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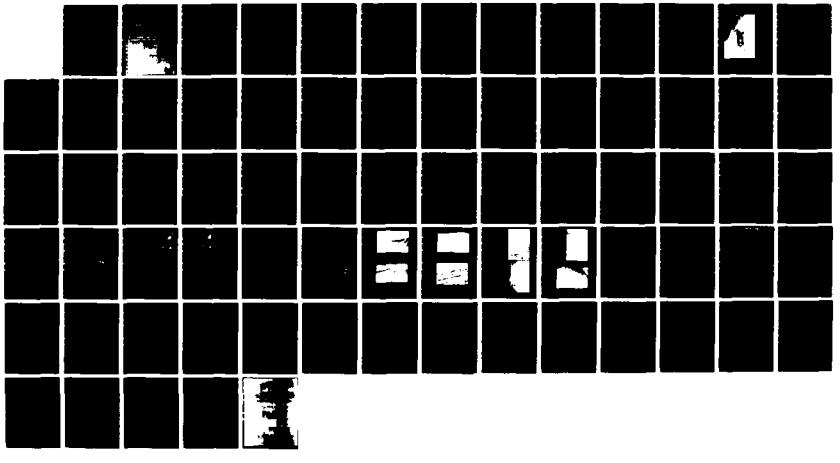

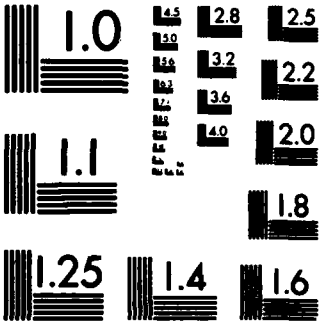

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NAUGATUCK RIVER BASIN

MORRIS & LITCHFIELD, CONNECTICUT

MORRIS RESERVOIR DAM
CT 00473

INSPECTION REPORT

INSPECTION PROGRAM

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Naugatuck River Basin
Morris & Litchfield, Connecticut

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

Morris Reservoir Dam is an 800 foot long earth embankment dam and has a maximum height of 110 feet. The visual inspection of Morris Reservoir Dam indicated that the dam is in good condition and is well maintained. Based on its large size and significant hazard classification in accordance with the Corps guidelines the test flood is equal to the PMF.

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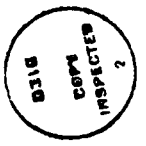
MORRIS RESERVOIR DAM

CT 00473

NAUGATUCK RIVER BASIN
MORRIS AND LITCHFIELD, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No.: CT 00473

Name of Dam: Morris Reservoir Dam

Town: Morris and Litchfield

County and State: Litchfield, Connecticut

Stream: Slab Meadow and Wigwam Brooks

Date of Inspection: December 5, 1978

Morris Reservoir Dam is an 800 foot long earth embankment dam and has a maximum height of 110 feet. Top width of the dam is 20 feet and appurtenant structures include a concrete spillway, spillway channel and outlet works. The spillway is on the right (west) side of the dam.

Engineering data available consisted of a set of plans dated 1910 showing plan, elevation and details of the dam. No construction specifications or design calculations were available.

The visual inspection of Morris Reservoir Dam indicated that the dam is in good condition and is well maintained. The inspection revealed that a surficial erosion channel up to 8 inches in depth is located on the downstream slope approximately 150 feet east of the spillway starting at the third berm down from the crest and extending to the toe. Occasional animal burrows were found on the downstream face of the dam. Loose rock and trees were observed overhanging the west side of the downstream channel. Slight erosion adjacent to the east side of the gate structure was observed. Occasional water observed on the berms is believed to be melt water.

Based on its large size and significant hazard classification in accordance with the Corps guidelines the test flood is equal to the Probable Maximum Flood. The spillway will pass the test flood outflow of 15,575 cfs with a pool elevation of 659.6 feet MSL which is 1 foot below top of dam.

Based on the findings of the visual inspection and hydrologic and hydraulic analysis, there is no need for further engineering studies or for major alterations to the dam. Provisions should be made by the owner to repair the erosion channel on the downstream

slope of the embankment. Animal holes should be backfilled with suitable material and planted with appropriate ground cover. Also trees that overhang the spillway channel and loose blocks of rock located in the channel should be removed. After the seasonal thaw, the standing water observed at the downstream toe should be investigated to verify the conclusion that it is melt water.

The recommendations and remedial measures are described in Section 7 and should be addressed within two years after receipt of this Phase I - Inspection Report by the owner.

Robert L. Jones, P.E.
Project Manager

Philip W. Genovese & Associates, Inc.
Hamden, Connecticut

This Phase I Inspection Report on **Morris Reservoir Dam** has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

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 spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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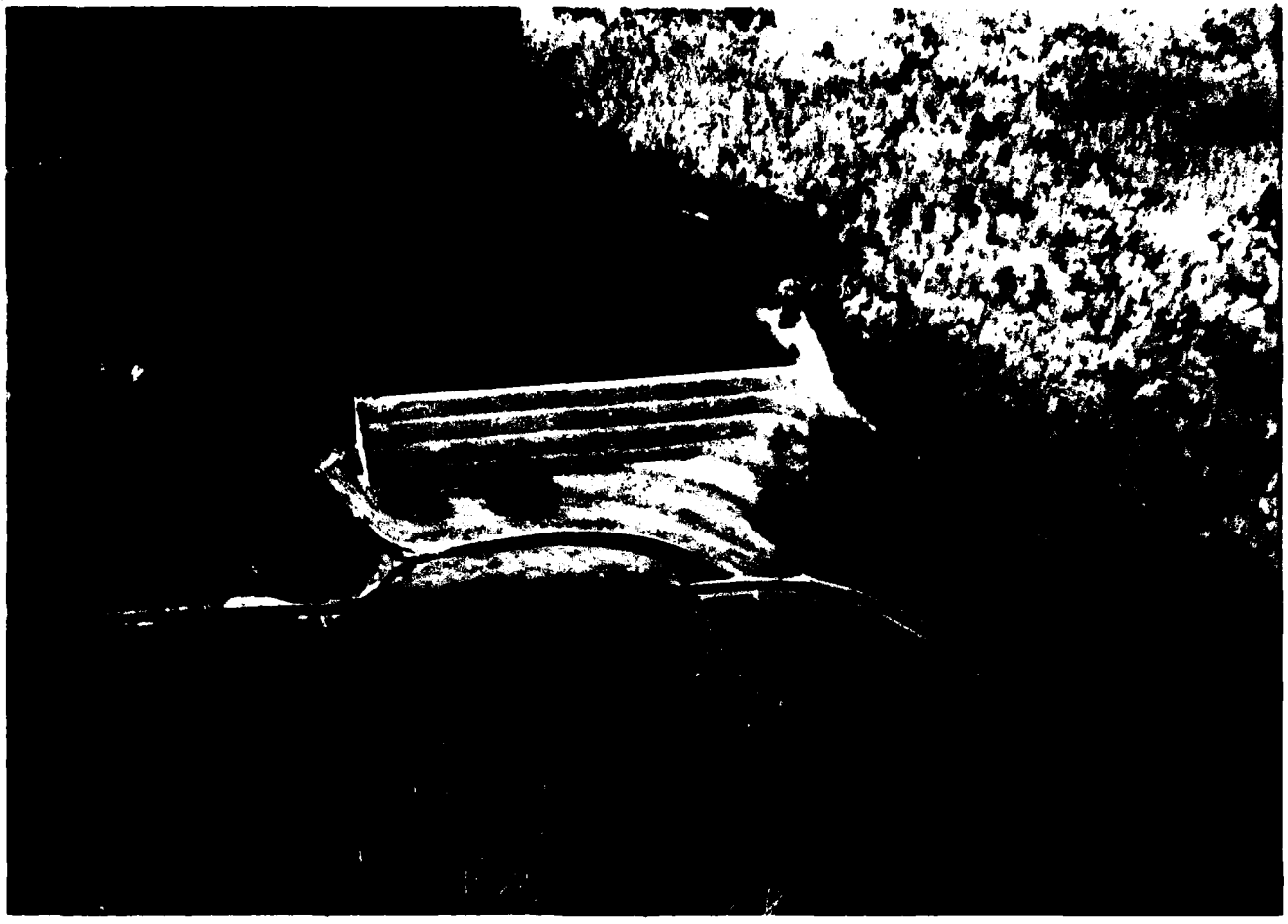

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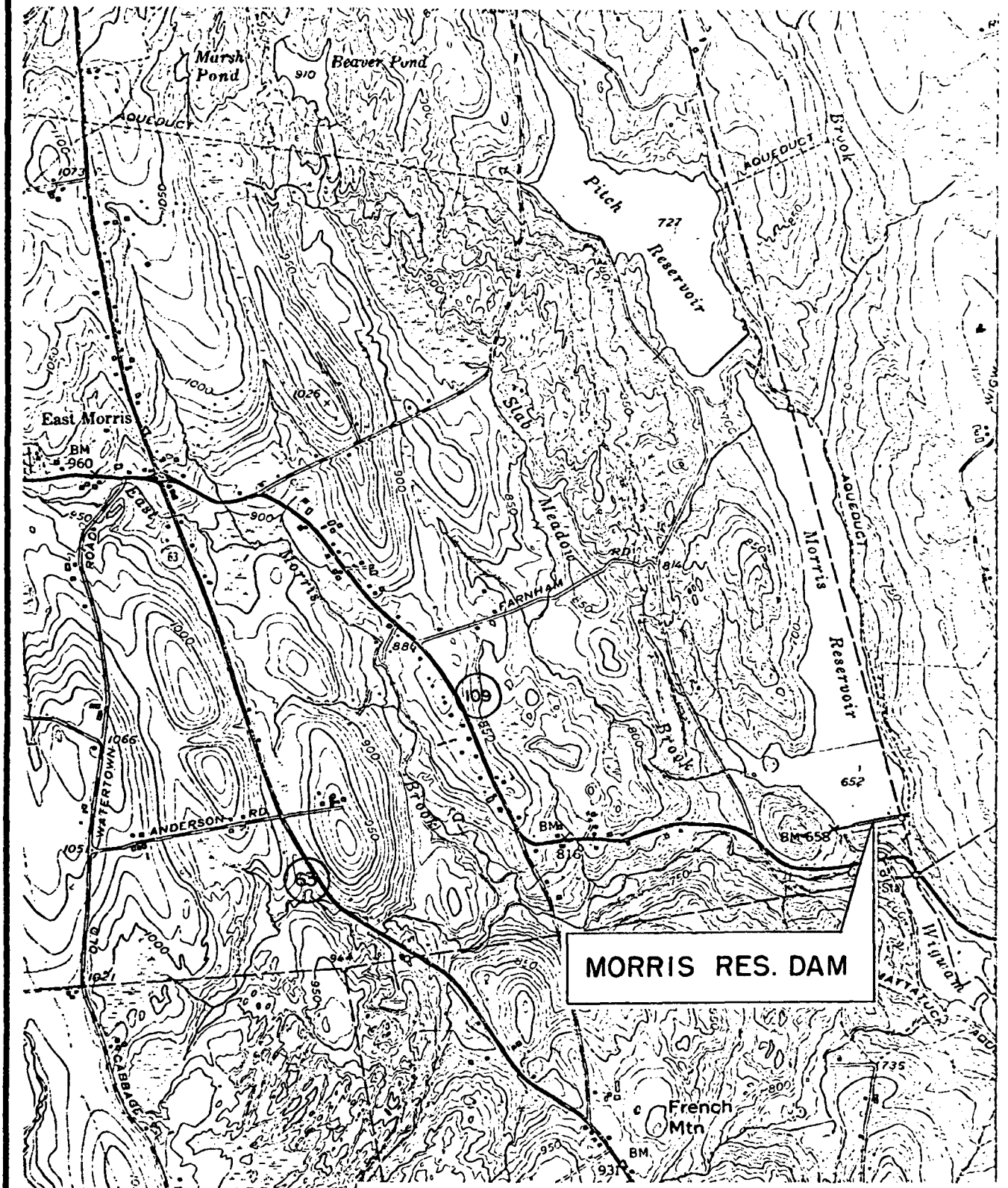


PHILIP W. GENOVESE AND ASSOCIATES, INC.
ENGINEERS-HAMDEN, CT.

U.S. ARMY ENGINEER DIV.
NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
LOCATION MAP

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Philip W. Genovese and Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Philip W. Genovese and Associates, Inc., under a letter of November 28, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C0019 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Morris Reservoir Dam is located on Slab Meadow and Wigwam Brooks in the Towns of Litchfield and Morris, Connecticut. The dam is immediately upstream from Wigwam Reservoir. The dam is shown on U.S.G.S. Quadrangle, Litchfield, Connecticut with coordinates approximately N 41°- 40.5', W 73°- 08.6', Litchfield County, Connecticut. The location of the dam is shown on the Location Map immediately preceding this page.

b. Description of Dam and Appurtenances. Morris Reservoir Dam consists of an earth embankment section terminated by a concrete headwall at the edge of the spillway channel. The embankment section of the dam has a total length of about 800 feet.

The maximum structural height, according to existing plans, is 110 feet for the earth embankment section. The existing plans indicate that the earth section of the dam is founded on bedrock. Plans also indicate a corewall from elevation 523 feet up to 654 feet extending from the spillway to the left (east) abutment.

The appurtenant structures consist of a concrete spillway, spillway channel and an outlet works structure. The spillway section consists of a 199.7 feet wide ogee-shaped concrete weir with crest elevation of 652.3 feet.

The outlet works consist of an upstream headwall, and a service gate chamber containing twelve gates. Of the twelve gates, six control intake and six control discharge from the gate chamber. Of the six intake gates and conduits, the lowest gate is located at elevation 597 and the highest gate is located at elevation 644. Discharge gates and conduits are of elevations 608, 619, 620, 631 and 642. Four gates control discharge to the discharge channel. Two gates control discharge to Waterbury's water supply system. Figure 1, located in Appendix B, shows the plan of the dam and its appurtenant structures. Photographs of each structure are shown in Appendix C. Sketches of the dam and its appurtenances are in Appendix D.

c. Size Classification. Large (hydraulic height - 110 feet high, storage 5865 acre-feet) based on storage ($\geq$1,000 to 50,000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The dam's potential for damage rates it as a significant hazard classification. A major breach would result in discharge into Wigwam Reservoir which is immediately downstream and subsequently into the storage pool behind the Corps of Engineers Black Rock Dam. There is no human habitation between Morris Reservoir Dam and Wigwam Reservoir. There is a water plant which is manned 24 hours per day and Connecticut Route 109 between the dam and Wigwam Reservoir.

e. Ownership. This dam is owned by the City of Waterbury, 236 Grand Street, Waterbury, Connecticut.

f. Operator. This dam is maintained and operated by the City of Waterbury, Connecticut Bureau of Water. The Superintendent of Reservoirs is Mr. Leonard J. Assard, telephone 203-283-9139.

g. Purpose of Dam. This dam is used for water supply for City of Waterbury. Water treatment occurs downstream at the plant located on Wigwam Reservoir.

h. Design and Construction History. This dam was probably constructed between 1910 and 1916. Plans dated 1909 and 1910 were signed by R. A. Cairns, City Engineer, Waterbury, Connecticut. A drawing titled "Record Map of Pipe Lines in Morris Dam" is dated 1916. All drawings are on file with the owner.

i. Normal Operating Procedure. No data was disclosed for maintenance of reservoir water levels, other than the reservoir is maintained as high as possible for hydraulic purposes. Water may be drawn from the reservoir to the intake structure or downstream gatehouse. The intake structure may discharge into the spillway channel or downstream gatehouse. The downstream gatehouse may discharge into Morris Brook or the water supply system.

1.3 Pertinent Data

a. Drainage Area. The drainage area tributary to Morris Reservoir consists of approximately 8.49 square miles of mountainous terrain. In addition to the reservoir, 3 percent of the basin is made up of lake and swamp area. Elevations in the basin range from about 650 feet to 1220 feet MSL.

The reservoir consists of about 135 acres at the normal (top of spillway) pool elevation. No dwellings are located along the reservoir shores.

b. Discharge at Dam Site

(1) The outlet works for the reservoir consists of six 30 inch diameter intake lines to the service gate chambers at elevations ranging from 597 to 644. A 30 inch diameter intake conduit is connected directly to the downstream gatehouse at elevation 563'. Water from the service gate chambers can be discharged to the spillway discharge channel, the downstream gatehouse or to Waterbury's water supply system. Water from the downstream gatehouse can be discharged to Morris Brook or water supply. See plan in Appendix B and sketches in Appendix D.

(2) There are no records of maximum discharge at the dam site, however, on August 19, 1955, a depth of flow of 2.4 feet was measured at the crest of the spillway. This would give a discharge of approximately 2950 cfs.

(3) The spillway capacity with a water surface at the top of dam (elevation 660.6) would be approximately 19,420 cfs.

(4) The spillway capacity with the water surface at the test flood elevation of 659.5 feet is approximately 15,575 cfs.

(5) The total project discharge at the test flood elevation of 659.5 feet is 15,575 cfs.

c. Elevation (feet above MSL)

(1) Streambed at centerline of dam - 550.6

(2) Maximum tailwater - N/A

(3) Upstream portal invert diversion tunnel - 563

(4) Recreation pool - N/A

(5) Full flood control pool - N/A

(6) Spillway crest (permanent spillway) - 652.3

(7) Design surcharge - unknown

(8) Top dam - 660.6

(9) Test flood surcharge - 659.5

d. Reservoir (miles).

(1) Length of maximum pool - 1.25

(2) Length of recreational pool - N/A

(3) Length of flood control pool - N/A

e. Gross Storage (acre-feet)

(1) Recreation pool - N/A

(2) Flood control pool - N/ A

(3) Spillway crest pool - 4590

(4) Top of dam - 5865

f. Reservoir Surface (acres)

(1) Recreation pool - N/A

(2) Flood control pool - N/A

(3) Spillway crest - 135

(4) Test flood pool - 156

(5) Top dam - 160

g. Dam

(1) Type - Earth embankment

(2) Length - 800 feet

(3) Height - 110 feet (maximum)

(4) Top width - 20 feet

(5) Side slopes - Upstream: 2.5:1 - Downstream 2:1

(6) Zoning - Reinforced concrete coreway overlaid with "Rolled Embankment."

(7) Impervious Core - Concrete: 12 feet wide at base to 2.5 feet wide at top - maximum height of 131 feet.

(8) Cutoff - Excavation to "ledge"

(9) Grout curtain - unknown

(10) Other - unknown

h. Spillway

(1) Type - Ogee-shaped concrete weir.

(2) Length of weir - 199.7 feet

(3) Crest elevation - 652.3 feet

(4) Gates - None

(5) Upstream channel - Concrete rectangular channel 199.7 feet wide and 7 feet deep.

(6) Downstream channel - Concrete rectangular channel variable width and depth.

i. Diversion and Regulating Tunnel.

See Section j below.

j. Regulating Outlets. The reservoir can be drained by a 30 inch outlet pipe set at approximately elevation 563 feet. This pipe is controlled by a gate valve, located at the downstream gatehouse. The six water supply intakes feed a 24 inch diameter line that can go to the downstream gatehouse or to Waterbury's water supply system. The intakes are controlled separately by valves and three control each chamber of the service gatehouse. Outlets are also controlled by gates.

SECTION 2
ENGINEERING DATA

2.1 Design

This dam was constructed between 1910 and 1916 for water supply purposes. A set of plans dated 1909-10 as prepared by R.A. Cairns, City Engineer, City of Waterbury showing plan, elevation, typical sections and details is available at the office of the Owner. No in-depth engineering data were found for this dam.

2.2 Construction

No construction records were available for use in evaluating the dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Other than the set of plans described above, no additional engineering data were found to be available.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. The field investigation indicated that the external features of Morris Reservoir Dam substantially agree with those on the available plans. Minor revisions to the water distribution system have been made.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Morris Reservoir Dam was made on December 5, 1978. The inspection team consisted of personnel from Philip W. Genovese and Associates, Inc. and Geotechnical Engineers, Inc. Representatives of the City of Waterbury, Bureau of Water were also present during portions of the inspection. Inspection checklists, completed during the visual inspection are included in Appendix A. At the time of the inspection, the water level was approximately four feet below the permanent spillway elevation. No water was passing over the spillway. The upstream face of the dam could only be inspected above this water level.

b. Dam. The dam consists of an earth embankment section about 800 feet long. The crest is at elevation 660.6 according to the design drawings.

According to the design drawings, the concrete core wall section is founded on bedrock. The only bedrock observed was in the spillway channel. There was no evidence of seepage.

The embankment section is covered with grass and showed no signs of distress. The upstream slope is covered with riprap to an elevation 4.5 feet above the flow line.

A surficial erosion channel is located on the downstream slope about 150 feet east of the spillway. This channel commences at the third berm from the crest and continues to the embankment toe. This feature can be seen in Photo 7.

Occasional standing water was observed on downstream berms that is believed to be melt water.

Animal burrows and mole hills up to 6 inches high were observed on the downstream face. Also, three animal burrows up to 1.5 feet in diameter and 3 feet deep were observed on the downstream slope where the embankment section flares into the east abutment. This can be seen in Photo 8.

There is limited information in the available design drawings as to whether the embankment section is founded on bedrock.

No seepage was observed at the downstream slope or downstream toe of the embankment.

c. Appurtenant Structures. Visual inspection of the concrete spillway, spillway channel, outlet works did not reveal any evidence of stability problems. The concrete surface and construction joints appeared to be in good condition although some slight erosion and seepage of the concrete training wall adjacent to the service gate chamber was observed. This can be seen in Photo 6.

The spillway structure consist of a concrete ogee-shaped weir with concrete training walls. The concrete spillway surface is in good condition.

The outlet works consists of an intake channel, a service gate chamber (containing two identical chambers) with six control gates, six discharge gates and a downstream gatehouse. As the intake structure was below water, it was not inspected. The intake conduits are located at various levels ranging from elevation 597 to 644. The discharge conduits, all 24 inches in diameter with two going to Waterbury's water supply and four to the discharge channel are located at elevations 608, 619, 620, 631 and 642. As all gates were below water in the gate chamber, they could not be inspected. However, all parts of the gate chamber that could be inspected appeared to be in good condition. All outlet gates are reported to be functional.

The spillway discharge channel is generally in good condition. There is evidence of loose rocks and trees overhanging the right (west) side of the spillway channel. This can be seen in Photo 5. Trees are overhanging the right (west) side of the spillway channel.

d. Reservoir Area. The reservoir area has mountainous terrain, partially wood covered. A more detailed description of the drainage area is included in Section 1.3 of this report. There was no development observed along the shoreline.

e. Downstream Channel. Four discharge pipes from the service gate chamber discharge into the spillway discharge channel which flows into Morris Brook. Morris Brook flows through a clean channel into Wigwam Reservoir.

3.2 Evaluation

Visual examination indicates that the dam is in good condition and well maintained. No seepage was observed from the foundation or abutments of embankment section of the dam. The inspection revealed the following:

a. A surficial erosion channel on the downstream slope:

b. Occasional standing water on downstream berms which is believed to be melt water.

c. Animal burrows and mole hills on the downstream face.

d. Erosion and evidence of seepage of the downstream spillway channel training wall.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure

Morris Reservoir Dam creates an impoundment of the water which is used primarily as a water supply source for the City of Waterbury. The normal operational procedure is to draw water from the reservoir and pipe it approximately 0.1 miles to the treatment plant on the Wigwam Reservoir. Water can also be discharged to the spillway channel through the service gate chamber and to Morris Creek through the downstream gatehouse.

4.2 Maintenance of Dam

This dam is visited on a frequent basis by personnel of the City of Waterbury, Bureau of Water. These visits are primarily for surveillance of the reservoir for water quality control purposes. General maintenance is accomplished during these visits.

4.3 Maintenance of Operating Facilities

Maintenance on the operating facilities is done on a regular basis.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

The current operating and maintenance procedures for the dam are to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in event of flood flow conditions or imminent dam failure.

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

Morris Reservoir Dam consists of an 800 foot long earth embankment and a 199.7 feet long concrete spillway. The maximum structural height of the dam is 110 feet and is therefore classified as high. Appurtenant structures other than the spillway consist of a spillway channel, an outlet works, a diversion conduit and a downstream gatehouse. The spillway crest is at elevation 652.3 feet. The outlet works consist of an upstream headwall, a service gate chamber (containing two chambers) and outlet conduits that discharge to the spillway channel or to the downstream gatehouse or the water supply system. The six intake conduits and outlet conduits are controlled by gate valves. Intake conduits are at various levels from elevation 597 to 644. Discharge conduits are at elevations 608, 619, 620, 631 and 642. Morris Reservoir Dam has a maximum storage of 5865 acre-feet.

a. Design Data. No hydrologic or hydraulic design data were disclosed for this dam.

b. Experience Data. The maximum discharge at this dam site is unknown. The maximum observed condition was reported to be 29 inches over the spillway or about 2950 cfs.

c. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

d. Test Flood Analysis. As no detailed design and operational information are available, hydrologic evaluation was performed using dam information gathered by field inspection, watershed size and an estimated test flood equal to the Probable Maximum Flood (PMF) as determined by guide curves issued by the Corps of Engineers. Based on a drainage area of 8.49 square miles, it was estimated that the test flood flow at this dam would be 17,925 cfs. Following the guidance for Estimating Effect of Surcharge Storage on Maximum Probable Discharges results in a test flood discharge of 15,575 cfs. As the maximum spillway capacity at the top of the dam is 19,420 cfs, the spillway will pass the PMF without overtopping the dam.

e. Dam Failure Analysis. The impact of failure of the dam at maximum pool (top of dam) was not assessed using the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. See comments in Appendix D.

Morris Reservoir outlets immediately to Wigwam Reservoir, both reservoirs are key water supply units for the City of Waterbury and surrounding areas.

There would be no purpose served in performing a breaching analysis and a resulting downstream flooding evaluation due to the fact that a breached Morris Dam would discharge its contents immediately to Wigwam Reservoir and subsequently into the storage pool behind the Corp's Black Rock Dam.

Other than the 24 hour per day attended water plant at the downstream toe of Morris Dam there appears to be no other habitation between Morris Dam and Black Rock Dam. Connecticut Route 109 runs between the dam and Wigwam Reservoir.

Wigwam Reservoir is immediately downstream of Morris Reservoir and a comparison of the two structures follows:

	Morris Reservoir Dam	Wigwam Reservoir Dams - South	
Total storage no freeboard (Acre-ft)	5865	2946	3226
Spillway storage no freeboard (Acre-ft)	4590	2166	2166
Storage between spillway and top of dam	1275	780	1060

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual examination did not disclose any immediate stability problems. Routine maintenance should be sufficient to prevent any long-term problems.

b. Design and Construction Data. Design drawings are available for the dam. They include general information regarding the overall dimensions of the dam and its appurtenances. This information is not sufficient to assess the stability of the dam and the safety must be judged primarily from visual observations.

c. Operating Records. No operating records pertinent to the structural stability of the dam were available.

d. Post Construction Changes. Since original construction was completed in about 1916 minor additions for piping purposes have been added at the site. This addition was, however, for water distribution. No changes have been made to the dam itself.

e. Seismic Stability. The dam is located in Seismic Zone 1, and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination indicates that the dam is in good condition. The inspection revealed:

(1) An erosion channel on the downstream slope of the embankment commencing at the third berm from the crest and extending down to the toe.

(2) Occasional standing water on downstream berms that is believed to be melt water.

(3) Animal burrows and mole hills on the downstream slope of the embankment.

(4) Slight erosion of the concrete training wall on the left (east) side of the spillway channel.

(5) Loose rock and trees overhanging the right (west) side of the spillway channel.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency. This dam is in good condition. The recommendations and remedial measures described in Section 7.2 and 7.3 should be accomplished within two years after receipt of this Phase I Inspection Report by the owner.

d. Need for Additional Investigation. The findings of this inspection indicate that there is no need for additional investigations.

7.2 Recommendations

Based on the findings of the visual inspection and hydrologic and hydraulic analysis, there is no need for further engineering studies or for major alterations to the dam.

7.3 Remedial Measures

a. The erosion channel on the downstream slope of the

embankment commencing at the third berm from the crest and extending down to the toe should be repaired and the third berm graded to drain into the berm drain.

b. The occasional standing water observed on downstream berms and the downstream toe of the embankment should be investigated by a competent professional engineer to confirm that the water is from melting. This investigation should commence at once.

c. Animal holes should be backfilled with suitable fill and appropriate grass cover planted.

d. Trees overhanging the spillway channel and all loose blocks of rock within the channel should be removed. Slopes of the channel should be planted with appropriate cover to prevent erosion.

e. An operational procedure and formal warning system for emergency conditions should be established.

f. A biennial technical inspection program should be developed.

7.4 Alternatives

There is no practical alternative to the recommendations in Sections 7.2 and 7.3.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT MORRIS DAM

DATE December 5, 1978

TIME 0930

WEATHER Sunny- 35°- 40° F

W.S. ELEV. 648.5 U.S.

City datum 510.22

PARTY:

1. Bob Jones	Party Chief	6. Karl Dalenberg	Geotechnical
2. Don Ballou	Hydraulic/Hydrologic	7. Dick Murdock	"
3.		8.	
4. Leonard Assard	Owner's Rep.	9.	
5.		10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE Earthen Dam Embankment NAME

DISCIPLINE NAME

	AREA EVALUATED	CONDITION
	DAM EMBANKMENT	
DB	Crest Elevation	660.6
DB	Current Pool Elevation	648.5
DB	Maximum Impoundment to Date	Unknown
GEI	Surface Cracks	None
GEI	Pavement Condition	Not paved, grass w/gravel roadway
GEI	Movement or Settlement of Crest	Not observed
GEI	Lateral Movement	None
GEI	Vertical Alignment	Good
GEI	Horizontal Alignment	Good
GEI	Condition at Abutment and at Concrete Structures	Some erosion adjacent to gatehouse
GEI	Indications of Movement of Structural Items on Slopes	None
GEI	Trespassing on Slopes	None, well maintained grassed slopes w/intermediate tiers
GEI	Sloughing or Erosion of Slopes or Abutments	Minor erosion in vicinity of Sta. 6+40
GEI	Unusual Movement or Cracking at or Near Toe	None observed
GEI	Unusual Embankment or Downstream Seepage	None
GEI	Piping or Boils	None
GEI	Foundation Drainage Features	None
GEI	Toe Drains	None
GEI	Instrumentation System	None
GEI	Vegetation	Well maintained slopes

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE Masonry Dam Embankment NAME

DISCIPLINE NAME

	AREA EVALUATED	CONDITION
	DIKE EMBANKMENT	
	Crest Elevation	N/A
	Current Pool Elevation	
	Maximum Impoundment to Date	
GEI	Surface Cracks	
GEI	Pavement Condition	
GEI	Movement or Settlement of Crest	
GEI	Lateral Movement	
GEI	Vertical Alignment	
GEI	Horizontal Alignment	
GEI	Condition at Abutment and at Concrete Structures	
GEI	Indications of Movement of Structural Items on Slopes	
GEI	Sloughing or Erosion of Slopes or Abutments	
GEI	Rock Slope Protection- Riprap Failures	
GEI	Unusual Movement or Cracking at or Near Toes	
GEI	Unusual Embankment or Downstream Seepage	
GEI	Piping or Boils	
GEI	Foundation Drainage Features	
GEI	Toe Drains	
GEI	Instrumentation System	
GEI	Vegetation	

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE Outlet Works - Intake Channel and Structure NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Under water, not observable
GEI Slope Conditions	
GEI Bottom Conditions	
GEI Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
GEI Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE Outlet Works - Control Tower NAME

DISCIPLINE NAME

	AREA EVALUATED	CONDITION
	OUTLET WORKS - CONTROL TOWER	
	a. Concrete and Structural	
BJ	General Condition	Good- Some spalling west side of structure
BJ	Condition of Joints	Good
BJ	Spalling	Minor
BJ	Visible Reinforcing	None visible
BJ	Rusting or Staining of Concrete	None visible
BJ	Any Seepage or Efflorescence	None visible
BJ	Joint Alignment	Good
BJ	Unusual Seepage or Leaks in Gate Chamber	None
BJ	Cracks	None
BJ	Rusting or Corrosion of Steel	None
	b. Mechanical and Electrical	
	Air Vents	
	Float Wells	
	Crane Hoist	
	Elevator	
	Hydraulic System	
	Service Gates	
	Emergency Gates	
	Lightning Protection System	
	Emergency Power System	
	Wiring and Lighting System	

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	N/A
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

PROJECT FEATURE NAME

DISCIPLINE NAME

	AREA EVALUATED	CONDITION
	OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
BJ	General Condition of Concrete	Fair
BJ	Rust of Staining	Some
BJ	Spalling	Some
BJ	Erosion or Cavitation	Minor
BJ	Visible Reinforcing	None
BJ	Any Seepage or Efflorescence	Some
BJ	Condition at Joints	Good
GEI	Drain holes	None observed
GEI	Channel	Concrete and stone lined
GEI	Loose Rock or Trees Overhanging Channel	None
GEI	Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECKLIST

PROJECT: MORRIS DAM DATE December 5, 1978

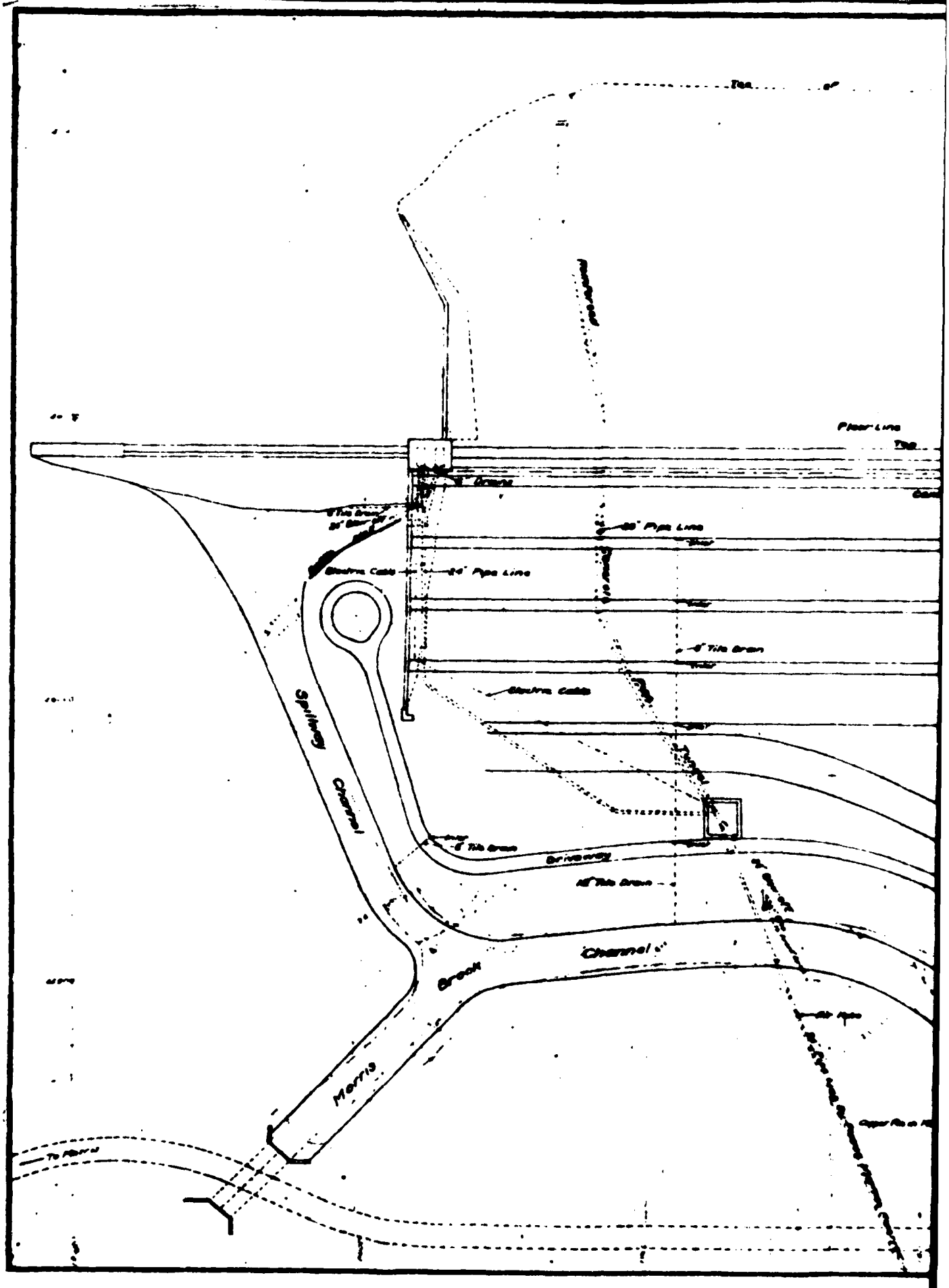
PROJECT FEATURE NAME

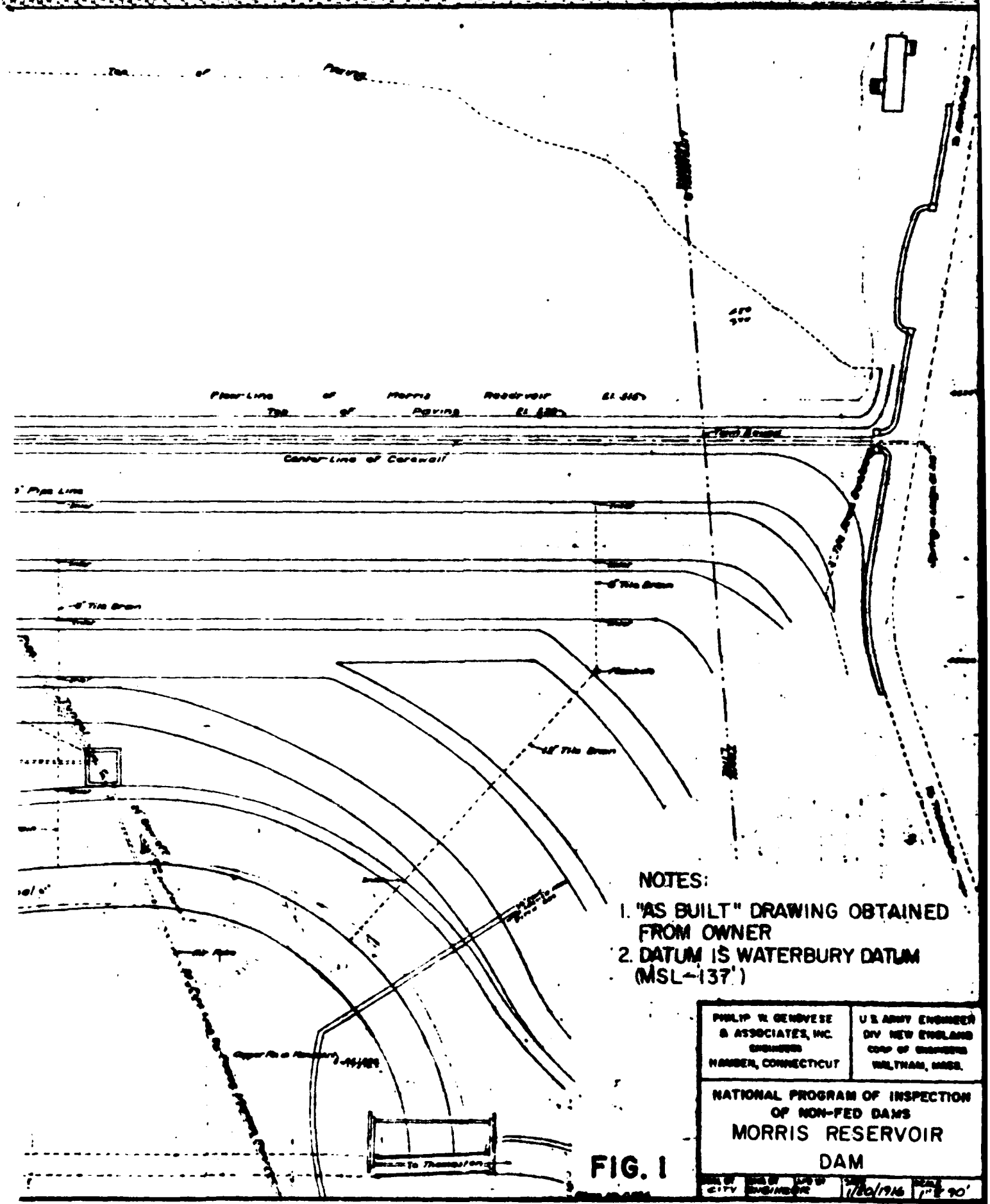
DISCIPLINE NAME

	AREA EVALUATED	CONDITION
	OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
	a. Approach Channel	Under water, upstream face of dam
GEI	General Condition	
GEI	Loose Rock Overhanging Channel	
GEI	Trees Overhanging Channel	
GEI	Floor of Approach Channel	
	b. Weir and Training Walls	
BJ	General Condition of Concrete	Fair
BJ	Rust or Staining	Some
BJ	Spalling	Some
BJ	Any Visible Reinforcing	No
BJ	Any Seepage or Efflorescence	Some
GEI	Drain Holes	None
	c. Discharge Channel	
GEI	General Condition	Good
GEI	Loose Rock Overhanging Channel	Some evidence of loose rock on right bank
GEI	Trees Overhanging Channel	Large trees overhanging channel along right side of channel
GEI	Floor of Channel	Good, some vegetation & loose rock, concrete found in some locations.
GEI	Other Obstructions	None

APPENDIX B

ENGINEERING DATA


Floor Line
Electric Cable
Electric Cable
Driveway
Channel
Brook
Morris



NOTES:

1. "AS BUILT" DRAWING OBTAINED FROM OWNER
2. DATUM IS WATERBURY DATUM (MSL~137')

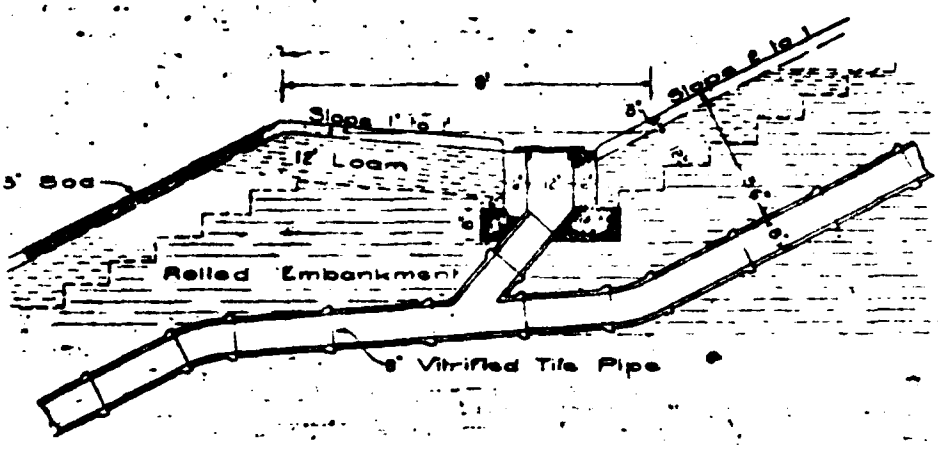
PHILIP W. GENOVESE & ASSOCIATES, INC. ENGINEERS HAMDEN, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

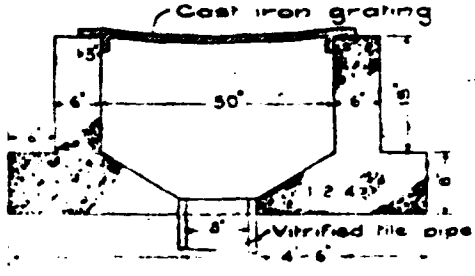
MORRIS RESERVOIR DAM

CITY			1/20/1976	1" = 90'

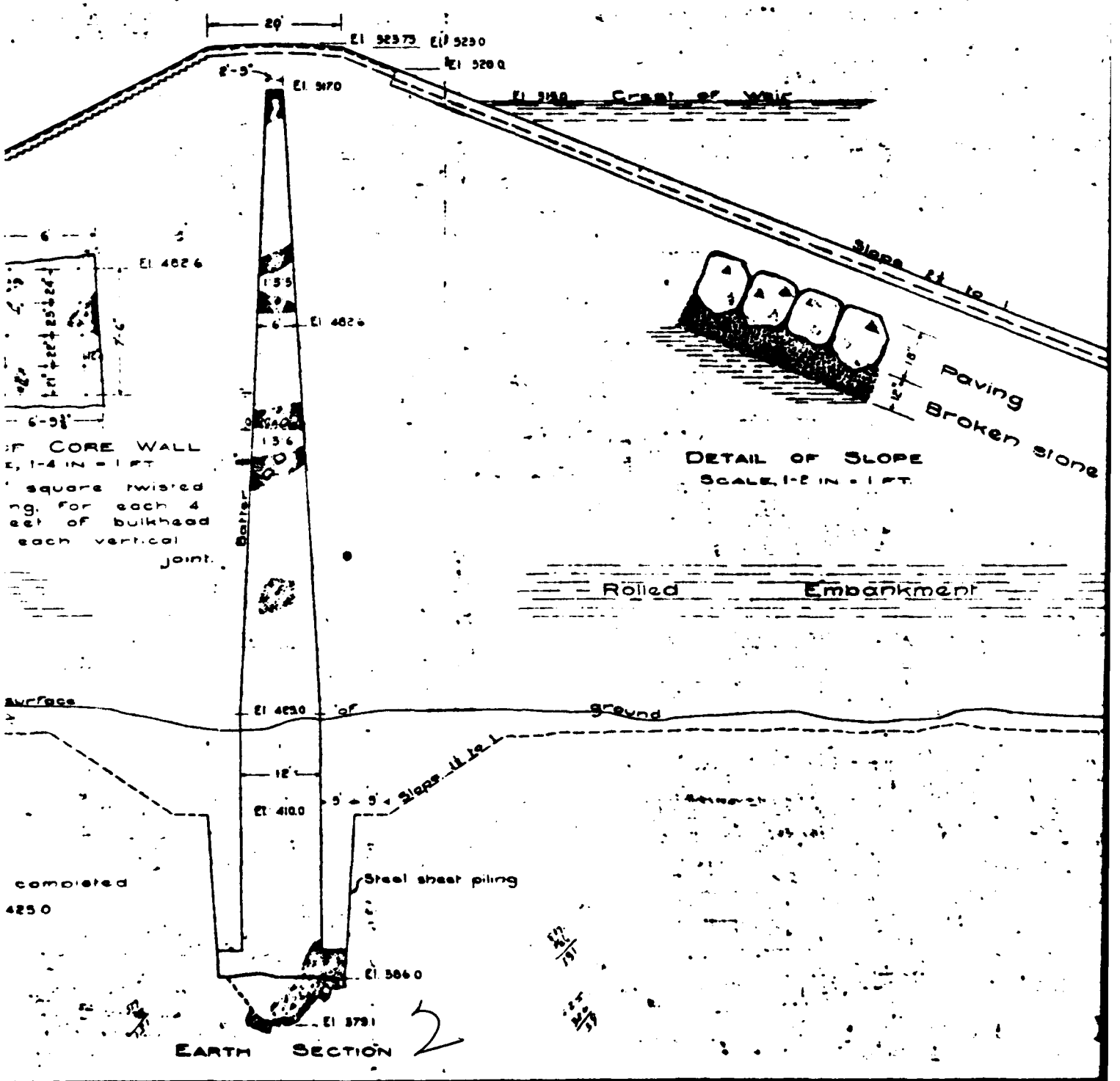
FIG. 1



SECTION AT BERM SHOWING INLET BASIN
SCALE, 1-2 IN = 1 FT



LONGITUDINAL SECTION
INLET BASIN
SCALE, 1 IN = 1 FT


20'
El 5237.5
El 5230
El 5220
5'-3"
El 5170
El 5150
Crest of Weir
Slope 1½ to 1
El 462.6
6'-9½"
F CORE WALL
E, 1-4 IN = 1 FT
square twisted
ng. for each 4
eet of bulkhead
each vertical
joint.
Batter
El 462.6
Paving
Broken stone
DETAIL OF SLOPE
SCALE, 1-2 IN = 1 FT.
Rolled Embankment
surface
El 453.0
of
ground
12'
5'
5'
Slope 1½ to 1
El 410.0
completed
425.0
Steel sheet piling
El 386.0
El 378.1
EARTH SECTION

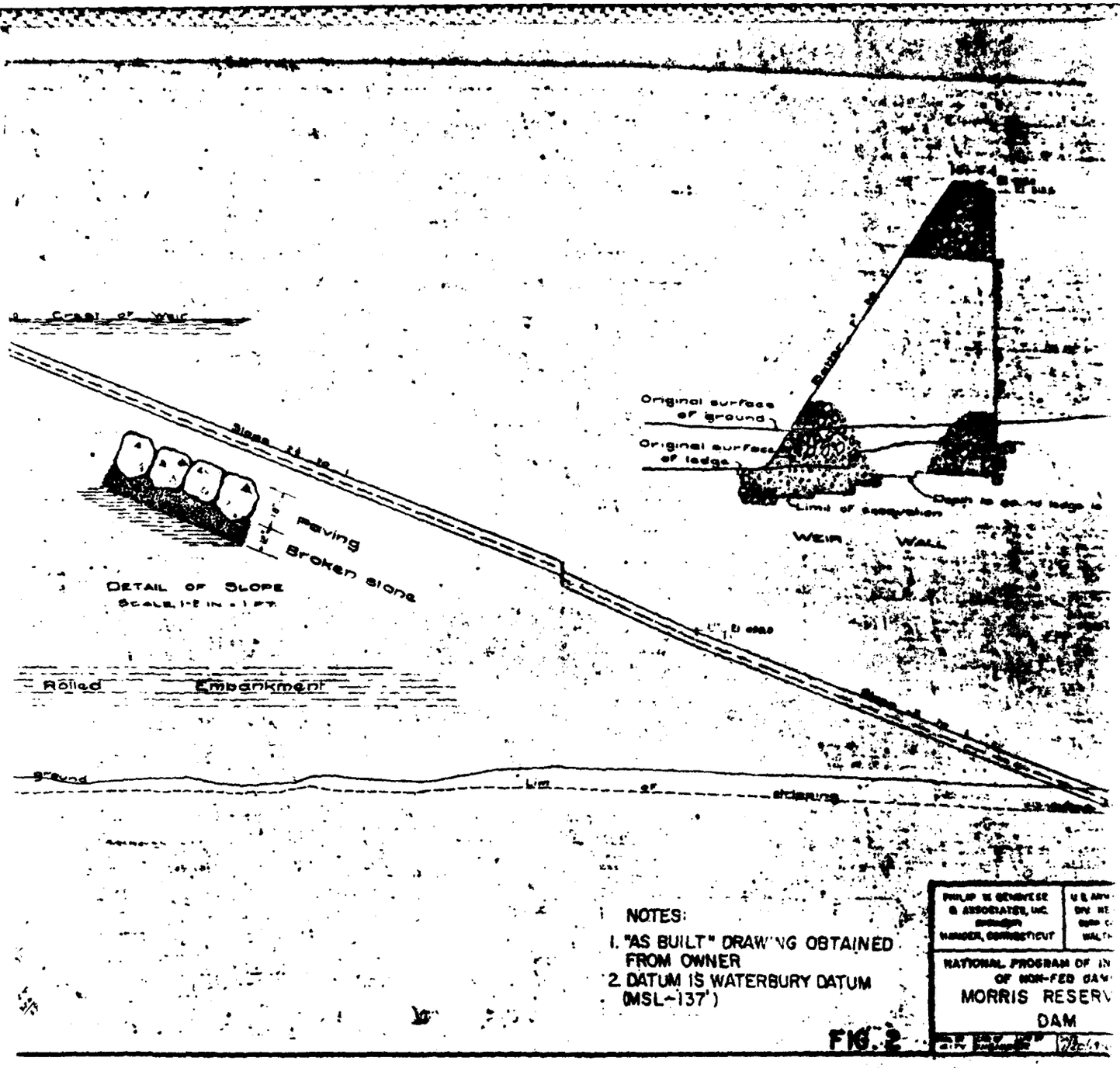
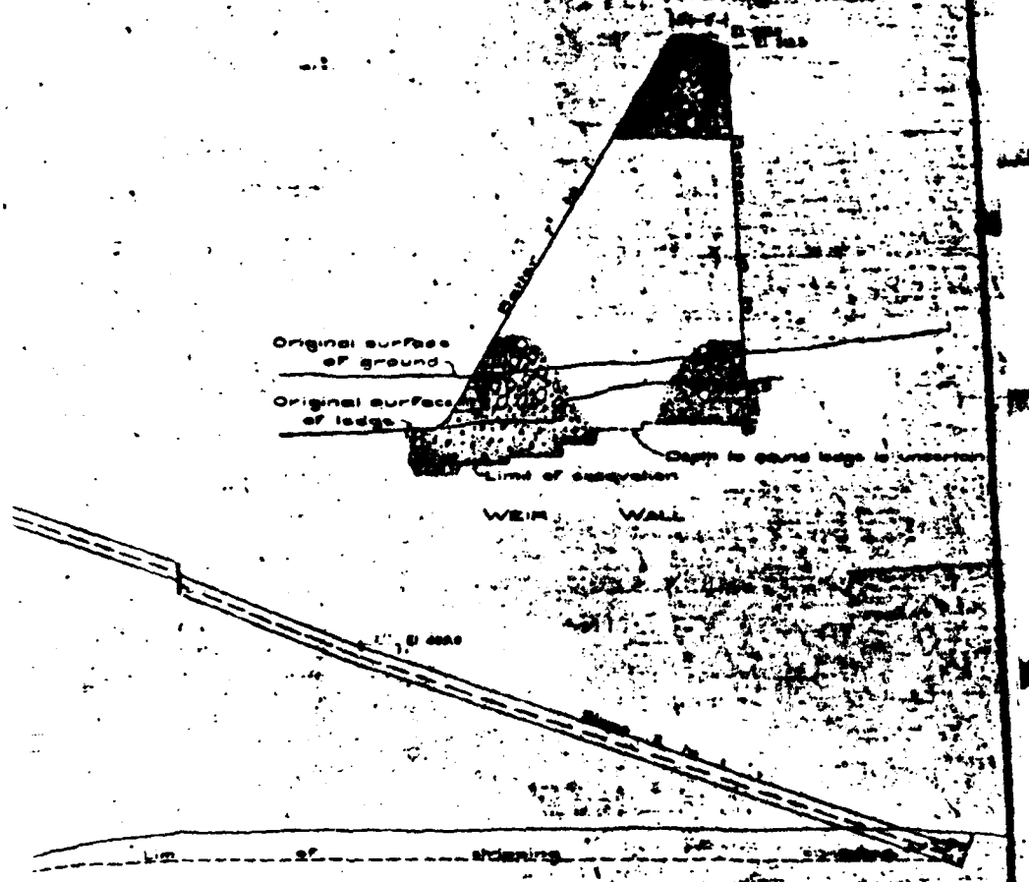

Crest of Weir
Slope 2:1 to 1
Paving
Broken Stone
DETAIL OF SLOPE
SCALE: 1" = 1 FT.
Original surface of ground
Original surface of ledge
Limit of excavation
WEIR
WALL
Rolled Embankment
ground
Limit of slope
NOTES:
1. "AS BUILT" DRAWING OBTAINED FROM OWNER
2. DATUM IS WATERBURY DATUM (MSL~137')
MORRIS RESERV
DAM

FIG. 2



NOTES:

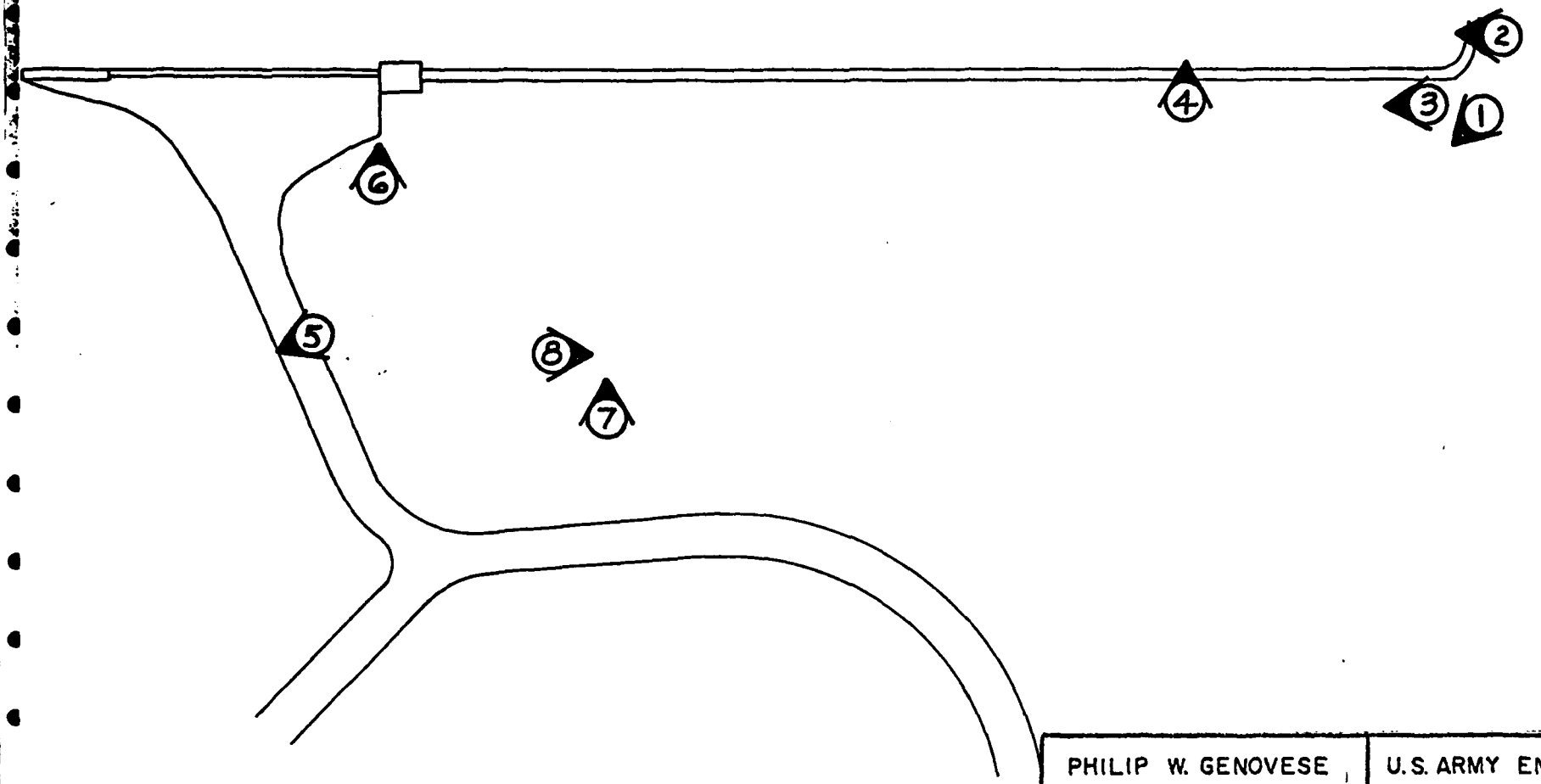
1. "AS BUILT" DRAWING OBTAINED FROM OWNER
2. DATUM IS WATERBURY DATUM (MSL-137')

FIG. 2

PHILIP H. GENOVESE & ASSOCIATES, INC. ENGINEERS MONROE, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS MORRIS RESERVOIR DAM	
DATE	7/20/76

APPENDIX C

PHOTOGRAPHS



LEGEND

(4) NUMBER REFERS TO CAPTION. ARROW INDICATES DIRECTION OF PHOTOGRAPH.

PHILIP W. GENOVESE & ASSOCIATES, INC. ENGINEERS HAMDEN, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORP OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

MORRIS RESERVOIR DAM

DWN. BY	CKD BY	APP. BY	DATE	SCALE
MJS	NRS	RLJ	2/21/79	N.T.S.

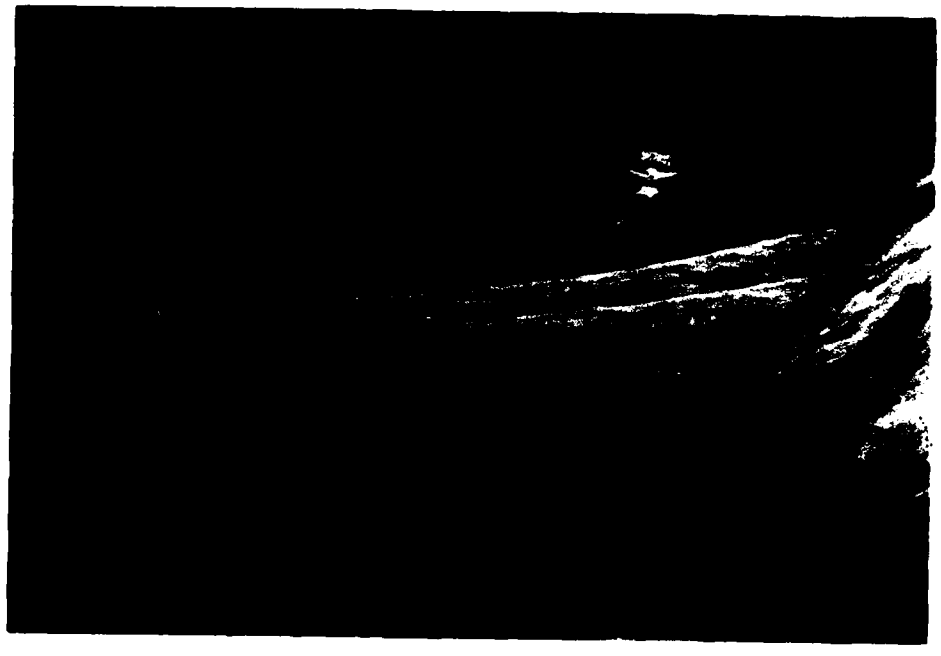


PHOTO NO. 1 - Looking downstream of dam at toe of embankment of Morris Creek from rock wall at left (east) abutment.

PHOTO NO. 2 - View of upstream face looking toward right (west) abutment.

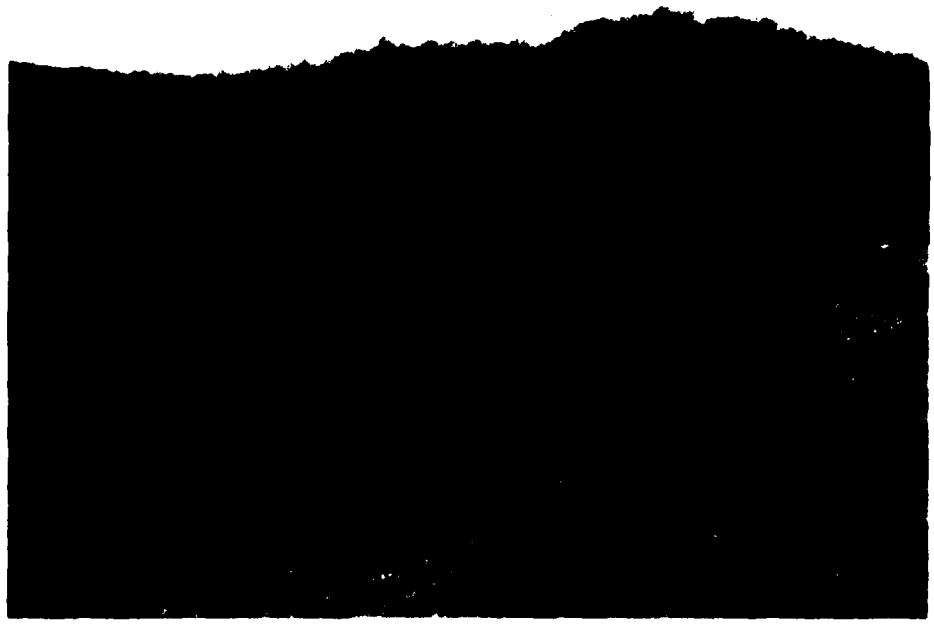


PHOTO NO. 3 - Looking along downstream face toward right (west)abutment.

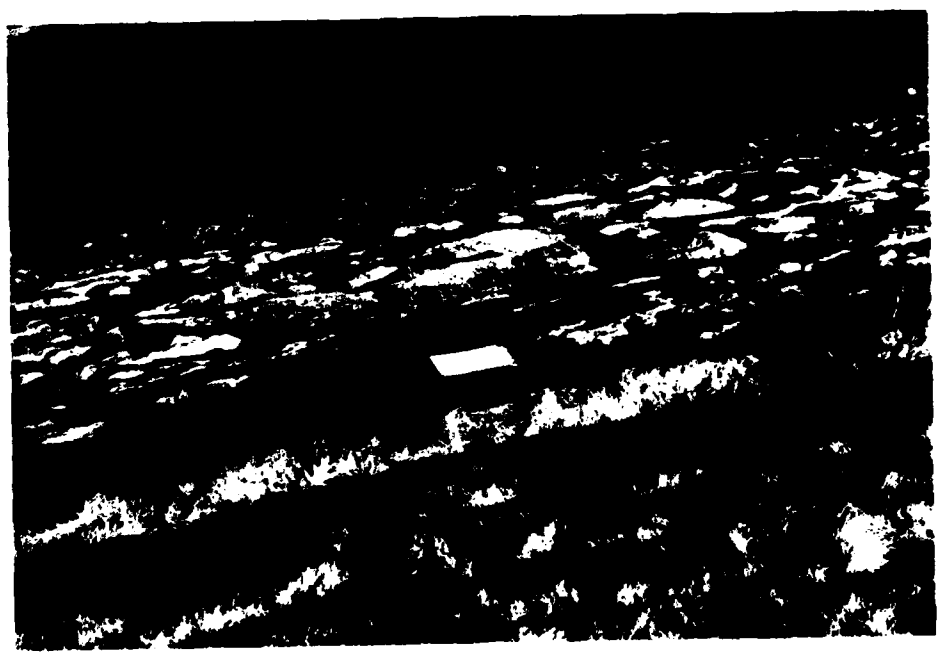


PHOTO NO. 4 - View of upstream face and hand placed riprap. Riprap is in good condition.

PHOTO NO. 5
View of spillway channel, trees and some loose rock overhanging right (west) bank of channel.

PHOTO NO. 6
Looking upstream along left (east) spillway training wall. Evidence of seepage and efflorescence.

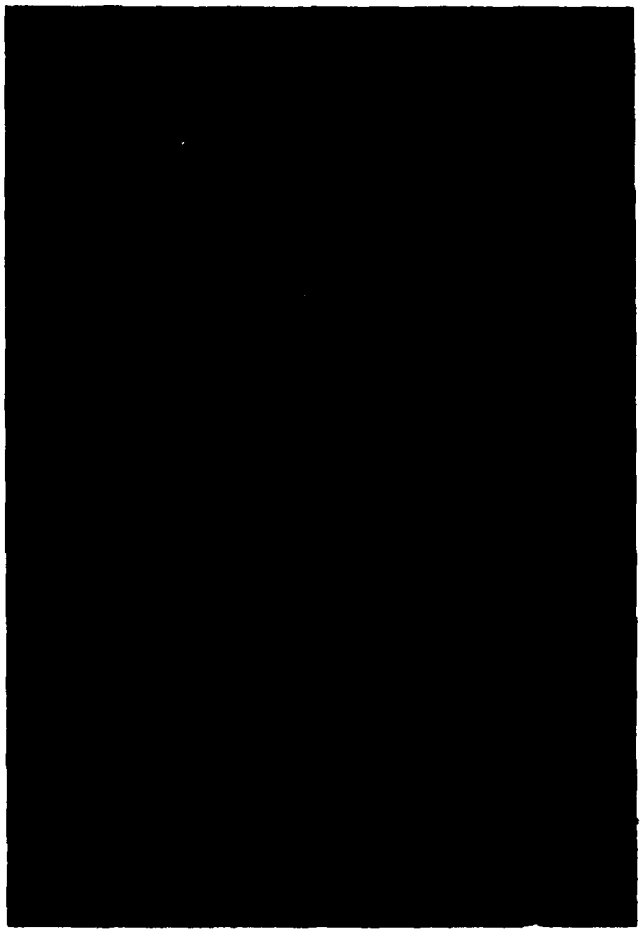


PHOTO NO. 7 - Erosion features from third berm to toe of downstream slope located 150' left (east) of the spillway.

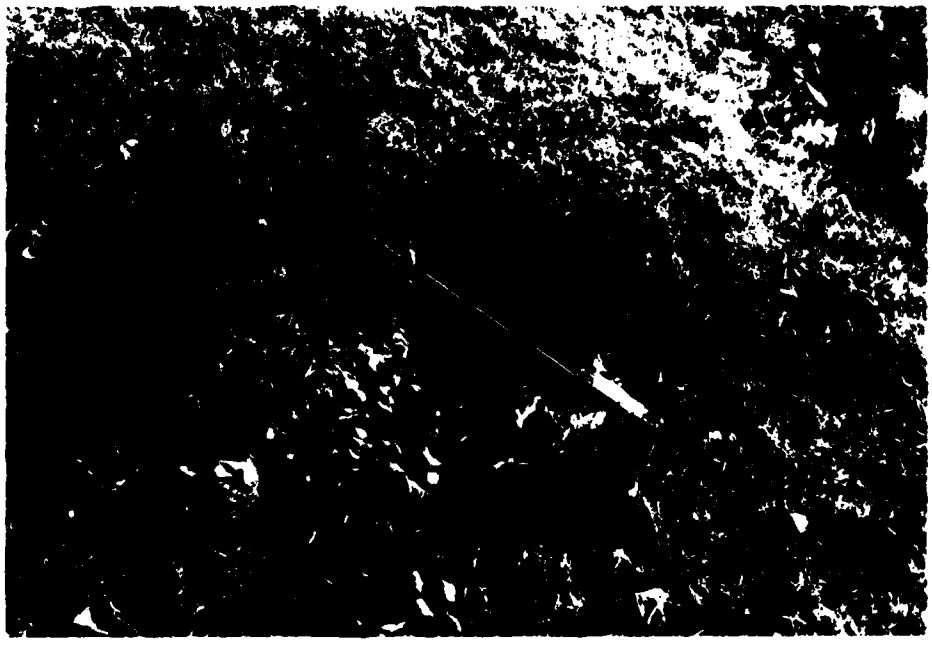
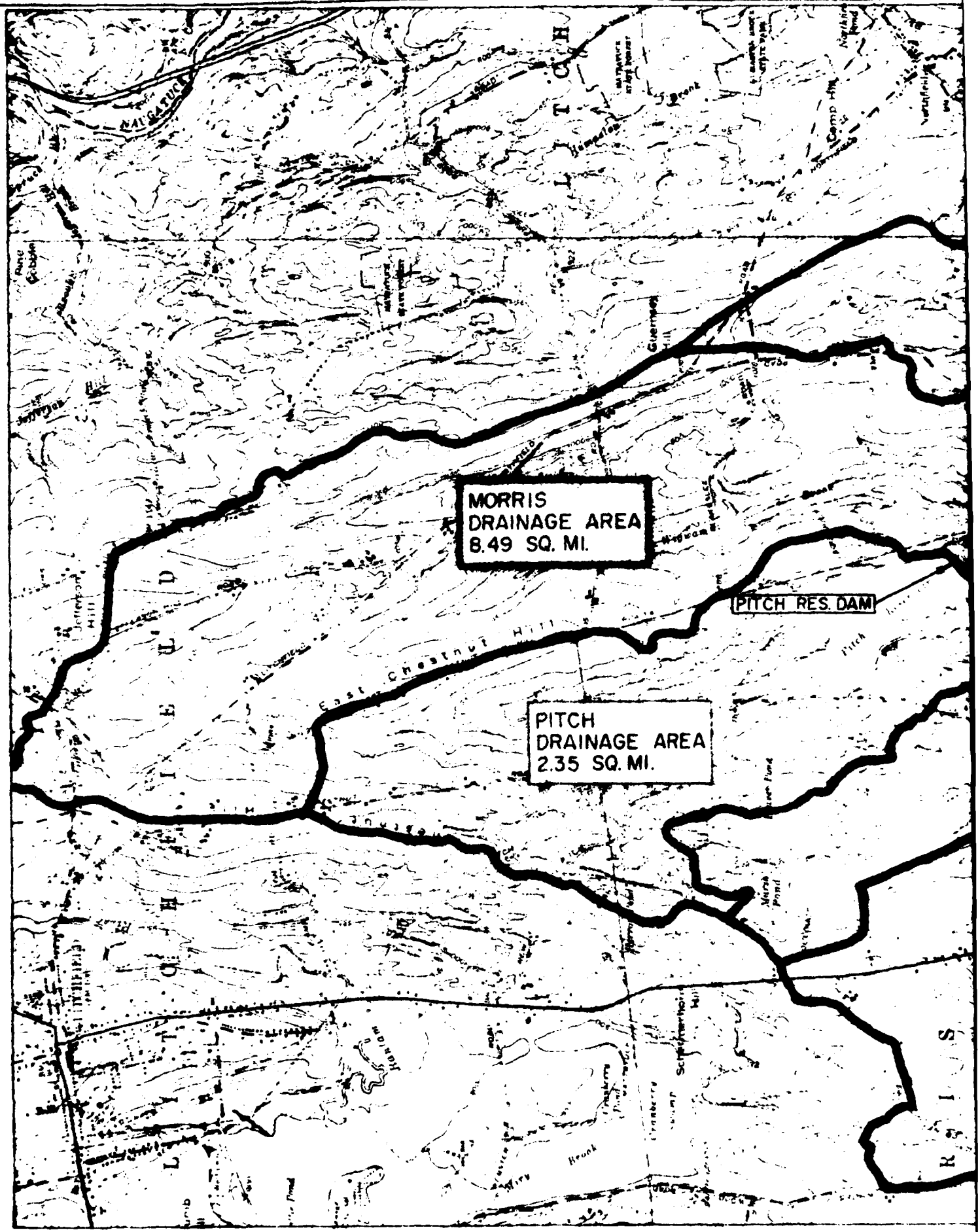
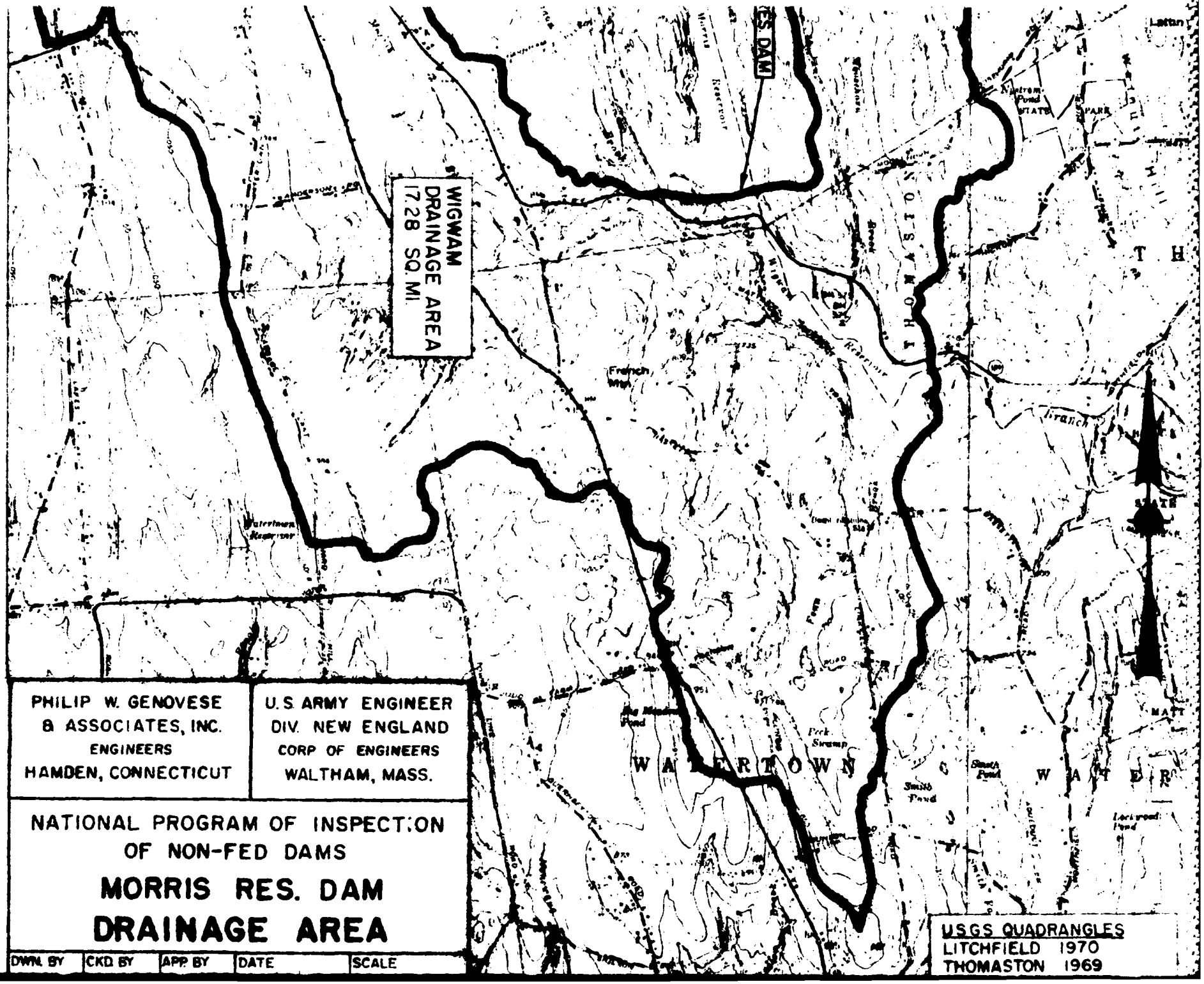


PHOTO NO. 8 - At point where embankment flares into left (east) abutment, apparent animal hole 1.5 feet long, 1 foot wide, 1 foot deep.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS


MORRIS
DRAINAGE AREA
8.49 SQ. MI.
PITCH RES. DAM
PITCH
DRAINAGE AREA
2.35 SQ. MI.


WIGWAM
DRAINAGE AREA
17.28 SQ. MI.
ES DAM
NOTASHOTA
WATERTOWN
PHILIP W. GENOVESE
& ASSOCIATES, INC.
ENGINEERS
HAMDEN, CONNECTICUT
U.S. ARMY ENGINEER
DIV. NEW ENGLAND
CORP OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION
OF NON-FED DAMS
MORRIS RES. DAM
DRAINAGE AREA
DWN. BY
CKD BY
APP BY
DATE
SCALE
USGS QUADRANGLES
LITCHFIELD 1970
THOMASTON 1969

Name ——— Morris Reservoir

Location ——— Morris & Litchfield, Ct.

Drainage Area ——— 5,434 acres / 8.49 sq-miles

Flow Line Area ——— 135 acres

Flow Line ——— Elev 652.3 (USGS)

Top of Dam ——— Elev 660.6 (USGS)

Dam Height ——— 110 feet

Size ——— Large

Hazard ——— Significant

Test Flood (TF) ——— PMF

PMF Runoff ——— 19 inches

PMF - Q_{peak} ——— 17,925 cfs

PMF - Volume ——— 8,603 Ac-Ft

Spillway Capacity ——— 19,420 cfs. (No Freeboard)

Q_{peak} Outflow (PMF) ——— 15,575 cfs

Stage @ Q_{peak} Outflow ——— Elev 659.55 (USGS)

Spillway Type ——— Concrete Ogee

Morris Reservoir

Jan 1979
By D.T. Gallos

Determine "size" & "hazard classification" in order to obtain the SDF (Test Storm)

Use tables 1, 2 & 3 of the D.O.A., O.C.E. guidelines, dated Nov. 1976.

Size classification

(a) Top of Dam : Elev 660.6 (USGS)
Low point ≅ Elev 550
Height of Dam ≅ 110.6'

From Table #1 the size classification is 'Large' as the structure ≥ 100' high

Hazard Potential

Immediately downstream of the dam is a secondary state highway (Rte 109) and a City of Waterbury main pumping plant for routing high & low level services. the plant is attended 24 hours per day. Also this dam is the 2nd of three in a series that serve as Waterbury's water supply. Consequently a category of Significant would appear to be the minimum acceptable hazard classification.

Test Storm (SDF)

Entering Table #3 with a hazard classification of Significant and a structure size of Large

Morris Reservoir

Jan 1979
By D.T. Ballou

we determine that a (SAF) Test Storm equivalent to the PMF is required.

The PMF can now be established based on data furnished by the Corp of Engineers N.E.D. The entering arguments are drainage area and the nature of the terrain.

The PMF will be arrived at two ways:

1. Considering entire D.A. above dam which = 8.49 sq-miles.

2. Subtracting D.A. for Pitch Reservoir which is 2.35 sq miles & would yield 8.49 - 2.35 = 6.14 sq-miles. To this would be added the outflow from Pitch Reservoir which was calculated to be 4,725 cfs @ the point of peak.

Compute:

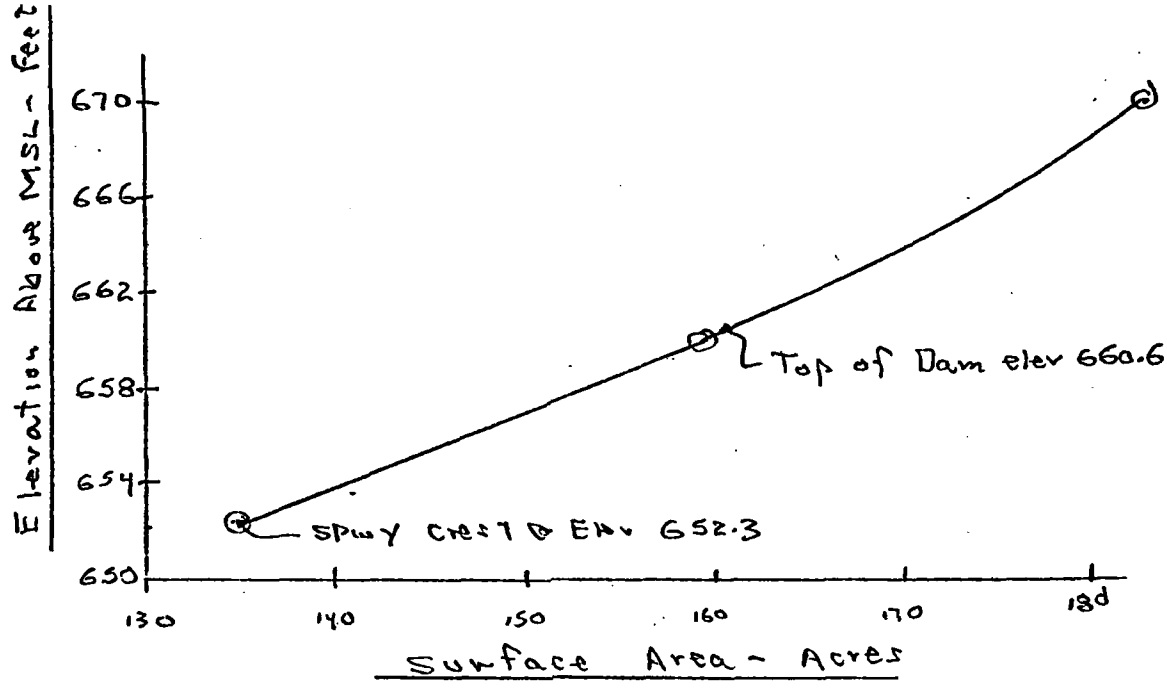
1. For entire DA:
   PMF = 2040 cfs/mi², yielding 17,320 cfs

2. Leaving out Pitch Res. D.A.
   PMF = 2150 cfs/mi², yielding 13,201 cfs
   add Pitch outflow = 4725 cfs
   17,925 cfs

For the PMF use 17,925 cfs

Morris Reservoir

Jan 1979
By DT Ballou



Area - Stage Graph

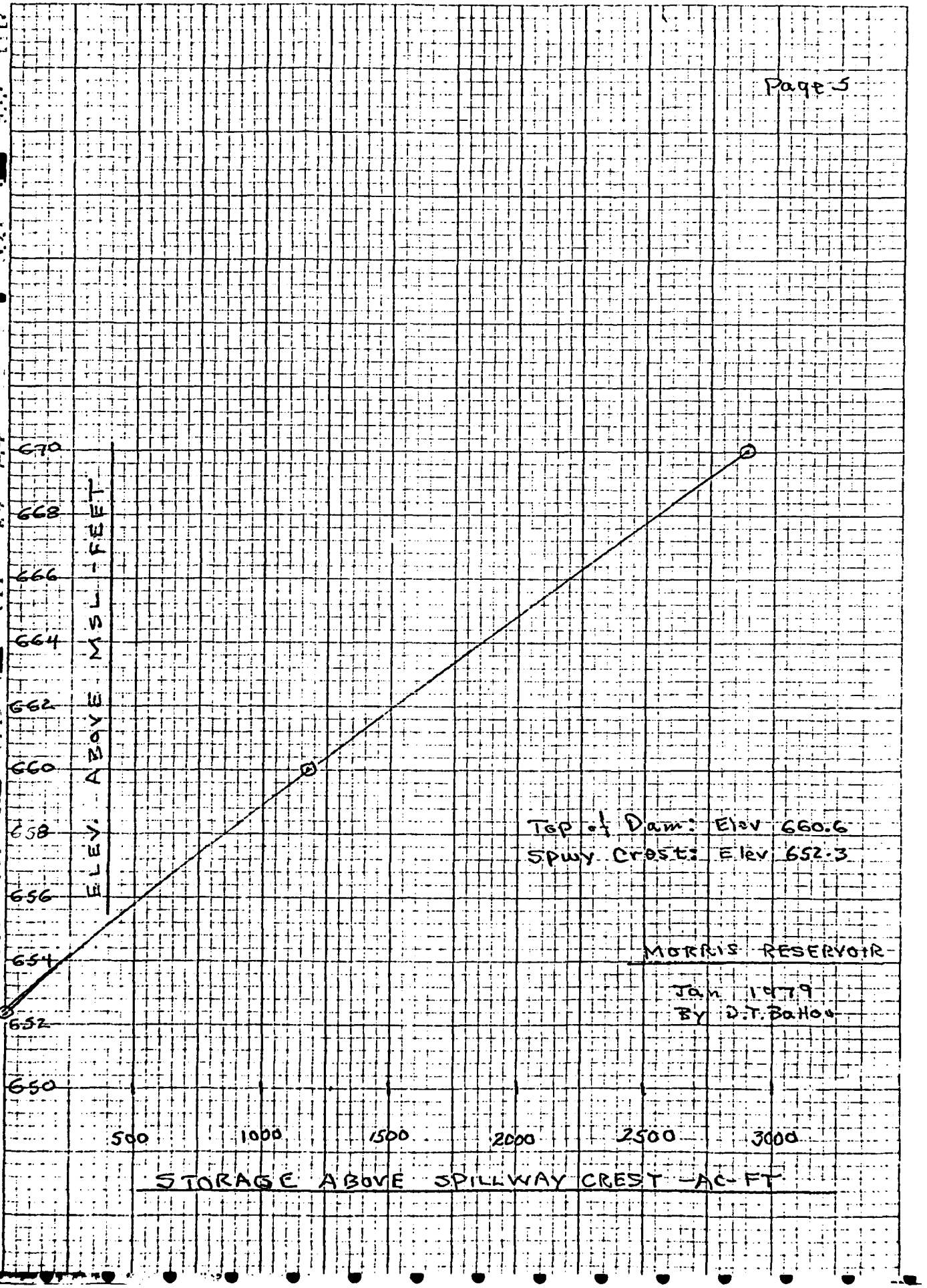
Estimate storage below spillway

Area @ flow line = 135 acres

Approximate height = elev 652.3 - 550, say 102'

$$\therefore \text{Vol} \simeq \tfrac{1}{3} bh = \tfrac{1}{3} \times 102 \times 135 \simeq 4590 \text{ AC-Ft}$$

$$\frac{1275}{5865}$$


ELEV. ABOVE MSL - FEET
670
668
666
664
662
660
658
656
654
652
650
500
1000
1500
2000
2500
3000
STORAGE ABOVE SPILLWAY CREST - AC-FT
Top of Dam: Elev 660.6
Spwy Crest: Elev 652.3
MORRIS RESERVOIR
Jan 1979
By D.T. Bahou

Morris Reservoir

Jan 1979
By D T Ballou

Find Runoff volume in PMF
note: that the PMF has 19" of runoff

Volume = D.A. x Runoff
= 5433.6 acres x 19" x $\frac{1}{12}$ = 8603 Ac-ft
This is for entire DA = 8.49 sq-miles.
The volume associated with the 6.14 sq miles would equal 6221 Ac-ft and would require adding the outflow volume from Pitch Reservoir which should be just 19" x $\frac{1}{12}$ x 1502 acres.

Check hydrograph Time using peak inflow of 17,925 cfs

Compute $T = 5 \times 24.2 \times \frac{\left[\begin{matrix}8603\\17{,}925\end{matrix}\right.}{Q} = 11.6$ hours

Work up Rating Curve for Service Spillway

From Kings Handbook, page 5-27, Fig 5-18 use a spillway discharge coefficient = 3.90

$Q = C L H^{3/2}$ where $C = 3.9$ & $L = 199.7'$

For the 75' overflow section on the west end of the dam use a flow coefficient = 2.7, This section will operate when the head on the service spillway exceeds 5.8 feet.

$Q_{ss} = 3.9 \times 199.7 H^{3/2} = 778.83 H^{3/2}$

$Q_{os} = 2.7 \times 75 H^{3/2} = 202.50 H^{3/2}$

Morris Reservoir

Jan 1979
by: DT Ballou

$Q_{ss} = 778.83\ H_{ss}^{3/2}$

$Q_{os} = 202.50\ H_{os}^{3/1}$

Elev	H_{ss} ft	H_{os} ft	$H_{ss}^{3/2}$	$H_{os}^{3/1}$	Q_{ss} cfs	Q_{os} cfs	Q_{total} cfs
652.3	—	—	—	—	—	—	—
653.3	1	—	1	—	779	—	779
654.3	2	—	2.83	—	2204	—	2204
655.3	3	—	5.20	—	4050	—	4050
656.3	4	—	8	—	6231	—	6231
657.3	5	—	11.18	—	8707	—	8707
658.3	6	0.2	14.7	.09	11,449	18	11,467
659.3	7	1.2	18.52	1.31	14,424	266	14,690
660.3	8	2.2	22.62	3.26	17,623	661	18,283
660.6	8.3	2.5	23.91	3.95	18,623	800	19,423

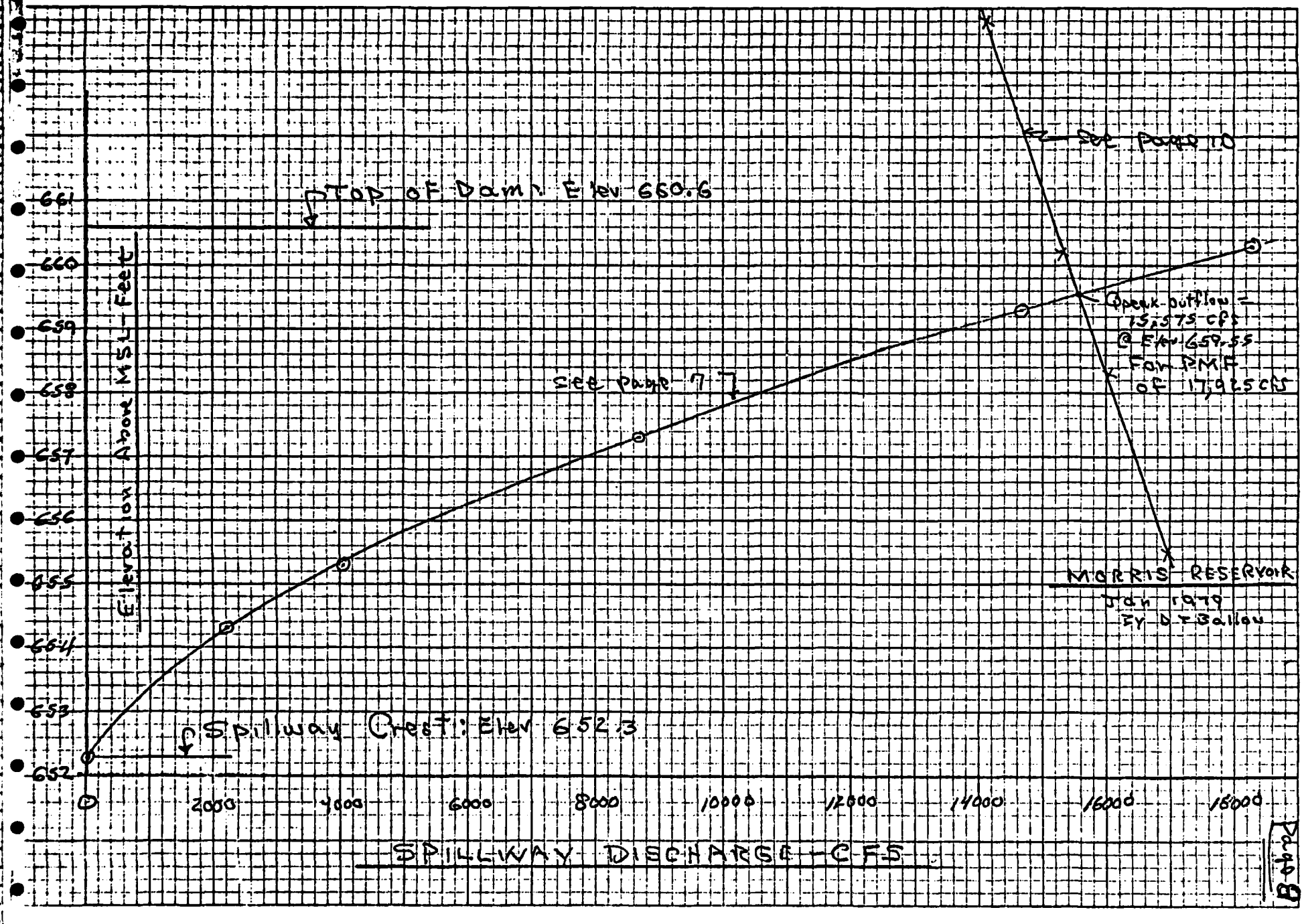
Note that the Top of Dam = Elev 660.6 and that Q_{peak} of inflow hydrograph is not greater than 17,925 cfs

---

May 1979

Find water surface elev that would occur, assuming Morris does not fail, if Morris could pass the 273,000 cfs breach Q from Pitch Reservoir, USE 2 equations @ top of this page, derived on page 6, plus $Q = 2.7 \times 700' H_e^{3/2}$ for flow over the 700' of embankment to the east of the spillway.

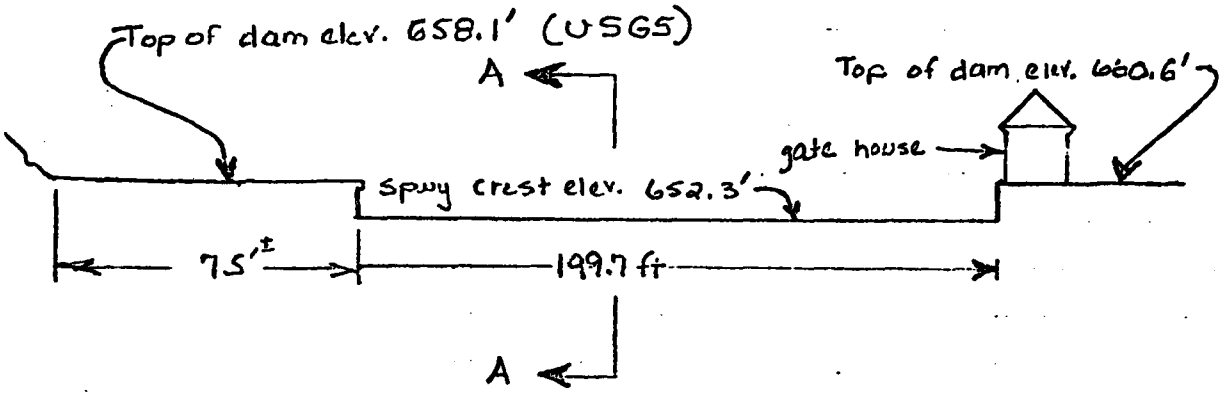
Water surface Elev	H_{ss} ft	H_{os} ft	H_e ft	Q_{ss} cfs	Q_{os} cfs	Q_e cfs	ΣQ cfs
678.7	26.4	20.6	18.1	105,645	18,933	145,539	270,118


Top of Dam: Elev 650.6
661
660
659
658
657
656
655
654
653
652
Elevation Above MSL - Feet
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
SPILLWAY DISCHARGE - CFS
Spillway Crest: Elev 652.3
see page 7
see page 10
Qpeak-outflow = 15,575 cfs @ Elev 659.55 For PMF of 17,925 cfs
MORRIS RESERVOIR
Dam 1979
EY D Ballou
Page 8

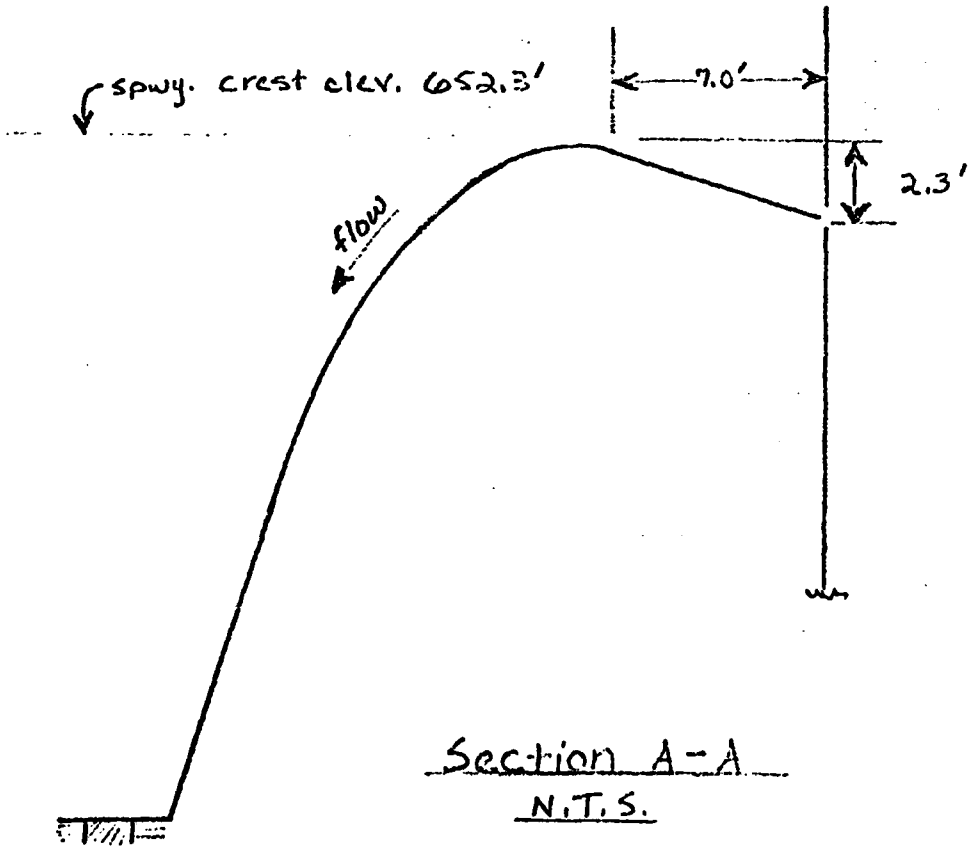
Jan. 1979

Morris Reservoir, Morris and Litchfield, Conn.

Service Spillway



Elevation View
Looking Upstream
N.T.S.



Section A-A
N.T.S.

Morris Reservoir

Jan 1979
By DT Ballou

Commence Short-cut method of routing.

Q_{peak} = 17,925 cfs

In finding surcharge storage determine storage associated with Qpeak inflow height. This represents a starting point to select several other heights from.

For Q_{p_1} = 17,925 cfs the stage-discharge curve indicates elev 660.2 (page 8)

From page 5, elev 660.2 yields 1,225 Ac-ft of storage. This would be equivalent to (1,225 Ac-ft / 5434 acres)(12"/ft) = 2.71 inches = Stor$_1$

∴ select heights of 1", 2", 2.71", 4"

$$Q_{p_i} = Q_{p_1}\left(1 - \frac{\text{Stor}_i}{19}\right) = 17{,}925\left(1 - \frac{\text{Stor}_i}{19}\right)$$

← height (inches)

Stor$_i$ (inches)	$\left(1 - \frac{\text{Stor}_i}{19}\right)$	Stor$_i$ Ac-ft	Q_{p_i}	Elev from Page 5
4.0"	0.789	1811	14,143	663.8
2.71"	0.857	1,225	15,362	660.2
2.0"	0.895	906	16,043	658.3
1.0	0.947	453	16,975	655.5

See plot on page 8

Final Qpeak outflow = 15,575 cfs @ Elev 659.55

This represents a stage 1 foot below top of Dam and a surcharge storage of 1100 Ac-Ft.

15,575/17,925 = 0.87

There would appear not to be any problems associated with overtopping.

April 1974
By: D.T. Ballou

Comments

Morris Reservoir outlets immediately to Wigwam Reservoir, both reservoirs are key water supply units for the City of Waterbury & surrounding areas.

There would be no purpose served in performing a breaching analysis and a resulting downstream flooding evaluation due to the fact that a breached Morris Dam would discharge its contents immediately to Wigwam Reservoir & subsequently into the storage pool behind the Corp's Black Rock Dam.

Other than the 24 hr per day attended main pumping plant @ the downstream toe of Morris Dam there appears to be no other habitation between Morris Dam and Black Rock Dam.

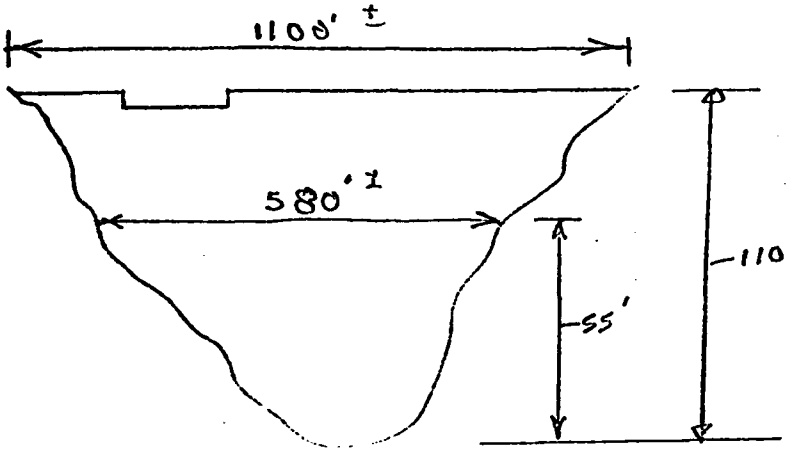
The breaching analysis has been included for informational purposes as regards to considerations of the two Wigwam Dams that lie immediately downstream of Morris

None of the conduits were utilized in the routing of the Test Flood

Morris Reservoir

May 1979
By DT Ballou

Perform Breaching Calculation



Elev View
Looking Upstream
NTS

Peak Failure Out flow = $Q_{p_1} = \frac{8}{27} \times W_b \sqrt{g}\, y_o^{3/2}$

$W_b = 580' \times 40\% = 232'$

$y_o = 110'$

and

$Q_{p_1} = \frac{8}{27} \times 232 \times 32.2^{1/2} \times 110^{3/2}$

$= 450,019$ cfs

The following 2 pages indicate Volume, elev s', height relationships for the three dams in series, ie, Pitch, Morris & the Wigwams

Morris Reservoir

may 1979
By O T Ballou

Commentary on Relationships of the 3 water supply Reservoirs in series where the upper reaches of the 2 downstream "reservoirs" are immediately downstream of the upstream dam.

Dam	Spillway Storage No Freeboard (AC-ft)	Total Storage No Freeboard AC-Ft	Spwy Crest Elev (USGS) (ft)	Dam Height ft	Top Elev of Dam (USGS) (ft)
Pitch	1085	4200	727.0	94	736.0
Morris	1275	~~4594~~ 5865	652.3	110	668.6
*Wigwam	780	2946	560.0	67	567.1
*Wigwam South	1060	3226	560.0	32	569.6

* These two Dams are on the same reservoir with essentially the same spillway crest elev, but top of dam varies by 2.5' from Wigwam → Wigwam South. Storage below Spwy Crest = 2166 AC-Ft, differences above involve Δ in spillway storage.

See comments on following page on breaching, storage, & resulting approximations of water levels in downstream reservoirs.

Morris Reservoir

May 1979
By DT Ballou

Comments:

1. The breaching Q (see page 9) is 271,000 cfs for Pitch Reservoir

   Utilizing rating equations for Morris Reservoir found on page 6 & 7, Appendix D of Morris & adding a third rating equation for embankment overflow that would occur over 700' on the east end of the dam it is found that a water surface of elev 678.7 will pass the 271,000 cfs. This represents an overtopping of 20.6 feet & therefore the dam would undoubtedly fail before this happened.

2. The total storage in Pitch with no freeboard is 4200 Ac-ft. Extending the stage-storage curve for Morris Reservoir would yield an elev of 678.0 required to contain the 4200 Ac-ft. within the confines of Morris Reservoir.

Similar comments hold true for the reservoir behind the Wigwam Dams. A review of the volume on the previous page shows Morris with a Total storage of ~~4549~~ 5926 Ac-ft as compared to 2946 to 3226 for the Wigwam Reservoir. Note that Morris Reservoir breaching Q = 450,000 cfs.

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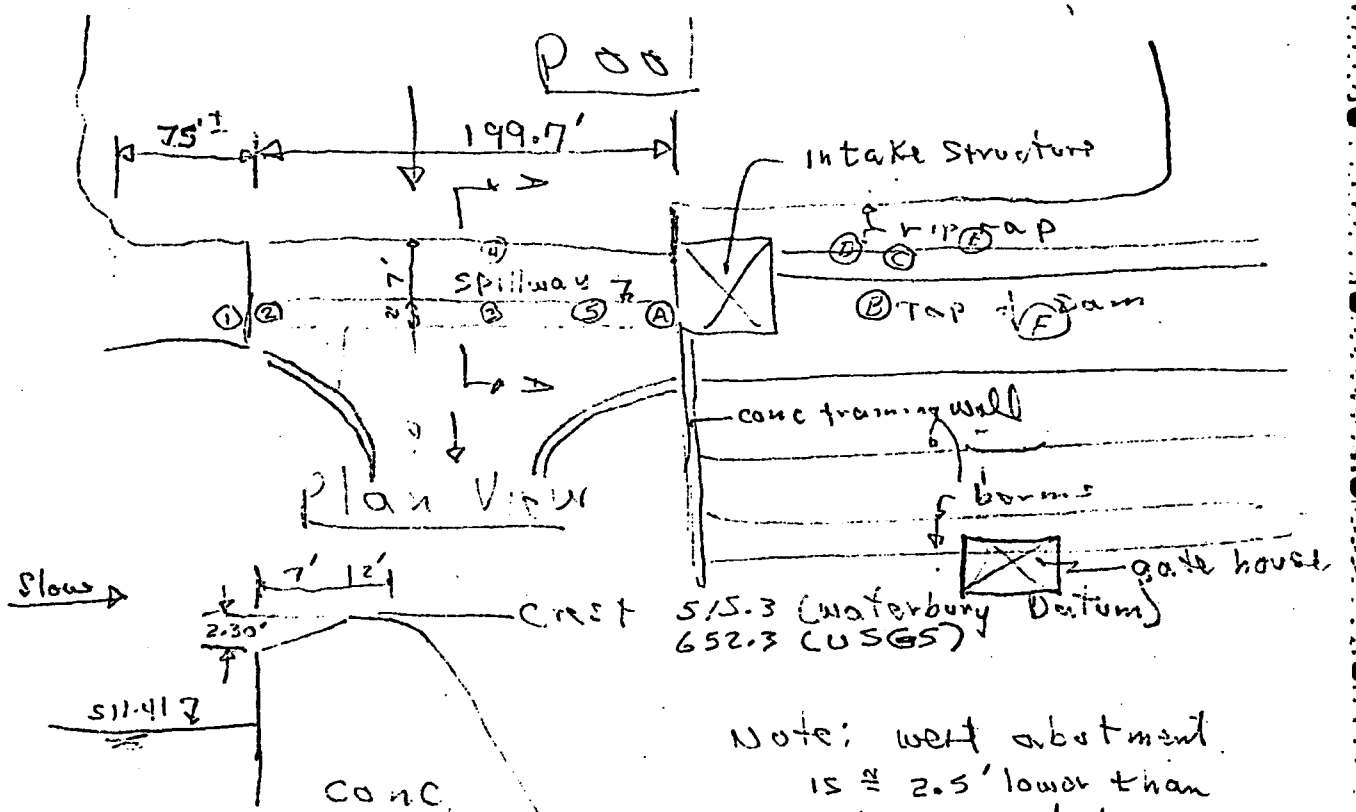
Morris Reservoir

Morris & Litchfield Conn.

Dec 5, 1978

By DT Ballou



Note: west abutment is ≅ 2.5' lower than the top of dam

Section A-A

HI = 665.1

Item	BS	FS	Elev
West spwy crest	12.80		652.3
West abutment		6.98	658.12
℄ spwy crest		12.85	652.25
spwy crest		12.85	652.25
[illegible] edge spwy		15.15	649.95

$HI_{\#1}$ = 665.30

$HI_{\#2}$ = 661.92

Item	BS	FS	Elev
(A) East spwy crest	13.00		652.3
(B) Top of Dam		4.73	660.57
(C) TPN1	6.08	9.46	655.84
(D) Riprap top		5.22	656.7
(E) Reservoir level		13.51	648.41
(F) Top of Dam (low point pocket)		1.92	660.0

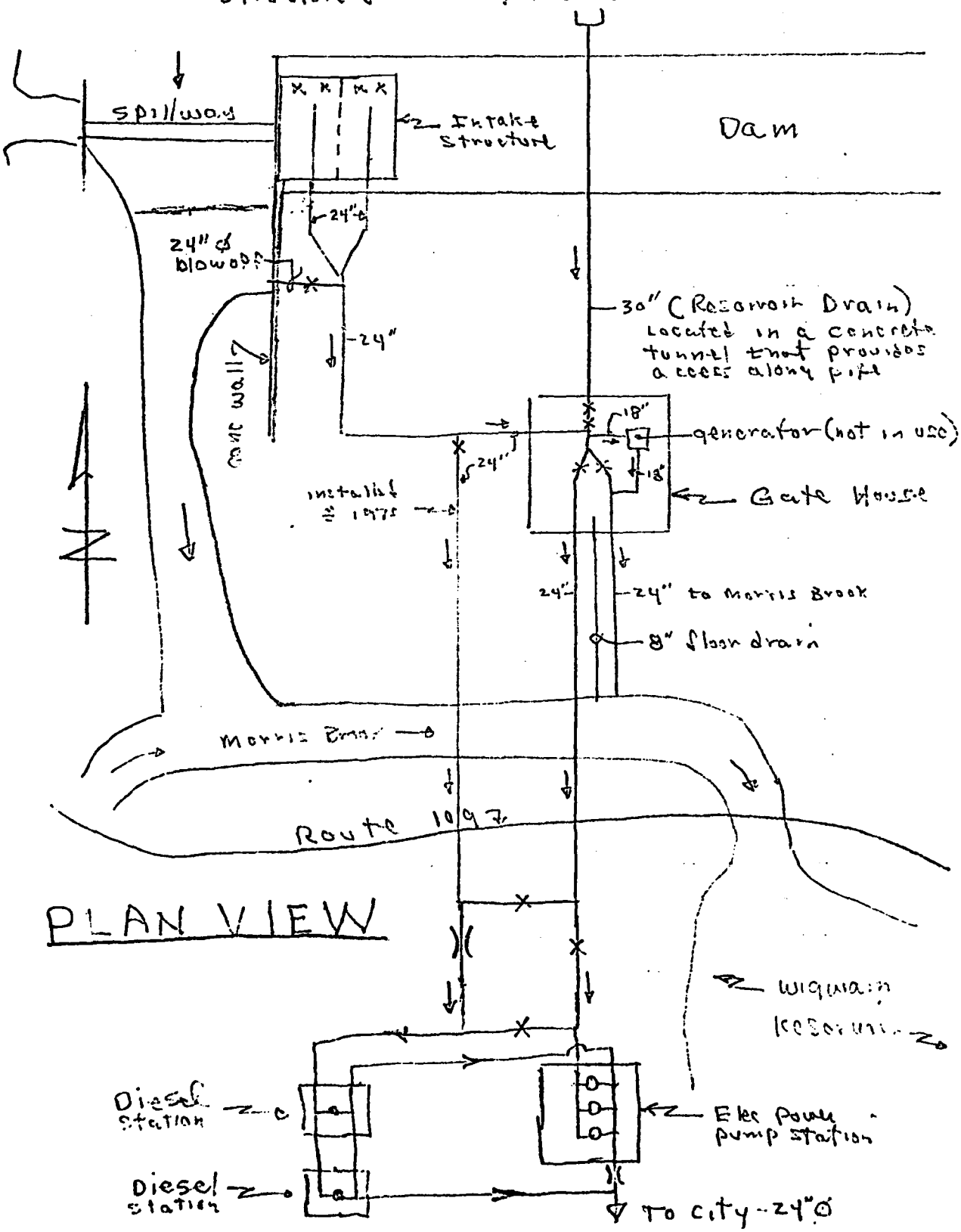
TEL 488-7439

12/5/78

Morris Reservoir

By D.T. Balbo

Intake has 2 chambers allowing take-off @ 4 levels (2 levels per chamber) leading to the 2-24"ϕ — Also 4 levels exist in spillway structure (accessibility for down stream releases)



Data from Eng plans - dated 1910

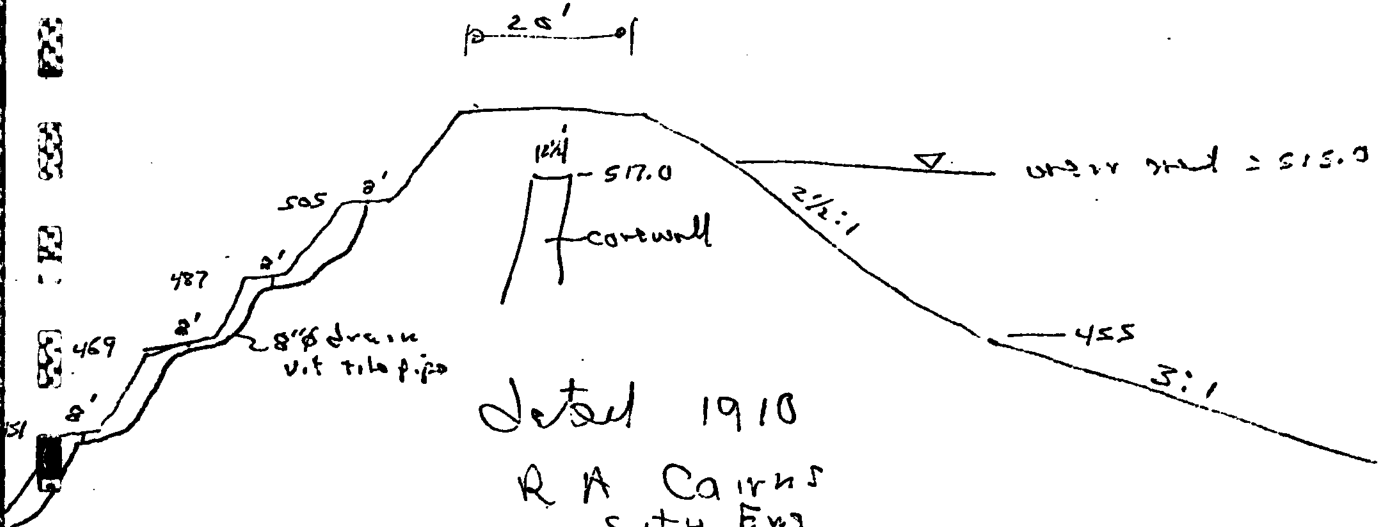
1/15/79

Morris

TOD el 523.75

~~ground~~ @ ℄ = 425.0 = top of corewall (1st pour)

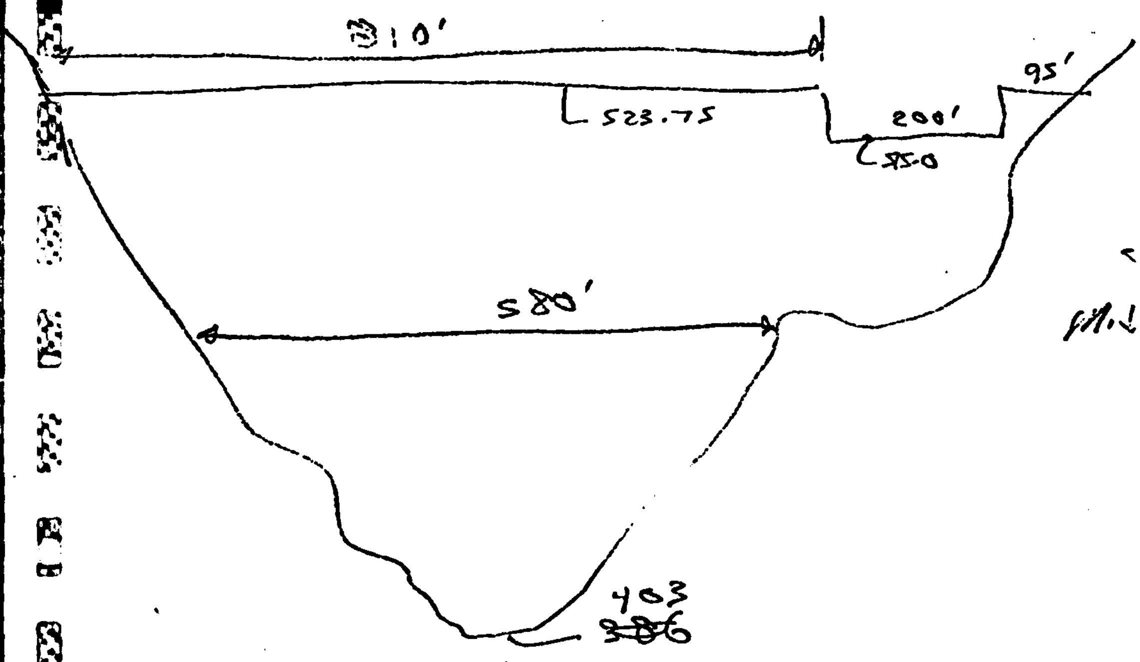
bottom of Corewall @ ℄ = 379.1



detail 1910

R A Cairns
City Eng
Canterbury

Maximum Section



Looking DS

403
~~386~~
60

el ~~485~~ 463 @ midheight

Midheight L ≈ 581'

APPENDIX E

INFORMATION AS CONTAINED IN THE INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) NID NUMBER	(3) REVENUE	(4) STATE	(5) COUNTY	(6) CONGR DIST	(7) STATE	(8) COUNTY	(9) CONGR DIST	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY	MO	YR
CT	873	NED	CT	009	06				MORRIS RESERVOIR DAM	4140.5	7309.0	11	MAY	79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	MORRIS RESERVOIR

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST DOWNSTREAM (MI.)	(21) POPULATION
01	07	SLAB MEADOW AND NIGHAM BROOKS	WATERTOWN	1	18000

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	NORMAL (ACRE–FT.)	(28) DIST	(29) OWN	(30) FED	(31) REG	(32) PRIV/FED	(33) SCS	(34) AGR	(35) DATE
RECTPG	1910	S	145	109	5864	4590	NED	N	N		N		N	11MAY79

(36) REMARKS

(37) O/S HAS	(38) SPILLWAY LENGTH (FT.)	(39) TYPE	(40) WIDTH (FT.)	(41) MAXIMUM DISCHARGE (CFS)	(42) VOLUME OF DAM (CY)	(43) POWER CAPACITY INSTALLED (MW)	(44) POWER CAPACITY PROPOSED (MW)	(45)	(46)	(47)	(48)	(49) NAVIGATION LOCKS LENGTH (FT.)	(50) WIDTH (FT.)	(51) LENGTH (FT.)	(52) WIDTH (FT.)
2	600	U	200	19420											

(53) OWNER	(54) ENGINEERING BY	(55) CONSTRUCTION BY
CITY OF WATERBURY	H.A.CAIRNS CITY ENG	

(56) REGULATORY AGENCY			
(57) DESIGN	(58) CONSTRUCTION	(59) OPERATION	(60) MAINTENANCE
NONE	NONE	NONE	CT DEP

(61) INSPECTION BY	(62) INSPECTION DATE DAY	MO	YR	(63) AUTHORITY FOR INSPECTION
PHILLIP W GENOVESE AND ASSOCIATES	05	OCT	78	P.L.92-367

(64) REMARKS


FILMED