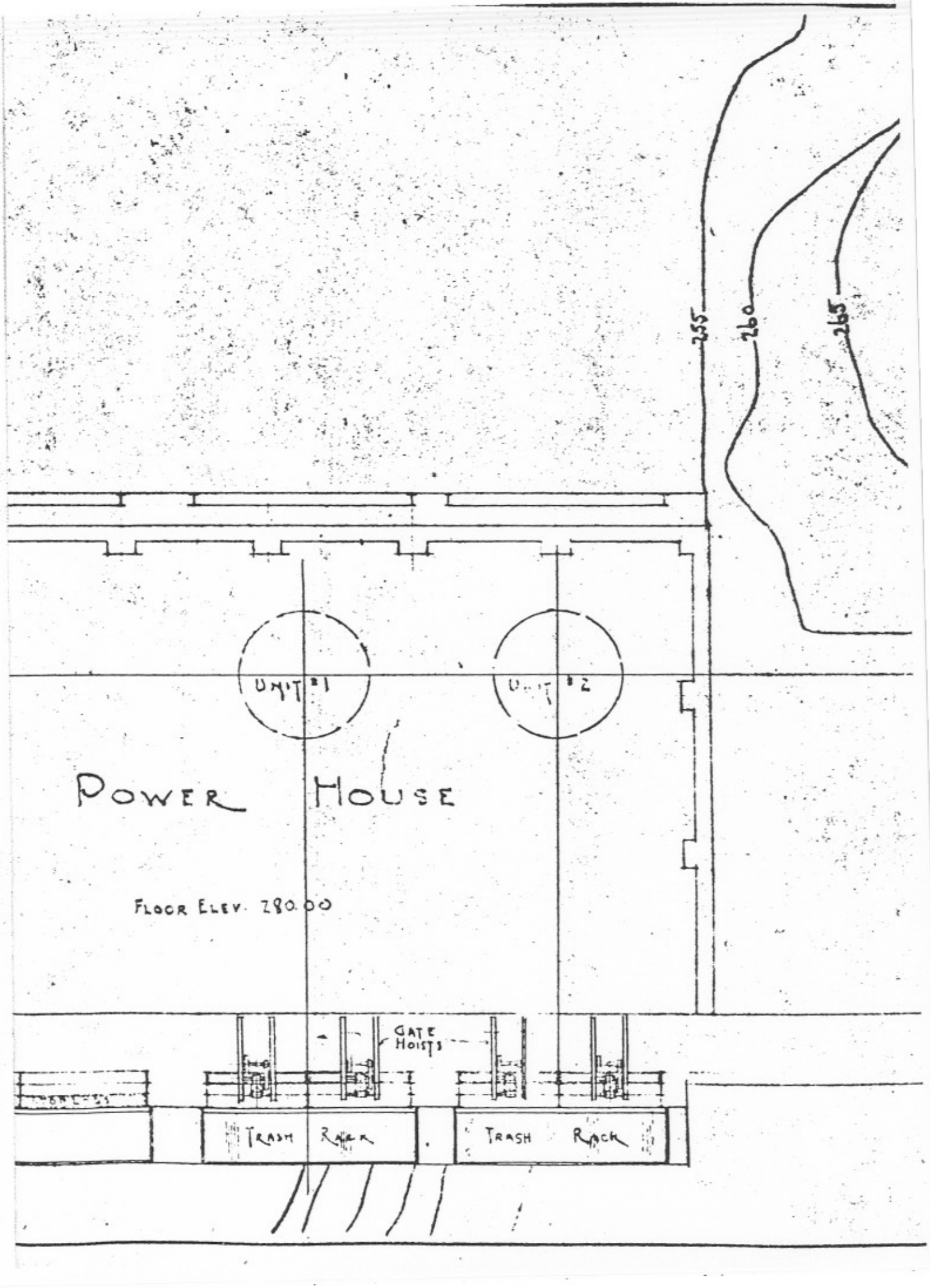
APPENDIX B

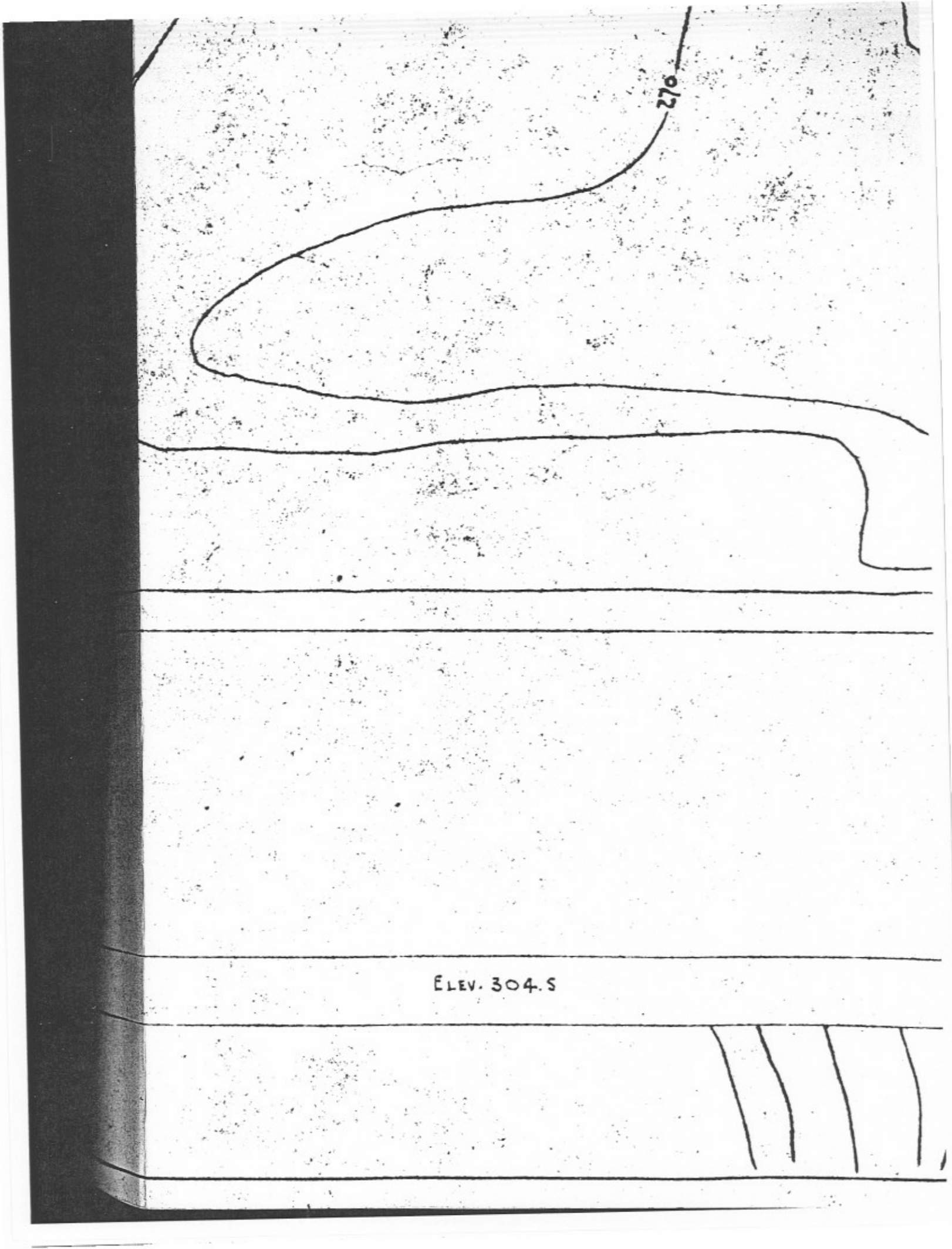
ENGINEERING DATA

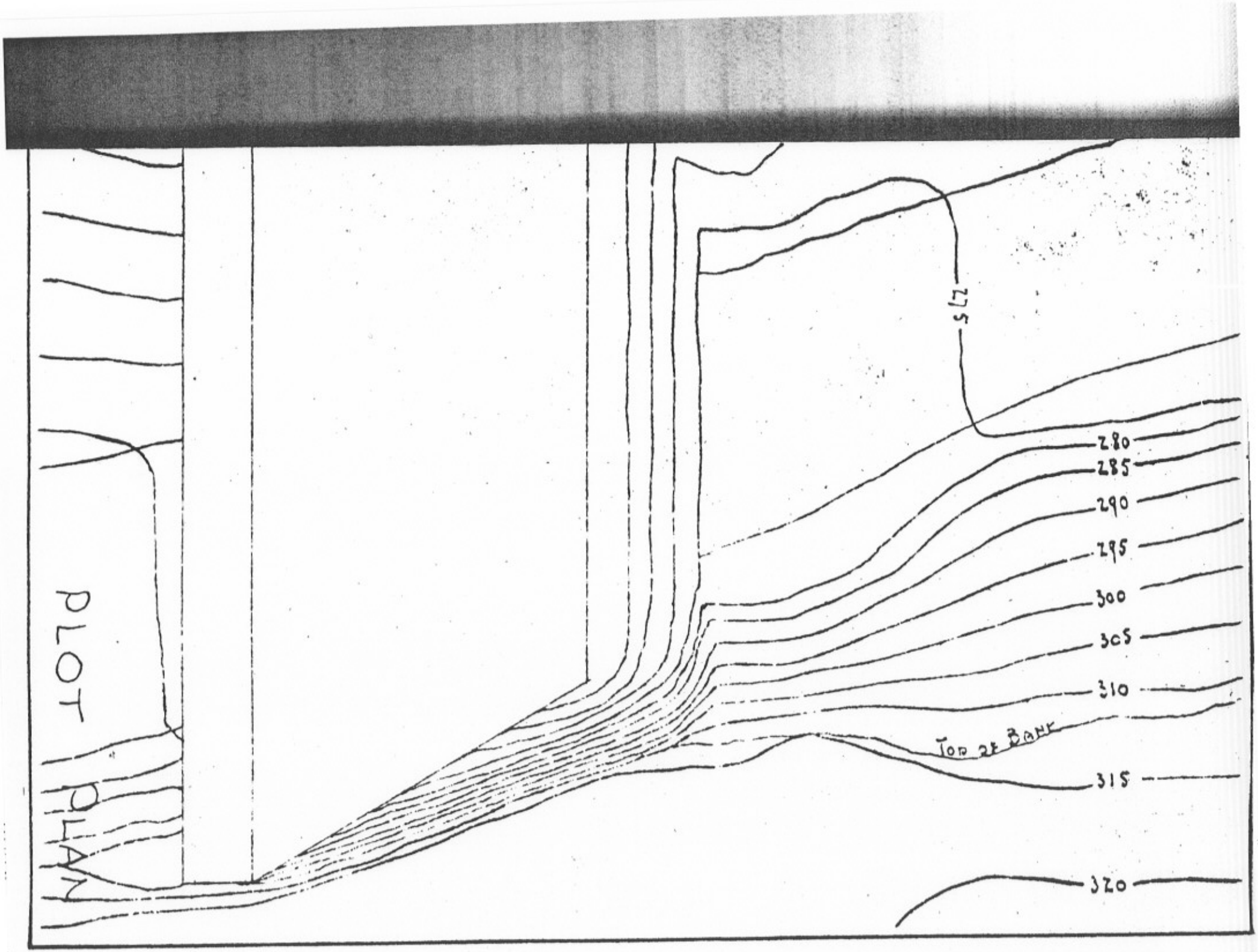
APPENDIX B

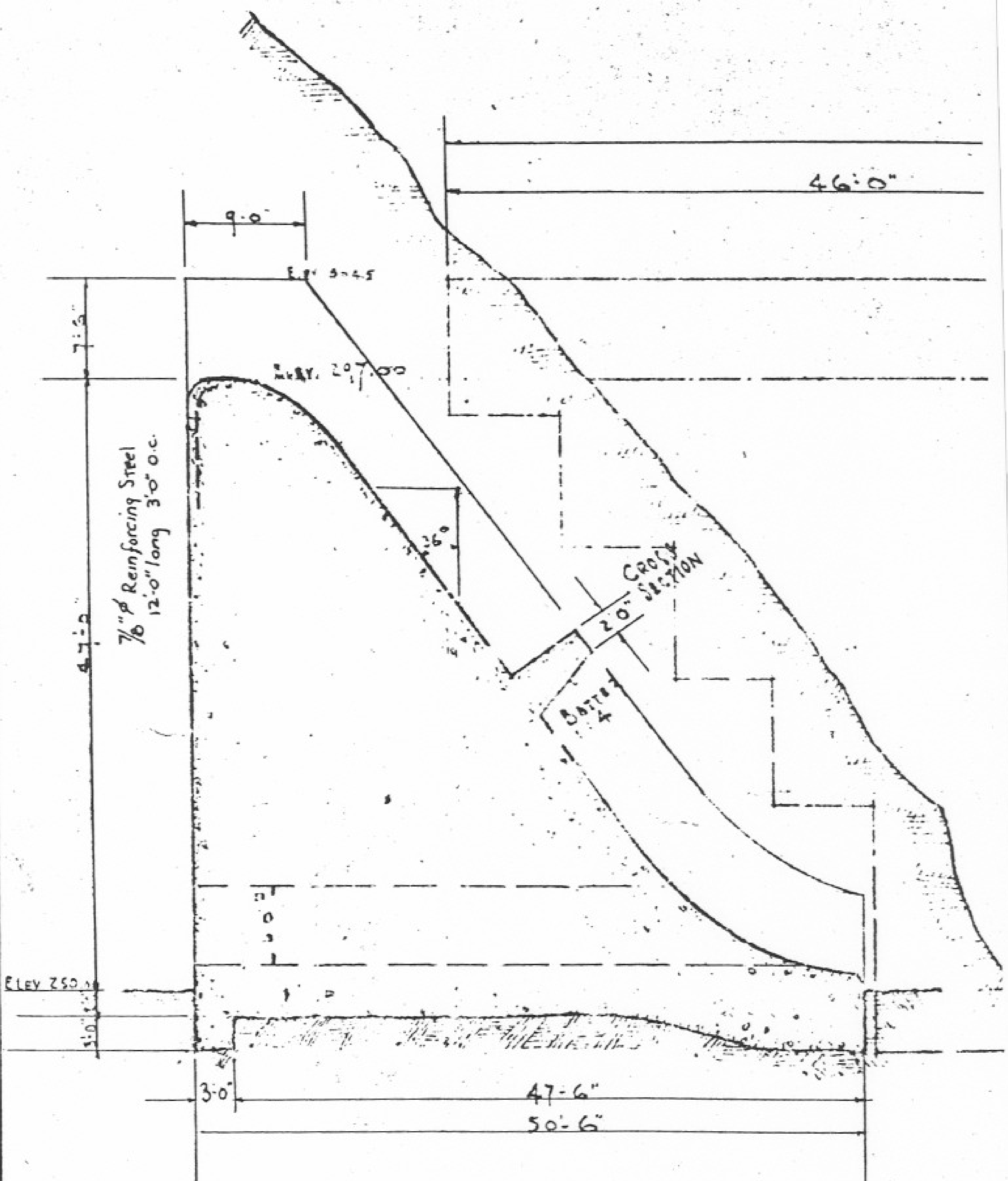

330
325
320
315
310
305
300
295
290
285
280
275
270
265


255
SPILLWAY
GATE HOI

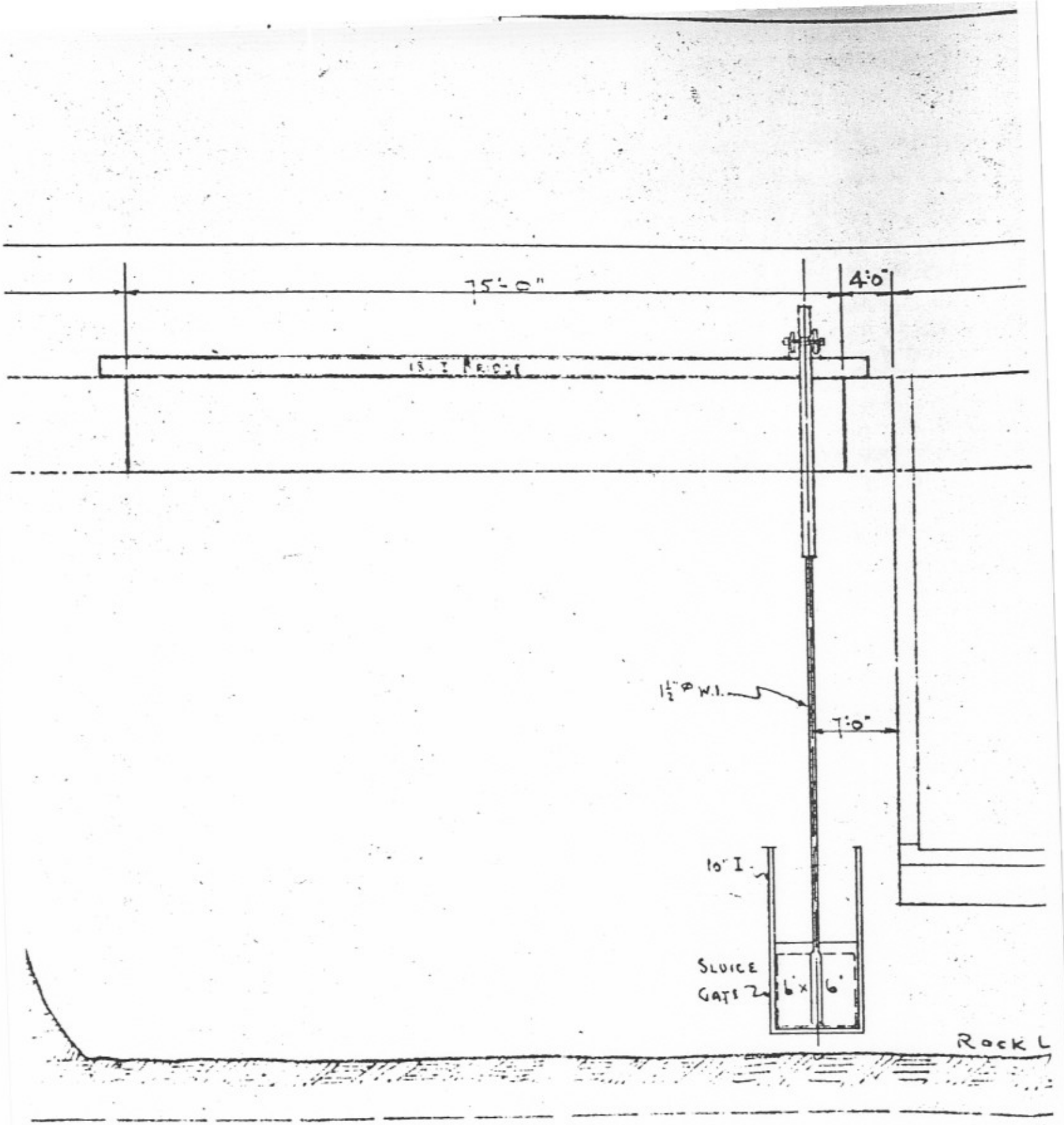

255
260
265
UNIT #1
UNIT #2
POWER HOUSE
FLOOR ELEV. 280.00
GATE HOISTS
TRASH RACK
TRASH RACK

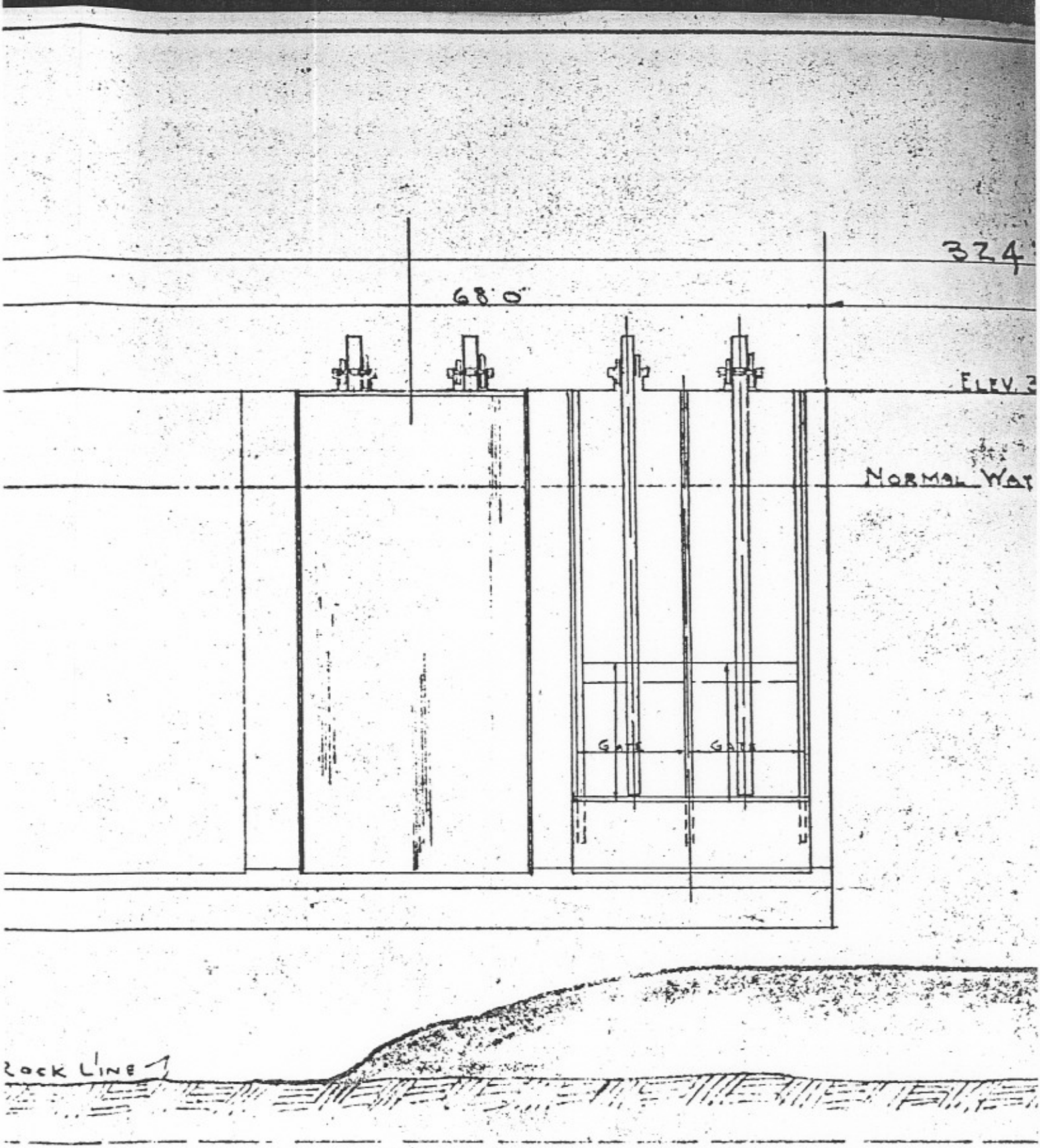

270
ELEV. 304.5


PLOT PLAN
275
280
285
290
295
300
305
310
TOP OF BANK
315
320

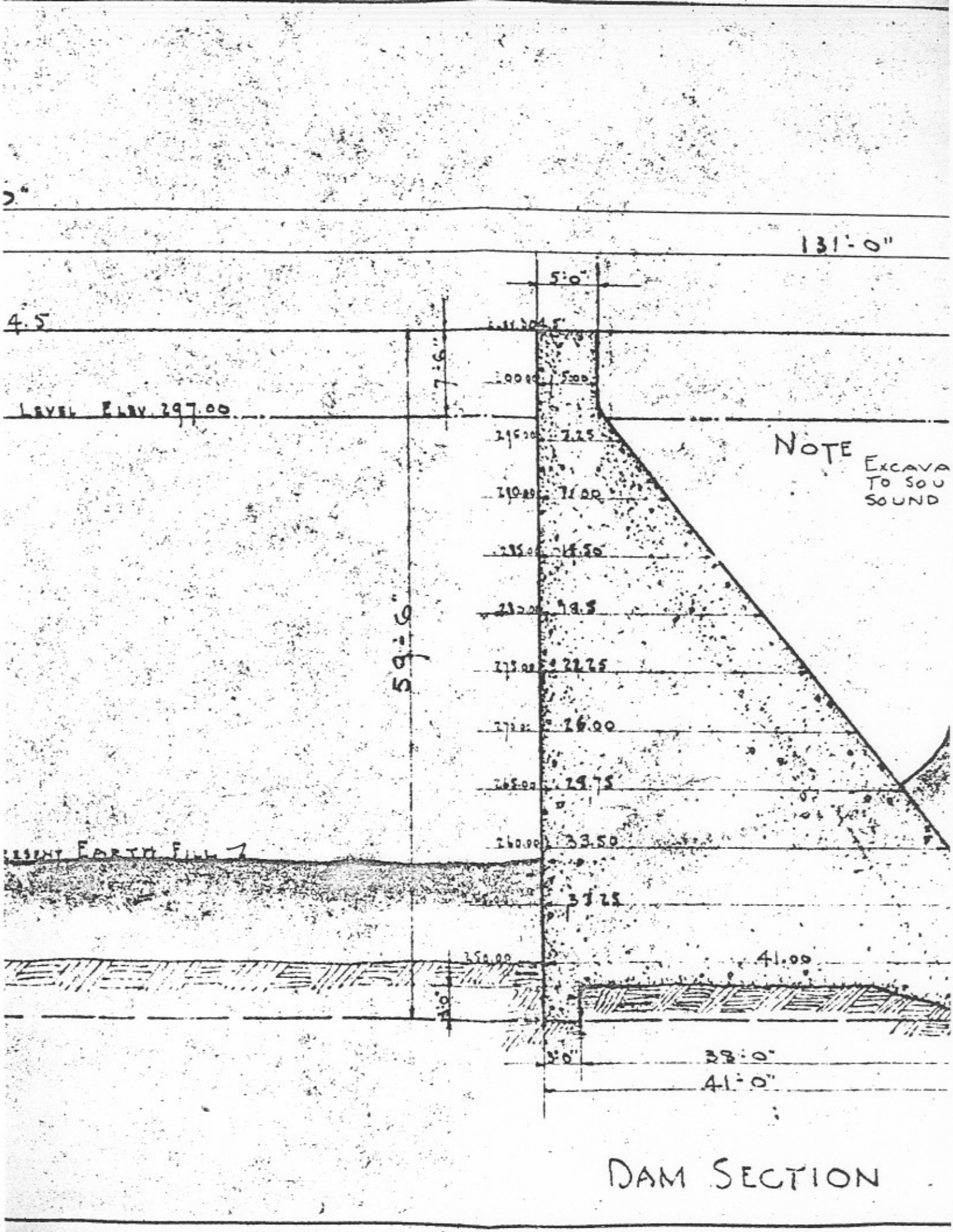


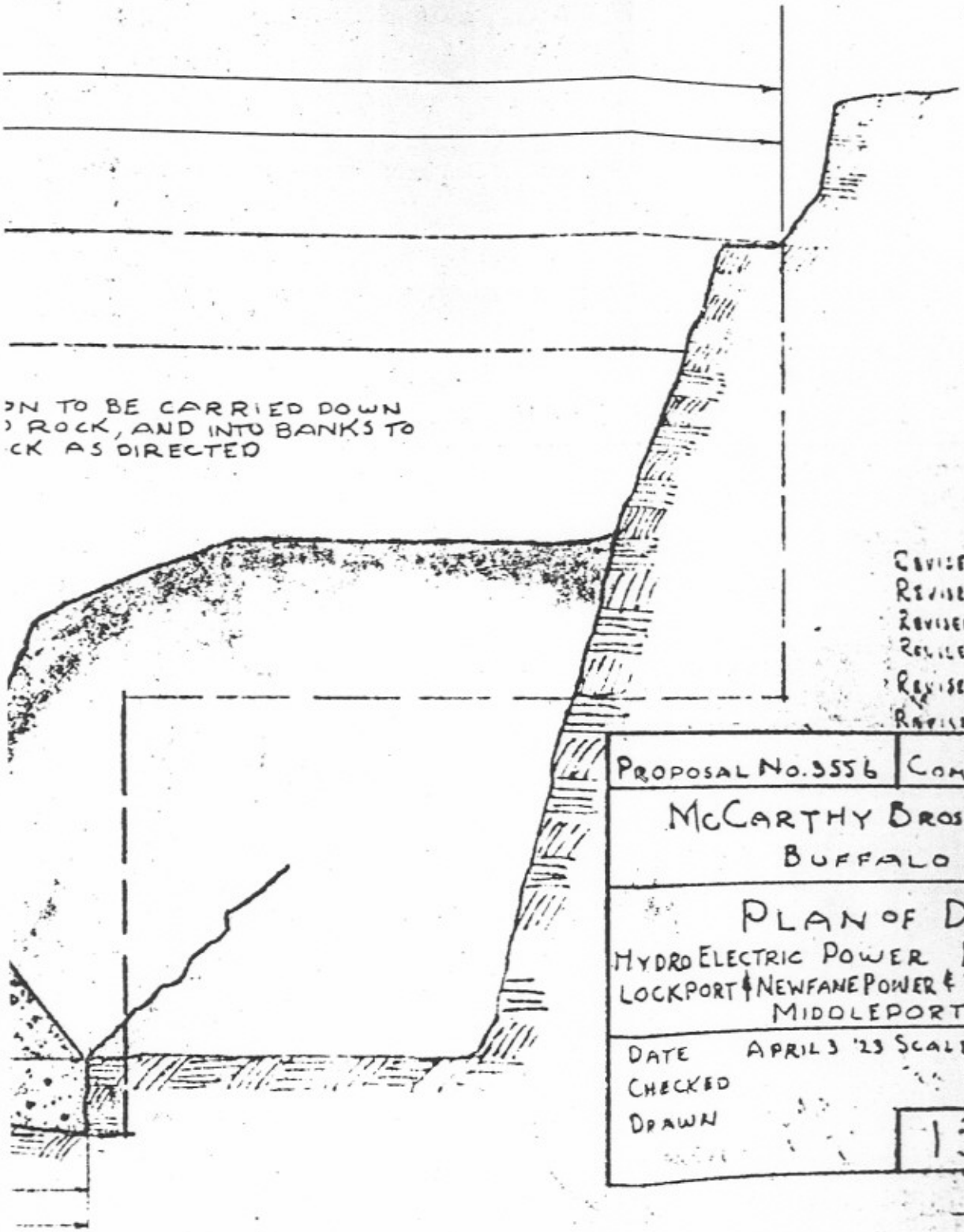
Spillway Section


75'-0"
4'-0"
1½" ø W.I.
7'-0"
10" I
SLUICE GATE
6' x 6'
ROCK L



UPSTREAM ELEVATION


131'-0"
5'-0"
4.5
7'-6"
LEVEL ELEV. 297.00
NOTE
EXCAVA
TO SOU
SOUND
7.25
11.00
14.50
18.5
22.25
26.00
29.75
33.50
37.25
41.00
50'-0"
3'-0"
38'-0"
41'-0"
DAM SECTION



REVISED 5-6-24 A-304-16
REVISED 4-26-24 A-304-8
REVISED 4-[illegible]-24 A-304-6
REVISED 4-23-24 A-304-4
REVISED 3-15-[illegible] A-304-A4
REVISED 4-[illegible] A-304-A2

PROPOSAL No. 3556	CONTRACT No.

McCARTHY BROS & FORD
BUFFALO N.Y.

PLAN OF DAM

HYDRO ELECTRIC POWER DEVELOPMENT
LOCKPORT & NEWFANE POWER & WATER SUPPLY CO.
MIDDLEPORT N.Y.

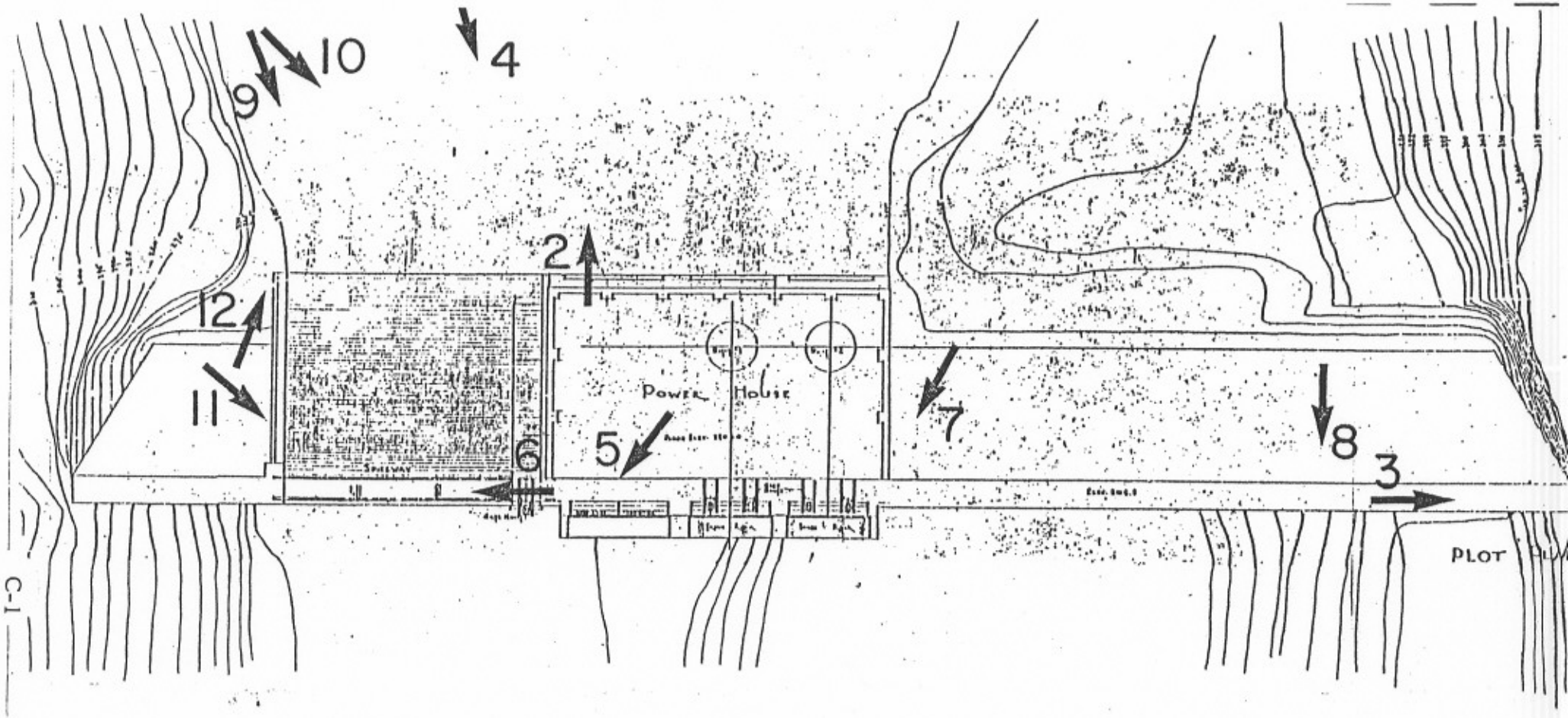
DATE APRIL 3 '23 SCALE N.T.S.
CHECKED
DRAWN

1332	E

B-3

APPENDIX C

PHOTOGRAPHS

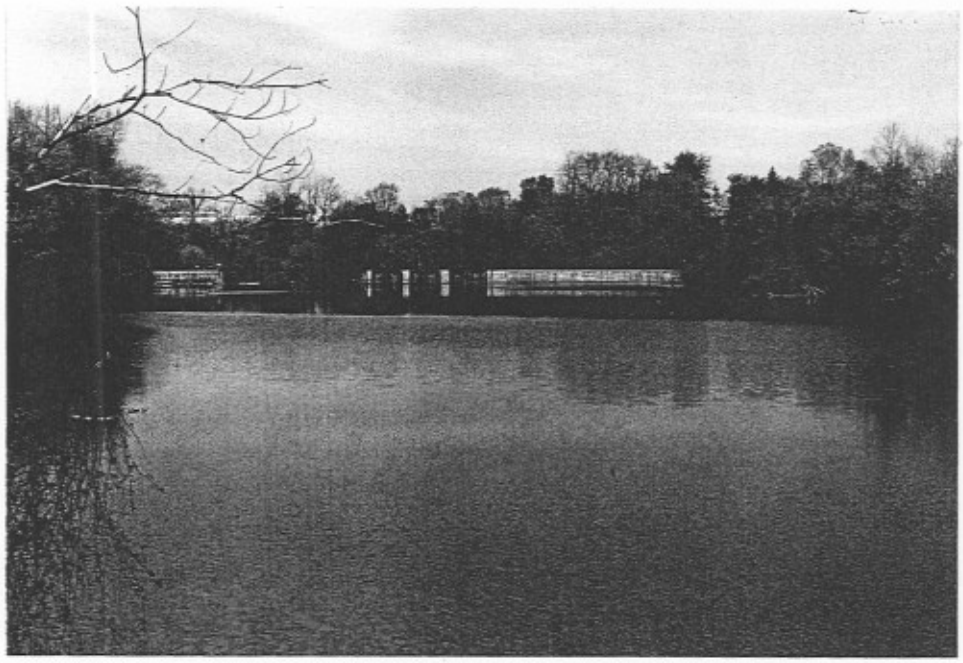


BURT DAM

NY00745

PHOTO ORIENTATION PLAN

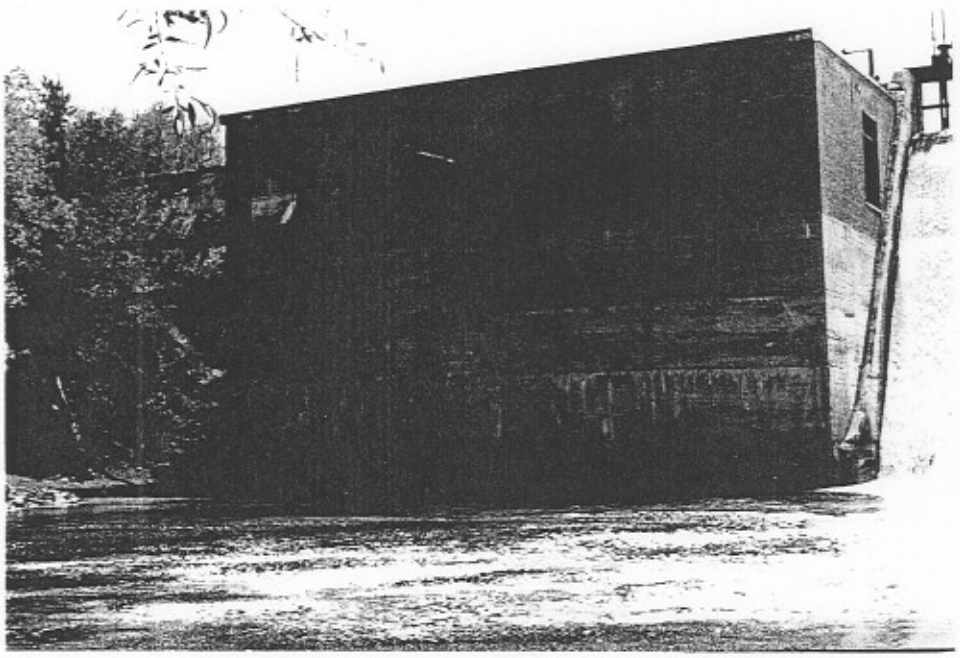
ENDMAN, ANTHONY, ASSOCIATES CONSULTING ENGINEERS & PLANNERS	DATE MAY 1981	



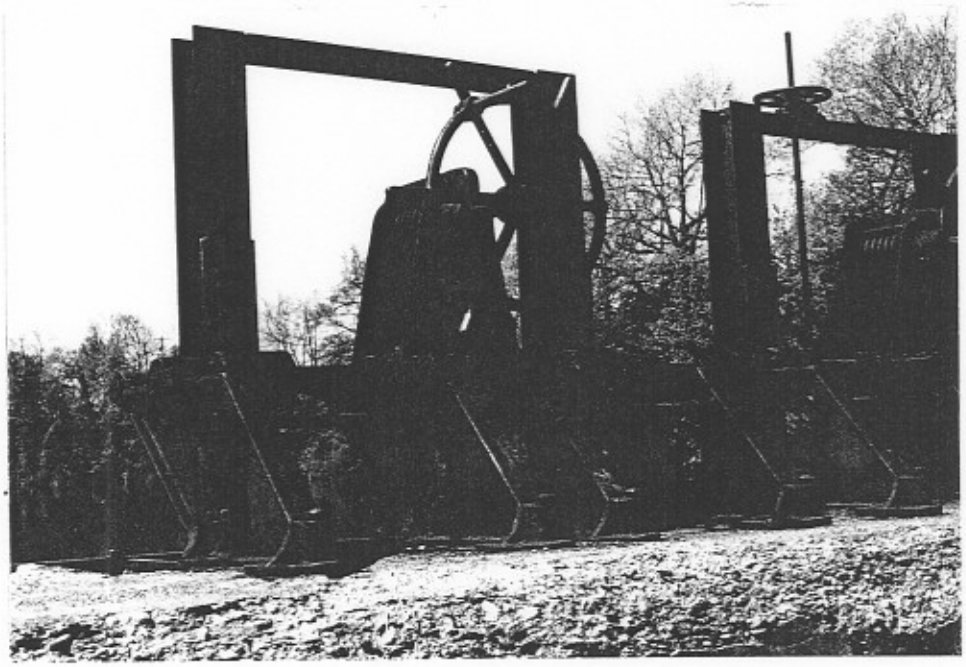
1. Upstream impoundment

2. Downstream channel

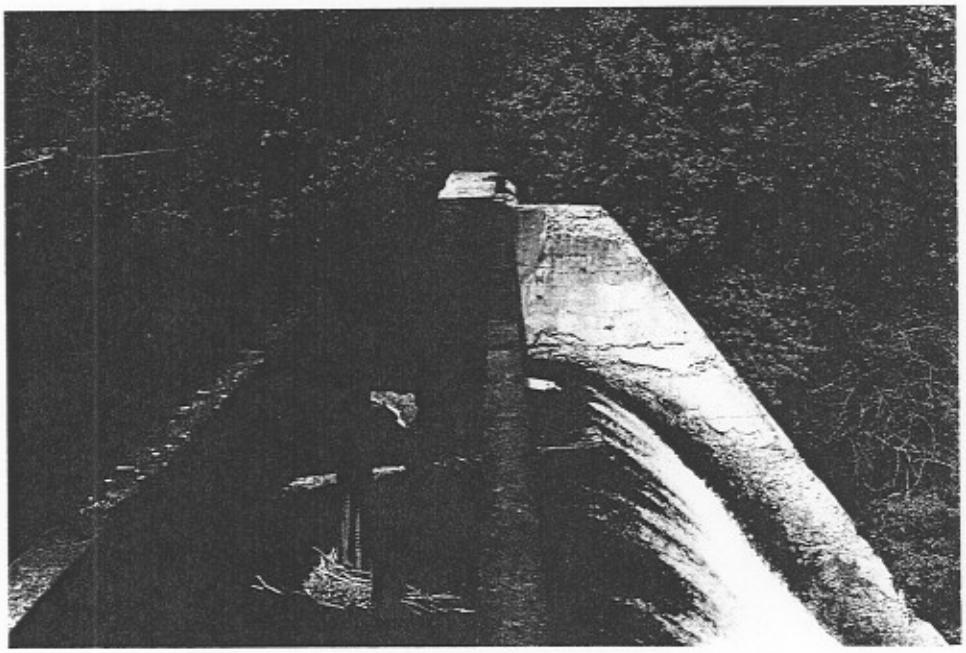
3. Stairs at east abutment



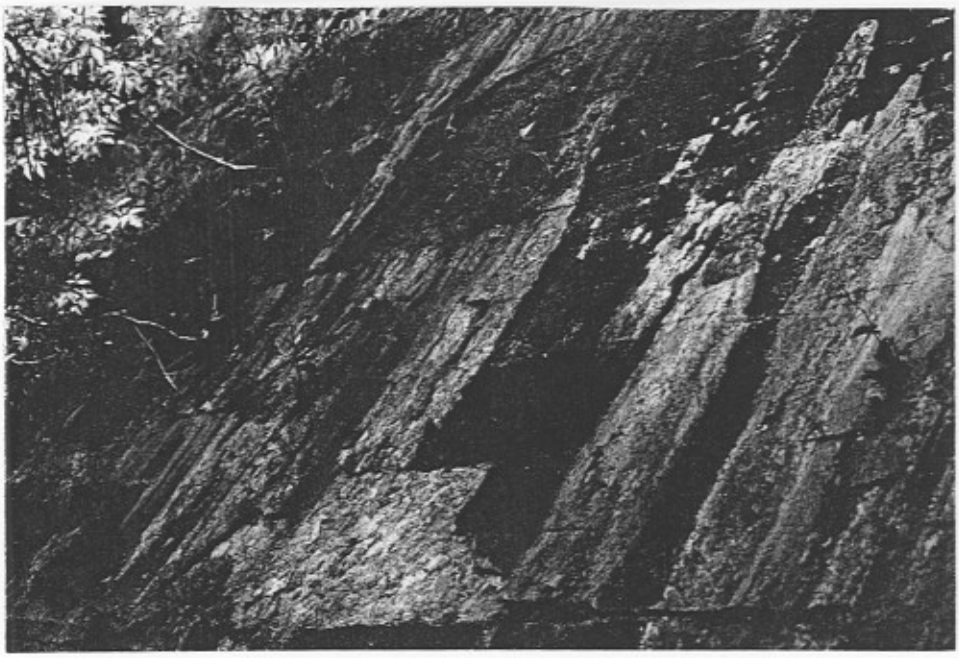
4. Abandoned powerhouse



5. Sluice gate mechanism for penstocks

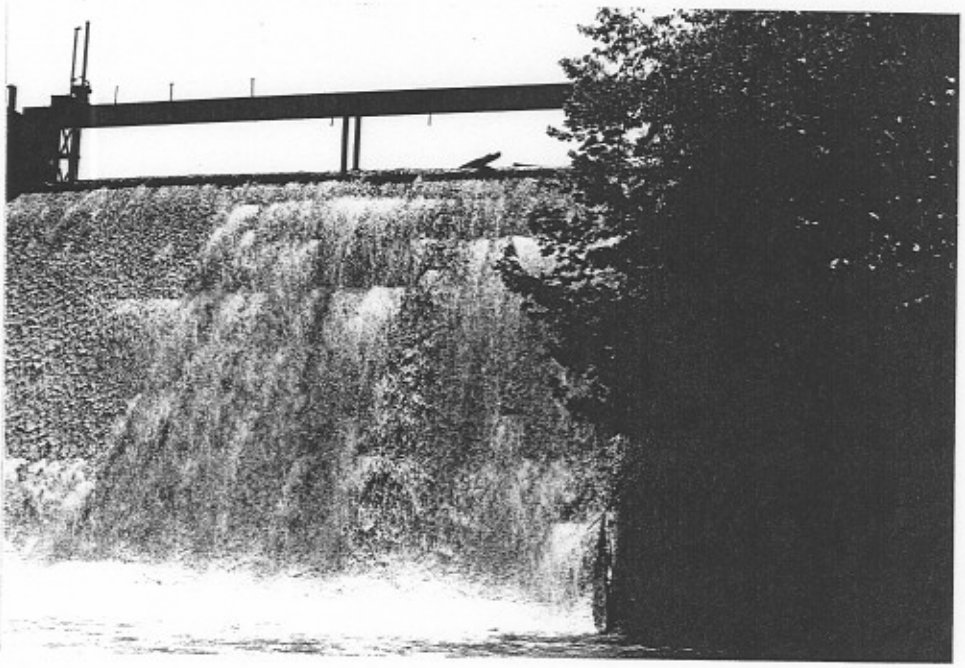


6. Bridge across spillway. Note missing grating.

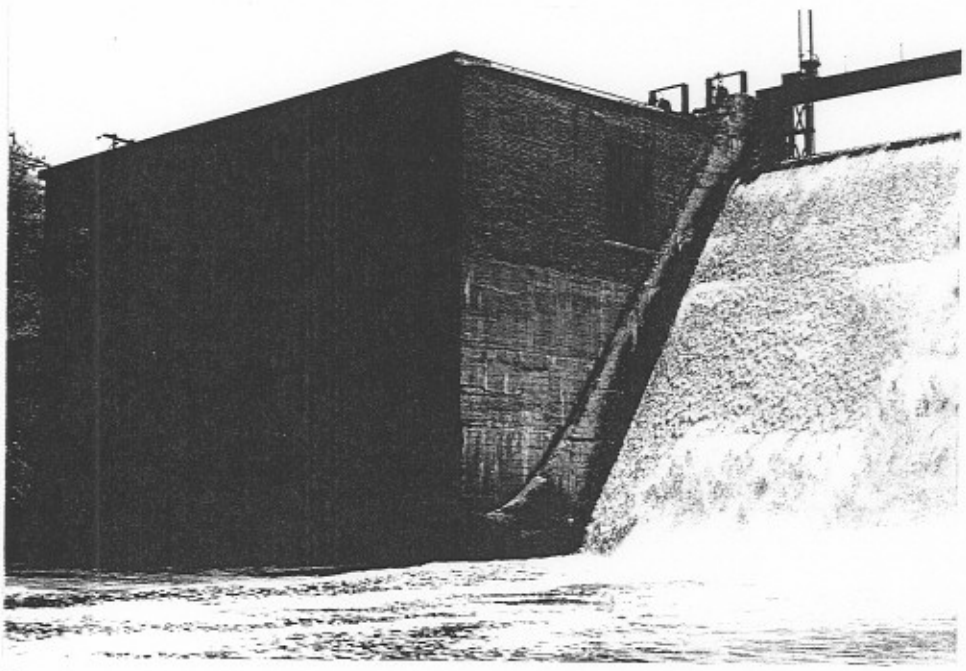


7. Downstream face of dam near east abutment. Note spalled concrete.

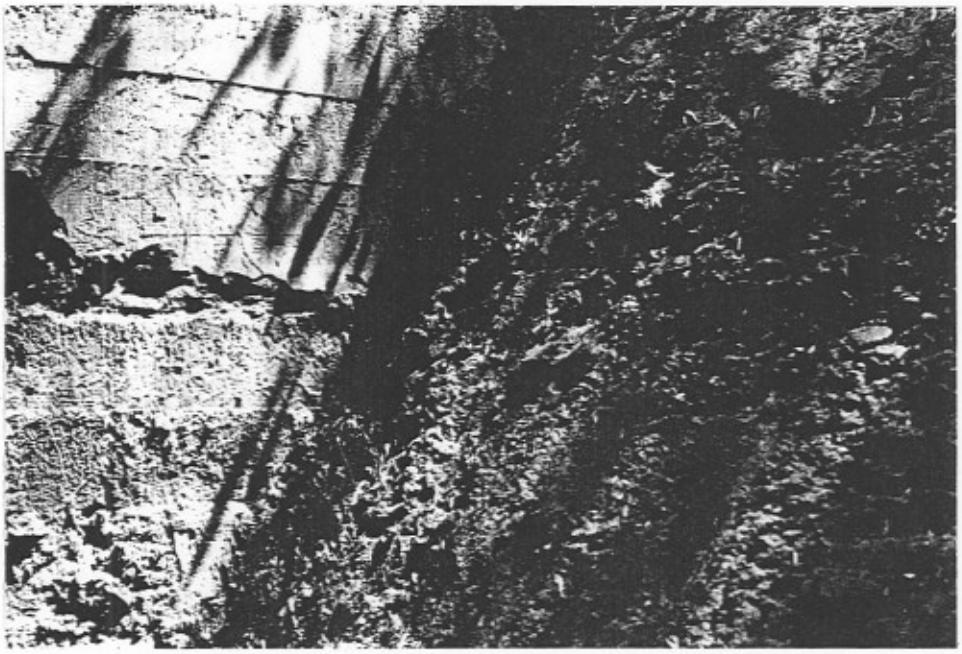
8. Downstream face of dam east of abandoned powerhouse. Note spalled concrete and effervesce.



9. Spillway



10. Abandoned powerhouse



11. West face of west spillway wall. Note water trickling down face of dam.

12. West face of west spillway wall. Note spalled concrete.

APPENDIX D

Burt Dam

CROSS SECTION LOCATION PLAN

Scale: 1" = 2000'

```
A1      ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF              DAM NY 745
A2      HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
A3      RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
B    100       1       0                                    0      -1       4
B1     5
J      1       6       1
J1    .2      .4      .5      .6      .8       1       0       0       0
K      0       1                       0       0       1       0
K1      COMPUTE HYDROGRAPH FOR SUB-AREA 1
M      1       1   39.22               77.4       0                       1
P      0    21.8       91     101      112     125
T                                                   1.      .1                   0
W   9.29     .63
X     2.     -.1       2.
K      0       2                       0       0       1       0
K1      COMPUTE HYDROGRAPH FOR SUB-AREA 2
M      1       1     20.               77.4       0                       1
P      0    21.8       91     101      112     125
T                                                   1.      .1                   0
W   5.31    0.63
X     2.     -.1       2.
K      2       A                       0       0       1       0
K1      COMBINE HYDROGRAPHS FROM SUB-AREAS 1 AND 2 AT POINT A
K      1       B                       0       0       1       0
K1      ROUTE THE COMBINED HYDROGRAPH FROM POINT A TO B BY MUSKINGUM METHOD
Y                               0       1
Y1     1       0       1    0.15     0.2       0      -1
K      0       3                                       1
K1      COMPUTE HYDROGRAPH FROM SUB-AREA 4
M      1       1   18.17               77.4       0                       1
P      0    21.8       91     101      112     125
T                                                   1.      .1                   0
W   5.64    0.63
X     2.     -.1       2.
K      2       B
K1      COMBINE ALL HYDROGRAPHS AT POINT B - INFLOW TO RESERVOIR
K      1 OUTFLOW                                       1
K1      CALCULATION OF OUTFLOW HYDROGRAPH FROM RESERVOIR
Y                               1       1
Y1     1                                          -297.      -1
Y4 297.0   298.0   299.0   300.0   301.0   302.0   303.0   304.0   304.5   305.0
Y4 307.0   309.0   311.0   313.0   315.0   317.0   319.0   320.0
Y5     0     298     842    1547    2382    3329    4376    5514    6116    6737
Y5  9416   12377   15597   19056   22738   30725   32843
$A     0.     95.    129     174     225
$E   250.    297.    300     310     320
$$   297.
$D 304.5
$L 253.3   315.3
$V 304.5   320.0
K      1       1                                       1
K1     CHANNEL ROUTING -MOD PULS RESERVOIR - 1
Y                               1       1
Y1     1
Y6   0.1   0.045     0.1     256     300     500  0.0022
Y7     0     300      80     256     270     256     380     300     381     300
Y7   382     300     383     300     384     300
```

```
K       1       2                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 1-2
Y                                       1       1
Y1      1
Y6    0.1    0.045      0.1      254      300      800   0.0022
Y7      0      300      110      254      240      254     400      300      401      300
Y7    402      300      403      300      404      300
K       1       3                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 2-3
Y                                       1       1
Y1      1
Y6    0.1    0.045      0.1      251      300     1300   0.0022
Y7      0      300      150      260      210      251     480      251      510      260
Y7    500      300      501      300      502      300
K       1       4                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 3-4
Y                                       1       1
Y1      1
Y6    0.1    0.045      0.1      249      300     1100   0.0022
Y7      0      300      120      260      190      249     500      249      520      260
Y7    600      300      601      300      602      300
K       1       5                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 4-5
Y                                       1       1
Y1      1
Y6    0.1    0.045      0.1      245      300     1800   0.0022
Y7      0      300      100      250      105      245     500      245      505      250
Y7    630      300      631      300      632      300
K       1       6                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 5-6
Y                                       1       1
Y1      1
Y6    0.1    0.045      0.1      241      290     1700   0.0022
Y7      0      290      105      250      210      241     520      241      550      250
Y7    630      290      631      290      632      290
K       1       7                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 6-7
Y                                       1       1
Y1      1
Y6   0.06    0.045     0.06      238      280     1600   0.0022
Y7      0      270      450      260      600      250     650      238     1040      238
Y7   1060      250     1590      280     1591      280
K       1       8                                               1
K1     CHANNEL ROUTING -MOD PULS REACH 7-8
Y                                       1       1
Y1      1
Y6   0.06    0.045     0.06      235      270     1400   0.0022
Y7      0      270       80      250     1100      235    1300      235     1800      250
Y7   2300      260     2550      270     2551      270
K      99
A
```

```
OK, SEG #HEC1DB
ENTER PROJECT NUMBER
80166-00.11
INPUT FILE ? NY745
1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************
1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
                                 RUNOFF HYDROGRAPH AT            1
                                 RUNOFF HYDROGRAPH AT            2
                                 COMBINE  2 HYDROGRAPHS AT       A
                                 ROUTE HYDROGRAPH TO             B
                                 RUNOFF HYDROGRAPH AT            3
                                 COMBINE  2 HYDROGRAPHS AT       B
                                 ROUTE HYDROGRAPH TO         UTFLOW
                                 ROUTE HYDROGRAPH TO             1
                                 ROUTE HYDROGRAPH TO             2
                                 ROUTE HYDROGRAPH TO             3
                                 ROUTE HYDROGRAPH TO             4
                                 ROUTE HYDROGRAPH TO             5
                                 ROUTE HYDROGRAPH TO             6
                                 ROUTE HYDROGRAPH TO             7
                                 ROUTE HYDROGRAPH TO             8
                                 END OF NETWORK

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

 RUN  DATE: 8/11/
      TIME: 1:54 PM
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF — DAM NY 745
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	-1	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= 0.20 0.40 0.50 0.60 0.80 1.00

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

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FOR SUB-AREA 1

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	39.22	0.00	77.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.80	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 9.29 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 9.23 HOURS, CP= 0.63 VOL= 1.00

60.	223.	450.	710.	990.	1268.	1502.	1665.	1755.	1766.
1668.	1496.	1327.	1177.	1044.	926.	821.	729.	646.	573.
508.	451.	400.	355.	315.	279.	248.	220.	195.	173.
153.	136.	121.	107.	95.	84.	75.	66.	59.	52.
46.	41.	36.	32.	29.	25.	23.	20.	18.	16.

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
									SUM	23.46	19.60	3.86	508802.
										(556.)	(498.)	(98.)	(14407.65)

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

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FOR SUB-AREA 2

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	20.00	0.00	77.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.80	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 5.31 CP=0.63 NTA= 0

RECESSION DATA
STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 29 END-OF-PERIOD ORDINATES, LAG= 5.34 HOURS, CP= 0.64 VOL= 1.00

110.	401.	787.	1172.	1444.	1534.	1403.	1153.	933.	755.
611.	495.	401.	324.	262.	212.	172.	139.	113.	91.
74.	60.	48.	39.	32.	26.	21.	17.	14.	

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
									SUM	23.46	19.60	3.86	273626.
										(596.)	(498.)	(98.)	(7748.22)

****

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS FROM SUB-AREAS 1 AND 2 AT POINT A

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

****

HYDROGRAPH ROUTING

ROUTE THE COMBINED HYDROGRAPH FROM POINT A TO B BY MUSKINGUM METHOD

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	1	0.150	0.200	0.000	-1.	0

****

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FROM SUB-AREA 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	18.17	0.00	77.40	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.80	91.00	101.00	112.00	125.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 5.64 CP=0.63 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 31 END-OF-PERIOD ORDINATES, LAG= 5.65 HOURS, CP= 0.63 VOL= 1.00

89.	325.	641.	966.	1209.	1313.	1240.	1049.	864.	711.
586.	482.	397.	327.	269.	221.	182.	150.	124.	102.
84.	69.	57.	47.	38.	32.	26.	21.	18.	15.
12.									

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
									SUM	23.46	19.60	3.86	246782.
										(596.)	(498.)	(98.)	(6988.08)

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

COMBINE HYDROGRAPHS

COMBINE ALL HYDROGRAPHS AT POINT B - INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
B	2	0	0	0	0	0	0	0

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

HYDROGRAPH ROUTING

CALCULATION OF OUTFLOW HYDROGRAPH FROM RESERVOIR

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-297.	-1

STAGE	297.00	298.00	299.00	300.00	301.00	302.00	303.00	304.00	304.50	305.00

	307.00	309.00	311.00	313.00	315.00	317.00	319.00	320.00		
FLOW .	0.00	298.00	842.00	1547.00	2382.00	3329.00	4376.00	5514.00	6116.00	6737.00
	9416.00	12377.00	15597.00	19056.00	22738.00	30725.00	32843.00	0.00		
SURFACE AREA=	0.	95.	129.	174.	225.					
CAPACITY=	0.	1488.	1823.	3332.	5322.					
ELEVATION=	250.	297.	300.	310.	320.					

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXFL
297.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
304.5	0.0	0.0	0.

CREST LENGTH AT OR BELOW ELEVATION	253.	315.
	304.5	320.0

PEAK OUTFLOW IS 13055. AT TIME 47.00 HOURS

PEAK OUTFLOW IS 26210. AT TIME 47.00 HOURS

PEAK OUTFLOW IS 32785. AT TIME 47.00 HOURS

PEAK OUTFLOW IS 39351. AT TIME 47.00 HOURS

PEAK OUTFLOW IS 52640. AT TIME 47.00 HOURS

PEAK OUTFLOW IS 65687. AT TIME 47.00 HOURS

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS RESERVOIR - 1

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

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	256.0	300.0	500.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 300.00 80.00 256.00 270.00 256.00 380.00 300.00 381.00 300.00
382.00 300.00 383.00 300.00 384.00 300.00

STORAGE	0.00	5.18	10.63	16.35	22.33	28.57	35.09	41.86	48.91	56.22
	63.79	71.64	79.74	88.12	96.75	105.66	114.83	124.27	133.97	143.93
OUTFLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25247.81
	30681.13	36654.48	43177.70	50261.23	57915.95	66153.00	74983.77	84419.83	94472.84	105154.67
STAGE	256.00	258.32	260.63	262.95	265.26	267.58	269.89	272.21	274.53	276.84
	279.16	281.47	283.79	286.10	288.42	290.74	293.05	295.37	297.68	300.00
FLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25247.81
	30681.13	36654.48	43177.70	50261.23	57915.95	66153.00	74983.77	84419.83	94472.84	105154.67

MAXIMUM STAGE IS 270.5

MAXIMUM STAGE IS 277.2

MAXIMUM STAGE IS 280.0

MAXIMUM STAGE IS 282.4

MAXIMUM STAGE IS 286.8

MAXIMUM STAGE IS 290.6

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 1-2

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

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	254.0	300.0	800.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 300.00 110.00 254.00 240.00 254.00 400.00 300.00 401.00 300.00

	402.00	300.00	403.00	300.00	404.00	300.00				
STORAGE	0.00	6.10	12.82	20.18	28.18	36.80	46.05	55.94	66.46	77.61
	89.39	101.81	114.85	128.53	142.84	157.78	173.36	189.56	206.40	223.87
OUTFLOW	0.00	416.20	1384.43	2846.60	4802.55	7265.58	10254.60	13791.18	17898.35	22595.87
	27919.85	33882.56	40512.32	47833.27	55869.49	64644.81	74182.94	84507.27	95641.02	107607.20
STAGE	254.00	256.42	258.84	261.26	263.68	266.11	268.53	270.95	273.37	275.79
	278.21	280.63	283.05	285.47	287.89	290.32	292.74	295.16	297.58	300.00
FLOW	0.00	416.20	1384.43	2846.60	4802.55	7265.58	10254.60	13791.18	17898.35	22595.87
	27919.85	33882.56	40512.32	47833.27	55869.49	64644.81	74182.94	84507.27	95641.02	107607.20

MAXIMUM STAGE IS 270.4

MAXIMUM STAGE IS 277.4

MAXIMUM STAGE IS 280.2

MAXIMUM STAGE IS 282.6

MAXIMUM STAGE IS 286.9

MAXIMUM STAGE IS 290.6

D-11

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 2-3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	251.0	300.0	1300.	0.00220

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

0.00	300.00	150.00	260.00	210.00	251.00	480.00	251.00	510.00	260.00
500.00	300.00	501.00	300.00	502.00	300.00				

STORAGE	0.00	21.77	45.53	71.21	98.24	126.08	154.67	184.00	214.08	244.90
	276.47	308.77	341.83	375.63	410.17	445.46	481.49	518.26	555.78	594.05

OUTFLOW	0.00	2061.09	6632.64	13345.73	22009.40	32417.48	44443.73	58013.29	73069.88	89565.48
	107476.98	126763.97	147406.63	169385.53	192684.06	217288.41	243186.94	270369.44	298827.63	328554.31
STAGE	251.00	253.58	256.16	258.74	261.32	263.89	266.47	269.05	271.63	274.21
	276.79	279.37	281.95	284.53	287.10	289.68	292.26	294.84	297.42	300.00
FLOW	0.00	2061.09	6632.64	13345.73	22009.40	32417.48	44443.73	58013.29	73069.88	89565.48
	107476.98	126763.97	147406.63	169385.53	192684.06	217288.41	243186.94	270369.44	298827.63	328554.31

MAXIMUM STAGE IS 258.6

MAXIMUM STAGE IS 262.3

MAXIMUM STAGE IS 264.0

MAXIMUM STAGE IS 265.4

MAXIMUM STAGE IS 268.0

MAXIMUM STAGE IS 270.4

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 3-4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	249.0	300.0	1100.	0.00220

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

0.00 300.00 120.00 260.00 190.00 249.00 500.00 249.00 520.00 260.00
600.00 300.00 601.00 300.00 602.00 300.00

STORAGE	0.00	21.76	45.00	69.74	95.96	123.44	151.82	181.12	211.33	242.45
	274.48	307.41	341.26	376.02	411.68	448.26	485.74	524.14	563.44	603.66
OUTFLOW	0.00	2518.29	8066.79	15998.30	26073.50	38190.63	52197.11	68010.63	85575.16	104845.22
	125801.81	148409.53	172655.00	198525.06	226010.69	255105.88	285806.75	318111.88	352021.56	387537.19

STAGE	249.00	251.68	254.37	257.05	259.74	262.42	265.11	267.79	270.47	273.16
	275.84	278.53	281.21	283.89	286.58	289.26	291.95	294.63	297.32	300.00
FLOW	0.00	2518.29	8066.79	15998.30	26073.50	38190.63	52197.11	68010.63	85575.16	104845.22
	125801.81	148409.53	172655.00	198525.06	226010.69	255105.88	285806.75	318111.88	352021.56	387537.19

MAXIMUM STAGE IS 256.0

MAXIMUM STAGE IS 259.8

MAXIMUM STAGE IS 261.2

MAXIMUM STAGE IS 262.7

MAXIMUM STAGE IS 265.2

MAXIMUM STAGE IS 267.4

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 4-5

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	245.0	300.0	1800.	0.00220

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

0.00 300.00 100.00 250.00 105.00 245.00 500.00 245.00 505.00 250.00
630.00 300.00 631.00 300.00 632.00 300.00

STORAGE	0.00	47.59	95.91	145.56	196.77	249.53	303.86	359.74	417.18	476.18
	536.73	598.84	662.52	727.75	794.53	862.88	932.79	1004.25	1077.27	1151.85
OUTFLOW	0.00	3606.99	11437.00	22459.17	36341.84	52869.69	71899.58	93329.88	117085.42	143105.47
	171358.41	201798.41	234403.81	269154.88	306036.50	345038.31	386152.69	429374.75	474703.06	522137.00
STAGE	245.00	247.89	250.79	253.68	256.58	259.47	262.37	265.26	268.16	271.05
	273.95	276.84	279.74	282.63	285.53	288.42	291.32	294.21	297.10	300.00
FLOW	0.00	3606.99	11437.00	22459.17	36341.84	52869.69	71899.58	93329.88	117085.42	143105.47

171358.41 201798.41 234403.81 269154.88 306036.50 345038.31 386152.69 429374.75 474703.06 521371.00

MAXIMUM STAGE IS 251.2

MAXIMUM STAGE IS 254.4

MAXIMUM STAGE IS 255.8

MAXIMUM STAGE IS 257.1

MAXIMUM STAGE IS 259.4

MAXIMUM STAGE IS 261.4

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 5-6

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	241.0	290.0	1700.	0.00220

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

0.00 290.00 105.00 250.00 210.00 241.00 520.00 241.00 550.00 250.00
630.00 290.00 631.00 290.00 632.00 290.00

STORAGE	0.00	33.15	70.19	111.12	155.60	201.60	248.80	297.20	346.80	397.60
	449.61	502.81	557.21	612.82	669.62	727.63	786.83	847.24	908.84	971.65
OUTFLOW	0.00	2376.16	7676.43	15352.24	25352.05	37530.88	51635.02	67571.52	85272.34	104685.80
	125772.02	148499.81	172844.34	198786.31	226310.22	255404.22	286059.31	318268.63	352027.25	387332.38
STAGE	241.00	243.58	246.16	248.74	251.32	253.89	256.47	259.05	261.63	264.21
	266.79	269.37	271.95	274.53	277.10	279.68	282.26	284.84	287.42	290.00
FLOW	0.00	2376.16	7676.43	15352.24	25352.05	37530.88	51635.02	67571.52	85272.34	104685.80
	125772.02	148499.81	172844.34	198786.31	226310.22	255404.22	286059.31	318268.63	352027.25	387332.38

MAXIMUM STAGE IS 247.9

MAXIMUM STAGE IS 251.5

MAXIMUM STAGE IS 252.9

MAXIMUM STAGE IS 254.2

MAXIMUM STAGE IS 256.6

MAXIMUM STAGE IS 258.7

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 6-7

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0600	0.0450	0.0600	238.0	280.0	1600.	0.00220

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

0.00 270.00 450.00 260.00 600.00 250.00 650.00 238.00 1040.00 238.00
1060.00 250.00 1590.00 280.00 1591.00 280.00

STORAGE	0.00	32.19	65.43	99.71	135.04	171.42	209.63	253.26	302.75	358.11
	419.33	489.36	570.64	663.17	766.94	880.86	998.86	1120.03	1244.37	1371.88
OUTFLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.80	61933.98	79197.67	98792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	485769.00
STAGE	238.00	240.21	242.42	244.63	246.84	249.05	251.26	253.47	255.68	257.89
	260.11	262.32	264.53	266.74	268.95	271.16	273.37	275.58	277.79	280.00
FLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.80	61933.98	79197.67	98792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	485769.00

MAXIMUM STAGE IS 244.2

MAXIMUM STAGE IS 247.4

MAXIMUM STAGE IS 248.6

MAXIMUM STAGE IS 250.0

MAXIMUM STAGE IS 252.1

MAXIMUM STAGE IS 253.9

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

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 7-8

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

D-16

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0600	0.0450	0.0600	235.0	270.0	1400.	0.00220

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

0.00 270.00 80.00 250.00 1100.00 235.00 1300.00 235.00 1800.00 250.00
2300.00 260.00 2550.00 270.00 2551.00 270.00

STORAGE	0.00	17.37	45.78	85.25	135.78	197.35	269.97	353.65	448.37	552.26
	662.08	777.79	899.40	1026.89	1160.02	1296.76	1436.66	1579.72	1725.95	1875.34
OUTFLOW	0.00	1039.68	3907.02	8908.19	16409.30	26766.31	40315.55	57394.49	78303.31	104469.47
	135252.22	170525.06	210360.53	254845.94	307213.25	368515.75	434543.50	505271.69	580677.88	660743.63
STAGE	235.00	236.84	238.68	240.53	242.37	244.21	246.05	247.89	249.74	251.58
	253.42	255.26	257.11	258.95	260.79	262.63	264.47	266.32	268.16	270.00
FLOW	0.00	1039.68	3907.02	8908.19	16409.30	26766.31	40315.55	57394.49	78303.31	104469.47
	135252.22	170525.06	210360.53	254845.94	307213.25	368515.75	434543.50	505271.69	580677.88	660743.63

MAXIMUM STAGE IS 241.5

MAXIMUM STAGE IS 244.1

MAXIMUM STAGE IS 245.0

MAXIMUM STAGE IS 245.9

MAXIMUM STAGE IS 247.4

MAXIMUM STAGE IS 248.6

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

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE 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 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	39.22	1	5922.	11845.	14806.	17767.	23689.	29612.
		(101.58)		(167.70)(	335.40)(	419.25)(	503.10)(	670.81)(	838.51)(
HYDROGRAPH AT	2	20.00	1	4634.	9268.	11585.	13903.	18537.	23171.
		(51.80)		(131.22)(	262.45)(	328.06)(	393.67)(	524.90)(	656.12)(
2 COMBINED	A	59.22	1	9678.	19357.	24196.	29035.	38713.	48392.
		(153.38)		(274.06)(	548.12)(	685.15)(	822.18)(	1096.24)(	1370.29)(
ROUTED TO	B	59.22	1	9664.	19328.	24160.	28992.	38656.	48319.
		(153.38)		(273.65)(	547.30)(	684.13)(	820.95)(	1094.60)(	1368.25)(
HYDROGRAPH AT	3	18.17	1	4022.	8044.	10055.	12066.	16088.	20109.
		(47.06)		(113.89)(	227.77)(	284.72)(	341.66)(	455.55)(	569.43)(
2 COMBINED	B	77.39	1	13099.	26198.	32748.	39297.	52396.	65495.
		(200.44)		(370.92)(	741.85)(	927.31)(	1112.77)(	1483.70)(	1854.62)(
ROUTED TO	OUTFLOW	77.39	1	13055.	26210.	32785.	39351.	52640.	65687.
		(200.44)		(369.69)(	742.20)(	928.36)(	1114.30)(	1490.59)(	1860.04)(
ROUTED TO	1	77.39	1	13053.	26192.	32815.	39377.	52619.	65662.
		(200.44)		(369.61)(	741.67)(	929.22)(	1115.02)(	1490.01)(	1859.35)(
ROUTED TO	2	77.39	1	13039.	26167.	32828.	39397.	52602.	65647.
		(200.44)		(369.22)(	740.97)(	929.58)(	1115.60)(	1489.53)(	1858.91)(
ROUTED TO	3	77.39	1	13011.	26132.	32835.	39382.	52617.	65609.
		(200.44)		(368.43)(	739.98)(	929.79)(	1115.18)(	1489.93)(	1857.85)(
ROUTED TO	4	77.39	1	13035.	26183.	32800.	39391.	52640.	65605.
		(200.44)		(369.11)(	741.42)(	928.79)(	1115.42)(	1490.59)(	1857.73)(
ROUTED TO	5	77.39	1	12989.	26103.	32841.	39384.	52649.	65582.
		(200.44)		(367.82)(	739.15)(	929.94)(	1115.23)(	1490.85)(	1857.08)(
ROUTED TO	6	77.39	1	12985.	26218.	32733.	39341.	52700.	65604.
		(200.44)		(367.69)(	742.41)(	926.88)(	1114.02)(	1492.30)(	1857.70)(
ROUTED TO	7	77.39	1	12975.	26252.	32705.	39277.	52703.	65612.

	(200.44)	(367.41)(	743.36)(	926.11)(	1112.20)(	1492.38)(	1857.91)(	
ROUTED TO	8 77.39	1 13018.	26237.	32668.	39275.	52627.	65622.	
	(200.44)	(368.63)(	742.96)(	925.06)(	1112.13)(	1490.23)(	1858.21)(	

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	297.00	297.00	304.50
STORAGE	1488.	1488.	2447.
OUTFLOW	0.	0.	6116.

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
0.20	307.15	2.65	2855.	13055.	12.00	47.00	0.00
0.40	310.40	5.90	3402.	26210.	19.00	47.00	0.00
0.50	311.74	7.24	3643.	32785.	22.00	47.00	0.00
0.60	312.99	8.49	3874.	39351.	24.00	47.00	0.00
0.80	315.20	10.70	4303.	52640.	28.00	47.00	0.00
1.00	316.75	12.25	4619.	65687.	30.00	47.00	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13053.	270.5	47.00
0.40	26192.	277.2	47.00
0.50	32815.	280.0	47.00
0.60	39377.	282.4	47.00
0.80	52619.	286.8	47.00
1.00	65662.	290.6	47.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13039.	270.4	47.00
0.40	26167.	277.4	47.00
0.50	32828.	280.2	47.00
0.60	39397.	282.6	47.00
0.80	52602.	286.9	47.00
1.00	65647.	290.6	47.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13011.	258.6	47.00
0.40	26132.	262.3	47.00
0.50	32835.	264.0	47.00
0.60	39382.	265.4	47.00

0.80	52617.	268.0	47.00
1.00	65609.	270.4	47.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13035.	256.0	47.00
0.40	26183.	259.8	47.00
0.50	32800.	261.2	47.00
0.60	39391.	262.7	47.00
0.80	52640.	265.2	47.00
1.00	65605.	267.4	47.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12989.	251.2	47.00
0.40	26103.	254.4	47.00
0.50	32841.	255.8	47.00
0.60	39384.	257.1	47.00
0.80	52649.	259.4	47.00
1.00	65582.	261.4	47.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12985.	247.9	47.00
0.40	26218.	251.5	47.00
0.50	32733.	252.9	47.00
0.60	39341.	254.2	47.00
0.80	52700.	256.6	47.00
1.00	65604.	258.7	47.00

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12975.	244.2	47.00
0.40	26252.	247.4	47.00
0.50	32705.	248.8	47.00
0.60	39277.	250.0	47.00
0.80	52703.	252.1	47.00
1.00	65612.	253.9	47.00

PLAN 1 STATION 8

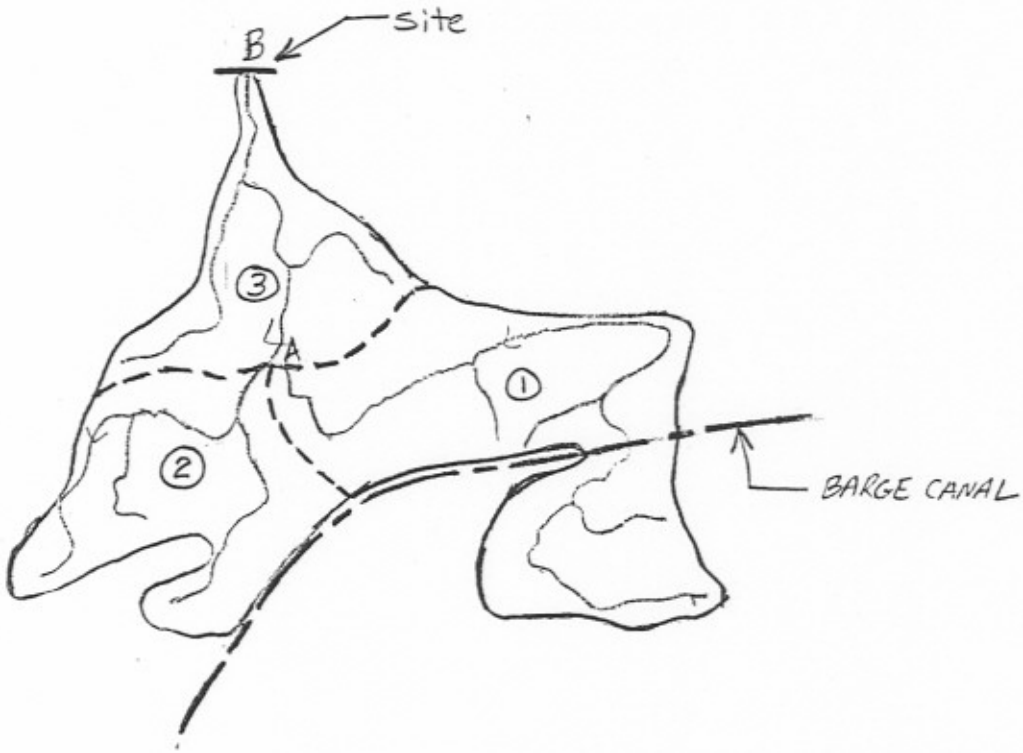
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13018.	241.5	48.00

0.40	26237.	244.1	47.00
0.50	32668.	245.0	47.00
0.60	39275.	245.9	47.00
0.80	52627.	247.4	47.00
1.00	65622.	248.6	47.00

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

Burt Dam Hydrology

The drainage area for Burt Dam is sub-divided into 3 smaller drainage areas as shown below.



Summary Of Required Data

Sub-Area No.	Drainage Area (mi^2)	L_c (ft.)	L_{ca} (ft.)	PMP Rainfall (Basin Avg.)	Reach Length (ft.)	Muskingum Coeff. K	Muskingum Coeff. X
1	25,102 AC = 39.22 MILE^2	125,400	39600'	21.8	—	—	—
2	12801 AC = 20 MILE^2	52,100	13,800	21.8	—	—	—
3	11,629 AC. = 18.17 MILE^2	36,800	24,000	21.8	36,000	0.15	0.2

TOTAL = 77.39 mi^2

BURT DAM NY 745
SUB-SECTIONS 1, 2 & 3

REFF. QUAD MAPS LOCKPORT, NEWFANE, CAMBRIA & GASPORT N.Y.
SCALE 1" = 2000' CONTOUR INT. 10 FT.

REACH MEAS. WITH A MAP WHEEL 1" = 2000'
AREA MEAS ON CROSS SECTION GRID 1" = 2000' & WITH PLANIMETER

SUB-AREA Nº 1

REACH LENGTH = 62.7 x 2000' = 125,400 ft. ✓

AREA IN ACRES = 25,101.92 AC. SEE CROSS SECT. SHEET Nº 1 FOR COMPUTATIONS ✓

SUB-AREA Nº 2

REACH LENGTH = 26.05 ✓ x 2000' = 52,100 ft (EAST BRANCH EIGHTEEN MILE CREE

AREA IN ACRES = 12 801 ✓ SEE CROSS SECT. SHEET Nº 2 FOR COMPUTATIONS

SUB-AREA Nº 3

REACH LENGTH = 18.4 x 2000' = 36,800 ft. (EIGHTEEN MILE CREEK)

AREA IN ACRES = 11,629.0 AC. SEE CROSS SECTION SHEET Nº 3 COMPUTATIONS ✓

BURT DAM NY 745

L & Lca DISTANCE MEAS. WITH A MAP MEAS. WHEEL SCALE 1" = 2000'

SUB-AREA Nº 1 REFF. QUAD MAPS NEWFANE & LOCKPORT, N.Y.

L DISTANCE = 62.7 x 2000' = 125,400 ft. ✓

Lca DISTANCE = 19.8 x 2000' = 39,600 ft. ✓

SUB-AREA Nº 2 REFF. QUAD MAPS LOCKPORT & CAMBRIA, NY

L DISTANCE = 26.05 x 2000' = 52,100 ft. ✓

Lca DISTANCE = 6.90 x 2000' = 13,800 ft. ✓

SUB-AREA Nº 3 REFF. QUAD MAPS LOCKPORT & GASPORT, N.Y.

L_c DISTANCE = 36,800

Lca DISTANCE = 12.0 x 2000' = 24,000 ft

SLOPE

CONTOUR El. = 345

CONTOUR El. AT DAM = 260

El. h = 85'

REACH LENGTH = 18 x 2000 = 36000'

SLOPE = 85 / 36000 = 0.0024

DETERMINATION OF SNYDER'S LAG TIME

SUB-AREA NO. 1

$C_t = 2.00$ ✓

$C_p = 0.63$ ✓

$$t_p = C_t (L_c L_{ca})^{0.3}$$

$$t_r = \frac{t_p}{5.5}$$

$$t_{pR} = t_p + 0.25 (t_R - t_r)$$

$L_c = 125400$ ft ✓ $= \frac{125400}{5280} = 23.75$ MILES ✓

$L_{ca} = 39600$ ft ✓ $= \frac{39600}{5280} = 7.50$ MILES ✓

$t_p = 2(23.75 \times 7.50)^{0.3} = 9.47$ hrs ✓

$t_r = \frac{9.47}{5.5} = 1.72$ hrs. $\rightarrow$ $t_R = 1$ hr ✓

$t_{pR} = 9.47 + 0.25 (1 - 1.72) = 9.29$ hrs. ✓

SUB-AREA NO. 2

$L_c = 52100\ ft = \frac{52100}{5280} = 9.87$ MILES

$L_{ca} = 13800\ ft = \frac{13800}{5280} = 2.61$ MILES

$T_p = .2\ (L_c \times L_{ca})^{0.3} = 5.30$ hours.

$T_r = \frac{5.30}{5.5} = 0.96 \rightarrow T_R = 1$ hr.

$T_{PR} = 5.30 + 0.25\ (1 - 0.96) = 5.31$ hrs

SUB-AREA NO. 3

$L_c = 36800' = 6.97$ MILES

$L_{ca} = 24000' = 4.55$ MILES

$T_p = 2\ (L_c \times L_{ca})^{0.3} = 5.64$ hrs.

$T_r = \frac{5.64}{5.5} = 1.03$ hrs $\rightarrow T_R = 1$ hr

$T_{PR} = 5.65 + 0.25\ (1 - 1.03) = 5.64$ hrs

DETERMINATION OF K FOR MUSKINGUM ROUTING

ASSUMPTIONS

$Q = 1.5$ cfs/ac.

$n = 0.06$

$R = y$ (HYDRAULIC RADIUS = CHANNEL DEPTH)

ASSUME RECTANGULAR CROSS SECTION OF LENGTH B

$$Q = \frac{1.49}{n} A R^{2/3} S_o^{1/2}$$

$$① \quad Q = \frac{1.49}{n} B y y^{2/3} S_o^{1/2} = \frac{1.49}{n} B y^{5/3} S_o^{1/2}$$

solve eq. ① for y $\quad y = \left[\frac{nQ}{1.49 S_o^{1/2} B}\right]^{3/5}$ ✓

$A = yB$

$V = \frac{Q}{A}$

$K = \tau = \frac{L}{V}$

$y = \left[\frac{nQ}{1.49 S_o^{1/2} B}\right]^{3/5}$

$n = 0.06$

$$K = 0.146 L B^{\frac{2}{5}} Q^{-\frac{2}{5}} S_o^{-0.3}$$ ✓

note: $K \cong$ Travel Time

ROUTING - MUSKINGUM METHOD

REACH A-B

$$K = 0.146\, \ell\, B^{\frac{2}{5}}\, Q^{-\frac{2}{5}}\, S_o^{-0.3}$$

$A = 25102 + 12801 = 37903$ ac.

ASSUME $Q = 1.5$ cfs/ac

$Q = 1.5 \times 37903 = 56854.5$ cfs ✓

$\ell = 36000'$, $S_o = 0.0024$

ASSUME AN AVERAGE OF 650' FOR B

$$K = 0.146 \times 3600 \times 650^{0.4} \times 56854.5^{-0.4} \times 0.0024^{-0.3}$$

$K = \cancel{5368}\ 537$ sec $= \cancel{1.49}\ 0.15$ hrs.

CHECK THE VALUE OF K

Assume $\Delta t = \frac{K}{1}$ $\Delta t = 0.15$ $X = 0.2$

$$\frac{\Delta t}{2(1-x)} \leq K \leq \frac{\Delta t}{2x} \quad \text{(Ref HEC-1)}$$

$$\frac{0.15}{2(1-0.2)} \leq 0.15 \leq \frac{0.15}{2(0.2)}$$

$$0.094 \leq 0.15 \leq 0.375 \quad \checkmark$$

Emergency Spillway

Ogee spillway, 75' wide, crest elev. = 297.00 7.5' below top of dn

The equation $Q = 3.97 L H_D^{3/2}$ will be used to describe the flow over the emergency spillway.

Ref. Henderson, Open Channel Flow, pg. 181.

$Q = 3.97 L H^{3/2} \Rightarrow 3.97(75') H_D^{3/2}$

$Q = 297.75 H_D^{3/2}$

Elev.	H_D	Q_s
297.0	0	0
298.	1.0	298
299.0	2.0	842
300.0	3.0	1547
301.0	4.0	2382
302.0	5.0	3329
303.0	6.0	4376
304.0	7.0	5514
304.5	7.5	6116
305.0	8.0	6737
307.0	10.0	9416
309.0	12.0	12377
311.0	14.0	15597
313.0	16.0	19056
315.0	18.0	22738
317.0	20.0	26632
319.0	22.0	30725
320.0	23.0	32843

BURT DAM

$A RAREA RESEVOIR SURFACE AREA

REFF. U.S. QUAD MAP NEWFANE NY SCALE 1"=2000'

Eq. $1 in^2 \times \frac{2000 ft^2}{in^2} \times \frac{1 AC}{43,560 ft^2}$

ELEV. 300

$$1.4 \times 2000 ft^2 \div \frac{1 AC}{43560} = 128.56 AC$$

ELEV 310

$$1.9 \times 2000 ft^2 \div \frac{1 AC}{43560} = 174.47 AC$$

ELEV. 320

$$2.45 \times 2000 ft^2 \div \frac{1 AC}{43560} = 224.98 AC$$

BY CWB DATE 5/28/81

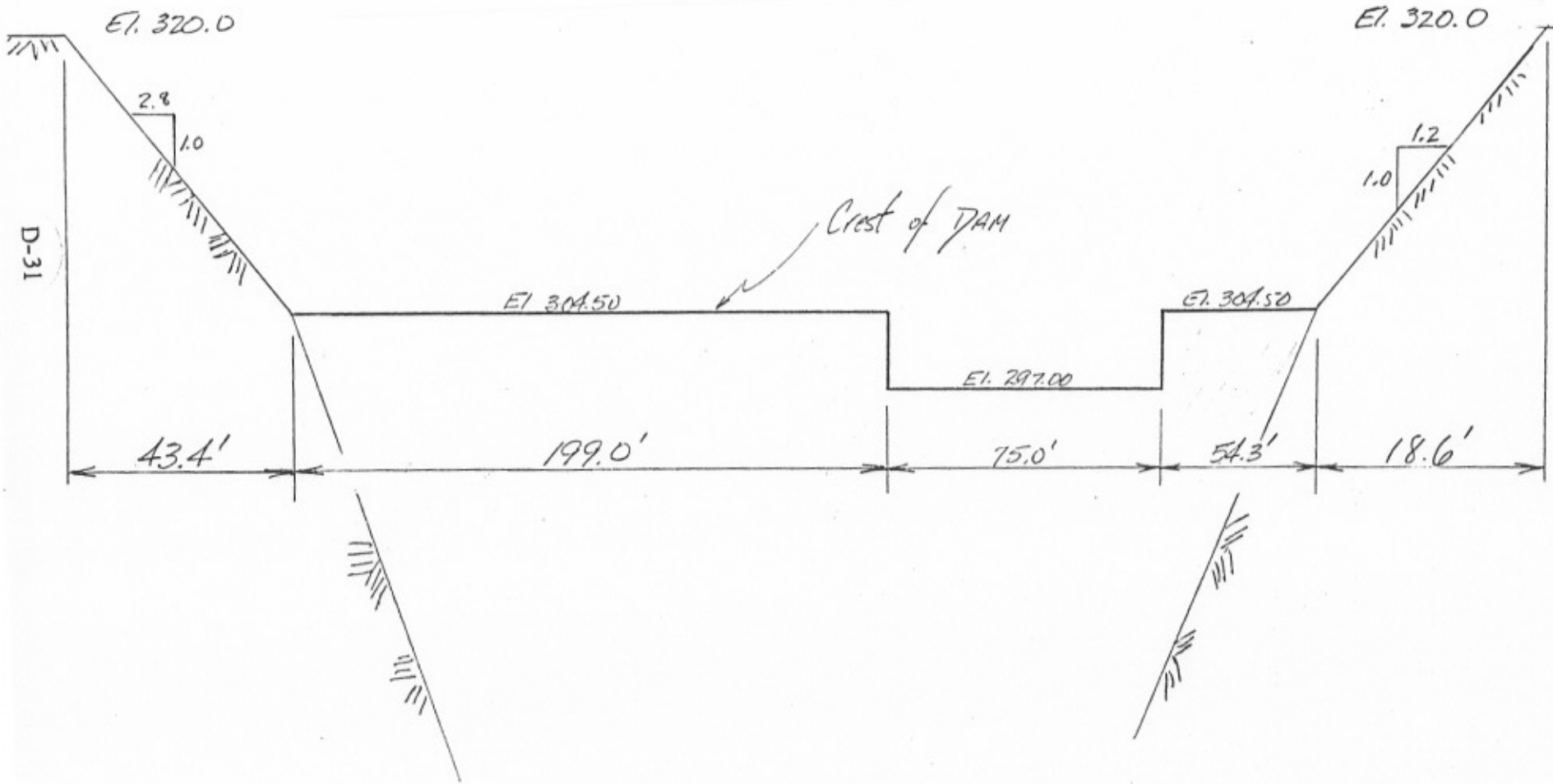
CKD BR DATE 6/4/81 SUBJECT DAM 745 - HYDRAULICS SUB-SHEET NO. 3 OF 13

OWNER

PROJECT NAME DAM INSPECTIONS (1016-00.11)

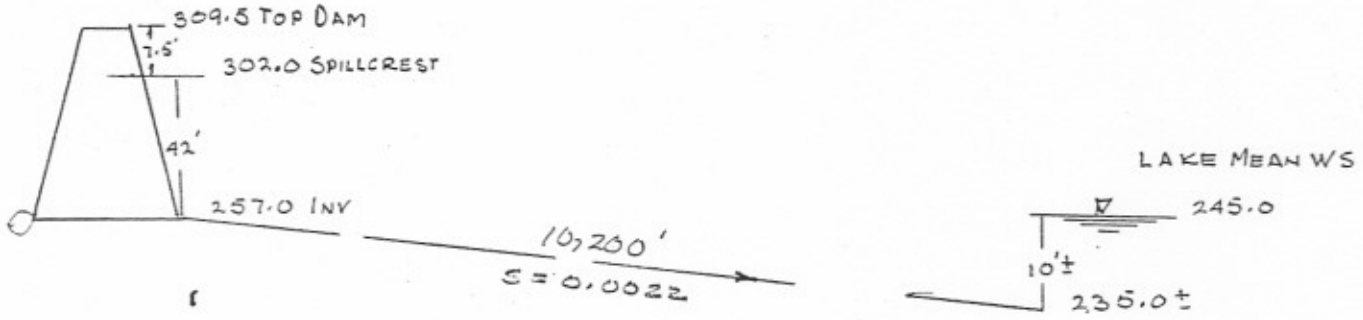
ERDMAN, ANTHONY, ASSOCIATES SHEET 11

BURT DAM (looking upstream)



BURT DAM

* length of section - should they taper to the lake/river or ...



Eq. SLOPE = DAM INV − LAKE INV. = h ÷ L

S = 257.0 − 235.0 = 22' ÷ 10,200 = 0.0022

REACH 1 LENGTH = 500' ✓

SLOPE 500' × 0.0022 = 1.1 − 257. = 255.9 CREEK INV

CROSS SECT. 300/0 255.9/80 255.9/270 300/380

REACH 2 LENGTH = 800' ✓

SLOPE = 800' × 0.0022 = 1.75' − 255.9 = 254.1 CREEK INV

CROSS SECT. 300/0 254.1/110 254.1/240 300/400

REACH 3 LENGTH = 1300' ✓

SLOPE = 1300' × 0.0022 = 2.86 − 254.1 = 251.2 CREEK INV.

CROSS SECT 300/0 260/150 251.2/210 251.2/480 260.0/510 300/560

REACH 4 LENGTH = 1100' ✓

SLOPE = 1100' × 0.0022 = 2.42 − 251.2 = 248.8 CREEK INV.

CROSS SECT. 300/0 260/120 248.8/190 248.8/500 260/520 300/600

REACH 5 LENGTH = 1800'

SLOPE = 1800' x 0.0022 = 3.96 - 248.8 = 244.8 CREEK INV.

CROSS SECT. = 300 250 244.8 244.8 250 300
0 100 105 500 505 630

REACH 6 LENGTH = 1700' ✓

SLOPE = 1700' x 0.0022 = 3.79 - 244.8 = 241.0 CREEK INV.

CROSS SECT. = 290 250 241.0 241.0 250 290
0 105 210 520 550 630

REACH 7 LENGTH = 1600' ✓

SLOPE = 1600' x 0.0022 = 3.52 - 241.0 = 237.5

CROSS SECT. 270 260 250 237.5 237.5 250 280
0 450 600 650 1040 1060 1590

REACH 8 LENGTH = 1400'

SLOPE = 1300 x 0.0022 = 2.86 - 237.5 = 234.6 ✓

CROSS SECT. 270 250 234.6 234.6 250 260 270
0 80 1100 1300 1800 2300 2550

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA
(DAM NY745)

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	304.5	149	2447
2) Design High Water (Max. Design Pool)	302.0	131	2127
3) Auxiliary Spillway Crest	N/A	—	—
4) Pool Level with Flashboards	N/A	—	—
5) Service Spillway Crest	297.0	95	1488

DISCHARGES

	Volume (cfs)
1) Average Daily	unknown
2) Spillway @ Maximum High Water	6116
3) Spillway @ Design High Water	5953
4) Spillway @ Auxiliary Spillway Crest Elevation	N/A
5) Low Level Outlet (gated reservoir drain)	0
6) Total (of all facilities) @ Maximum High Water	6116
7) Maximum Known Flood (observed high water)	1867
8) At Time of Inspection	250

CREST: ELEVATION: 304.5

Type: Broad Crested Weir

Width: 5 ft. Length 328 ft.

Spillover

Location On Both Sides of the Spillway

SPILLWAY:

SERVICE		AUXILIARY
297.0	Elevation	None
Concrete Ogee	Type	
75 ft.	Width	

Type of Control

✓	Uncontrolled	

Controlled:

	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
	Chute Length	
	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : None

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

_____

Method of Controlled Releases (mechanisms):

None

_____

DRAINAGE AREA: 77.4 sq. mi.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: farmlands with orchards and woodlands

Terrain - Relief: flat, northward sloping

Surface - Soil: lake deposited sands and clays

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

None

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

None

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

None

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

Location: None

Elevation:

Reservoir:

Length @ Maximum Pool ±0.25 (Miles)

Length of Shoreline (@ Spillway Crest) ±0.40 (Miles)

80)

APPENDIX E

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May, 1961.

2) F.M. Henderson, Open Channel Flow, Macmillian Publishing Co., Inc., 1966.

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

4) T. W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1969.

5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes , Information Bulletin 119, 1977.

8) U.S. Department of Commerce, Hydrometeorological Report No. 33, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas From 10 to 1000 Square Miles and Durations of 6, 12, 24, and 48 hours, April 1956.

9) U.S. Department of the Army, Engineering Manual 1110-2-1411, Standard Project Flood Determinations, March 1952.

10) U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations, September, 1978.

APPENDIX F

STABILITY ANALYSIS

Farrell DATE 6-15-81 ERDMAN, ANTHONY, ASSOCIATES SHEET 1 OF 7

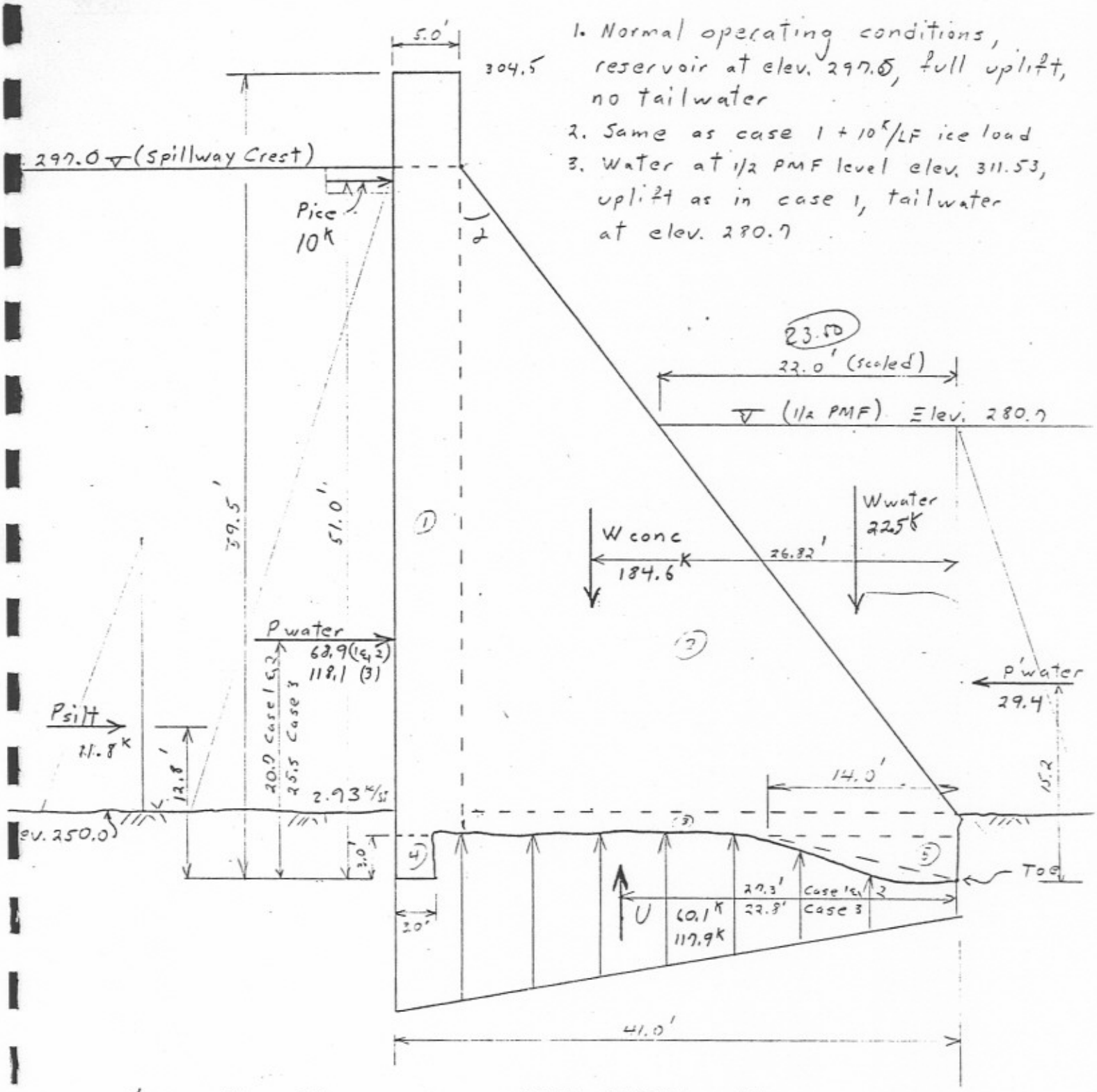
DATE 6/22/81 SUBJECT Stability Analysis SUB-SHEET NO.

OWNER PROJECT NAME Burt Dam - Phase I Inspection

Elev. 311.53 ▽ (½ PMF)

Loadings Considered:

1. Normal operating conditions, reservoir at elev. 297.0, full uplift, no tailwater
2. Same as case 1 + 10 K/LF ice load
3. Water at ½ PMF level elev. 311.53, uplift as in case 1, tailwater at elev. 280.7



DAM SECTION

$tg\alpha = \frac{36}{47} = 0.766$

$0.766 \times (280.7 - 250) = 23.50$

Weight of Concrete - Wconc.

					Dist from Toe		
Area: ①	5.0' x 56.5'	=	282.5# ✓	x	38.5' ✓	=	10876.25 ✓
②	36.0' x 47.0' x 1/2 ✓	=	846.0	x	24.0 ✓	=	20304. ✓
③	2.0 x 36.0	=	72.0	x	18.0	=	1296. ✓
④	3.0 x 3.0	=	9.0	x	39.5 ✓	=	355.5 ✓
⑤	3.0 x 14.0 x 1/2	=	21.0	x	4.67	=	98.07 ✓
			1230.5#				32929.82

$W_{conc} = 1230.5^{\#}/1 \times .15^{K}/\# = \underline{184.6}\ ^{K}/1$ ✓

Resultant (from Toe) = $\frac{32929.82}{1230.5} = \underline{26.76'}$ ✓

Water Force Pwater on Upstream Face

Case 1 & 2

$$Pwater = \frac{(297.0 - 250.0)^2 \times .0624}{2} = \underline{68.9}\ ^{K}/1$$ ✓

Case 3

$$Pwater = \frac{(311.53 - 250.0)^2 \times .0624}{2} = \underline{118.1}\ ^{K}/1$$ ✓

Water Force P'water on Downstream Face

Case 3

$$P'water = \frac{(280.7 - 250.0)^2 \times .0624}{2} = \underline{29.4}\ ^{K}/1$$ ✓

Silt Force Psilt on Upstream Face

Assume depth of silt equals 1/2 depth of water.

PCA "Small Concrete Dams" p. 9

$$Psilt = \frac{\left(\frac{297.0 - 250.0}{2}\right)^2 \times .085 \times .5}{2} = 11.8\ ^{K}/1$$ ✓ Assume k = .5

Weight of Water Wwater

$$W_W = (280.7 - 250.0) \times \frac{23.5}{27.0} \times 1/2 \times .0624 = 22.5^{K}$$ ✓

Hydrostatic Uplift Force U

Case 1 & 2

$U = (297.0 - 250.0) \times 41.0 \times 1/2 \times .0624 = 60.1^{K}/l$ ✓

Resultant (from toe) $= (41) \times \frac{2}{3} = 27.3'$ ✓

Case 3 $U = (280.7 - 250) \times 41.0 \times .0624 + (311.53 - 280.7) \times 41.0 \times 1/2 \times .062$

$= 78.5 + 39.4 = 117.9^{K}/l$ ✓

Resultant (from toe) $= \frac{30.7 \times 41.0 \times \frac{41.0}{2} + 30.83 \times 41.0^2 \times 1/2 \times 2/3}{30.7 \times 41.0 + 30.83 \times 41 \times 1/2}$

$= 22.8'$ ✓

Ice Force Pice

Pice $= 10^{K}/l$

Resultant $= 51.0'$

arm: $\frac{47.0}{3} + 5.0 = 20.7'$

$\frac{2 \times 41}{3} = 27.3'$

$\frac{23.5}{3} + 5 = 12.8'$

Stability Check

Case 1

ΣM overturning $= 60.1 \times 27.3' + 68.9 \times 20.7' + 11.8 \times 12.8 = 3218^{1K}$ ✓

ΣM resisting $= 184.6 \times 26.76 = 4940^{1K}$

$\Sigma F_V = 184.6 - 60.1 = 124.5^{K} \downarrow$

$\bar{x} = \frac{\Sigma M_R - \Sigma M_O}{\Sigma V} = \frac{4940 - 3218}{124.5} = 13.8'$ ✓

$F.S._{OT} = \frac{4940}{3218} = 1.54$ ✓ (1.53)

$e = B/2 - \bar{x} = \frac{41}{2} - 13.8 = 6.7'$

$B/6 = \frac{41}{6} = 6.8' > 6.7'$ ok

conc. on rock, some laminations — PCA "Small Concrete Dams" p 12

S.F. sliding $= \frac{.7 \times 124.5}{68.9 + 11.8} = 1.08$ N.G.

No Uplift $= \frac{.7 \times 184.6}{68.9 + 11.8} = 1.60$

Case 2 $\Sigma M_o = 60.1^{k} \times 27.3' + 68.9 \times 20.7 + 11.8 \times 12.8 + 10.0 \times 51.0 = 3728.^{1k}$ ✓

$\Sigma_R = 184.6 \times 26.82' = 4951^{1k}$ ✓

$\Sigma V = 184.6 - 60.1 = 124.5^{k} \downarrow$ ✓ $\quad FS_{OT} = \frac{4951}{3728} = 1.33$

$\bar{x} = \frac{4951 - 3728}{124.5} = 9.82'$

$e = B/2 - \bar{x} = \frac{41}{2} - 9.82 = 10.68' > 6.8$ N G

$F.S._{sliding} = \frac{.7 \times 124.5}{68.9 + 11.8 + 10} = .96$

$\frac{61.5}{3} + 5 = 20.5 + 5 = 25.5$

$30.7/3 + 5 = 10.2 + 5 = 15.2$

Case 3 $\Sigma M_o = 117.9 \times 22.8 + 118.1 \times 25.5 + 11.8 \times 12.8 = 5850.7$ ✓

$\Sigma_R = 184.6 \times 26.82 + 23.5 \times \frac{23.5}{3} + 29.4 \times 15.2 = 5574.1$ ✓

$\Sigma V = 184.6 + 22.5 - 117.9 - 89.2^{k}$ ✓

$F.S._{OT} = \frac{5574.1}{5850.7} = .95$

$\bar{x} = \frac{5574.1 - 5850.7}{89.2} = -3.1$

$e = B/2 - \bar{x} = \frac{41}{2} + 3.1 = 23.6 > 6.8$ N G

$F.S._{sliding} = \frac{.7 \times 89.2}{118.1 + 11.8 - 29.4} = .62$

APPENDIX G

PREVIOUS INSPECTION REPORTS/
AVAILABLE DOCUMENTS

CONSERVATION

DAM INSPECTION REPORT
(By Visual Inspection)

15C 272

Dam Number	River Basin	Town	County	Hazard Class	Date & Inspector
272	LW LK ONTARIO	NEWFANE	NIAGARA	C	9/77 BC

Stream = EIGHTEEN MILE CREEK Owner = NIAGARA MOHAWK - ?

Type of Construction

- [ ] Earth w/Concrete Spillway
- [ ] Earth w/Drop Inlet Pipe
- [ ] Earth w/Stone or Riprap Spillway
- [x] Concrete
- [ ] Stone
- [ ] Timber
- [ ] Other _____

Use

- [ ] Water Supply
- [ ] Power
- [ ] Recreation - [ ] High Density
- [ ] Fish and Wildlife
- [ ] Farm Pond
- [x] No Apparent Use-Abandoned
- [ ] Flood Control
- [ ] Other _____

Estimated Impoundment Size 95 Acres ## Estimated Height of Dam above Streambed 45 Ft.

Condition of Spillway

- [x] Service satisfactory
- [ ] In need of repair or maintenance
- [ ] Auxiliary satisfactory
- [ ] In need of repair or maintenance

Explain: Small Cracks in Concrete - No Leaks 1-6'x6' sluice gate to drain impoundment

Condition of Non-Overflow Section

- [x] Satisfactory
- [ ] In need of repair or maintenance

Explain: _____

Condition of Mechanical Equipment

- [ ] Satisfactory
- [ ] In need of repair or maintenance

Explain: Not Generating any power GENERATORS REMOVED 2-penstocks 9'X14' blocked off.

Siltation [ ] High [ ] Low

Explain: _____

Remarks: C-HAZARD - MARINA, Houses 2 MILES Downstream

Evaluation (From Visual Inspection)

- [ ] Repairs req'd. beyond normal maint.
- [x] No defects observed beyond normal maint.

THOS. J. MORRISON, DIVISION ENGINEER

STATE OF NEW YORK
DEPARTMENT OF STATE ENGINEER
WESTERN DIVISION
ROCHESTER

DWIGHT B. LA DU
STATE ENGINEER

ARNOLD G. CHAPMAN
DEPUTY

M/L

SUBJECT: Power dam at Eighteen Mile Creek, at Burt, N.Y.

Sept. 12, 1924.

272 W V

15 C 2272

STATE
SEP 15
REFD TO

Hon. Dwight B. La Du,
State Engineer,
Albany, N. Y.

Dear Sir:-

Referring to the construction of the concrete power dam on Eighteen Mile creek, at Burt, N. Y., I have twice visited the site- once on August 13th, when a part of the foundation was ready for inspection, and again on August 28th, when the Contractors were ready to pour concrete.

At the time of my first visit a portion of the east end of the dam had been excavated and the trenches in the rock for the foundation made. The rock on the surface is rather soft red sandstone, which tends to disintegrate on exposure. Lower down the rock is considerably higher and appears to be quite free from seams. I suggested that a narrow trench be cut back into the side of the rocky cliff so as to key the dam more securely into the side. On my second visit a section about 40-feet long at the east end of the dam had been prepared for concreting, and the key that I had suggested on my former visit had been dug. The rock foundation was in very good shape to receive the concrete.

The Company is to notify me when another section of the foundation will be ready and when I am so notified I will inspect that.

Very truly yours,
Thos. J. Morrison,

Thos. J. Morrison

Division Engineer.

McCarthy Bros. & Ford,

Electrical Headquarters

Supplies-Engineering-Contracting-Repairs

75-79 West Mohawk St.
Buffalo, N.Y.

OFFICE OF STATE ENGINEER
RECEIVED
MAY 7 1924
ANSD

May 6 1924

Mr A R McKim
Dept of State Engineer & Surveyor
Albany New York

Subject Dam #272 W Ontario- Burt
Lockport & Newfane Water & Supply Co

Dear Sir:

With further reference to our telephone conversation today. After talking with you, I received your letter and find that the old print of Drawing 1330-E was sent you instead of the revised print. I am accordingly attaching two prints of revised Drawing 1330-E showing the revised section of the Dam thru the power house.

Also am attaching two prints of drawing 1332-E showing revised section of the spillway with steel re-inforcing as you suggest.

With reference to the application, advise that our pen stocks will at all times be capable of accommodating a flow of not less than 2141 CFS. As a matter of fact they will accommodate a still greater flow of water.

On the basis of the application which you have and the revised prints enclosed herewith, can you not let us have immediate approval of this Dam and oblige

Very truly yours,

MCCARTHY BROS & FORD

Karr Parker

Engineering Manager.

Karr Parker-B

Note: Blue prints being sent under separate cover.

McCARTHY BROS. & FORD,

ELECTRICAL HEADQUARTERS

SUPPLIES-ENGINEERING-CONTRACTING-REPAIRS

75-79 WEST MOHAWK ST.
BUFFALO, N.Y.

April 25 1924

OFFICE OF THE STATE ENGINEER
APR 28 1924
REFER TO ANSD
McKim

Arnold H Chapman, Deputy State Engineer
Telephone Building
Albany N Y

Attention Mr A R McKim.
Subject Lockport & Newfane Power & Water Supply Co.
Dam 272 W Ontario, Burt.

Gentlemen:

With further reference to the conference which I had with Mr McKim on the 22nd instant regarding the application of the Lockport and Newfane Power & Water Supply Co for the erection of a dam on Eighteen Mile Creek at Burt N Y, I have revised the application and plans in accordance with the agreement reached at this conference and am forwarding herewith.

EXHIBIT A Application for the construction of the dam. This supercedes the previous application which was sent you.

EXHIBIT B Three prints of revised drawing 1330-E showing Power House plan and cross-section.

EXHIBIT C Three prints of SK 1019 showing graphically the forces in the dam, and three prints of Dwg 1332-E showing the dam.

You will note that we are providing for a maximum flow in accordance with your letter of the 16th instant. We point out that this flow is 12 times the normal flow of this stream and 5 times the greatest known flood and we believe that the maximum runoff which is being calculated is very much in excess of anything that it is necessary to provide for. However, in view of the fact that we have met your conditions, we would ask that you let us have your approval of the revised plans at the earliest possible date.

Work is already under way at the site of the dam and I appreciate very much Mr McKim's promise to give the revised application immediate attention and wish to thank him for courtesies extended to me while in Albany. In replying kindly address your communications to me and oblige

Very truly yours,

Karr Parker

Engineering Manager.

Karr Parker-B

3-25-34-1000 (6-1905)

STATE OF NEW YORK
DEPARTMENT OF
State Engineer and Surveyor
ALBANY

Received April 30 - 1924 Dam No. 272 W Ont Watershed

Disposition Approved May 9-1924 & May 28 Serial No. 3568

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked 1330-E & 1332-E and Sheet #3 State Engineers Map of Eighteen Mile Creek 1919 Report Vol.1. site Western N Y Water Co. herewith submitted for the {construction / ~~reconstruction~~} of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about October 1 1924 (Date)

1. The dam will be on Eighteen Mile Creek flowing into Lake Ontario in the town of Newfane, County of Niagara and 250 ft south of Highway Bridge at Burt N Y. 1.9 miles from Olcott Light House. (Give exact distance and direction from a well-know bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is Lockport & Newfane Power & Water Supply Co, Middleport N.Y.

3. The dam will be used for Generation of Electric Power.

4. Will any part of the dam be built upon or its pond flood any State lands? No

5. The watershed at the proposed dam draining into the pond to be formed thereby is 85 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 95 acres and will impound 173,000,000 cubic feet of water.

7. The lowest part of the natural shore of the pond is 15 feet vertically above the spillcrest, and everywhere else the shore will be at least 20- 42 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 1000-1200 cubic feet per second on Estimate no records. See State Engineers Report 1919 p. 227-241. (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam No such possibility

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Limestone

11. The material of the right bank, in the direction with the current, is limestone, at the spillcrest elevation this material has a top slope of 14.4 inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of several miles, see Map feet, and the top surface extends for a vertical height of 30 feet above the spillcrest.

12. The material of the left bank is limestone, has a top slope of 34 inches to a foot horizontal, a thickness of several miles, see Map feet, and a height of 15 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Very hard and impervious

14. If the bed is in layers, are the layers horizontal or inclined? horizontal If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping

15. What is the thickness of the layers? 6- 12 inches

16. Are there any porous seams or fissures? No

17. WASTES. The spillway of the above proposed dam will be 75 feet long in the clear; the waters will be held at the right end by a Dam the top of which will be 7.5 feet above the spillcrest, and have a top width of 5 feet; and at the left end by a dam, See Dwg 1330-E the top of which will be 7.5 feet above the spillcrest, and have a top width of 5 feet.

18. There will be also for flood discharge a pipe inches inside diameter and the bottom will be feet below the spillcrest, a sluice or gate 6 feet wide in the clear by 6 feet high, and the bottom will be 45 feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of Concrete, 75 feet long across the stream, 15 feet wide and 9-4 feet thick. The downstream side of the apron will have a thickness of 6 feet for a width of 3 feet. See details on Dwg 1332-E.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over ¼ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction. Regular inspection by a Professional Engineer licensed in the State of New York.

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? No. Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?

...eer's letter 4-16-24 is

A. 85 sq miles drainage on X64 CFS = 5440 CFS

B. Maximum amount from Canal as per agreement with the State of New York 500 CFS

Total 5940 CFS

In respect to Item A we submit that this figure is very much in excess of any floods which we have ever experienced on 18 Mile Creek, going back years. Under chapter 425 Laws of 1918 the State Engineer made a careful survey of this stream, see pp 227-241 of 1919 Report and calculated that 307 acres of bottom land would be flooded if the flow was increased to 00 CFS - as a matter of experience all this land has not been flooded as far back as local records go.

The above flow will be provided for as follows (See Dwg 1332-E)

2 - Penststocks 9' x 14' 690 CFS

1 - " 11' x 18' 551 CFS

1 - 6'x6' submerged sluice gate (h = 50') 1742 CFS

$Q = CA\sqrt{2gh} = 0.85 \times 36 \sqrt{64.4 \times 50}$

$Q = 1742$

Spillway 75' long x 5' max. depth of water 2970 CFS

Total 5953 CFS

Spillway Discharge Calculation

Francis' Formula $Q = 3.33\ lh^{3/2}$

$l = 75', \quad h = 5'$

$Q = 3.33 \times 75 \times 5^{3/2} = 2970$ CFS

It will be noted that the normal elevation of water on the dam is 297 and the maximum elevation under the above flood condition with 5 ft of water on the spillway would be 302. It will be further noted that the water cannot wash around the ends of the dam or overflow the banks and that no damage would be done if the non-overflow section should be over-topped - which latter condition we consider impossible as the maximum flow being provided for is 12 times the normal flow of the stream and 5 times the greatest known floods on this stream. Careful tests and records of other hydro-electric plants on this stream show, for the past 8 years, that the average flow is

Canal water 375 CFS

Natural run off 75- 125 CFS

Total Flow 500 CFS

The above information is correct to the best of my knowledge and belief.

Middleport, New York
(Address of signer)

Lockport & Newfane Power & Water Supply Co

April 24 1924
(Date)

F. S. Tracey Manager
(A person signing for owner should indicate his title or authority)

Lockport and Newfane Power and Water Supply Co.

OFFICE 16 STATE STREET

MIDDLEPORT, N. Y., April 14th, 1924.

RECEIVED
OFFICE STATE ENG.
APR 15 1924
REF'D TO ANS'D

Mr. Arnold Chapman,
Ass't. State Eng.
Albany, N. Y.

Dear Sir:-

I have your letter of recent date covering the proposed dam #272 at Newfane N. Y.

Since receiving your letter, I have noticed that we had the location as being 250 ft. south of the highway bridge below Newfane, N. Y. This location should have been 250 ft. south of the highway bridge at Burt, N. Y., or about 11,000 ft. north of the highway bridge at Newfane, N. Y. and approximately 1000 ft. south of the lake level in this Creek.

You also state that the maximum flow would overflow the complete dam and spillway approximately one foot. Kindly let me know the cubic flow you are taking as a maximum flow. We have measured the maximum flow that has been known as the maximum flow for the past twenty years and found that it would not exceed 1000 cu. ft. per second.

If you will give me this information as soon as possible, I will forward it to our engineer so that we may have a new set of plans sent to you at once.

Thanking you, we remain

Yours very truly,

LOCKPORT & NEWFANE POWER & WATER SUPPLY CO.

By P. H. Tracy Mgr.

FST:AL

2-15-22-1000 (5-2749)

STATE OF NEW YORK
DEPARTMENT OF
State Engineer and Surveyor
ALBANY

Received March 25th 1924 Dam No 272 W One Watershed

Disposition Not approved Serial No 558

Site inspected Lake application approved

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed plans, marked 1330-E & 1332-E

Location Map Project N Y #15

herewith submitted for the {construction / ~~reconstruction~~} of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam.

1. The dam will be on Eighteen Mile Creek branch of in the town of Newfane, County of Niagara and 250 ft south of highway bridge below Newfane N Y
(Give exact distance and direction from a well-known bridge, dam, village, main cross-roads or mouth of a stream)

2. The name and address of the owner is Lockport & Newfane Power & Water Supply Co Middleport N Y.

3. The dam will be used for Generation of Electric Power.

4. Will any part of the dam be built upon or its pond flood any State lands? No

5. The watershed at the proposed dam draining into the pond to be formed thereby is 85 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 95 acres and will impound 173,000,000 cubic feet of water.

7. The lowest part of the natural shore of the pond is 15 feet vertically above the spillcrest, and everywhere else the shore will be at least 20-42 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 800-1000 cubic feet per second on Estimate no records. (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam No such possibility

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Limestone

11. The material of the right bank, in the direction with the current, is limestone; at the spillcrest elevation this material has a top slope of 14.4 inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of / feet, and the top surface extends for a vertical height of 30 feet several miles, see Map above the spillcrest.

12. The material of the left bank is limestone has a top slope of 34 inches to a foot horizontal, several miles, see map a thickness of / feet, and a height of 15 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Very hard and impervious

14. If the bed is in layers, are the layers horizontal or inclined? horizontal If inclined what is the direction of the slope relative to the center line of the dam and the inches vertical to a foot horizontal?

15. What is the thickness of the layers? 6-12 inches

16. Are there any porous seams or fissures? No

17. WASTES. The spillway of the above proposed dam will be 45 feet long in the clear; the waters will be held at the right end by a Dam the top of which will be 4.5 feet above the spillcrest, and have a top width of 5 feet; and at the left end by a Dam, See Dwg 1330-E the top of which will be 4.5 feet above the spillcrest, and have a top width of 5 feet.

18. There will be also for flood discharge a pipe inches in diameter and the bottom will be feet below the spillcrest, a sluice or gate 6 feet wide in the clear by 6 feet high, and the bottom will be 45 feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of concrete, 45 feet long, 15 feet wide and 9-4 feet thick. The downstream side of the apron will have a thickness of 6 feet for a width of 2 feet. See Details on Dwg 1332-E.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings of the proposed structure. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the plans any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back sheet of this application make a sketch to scale for each different cross-section at the highest point; showing the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; and the abutments by their top width and top lengths from the upstream face of the spillcrest and give the elevation of the top in reference to the spillcrest.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at both ends of the spill; and of the spillcrest for the above proposed dam.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand one-half a cubic foot is desired; for cement, three pints; and for the natural bed, twenty cubic inches.

24. INSPECTION. State how inspection is to be provided for during construction Regular inspection by a Professional Engineer licensed in the State of New York.

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? No. Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y. ?

I have carefully checked over the matter of the maximum flow of water that can be expected in Eighteen Mile Creek and I am informed by some of the plant officials in Lockport who have had experience with this stream for many years, that 800 CFS has been considered to be a very great flood and that only once in the past 15 years did the flow ever reach 1000 CFS. This occasion was in the winter time. Very careful surveys have been made by the State Engineer showing the land which will be flooded if 1000 CFS is put down this Creek. Our estimate of the maximum floods that ever have obtained on this Creek is based on the known area of land which has been flooded at these times.

The spillway as proposed is ample to take care of more than 1000 CFS with all the turbine gates closed and in addition to that, there is of course, the sluice gate which can also be used. It must be kept in mind that practically all of the water coming down this Creek is discharged from the Canal and that the stream is short, the drainage there is small and it is relatively not subject to floods to anything like the extent that a stream would be if its entire volume was supplied from runoffs of a large drainage area.

See Colume 1 page 227 of Report of New York State Engineer and Surveyor (1919) on Survey of Eighteen Mile Creek - note maps accompanying this report and showing site of proposed dam.

The above information is correct to the best of my knowledge and belief.

Middleport, N.Y.
(Address of signer)

The Lockport & Newfane Power and Water Supply Company
by E. Kenyon President
Roy L. Wheeler Secretary,

March 24 - 1924.
(Date)

(A person signing for Applicant should indicate his title or authority).