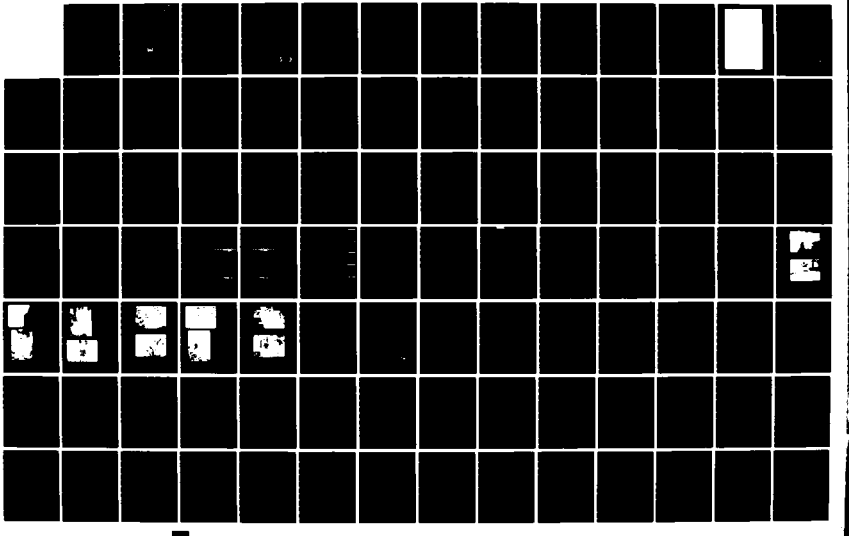
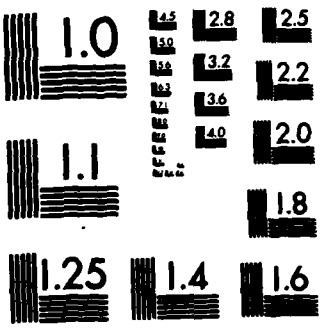
AD-A144 165 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/2
SWAN LAKE DAM (CT 003.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV SEP 80

UNCLASSIFIED F/G 13/13 NL





NAUGATUCK RIVER BASIN

OXFORD, CONNECTICUT

SWAN LAKE DAM
CT 00328

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

SEPTEMBER 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00328	2. GOVT ACCESSION NO. AD-A094165	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Swan Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE September 1980 13. NUMBER OF PAGES 60
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

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

DAMS, INSPECTION, DAM SAFETY,
Naugatuck River Basin
Oxford, Connecticut

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

The Swan Lake Dam consists of an earth embankment with a top width of 25 feet, a maximum height of 16 feet, and an overall length of 325 feet including a 25 foot long overflow spillway located near the center of the dam. Based on the visual inspection, the dam is judged to be in poor condition. The dam is classified as "Small" in size with a "High" hazard potential. A test flood equal to ½ the Probable Maximum Flood was selected.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SWAN LAKE DAM
CT 00328

NAUGATUCK RIVER BASIN
OXFORD, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

49-026

9/80

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

IDENTIFICATION NO: CT 00328

NAME OF DAM: Swan Lake Dam

TOWN: Oxford

COUNTY AND STATE: New Haven County, Connecticut

STREAM: Tributary to Little River

DATE OF INSPECTION: July 28, 1980

BRIEF ASSESSMENT

The Swan Lake Dam consists of an earth embankment with a top width of 25 feet, a maximum height of 16 feet, and an overall length of 325 feet including a 25 foot long overflow spillway located near the center of the dam. The upstream edge of the dam crest is protected by a precast concrete block wall. The outlet works located to the left of the spillway consist of a concrete intake structure which discharges through a 24-inch reinforced concrete low level outlet or blowoff pipe at the downstream toe of the dam.

The dam impounds Swan Lake which is used for recreational purposes by the surrounding property owners.

Based on the visual inspection, the dam is judged to be in poor condition. Features that could affect the future integrity of the dam are seepage at the downstream toe; missing mortar and voids in the downstream spillway slope; the condition of the downstream channel; the presence of trees and stumps on the downstream slope; erosion and settlement behind the upstream concrete block wall; erosion on the downstream slope; and inadequate spillway capacity.

The dam is classified as "Small" in size with a "High" hazard potential. A test flood equal to one-half the Probable Maximum Flood (1/2 PMF) was selected in accordance with the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams. The test flood inflow of 1,042 cfs results in a test flood routed outflow of 860 cfs that would overtop the dam by 0.7 feet.

The spillway capacity with water level at top of dam is about 245 cfs and is equal to 28 percent of the test flood routed outflow.

It is recommended that a qualified, registered engineer be retained to perform a detailed hydrologic and hydraulic analysis; to investigate the downstream seepage, the conditon of the downstream spillway slope and channel, the erosion and settlement behind the upstream wall, and the condition of the low level outlet or blowoff pipe; and to oversee the removal of trees and stumps from the downstream slope. In addition, the dam crest and downstream slope should be cleared of all brush; the debris should be cleaned from the downstream channel; a program of annual technical inspections by qualified, registered engineers should be instituted; an operations and maintenance manual should be prepared; and a formal warning system put into effect.

The owner should implement the recommendations as described herein and in greater detail in Section 7 of this Report within one year after receipt of this Phase I Inspection Report.

Ronald G. Litke, P.E.
Project Engineer

Roald Haestad
President

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.

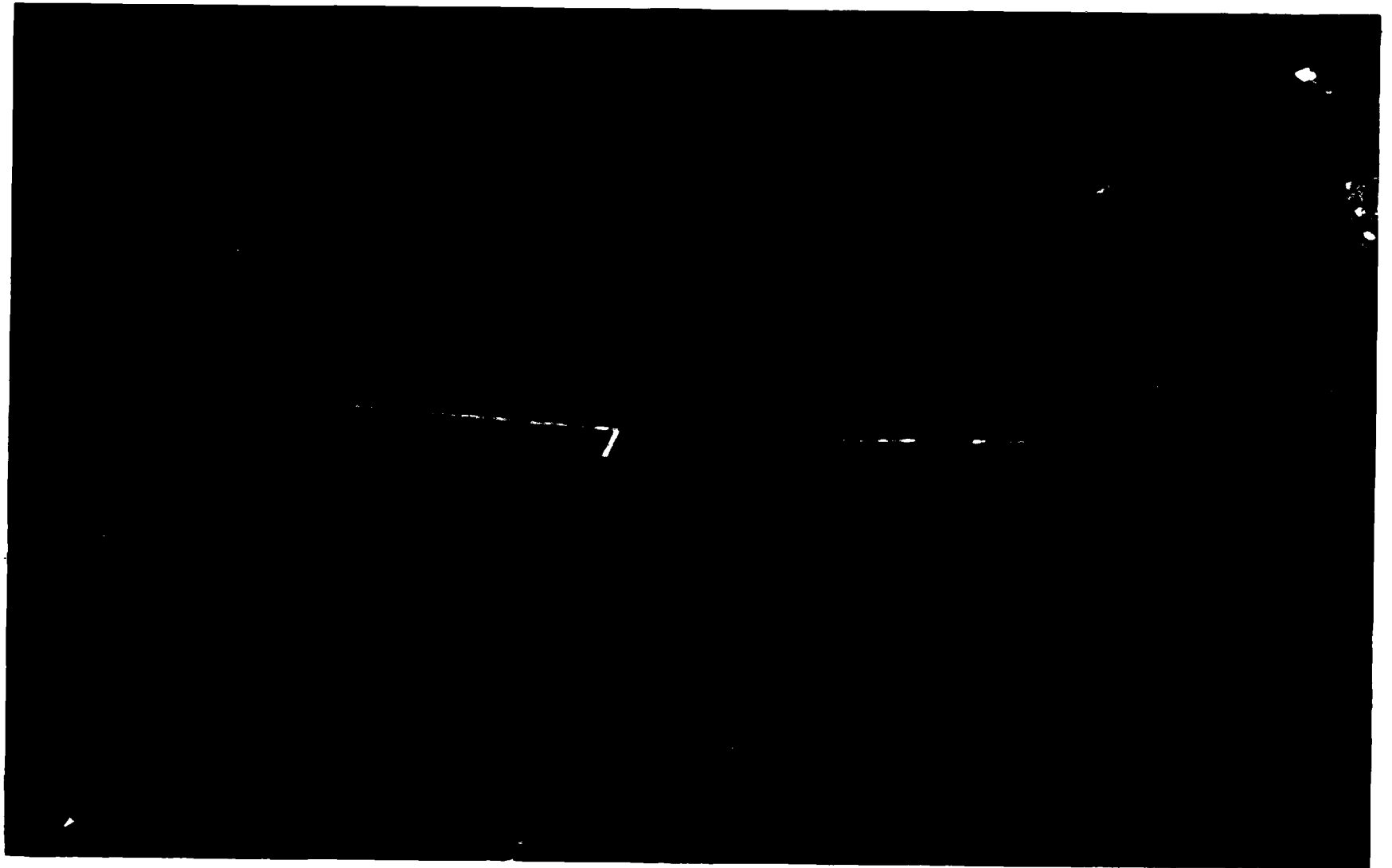
Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because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

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety of the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

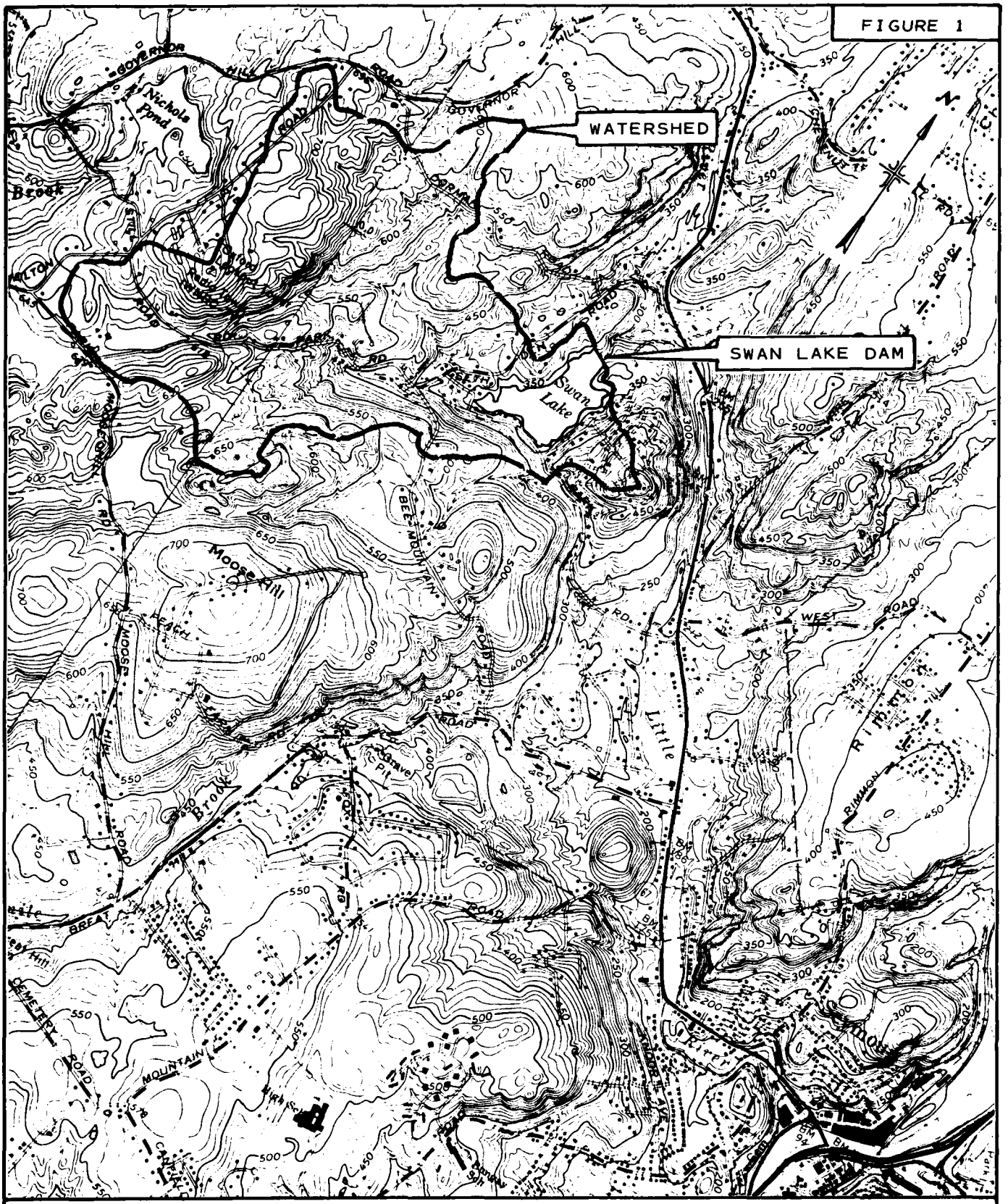
INDEX TO REPORT

INDEX TO APPENDIXES



OVERVIEW PHOTO

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM - CT 00328
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		TRIBUTARY TO LITTLE RIVER
		OXFORD, CONNECTICUT 19 APRIL '80



LOCATION PLAN

SWAN LAKE DAM
OXFORD, CONNECTICUT

SCALE: 1" = 2000'

ROALD HAESTAD, INC. NAUGATUCK QUADRANGLE 1972

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

PROJECT INFORMATION
SECTION 1

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. Roald Haestad, 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 Roald Haestad, Inc., under a letter of April 14, 1980, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0048 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The Swan Lake Dam is located off of Seth Den Road, approximately 1,200 feet southwest of Connecticut Route 67, on an unnamed tributary to the Little River in the Town of Oxford, Connecticut. The dam is shown on the Naugatuck U.S.G.S. Quadrangle Map having coordinates of latitude N41° 25.1', and longitude W73° 06.6'.

b. Description of Dam and Appurtenances

The Swan Lake Dam consists of an earth embankment with a top width of 25 feet, a maximum height of 16 feet and an overall length of 325 feet including a 25 foot long overflow spillway located near the center of the dam. The upstream edge of the dam is protected by 6 foot long by 3 foot wide by 1.5 foot high concrete blocks stacked two rows high with staggered joints. The dam has an average downstream slope of 2 horizontal to 1 vertical. At the top of the slope there is a vertical stone masonry wall with an average height of 3 feet that extends across most of the dam. Near the left end of the dam a large quantity of miscellaneous fill has been dumped on the downstream slope. The downstream slope is overgrown with trees, brush and vines. The overflow spillway consists of a stone masonry broad crested weir with an average slope of 1.5 horizontal to 1 vertical on the stone masonry downstream face. The training walls consist of a continuation of the upstream concrete block walls on either side of the spillway approach channel which abut stone masonry walls near the spillway crest. The top of the upstream concrete wall is 2.1 feet above spillway crest.

The outlet works located approximately 35 feet to the left of the spillway consist of a concrete intake structure with

a manually operated upstream sluice gate which outlets through a 24-inch reinforced concrete low level outlet or blowoff pipe at the downstream toe of the dam. The plan showing the intake structure appears to indicate the upstream end of the pipe is 6 inches in diameter.

c. Size Classification - "Small"

According to the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, a dam is classified as "Small" in size if the height is between 25 feet and 40 feet, or if the dam impounds between 50 Acre-Feet and 1,000 Acre-Feet of water. The dam has a maximum height of 16 feet and a maximum storage capacity of 278 Acre-Feet. Therefore, the dam is classified as "Small" in size based on the storage capacity of 278 Acre-Feet.

d. Hazard Classification - "High"

Based upon the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the hazard classification of Swan Lake Dam is "High". A dam failure analysis indicates that 21 houses and several commercial establishments located downstream of the dam along the Little River would be affected in the event of a dam breach, possibly resulting in the loss of more than a few lives.

The maximum spillway discharge of 245 cfs prior to dam failure would be contained within the existing river channel. The flood wave due to dam breach would flood houses up to 8 feet above sill elevation. Increases in depth of flow due to the dam breach range from 15 feet at section 3 to about 5 feet at section 10 (See Figure 5, page D-39).

e. Ownership

Former Owners: Mr. Swan
Michael Desantis

Present Owner: Swan Lake Estates Association
Pauline Talmadge, Secretary
216 Wakelee Avenue
Ansonia, Connecticut 06401
(203) 734-8482 - office
(203) 888-3794 - home

f. Operator

Pauline Talmadge, Secretary
Swan Lake Estates Association
216 Wakelee Avenue
Ansonia, Connecticut 06401
(203) 734-8482 - office
(203) 888-3794 - home

g. Purpose of Dam

The dam was originally constructed to supply water power to a local manufacturer. At the present time the lake is used for recreation by the surrounding residents.

h. Design and Construction History

The dam was originally constructed around 1800 as a source of water power for a local manufacturer. There is no information available on the original design or construction of the dam. In 1976 a new concrete intake structure was constructed by Park City Builders, Inc. of Orange, Connecticut. In November 1976 the up-stream concrete block wall was constructed by Schiavi Construction, Inc. of Seymour, Connecticut. It was reported that the crest width was also increased at this time.

i. Normal Operational Procedures

The low level outlet or blowoff is opened during heavy storms. The lake level is occasionally lowered to allow residents to make repairs to docks and beaches.

1.3 Pertinent Data

a. Drainage Area

The drainage area consists of 0.98 square miles of "rolling" wooded hills with some residential development mainly located around the perimeter of the lake.

b. Discharge at Damsite

Discharge at the damsite is normally over the 25 foot overflow spillway. The outlet works consist of a concrete intake structure that discharges through a 24-inch reinforced concrete low level outlet or blowoff pipe.

1.	Outlet Works (conduits) Size:	24-inch at outlet end
	Invert Elevation at outlet:	331.0
	Discharge Capacity:	64 cfs*
2.	Maximum Known Flood at Damsite:	Unknown
3.	Ungated Spillway Capacity at Top of Dam:	245 cfs
	Elevation:	347.1 feet
4.	Ungated Spillway Capacity at Test Flood Elevation:	860 cfs
	Elevation:	347.8 feet
5.	Gated Spillway Capacity at Normal Pool Elevation:	N/A
	Elevation:	
6.	Gated Spillway Capacity at Test Flood Elevation:	N/A
	Elevation:	
7.	Total Spillway Capacity at Test Flood Elevation:	860 cfs
	Elevation:	347.8 feet
8.	Total Project Discharge at Top of Dam:	245 cfs
	Elevation:	347.1 feet
9.	Total Project Discharge at Test Flood Elevation:	860 cfs
	Elevation:	347.8 feet

*Assuming 24-inch pipe from intake structure to downstream toe

c. Elevation - Feet Above Mean Sea Level (NGVD)

1. Streambed at Toe of Dam:	331
2. Bottom of Cutoff:	Unknown
3. Maximum Tailwater:	N/A
4. Recreation Pool:	345
5. Full Flood Control Pool:	N/A
6. Spillway Crest:	345
7. Design Surcharge - Original Design:	Unknown
8. Top of Dam:	347.1
9. Test Flood Surcharge:	347.8

d. Reservoir - Length in Feet

1. Normal Pool:	2,000 feet
2. Flood Control Pool:	N/A
3. Spillway Crest Pool:	2,000 feet
4. Top of Dam:	2,000 feet
5. Test Flood Pool:	2,000 feet

e. Storage - Acre-feet

1. Normal Pool:	216 Acre-Feet
2. Flood Control Pool:	N/A
3. Spillway Crest Pool:	216 Acre-Feet
4. Top of Dam:	278 Acre-Feet
5. Test Flood Pool:	301 Acre-Feet

f. Reservoir Surface - Acres

1. Normal Pool:	27 Acres
2. Flood-Control Pool:	N/A
3. Spillway Crest:	27 Acres
4. Test Flood Pool:	33 Acres
5. Top of Dam:	32 Acres

g. Dam

1.	Type:	Earthen embankment
2.	Length:	325 feet
3.	Height:	16 feet
4.	Top Width:	25 feet
5.	Side Slopes:	Upstream: Vertical concrete block wall slope beyond block wall unknown Downstream: 2 horizontal to 1 vertical
6.	Zoning:	Unknown
7.	Impervious Core:	Unknown
8.	Cutoff:	Unknown
9.	Grout Curtain:	N/A
10.	Other:	

h. Diversion and Regulating Tunnel N/A

i. Spillway

1. Type:	Stone masonry broad crested weir with a slope of 1.5 horizontal to 1 vertical on downstream face
2. Length of Weir:	25 feet
3. Crest Elevation with Flash Boards: without Flash Boards:	 N/A 345
4. Gates:	N/A
5. Upstream Channel:	Sand and gravel floor with concrete block training walls
6. Downstream Channel:	Natural streambed clogged with debris
7. General:	

j. Regulating Outlets

1. Invert:	331.0
2. Size:	24-inch @ outlet
3. Description:	Reinforced concrete pipe through earth embankment
4. Control Mechanism:	Manually operated sluice gate at upstream intake structure
5. Other:	Plans of intake structure appear to indicate that a 6-inch diameter pipe discharges from structure. Capacity = 64 cfs assuming 24-inch pipe from structure to downstream toe.

ENGINEERING DATA
SECTION 2

2.1 Design Data

There was no information on the original design of the dam available for review. A plan entitled "Swan Lake Estates, Oxford, Connecticut - Repair Lake Outlet" 3/30/76, prepared by Park City Builders, Inc. of Orange, Connecticut, was available and reviewed. (See page B-3 in Appendix B.) The plan shows details for the new intake structure.

2.2 Construction Data

The only construction information available for review was the above-noted plan showing the new intake structure, and a letter dated 5/11/77 from Schiavi Construction, Inc., Seymour, Connecticut, to Swan Lake Association describing the construction of the upstream concrete block wall in November of 1976.

2.3 Operation Data

There is no operation data available for the dam.

2.4 Evaluation of Data

a. Availability

The data that was available was obtained from the State of Connecticut Department of Environmental Protection and the Swan Lake Estates Association, owner of the dam.

b. Adequacy

The information that was available, along with the visual inspection, past performance history, and hydraulic and hydrologic calculations were adequate to assess the condition of the dam.

c. Validity

Field inspections and surveys indicate that the low level outlet or blowoff discharges through a 24-inch reinforced concrete pipe at the downstream toe of the dam. The plan showing the intake structure appears to indicate that the upstream end of the pipe is 6 inches in diameter.

VISUAL INSPECTION

SECTION 3

3.1 Findings

a. General

The visual inspection of the dam was conducted on July 28, 1980. At the time of inspection the water level was approximately 0.1 feet below spillway elevation.

The Swan Lake Dam consists of an earth embankment with an overflow spillway located near the center of the dam, and outlet works located to the left of the spillway.

The general condition of the dam at the time of inspection was poor.

b. Dam

The crest of the dam is about 25 feet wide and is covered with tall grass and weeds, Photo 1. There is no evidence of trespass or erosion on the crest. At the right abutment there is an excavated hole approximately 3 feet deep.

The upstream face of the dam and the spillway training walls consist of 6 feet long by 3 feet wide by 1.5 feet high concrete blocks stacked two rows high with staggared joints, Photo 2. Open joints up to about 1 inch wide were observed between adjacent blocks. At a few locations, the wall showed evidence of up to several inches of settlement, lateral displacement or tipping, Photo 1. Directly behind the wall several depressions up to 16 inches deep and about 1 foot wide were noted above the joints in the lower row of blocks, Photo 3. There is some erosion around the ends of the block wall at both abutments and at the spillway, Photo 2.

A short section of the upstream slope was visible below water, and appeared to be covered with intermittent riprap and gravel.

The downstream face of the dam has an average slope of about 2 horizontal to 1 vertical, based on the field survey performed for this inspection. The slope is heavily overgrown with trees, brush and vines, Photo 4. Near the left end of the dam, a large quantity of miscellaneous fill, including boulders, soil, stumps, logs and brush has been dumped on the downstream slope, Photo 5. A vertical stone masonry wall about 3 feet high was observed along most of the dam at the intersection of the crest and the downstream slope, Photo 6. An erosion channel about 2 feet deep and 3 feet wide was located to the left of the outlet pipe, extending from near the crest to the toe. There were several rotting tree stumps on the downstream slope.

Seepage was observed at many locations at the downstream toe. To the left of the low level outlet or blowoff, a seep originated near the base of two large trees, Photo 7. A large seep was located about 25 feet to the right of the spillway. At this seep there was a small delta deposit just below the seepage area. The flow from all seeps was clear, and the area around the seeps was stained with rusty orange floccules, Photo 8.

c. Appurtenant Structures

The appurtenant structures consist of the spillway and the outlet works.

Spillway

The spillway is located near the center of the dam and consists of a mortared cut stone crest with a mortared stone downstream

slope, Photo 9. The downstream slope is about 1.5 horizontal to 1 vertical. The spillway crest is located at the downstream edge of the dam crest. The upstream approach channel has concrete block training walls, Photo 2, and a sand and gravel floor which slopes slightly towards the lake from the spillway crest.

The mortar on the spillway slope is broken and missing in many places, leaving large voids between the stones, Photo 9. A few of the stones are loose and can be readily moved. A small seep was noted just at the base of the spillway slope. The flow from the seep was clear, with rusty orange floccules covering the area around the seep. To the right of the downstream spillway slope is a stepped stone training wall.

Outlet Works

The outlet works consist of a concrete intake structure at the upstream edge of the dam crest that discharges through a 24-inch reinforced concrete low level outlet or blowoff pipe, Photos 11 and 12. The intake structure contains a manually operated sluice gate that is reported to be operable. The structure and the operating mechanism appear to be in good condition. The concrete intake structure extends back into the dam crest further than indicated on the construction plans.

d. Reservoir Area

There were no indications of instability along the edges of the reservoir in the vicinity of the dam.

e. Downstream Channel

The downstream spillway channel is the natural streambed. At the base of the spillway slope, the channel is completely blocked by logs, vines and debris, Photo 10. Recent flow over the spillway

appears to have been flowing around the blockage to the right along the toe of the dam and then back to the streambed. The channel is heavily overgrown with trees, brush and vines.

The low level outlet or blowoff discharges into an unlined channel at the toe of the downstream slope. There are several boulders placed around the end of the pipe. Due to partial blockage by fallen branches and vegetation, water has ponded around the end of the outlet pipe, submerging the pipe to about the springline, Photo 12.

3.2 Evaluation

Based on the visual observations, the dam appears to be in poor condition. The following features could affect the future integrity of the dam:

1. Seepage at the downstream toe may cause erosion of the dam or foundation soils, leading to piping failure of the embankment.
2. Missing or weak mortar on the downstream spillway slope could lead to dislodging of stones and failure of the spillway.
3. Blockage of the channel at the base of the spillway slope could cause rapid erosion at the toe of the spillway and adjacent embankment sections, leading to failure of the slope.
4. Unprotected channels at the discharge end of the low level outlet or blowoff pipe and at the base of the spillway slope could permit rapid erosion in these areas, leading to undermining and failure of the low level outlet or blowoff pipe and/or spillway.

5. Voids between the concrete blocks on the upstream wall may continue to permit erosion and settlement behind the wall into the crest of the dam.
6. Trees and stumps on the downstream slope and in the immediate toe area may decay or be uprooted in large storms, leaving open root holes which may act as seepage paths, leading to internal erosion and piping failure of the foundation or embankment.
7. The erosion on the downstream slope to the left of the low level outlet or blowoff could progress back into the crest of the dam and become a source for concentration of seepage, leading to internal erosion and piping failure of the embankment.
8. The low level outlet or blowoff pipe should be investigated to determine its condition.

OPERATIONAL AND MAINTENANCE PROCEDURES
SECTION 4

4.1 Operational Procedures

a. General

The low level outlet or blowoff is opened during heavy rains. The lake level is occasionally lowered to allow the surrounding residents to repair docks and beaches.

b. Description of Any Warning System In Effect

There is no formal warning system in effect. The lake level is monitored during heavy storms by the surrounding residents and the low level outlet or blowoff is opened as required.

4.2 Maintenance Procedures

a. General

Normal maintenance is reported to consist of the occasional clearing of brush from the crest of the dam.

b. Operating Facilities

The control mechanism for the low level outlet or blowoff is locked so that vandals do not open the gates.

4.3 Evaluation

Present operations and maintenance procedures are inadequate, as is evident by the general condition of the dam.

An operations and maintenance manual should be prepared for the dam and operating facilities, and a formal warning system should be put into effect. In addition, the dam should be inspected annually by a qualified, registered engineer.

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES
SECTION 5

5.1 General

The spillway for Swan Lake Dam is a 25 foot long overflow section located near the center of the dam. The spillway consists of a stone masonry broad crested weir with a stone masonry downstream face with an average slope of 1.5 horizontal to 1 vertical. The top of the upstream concrete block wall is 2.1 feet above spillway level. The spillway has a capacity of about 245 cfs before overtopping the dam.

The low level outlet or blowoff consists of a concrete intake structure which outlets through a 24-inch reinforced concrete pipe to the downstream toe of the dam. The capacity of the outlet is 64 cfs assuming a 24-inch pipe from the intake structure to the downstream toe.

The dam has a tributary watershed of 0.98 square miles. The terrain is "rolling" wooded hills with some residential development. A large percentage of the residential development is located around the perimeter of the lake. Watershed elevations vary from about 750 feet along the western end of the watershed to 345 feet at the dam.

5.2 Design Data

No design data on the dam or spillway were available for review. A plan showing details of a new intake structure was available and reviewed. (See Page B-3 in Appendix B.)

5.3 Experience Data

No records of past flood experience were available. It was reported that the dam has never been known to have overtopped.

5.4 Test Flood Analysis

Based on the dam failure analysis, the dam is classified as "High" potential hazard. The size of the dam is "Small", based on a height of 16 feet and storage capacity of 278 Acre-Feet. According to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the test flood should be in the range of 1/2 the Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF) depending on the involved risk. A test flood equal to 1/2 PMF was selected because of the low hydraulic height of the dam and the small storage capacity of the impoundment. The test flood was calculated using 2,125 cubic feet per second per square mile (csm) inflow for the PMF, from the minimum 2 square mile drainage area shown on the Guide Curves supplied by the Corps of Engineers, and the 0.98 square mile watershed of Swan Lake Dam. The peak 1/2 PMF inflow was calculated to be 1,042 cfs and the routed outflow 860 cfs. The flood routing through the reservoir was done in accordance with "Estimating Effect of Surcharge Storage on Maximum Probable Discharges" provided by the Corps of Engineers.

The spillway capacity was calculated to be about 245 cfs or 28 percent of the test flood routed outflow. The test flood would overtop the dam by 0.7 feet.

The spillway capacity of this dam appears to be inadequate, and overtopping could occur in the future.

5.5 Dam Failure Analysis

A dam failure analysis was made using the "Rule of Thumb" guidance provided by the Corps of Engineers. Failure was assumed when the water level reached the top of the dam.

The dam breach would release up to 9,700 cfs into the stream below the dam. The flood wave would travel 1,000 feet downstream in a steep and narrow gorge before discharging into the Little River.

Three residential homes located on the bank of the Little River would have flood waters up to the sill levels of the homes. The flood waters would continue downstream, overtopping Connecticut Route 67 at an average depth of 2 feet for a distance of 1,200 feet. Commercial establishments located to the north of Connecticut Route 67 would also receive damage from the flood waters. The flood waters would then cross Connecticut Route 67 and flood 1 home and a restaurant to approximately 1.5 feet above sill level before being contained in a well-defined channel. The flood wave would then overtop Park Road by approximately 4 feet and the sills of 5 residential homes near the road by 2 feet to 8 feet. Further downstream the flood waters would overtop Connecticut Route 67 by about 2.5 feet and as a result 12 residential homes would be flooded an undetermined amount. Hoadley Pond Dam would be overtopped by approximately 1.3 feet and the backwater from the dam would flood residential homes adjoining the pond. Beyond this point no damage is expected from the flood waters as they continue downstream to the Naugatuck River.

The maximum spillway flow of about 245 cfs prior to dam failure would be contained within the existing river channel. Increases in depth of flow due to the dam breach would range from 15 feet at section 3 to about 5 feet at section 10. (See Figure 5, page D-39.)

The failure of Swan Lake Dam could result in the loss of more than a few lives. Therefore, the dam is classifed as "High" potential hazard.

EVALUATION OF STRUCTURAL STABILITY
SECTION 6

6.1 Visual Observations

The visual observations did not disclose any evidence of present or past structural instability except for possible settlement, lateral displacement and tipping of the upstream concrete block wall. The future integrity of the dam could be affected by:

1. Seepage at the downstream toe;
2. Erosion at the toe caused by blocked and unprotected spillway and outlet channels;
3. Dislodging of stones from the downstream spillway slope;
4. Erosion behind the upstream wall and on the downstream face;
5. Trees and stumps on the downstream slope and toe; and
6. The unknown condition of the low level outlet or blowoff pipe.

6.2 Design and Construction Data

No design and construction data are available for the embankment or spillway.

6.3 Post-Construction Changes

A new intake structure for the low level outlet or blowoff was constructed by Park City Builders, Inc. in 1976. The upstream concrete block wall was installed in November 1976 to repair and prevent erosion of the upstream slope.

6.4 Seismic Stability

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

ASSESSMENT, RECOMMENDATIONS, & REMEDIAL MEASURES
SECTION 7

7.1 Dam Assessment

a. Condition

On the basis of the visual inspection and a review of available data, the dam is judged to be in poor condition. The future integrity of the dam could be affected by:

1. Seepage at the downstream toe of the dam;
2. Missing mortar and voids in the stonework of the downstream spillway slope;
3. Blockage of the channel downstream of the spillway;
4. Trees and rotting stumps on the downstream slope and in the toe area;
5. Unprotected channels at the base of the spillway and at the low level outlet or blowoff pipe;
6. Erosion and settlement behind upstream concrete block wall;
7. Erosion on the downstream slope; and
8. The unknown condition of the low level outlet or blowoff pipe.

An evaluation of the hydraulic and hydrologic features of the dam determined that the spillway is capable of passing 28 percent of the test flood routed outflow (1/2 PMF).

b. Adequacy of Information

Because of the limited amount of information available, the assessment of the condition of the dam was based on the visual inspection, past performance history, and hydraulic and hydrologic calculations made for this Report.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Clear brush and vines from crest, downstream slope and toe area. Repair erosion of downstream slopes, fill hole at right abutment and establish a regular mowing program.
2. Remove debris from downstream channel.
3. Institute a program of annual technical inspections by qualified, registered engineers.
4. Put into effect a formal warning system to include monitoring of the dam during extremely heavy rains and procedures for notifying downstream authorities in the event of an emergency.
5. Prepare a formal operations and maintenance manual for the dam and operating facilities.

7.4 Alternatives

There are no practical alternatives to the above recommendations.

APPENDIX A

VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: Swan Lake Dam

DATE: July 28, 1980 TIME: 11:30 am WEATHER: Partly Sunny 80°

W.S. ELEVATION: 344.9 U.S. N/A DN.S
(0.1' below spillway)

	PARTY	DISCIPLINE
1.	Ronald G. Litke, P.E. - Roald Haestad, Inc.	Civil/Structural
2.	Donald L. Smith, P.E. - Roald Haestad, Inc.	Civil/Hydrology
3.	Gonzalo Castro, PhD, P.E. - Geotechnical Engineers, Inc.	Geotechnical
4.	Frank Leathers, P.E. - Geotechnical Engineers, Inc.	Geotechnical
5.		
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam Embankment	RGL,DLS,GC,FL	Overgrown with brush, some downstream seepage
2.	Outlet Works - Intake Channel and Structure	RGL,DLS,GC,FL	Channel underwater. Structure fair condition.
3.	Outlet Works - Control Tower	RGL,DLS	Manual operator located at intake structure.
4.	Outlet Works - Transition and Conduit	RGL,DLS	Unknown pipe - upstream 24" RCP - downstream
5.	Outlet Works - Outlet Structure & Channel	RGL,DLS,GC,FL	No structure. Channel, obstructed natural streambed.
6.	Outlet Works - Spillway Weir, Approach and Discharge Channel	RGL,DLS,GC,FL	Discharge channel obstructed. Voids in stonework of downstream spillway slope.
7.			
8.			
9.			
10.			
11.			

PERIODIC INSPECTION CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

PROJECT FEATURE: Dam Embankment NAME: RGL,DLS

DISCIPLINE: Civil and Geotechnical Engineers NAME: GC,FL

AREA ELEVATION	CONDITIONS
DAM EMBANKMENT	
CREST ELEVATION	347.1
CURRENT POOL ELEVATION	344.9
MAXIMUM IMPOUNDMENT TO DATE	Unknown
SURFACE CRACKS	None observed
PAVEMENT CONDITION	N/A
MOVEMENT OR SETTLEMENT OF CREST	None observed
LATERAL MOVEMENT	None observed
VERTICAL ALIGNMENT	Good
HORIZONTAL ALIGNMENT	Too irreg. to judge, except upstream con. block wall shows good horiz. alignment.
CONDITION AT ABUTMENT AND AT CONCRETE STRUCTURES	Some erosion around ends of upstream concrete blockwalls.
INDICATIONS OF MOVEMENT OF STRUCTURAL ITEMS ON SLOPES	Several inches of settlement and some lateral tipping and displacement of upstream concrete block wall.
TRESPASSING ON SLOPES	None observed
VEGETATION ON SLOPES	Trees,brush and vines on downstream slope. Crest covered with tall grass and weeds.
SLOUGHING OR EROSION OF SLOPES OR ABUTMENTS	Erosion through some joints in upstream concrete block wall and around ends of wall, settlement behind wall.
ROCK SLOPE PROTECTION - RIPRAP FAILURES	Concrete block wall on upstream slope at water level. Intermittant riprap on slope below water level.
UNUSUAL MOVEMENT OR CRACKING AT OR NEAR TOES	None observed
EMBANKMENT OR DOWNSTREAM SEEPAGE	Seepage at several places along downstream toe.
PIPING OR BOILS	Small delta deposit at seep to right of spillway.
FOUNDATION DRAINAGE FEATURES	None observed
TOE DRAINS	None observed
INSTRUMENTATION SYSTEM	None observed

PERIODIC INSPECTION CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

PROJECT FEATURE: Outlet Works - Intake Structure and Intake Channel NAME: RGL,DLS

DISCIPLINE: Civil and Geotechnical Engineers NAME: GC,FL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
A. APPROACH CHANNEL:	Not visible under water.
SLOPE CONDITIONS	
BOTTOM CONDITIONS	
ROCK SLIDES OR FALLS	
LOG BOOM	N/A
DEBRIS	
CONDITION OF CONCRETE LINING	
DRAINS OR WEEP HOLES	
B. INTAKE STRUCTURE:	
CONDITION OF CONCRETE	Fair. Some cracking of wingwalls.
STOP LOGS AND SLOTS	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

PROJECT FEATURE: Outlet Works - Control Tower NAME: RGL,DLS

DISCIPLINE: Civil and Geotechnical Engineers NAME: GC,FL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	There is no control tower. Outlet gate located on intake structure.
A. CONCRETE AND STRUCTURAL:	
GENERAL CONDITION	N/A
CONDITION OF JOINTS	N/A
SPALLING	N/A
VISIBLE REINFORCING	N/A
RUSTING OR STAINING OF CONCRETE	N/A
ANY SEEPAGE OR EFFLORESCENCE	N/A
JOINT ALIGNMENT	N/A
UNUSUAL SEEPAGE OR LEAKS IN GATE CHAMBER	N/A
CRACKS	N/A
RUSTING OR CORROSION OF STEEL	N/A
B. MECHANICAL AND ELECTRICAL:	
AIR VENTS	N/A
FLOAT WELLS	N/A
CRANE HOIST	N/A
ELEVATOR	N/A
HYDRAULIC SYSTEM	N/A
SERVICE GATES	Manually operated sluice gate reported to be operable.
EMERGENCY GATES	N/A
LIGHTNING PROTECTION SYSTEM	N/A
EMERGENCY POWER SYSTEM	N/A
WIRING AND LIGHTING SYSTEM IN GATE CHAMBER	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

PROJECT FEATURE: Outlet Works - Transition and Conduit NAME: RGL

DISCIPLINE: Civil Engineers NAME: DLS

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	Conduit is 24" RCP @ outlet at downstream toe. Plans indicate 6" pipe at upstream end.
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 CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

PROJECT FEATURE: Outlet Works - Outlet Structure and Outlet Channel NAME: RGL,DLS

DISCIPLINE: Civil and Geotechnical Engineers NAME: GC,FL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	There is no outlet structure. A 24-inch reinforced concrete low level outlet or blowoff extends from the toe of the downstream slope.
GENERAL CONDITION OF CONCRETE	N/A
RUST OR STAINING	N/A
SPALLING	N/A
EROSION OR CAVITATION	N/A
VISIBLE REINFORCING	N/A
ANY SEEPAGE OR EFFLORESCENCE	N/A
CONDITION AT JOINTS	N/A
DRAIN HOLES	N/A
CHANNEL	Natural streambed
LOOSE ROCK OR TREES OVERHANGING CHANNEL	Channel heavily overgrown with brush, vines and trees.
CONDITION OF DISCHARGE CHANNEL	Channel obstructed by stones, fallen branches and leaves. End of outlet submerged to springline in ponded water.

PERIODIC INSPECTION CHECK LIST

PROJECT: Swan Lake Dam DATE: 7/28/80

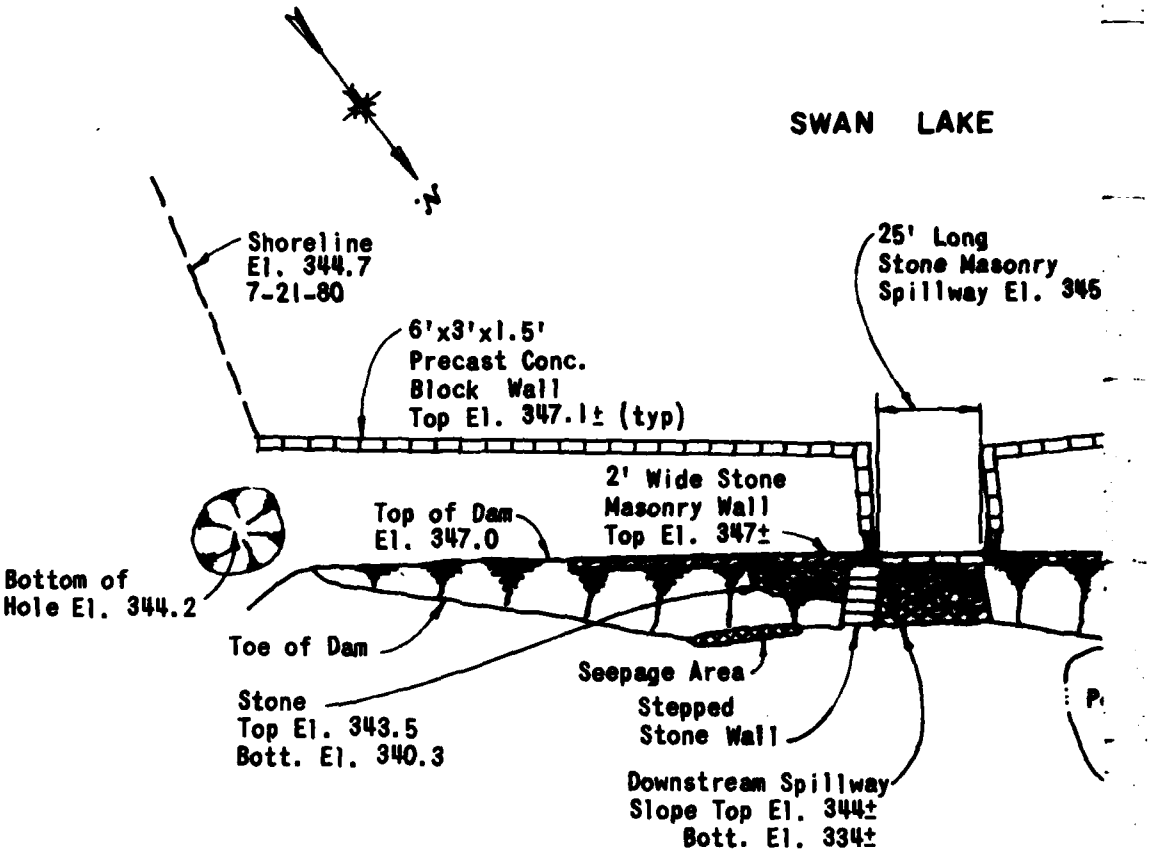
PROJECT FEATURE: Outlet Works - Spillway Weir, Approach & Discharge Channel NAME: RGL,DLS

DISCIPLINE: Civil and Geotechnical Engineers NAME: GC,FL

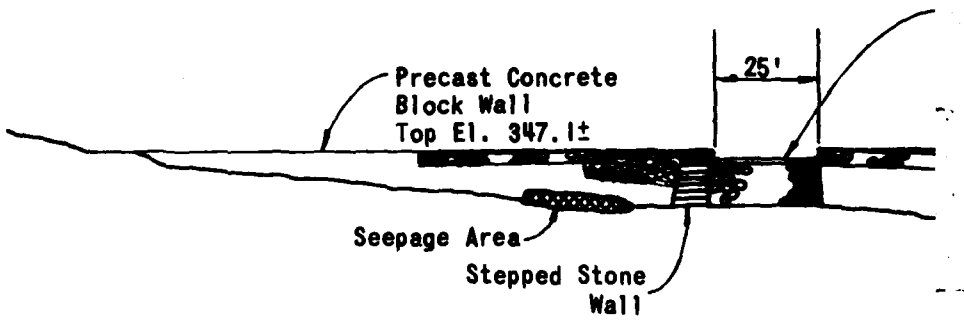
AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
A. APPROACH CHANNEL:	
GENERAL CONDITION	Good
LOOSE ROCK OVERHANGING CHANNEL	None
TREES OVERHANGING CHANNEL	None
FLOOR OF APPROACH CHANNEL	Sand and gravel
B. WEIR AND TRAINING WALLS:	
GENERAL CONDITION OF CONCRETE	Conc. block training walls in good cond. Deteriorated stone masonry. Voids in d.s. slope of stone masonry spillway.
RUST OR STAINING	None observed
SPALLING	None observed
ANY VISIBLE REINFORCING	N/A
ANY SEEPAGE OR EFFLORESCENCE	N/A
DRAIN HOLES	None. Drainage through joints between concrete blocks and voids between stones on spillway slope.
C. DISCHARGE CHANNEL:	Natural streambed.
GENERAL CONDITION	Natural streambed, clogged with debris.
LOOSE ROCK OVERHANGING CHANNEL	None
TREES OVERHANGING CHANNEL	Trees and brush growing in and overhanging channel.
FLOOR OF CHANNEL	Gravel and cobbles.
OTHER OBSTRUCTIONS	Channel at base of spillway slope clogged by logs, debris and vegetation.

APPENDIX B

ENGINEERING DATA

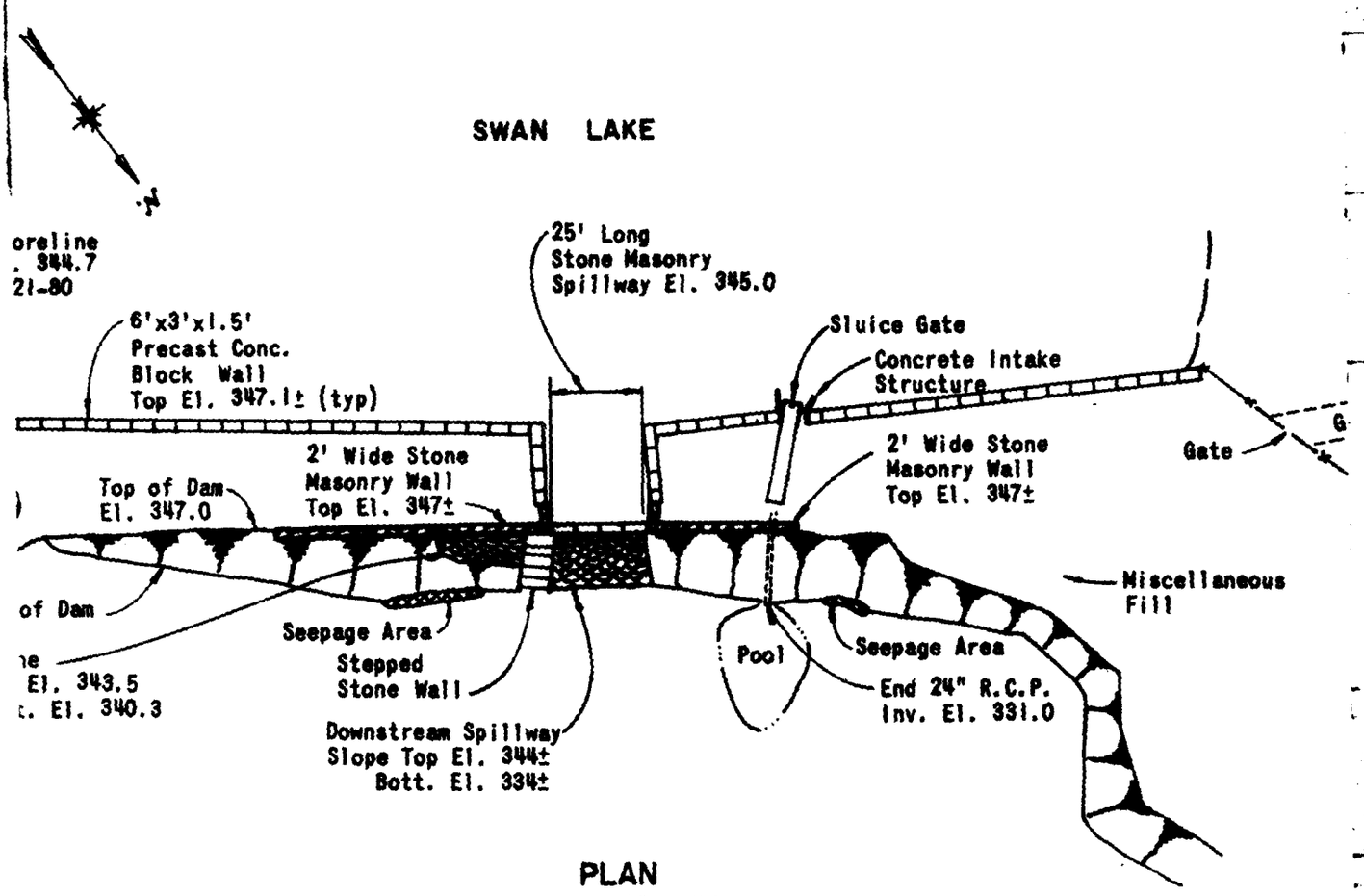


PLAN
Scale: 1" = 40'

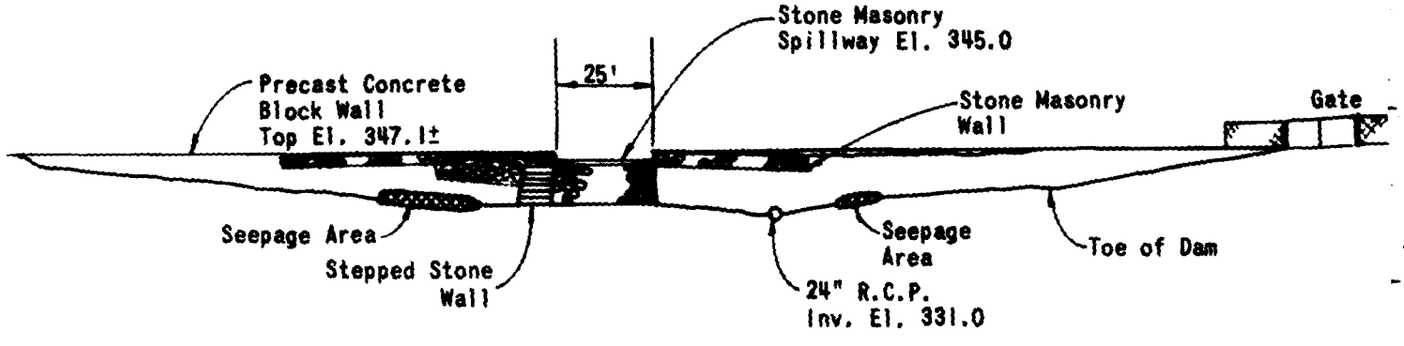


ELEVATION
Scale: 1" = 40'

(1)

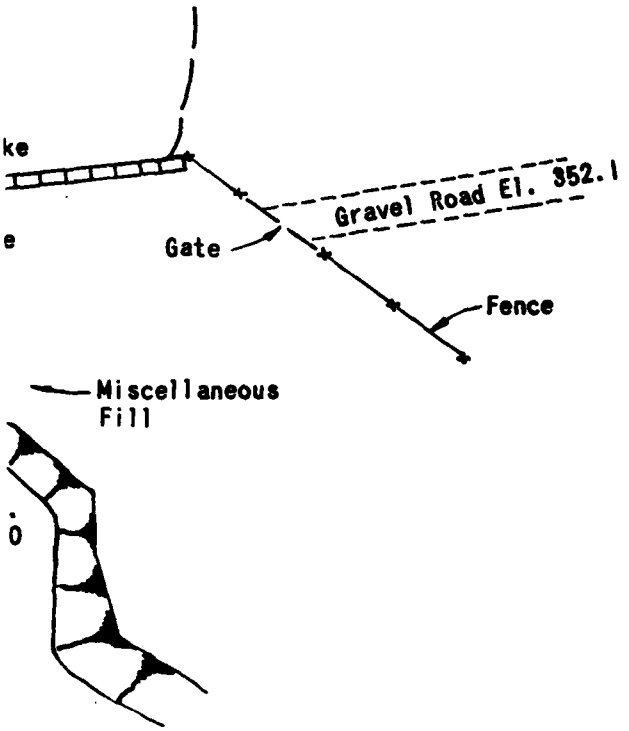


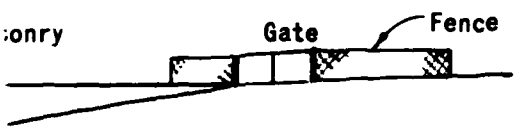
PLAN
Scale: 1" = 40'



ELEVATION
Scale: 1" = 40'

FIGURE 2





Toe of Dam

3 of (3)

ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

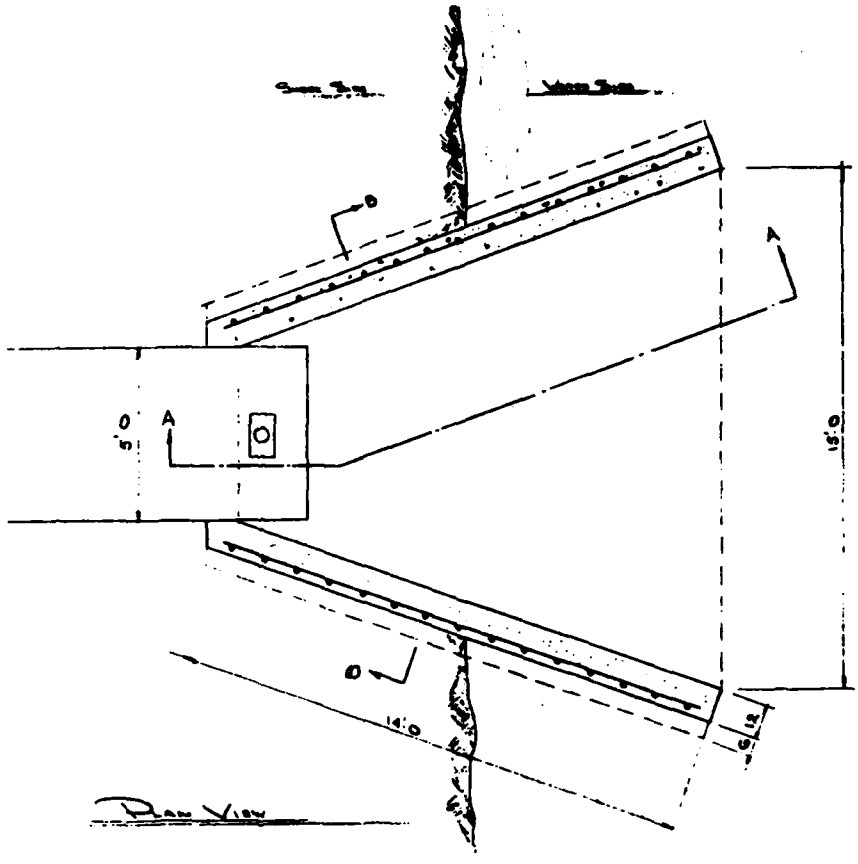
SWAN LAKE DAM

DRAWN	CHECKED	APPROVED	SCALES AS NOTED
JRS	RGL	RH	DATE SEPT. 1980 PAGE 8-1

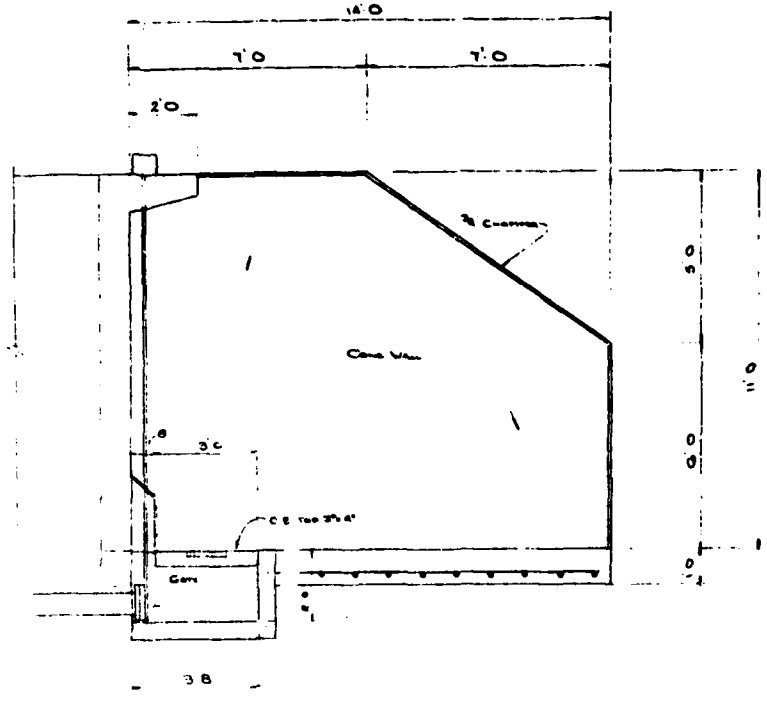
LIST OF REFERENCES

The following references are located at the State of Connecticut Department of Environmental Protection, Office of the Superintendent of Dams, State Office Building, Hartford, Connecticut, and at Swan Lake Estates Association, c/o Pauline Talmadge, 216 Wakelee Avenue, Ansonia, Connecticut.

1. Plan, "Swan Lake Estates, Oxford, Connecticut, Repair Lake Outlet", prepared by Park City Builders, Inc., 300 Boston Post Road, Orange, Connecticut, and dated 3/30/76.
2. Letter from Schiavi Construction, Inc., Seymour, Connecticut, to Swan Lake Associates describing the construction of the upstream concrete block wall.

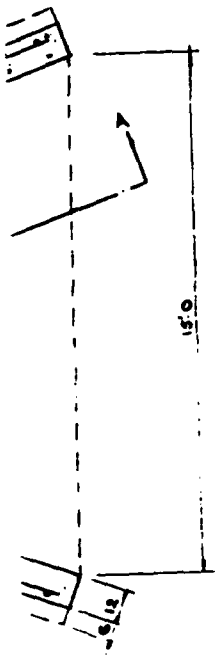


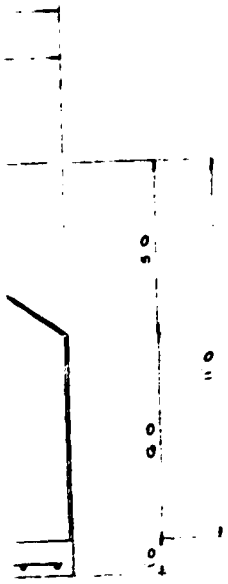
Plan View

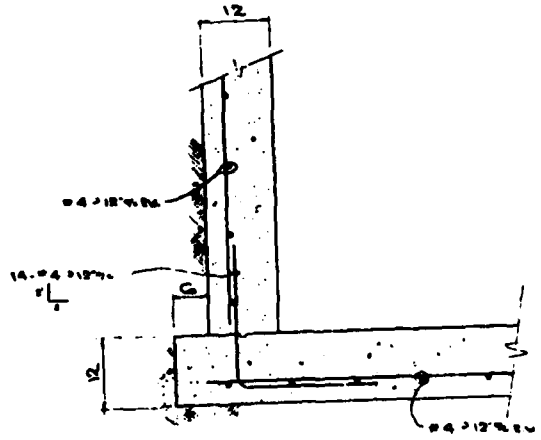


Section A-A

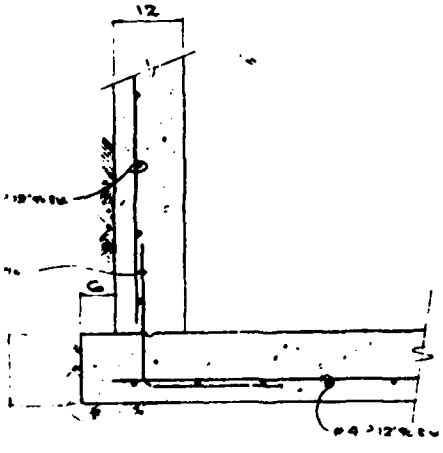
(1)







SECTION B



SECTION B

PARK CITY BUILDERS, INC.
300 BOSTON POST ROAD ORANGE, CONN.

REVISIONS			SWAN LAKE ESTATES
NO	DATE	BY	OXFORD, CONNECTICUT
1			
2			REAR LAKE OMAR
3			
4			
5			
6			

3

SCHIAVI CONSTRUCTION, INC.

Excavating — Road Building

7 HOYROCK ROAD SEYMOUR, CONN. 06483

Telephone: 888-9060

May 11, 1977

Swan Lake Association
c/o Mrs. Pauline Talmadge
316 Valsalee Avenue
Ansonia, Conn. 06401

Dear Mrs. Talmadge,

In November of 1976 we constructed a block wall 300 feet long, with two 18 foot returns at spillway, to stop erosion [illegible] the dam area of Swan Lake. The blocks were 3 x 6 [illegible] high. Backfilling and grading was also done at this time.

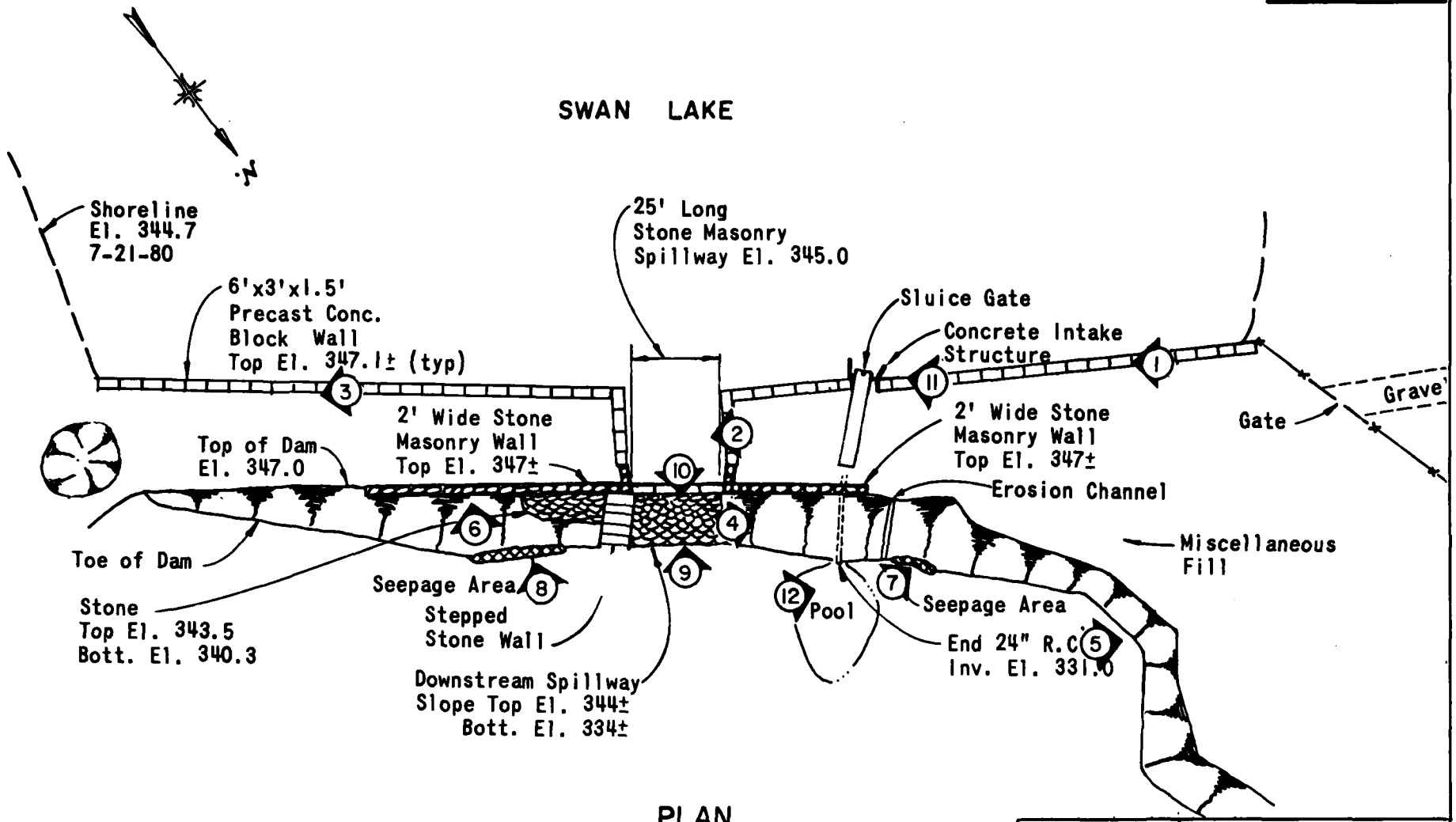
Yours truly,

Donald Schiavi

APPENDIX C

PHOTOGRAPHS

FIGURE 3



PLAN

Scale: 1" = 40'

Denotes photo number and direction in which photo was taken

HOALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PHOTO LOCATION PLAN

SWAN LAKE DAM

OXFORD, CONNECTICUT

DRAWN	CHECKED	APPROVED	SCALES AS NOTED	
JRS	RGL	RH	DATE SEPT 1980	PAGE C-1

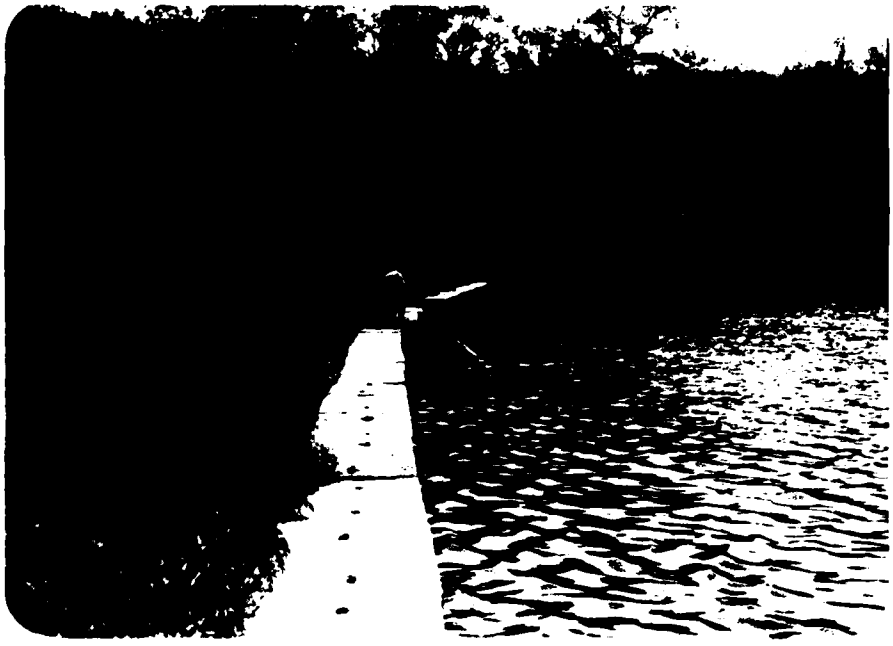


PHOTO NO. 1

DAM FROM LEFT END. NOTE DISPLACEMENT
OF UPSTREAM WALL AND BRUSH ON CREST OF DAM.

PHOTO NO. 2

RIGHT SPILLWAY TRAINING WALL. NOTE
EROSION AT DOWNSTREAM END OF WALL.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 3

DEPRESSION IN CREST BEHIND UPSTREAM WALL, JUST ABOVE JOINT IN LOWER COURSE OF BLOCKS.

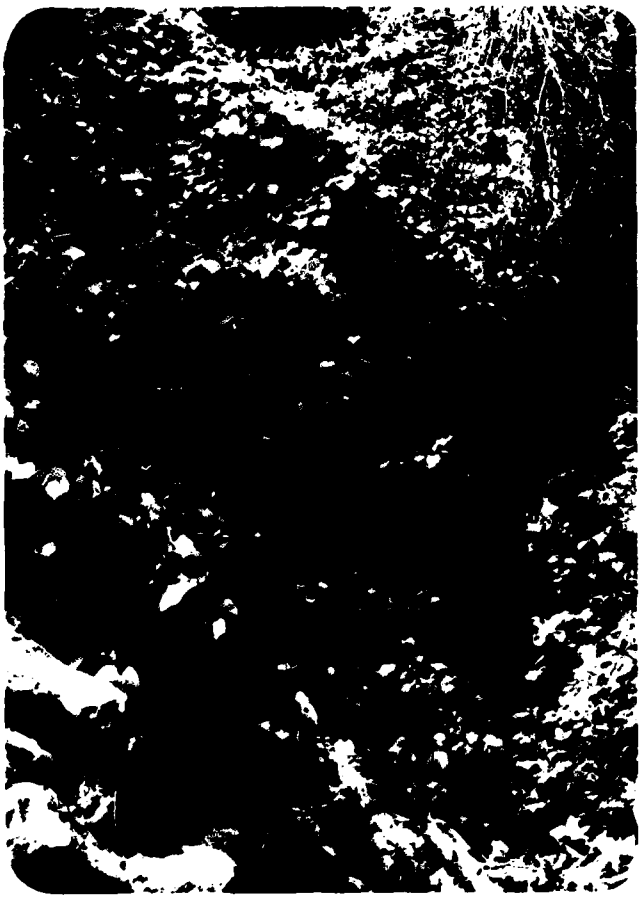


PHOTO NO. 4

VEGETATION ON DOWNSTREAM SLOPE TO LEFT OF SPILLWAY.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 5

MISCELLANEOUS FILL ON DOWNSTREAM SLOPE NEAR LEFT END OF DAM.

PHOTO NO. 6

MORTARED STONE WALL AT CREST OF DOWNSTREAM SLOPE.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 7

SEEPAGE AT DOWNSTREAM TOE TO
THE LEFT OF THE OUTLET.

PHOTO NO. 8

SEEPAGE AREA AT TOE OF DAM, 25 FEET RIGHT OF
SPILLWAY (5-10 GPM). NOTE DEPOSIT OF ORANGE-STAINED
SOIL NEAR SOURCE OF SEEPAGE.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 9

DOWNSTREAM FACE OF SPILLWAY. NOTE VOIDS IN MORTAR BETWEEN STONES.

PHOTO NO. 10

DOWNSTREAM FACE OF SPILLWAY AND DOWNSTREAM CHANNEL VIEWED FROM SPILLWAY CREST.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 11

INTAKE STRUCTURE FOR
LOW LEVEL OUTLET OR BLOWOFF.

PHOTO NO. 12

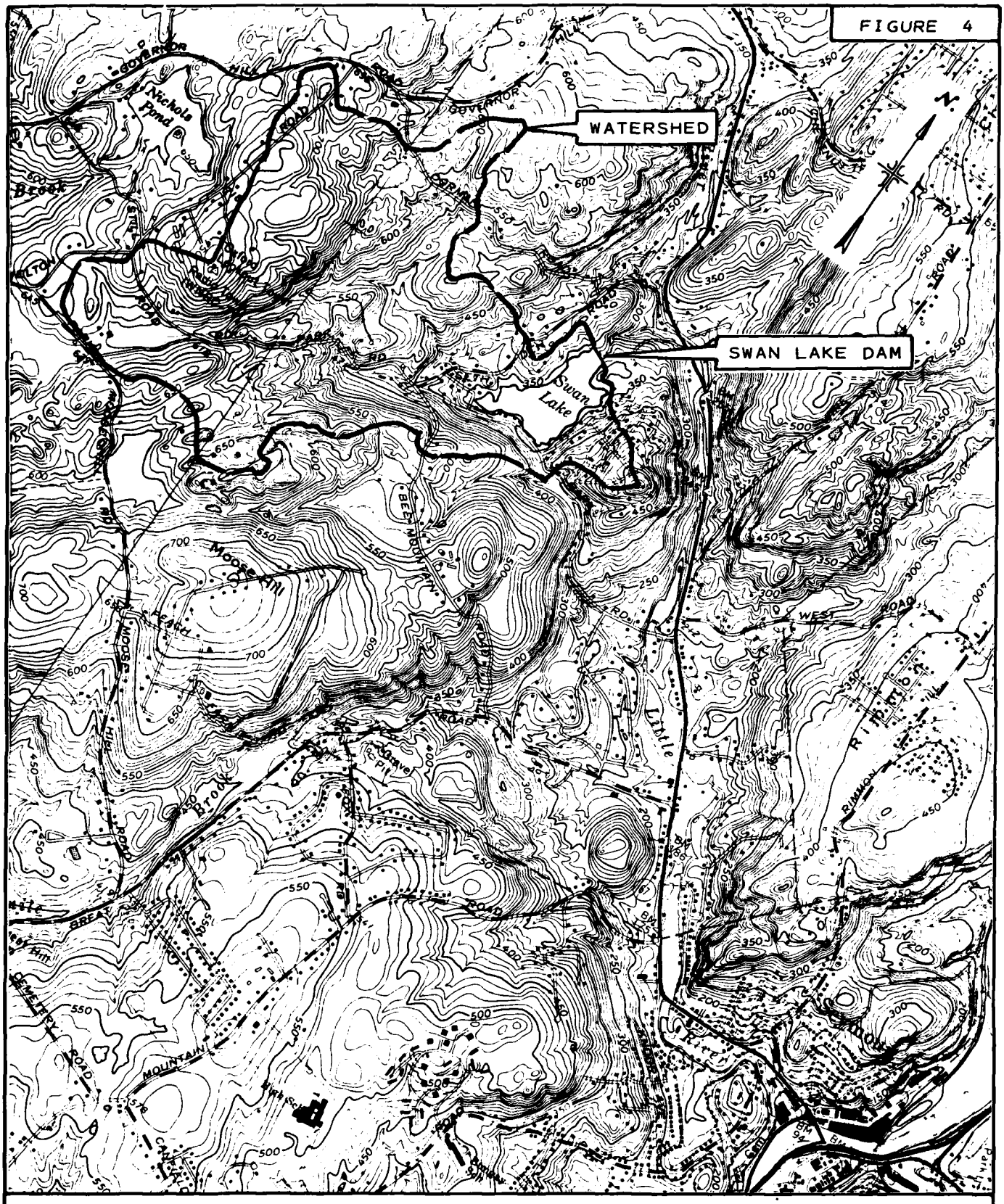
DOWNSTREAM END OF
LOW LEVEL OUTLET OR BLOWOFF PIPE.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	SWAN LAKE DAM TR. TO LITTLE RIVER OXFORD, CONNECTICUT CT 00328 28 JULY '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

FIGURE 4



WATERSHED MAP

SWAN LAKE DAM
OXFORD, CONNECTICUT

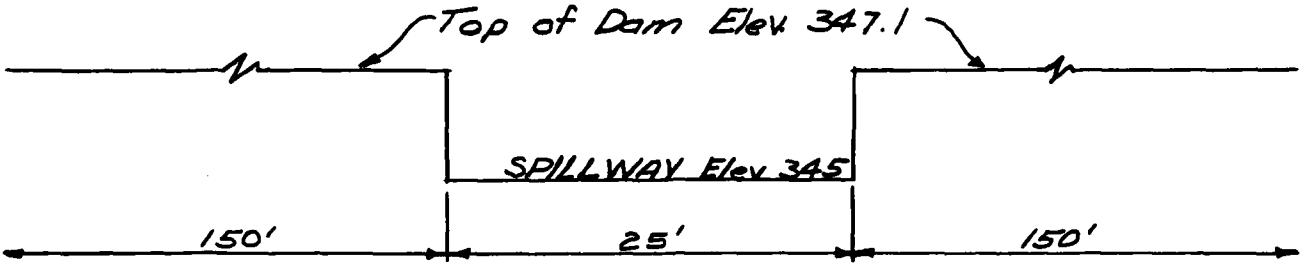
SCALE: 1" = 2000'

ROALD HAESTAD, INC.

NAUGATUCK QUADRANGLE 1972

SUBJECT SWAN LAKE DAM - Project Discharge Capacity

Spillway and Dam Profile: (Not to scale)



Discharge Coefficients: 1) Spillway C = 3.2
2) Dam C = 2.7

Spillway Capacity @ top of dam:

$Q = C L H^{3/2} = 3.2(25)(2.1)^{3/2}$
$Q = 243.5$ use 245 cfs

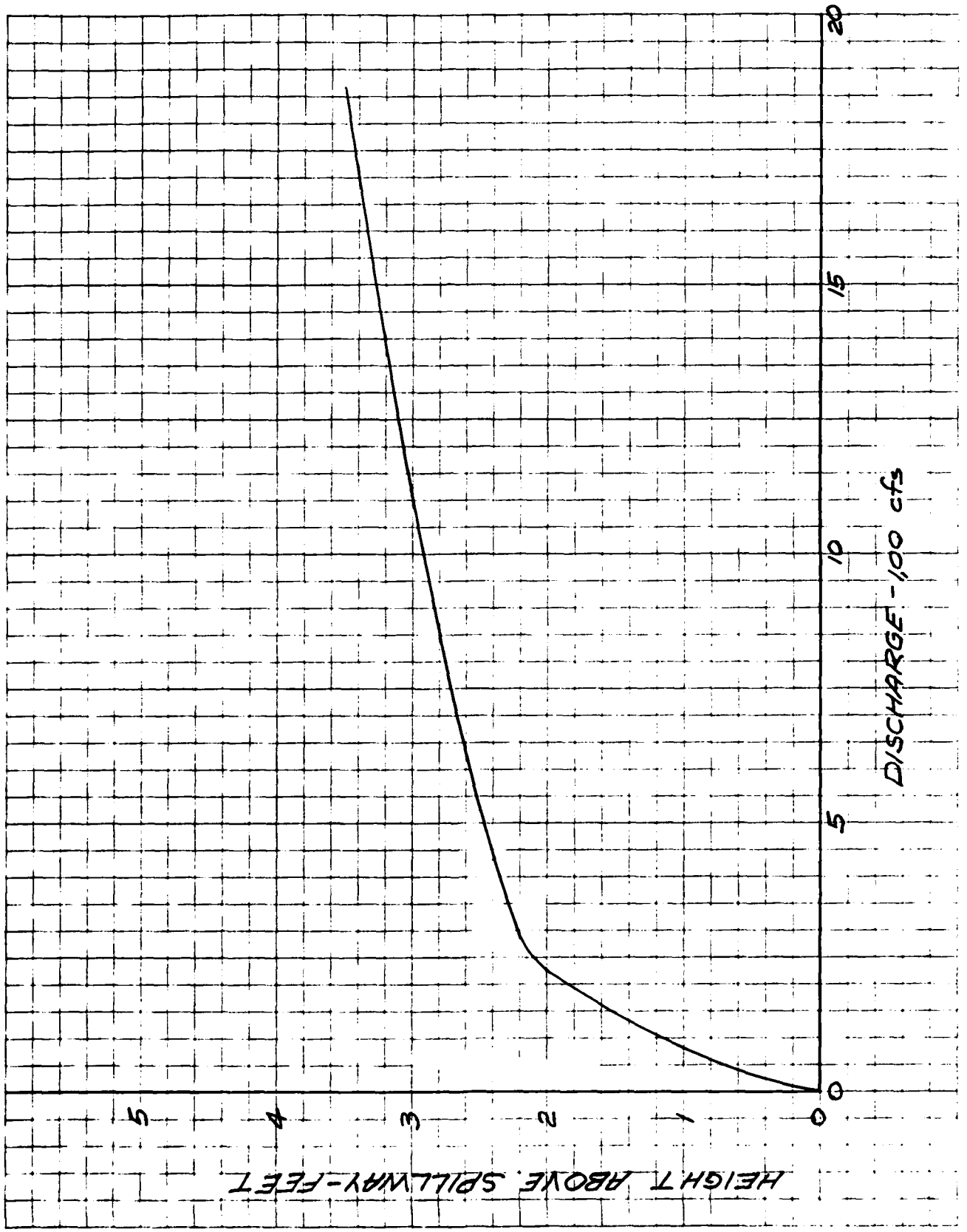
Height Above Spillway (feet)	Spillway Discharge Capacity (cfs)	Dam. Discharge Capacity (cfs)	Total Discharge Capacity (cfs)
0	0	0	0
1.0	80	0	80
2.0	226	0	226
2.5	316	205	521
3.0	416	692	1,108
3.5	524	1,342	1,866
4.0	640	2,121	2,761

BY SAL DATE 8/20/80 **ROALD HAESTAD, INC.** SHEET NO 2 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 8/20/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - Project Discharge Capacity Curve



BY SAL DATE 8/15/80 **ROALD HAESTAD, INC.** SHEET NO 3 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 8/20/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - Surcharge Storage Capacity

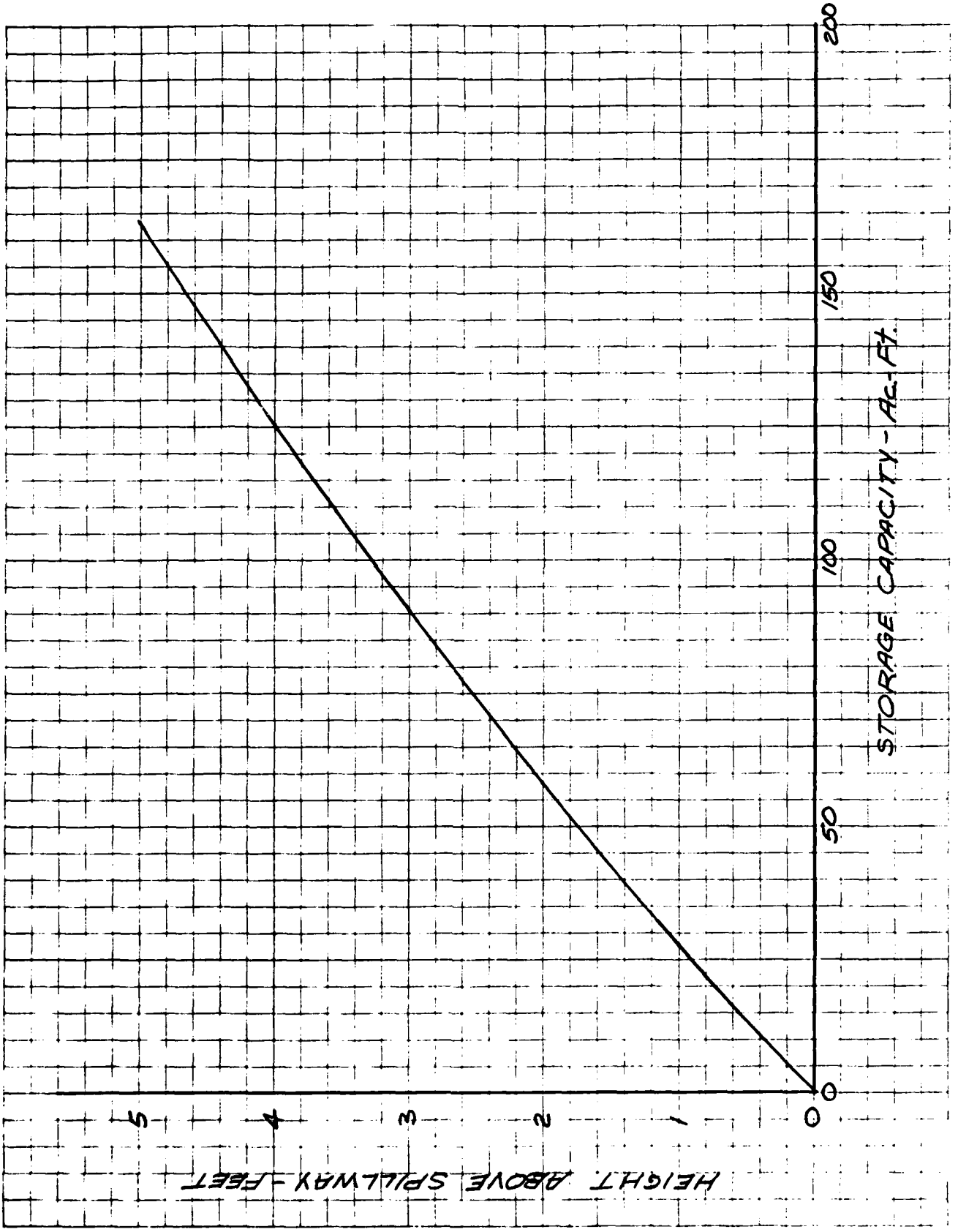
Height Above Spillway (Feet)	Surface Area (Acres)	Average Surface Area (Acres)	Storage Capacity (Ac-Ft)
0	26.6		0
		27.8	
1	29.0		27.8
		30.2	
2	31.4		58.0
		32.6	
3	33.8		90.6
		35.0	
4	36.2		125.6
		37.4	
5	38.6		163.0

BY SAL DATE 8/15/80 **ROALD HAESTAD, INC.** SHEET NO 4 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 8/20/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - Surcharge Storage Capacity Curve



Test Flood = 1/2 PMF

Drainage Area = 630 acres = 0.98 sq mi

From Corps of Eng. chart for "Rolling" Terrain

MPF = 2,125 cfs/sq. mile (2.0 sq mi Minimum)

PMF = 2,125 cfs/sq mi × 0.98 sq. mi. = 2,082.5 use 2,083 cfs

1/2 PMF = 1/2 (2,083 cfs) = 1,041.5 use 1,042 cfs

Q_{P1} = 1,042 cfs

H_1 = 2.95 use 3ft above spillway, from Discharge Capacity Curve

$STOR_1$ = 90 ac-ft, from storage capacity curve

= 1.7" runoff from 0.98 sq mi

Maximum Probable Flood Runoff in New England equals approx. 19". Therefore 1/2 PMF equals approx. 1/2 (19") = 9.5"

$Q_{P2} = Q_{P1}(1 - STOR_1/9.5) = 1,042 \text{ cfs}(1 - 1.7/9.5) = 856$ cfs

H_2 = 2.8 ft $STOR_2$ = 84 ac-ft

$STOR_{AVE} = (STOR_1 + STOR_2)/2 = (90+84)/2 = 87$ ac-ft
= 1.66" runoff

$Q_{P3} = Q_{P1}(1 - STOR_{AVE}/9.5) = 1,042 \text{ cfs}(1 - 1.66/9.5) = 860$ cfs

H_3 = 2.8 ft

Spillway Capacity @ top of dam:

$Q = C L H^{3/2} = 3.2(25)(2.1)^{3/2}$
$Q = 243.5$ use 245 cfs

% of 1/2 PMF = $(245/860) \times 100 = 28\%$ of 1/2 PMF

S = Storage at time of failure with water level at top of dam.

S = Storage at spillway level + Freeboard storage

S = (Surface area × Average depth*) + (From surcharge storage capacity curve).

S = (26.6 acres × 8.1 feet) + (62 acre-ft)

S = 215.5 ac-ft + 62 ac-ft = 277.5 use 278 ac-ft.

Q_{pl} = Peak Failure Outflow = $8/27\ W_b \sqrt{g}\ Y_o^{3/2}$

W_b = Breach Width - 40% of dam length across river at mid-height = 0.4(225) = 90'

Y_o = Total height from river bed to pool level at time of failure = 16'

$Q_{pl} = 8/27\ (90)(\sqrt{32.2})(16)^{3/2}$

Q_{pl} = 9,684.5 use 9,690 cfs

*Note: Average depth taken from "A Connecticut Fishery Survey", 1959

BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 7 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 1A

MAIN CHANNEL

H	W	A	R	S	V	Q
1.0	23	17	.75	.0114	3.27	55
2.0	29	42	1.46	.0114	5.11	215
3.0	35	73	2.09	.0114	6.48	473
4.0	41	110	2.67	.0114	7.63	837
5.0	47	152	3.21	.0114	8.64	1314
6.0	53	200	3.74	.0114	9.56	1915
7.0	60	254	4.26	.0114	10.42	2649
8.0	65	313	4.80	.0114	11.28	3537
9.0	71	377	5.33	.0114	12.10	4564
10.0	76	445	5.84	.0114	12.87	5726
11.0	82	517	6.34	.0114	13.59	7029
12.0	87	594	6.82	.0114	14.27	8476

MANNING COEFFICIENT=N=.0400

BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 8 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 1B

RIGHT OVERBANK

H	W	A	R	S	V	Q
8.0	148	88	.59	.0114	2.24	197
9.0	152	236	1.56	.0114	4.27	1008
10.0	155	387	2.49	.0114	5.84	2259
11.0	159	540	3.40	.0114	7.18	3879
12.0	162	696	4.29	.0114	8.37	5826

MANNING COEFFICIENT=N=.0500

SECTION NUMBER 1

TOTAL SECTION

	AREA			DISCHARGE		
H	A	B	TOTAL	A	B	TOTAL
1.0	17	0	17	55	0	55
2.0	42	0	42	215	0	215
3.0	73	0	73	473	0	473
4.0	110	0	110	837	0	837
5.0	152	0	152	1314	0	1314
6.0	200	0	200	1915	0	1915
7.0	254	0	254	2649	0	2649
8.0	313	88	401	3537	197	3734
9.0	377	236	613	4564	1008	5572
10.0	445	387	832	5726	2259	7985
11.0	517	540	1058	7029	3879	10907
12.0	594	696	1290	8476	5826	14302

STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 500 FT.

INFLOW INTO REACH=QP1= 9690 CFS
DEPTH OF FLOW=H1= 10.6 FT.
CROSS SECTIONAL AREA=A1= 967 SQ. FT.
STORAGE IN REACH=V1= 11.1 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 9303 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 10.5 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 938 SQ. FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 10.8 AC. FT.

REACH OUTFLOW=QP2= 9309 CFS
DEPTH OF FLOW=H2= 10.5 FT.

BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 11 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 2A

MAIN CHANNEL

H	W	A	R	S	V	Q
1.0	20	10	.50	.0090	1.48	15
2.0	40	40	1.00	.0090	2.34	94
3.0	60	90	1.49	.0090	3.07	276
4.0	80	160	1.99	.0090	3.72	595
5.0	100	250	2.49	.0090	4.31	1078
6.0	116	358	3.09	.0090	4.99	1782
7.0	131	480	3.67	.0090	5.59	2683
8.0	146	618	4.23	.0090	6.15	3795
9.0	161	770	4.78	.0090	6.67	5134
10.0	176	938	5.32	.0090	7.16	6712
11.0	182	1115	6.11	.0090	7.86	8760
12.0	188	1298	6.89	.0090	8.50	11034
13.0	195	1485	7.63	.0090	9.11	13527
14.0	201	1678	8.36	.0090	9.68	16236
15.0	207	1875	9.07	.0090	10.22	19160

MANNING COEFFICIENT=N=.0600

SECTION NUMBER 2B

LEFT OVERBANK

H	W	A	R	S	V	Q
11.0	41	20	.49	.0090	1.46	29
12.0	82	80	.98	.0090	2.31	185
13.0	123	180	1.46	.0090	3.03	545
14.0	164	320	1.95	.0090	3.67	1174
15.0	205	500	2.44	.0090	4.26	2128

MANNING COEFFICIENT=N=.0600

SECTION NUMBER 2

TOTAL SECTION

	AREA			DISCHARGE		
H	A	B	TOTAL	A	B	TOTAL
1.0	10	0	10	15	0	15
2.0	40	0	40	94	0	94
3.0	90	0	90	276	0	276
4.0	160	0	160	595	0	595
5.0	250	0	250	1078	0	1078
6.0	358	0	358	1782	0	1782
7.0	480	0	480	2683	0	2683
8.0	618	0	618	3795	0	3795
9.0	770	0	770	5134	0	5134
10.0	938	0	938	6712	0	6712
11.0	1115	20	1135	8760	29	8789
12.0	1298	80	1378	11034	185	11219
13.0	1485	180	1665	13527	545	14072
14.0	1678	320	1998	16236	1174	17410
15.0	1875	500	2375	19160	2128	21288

STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 1300 FT.

INFLOW INTO REACH=QP1= 9309 CFS
DEPTH OF FLOW=H1= 11.2 FT.
CROSS SECTIONAL AREA=A1= 1187 SQ. FT.
STORAGE IN REACH=V1= 35.4 AC. FT.

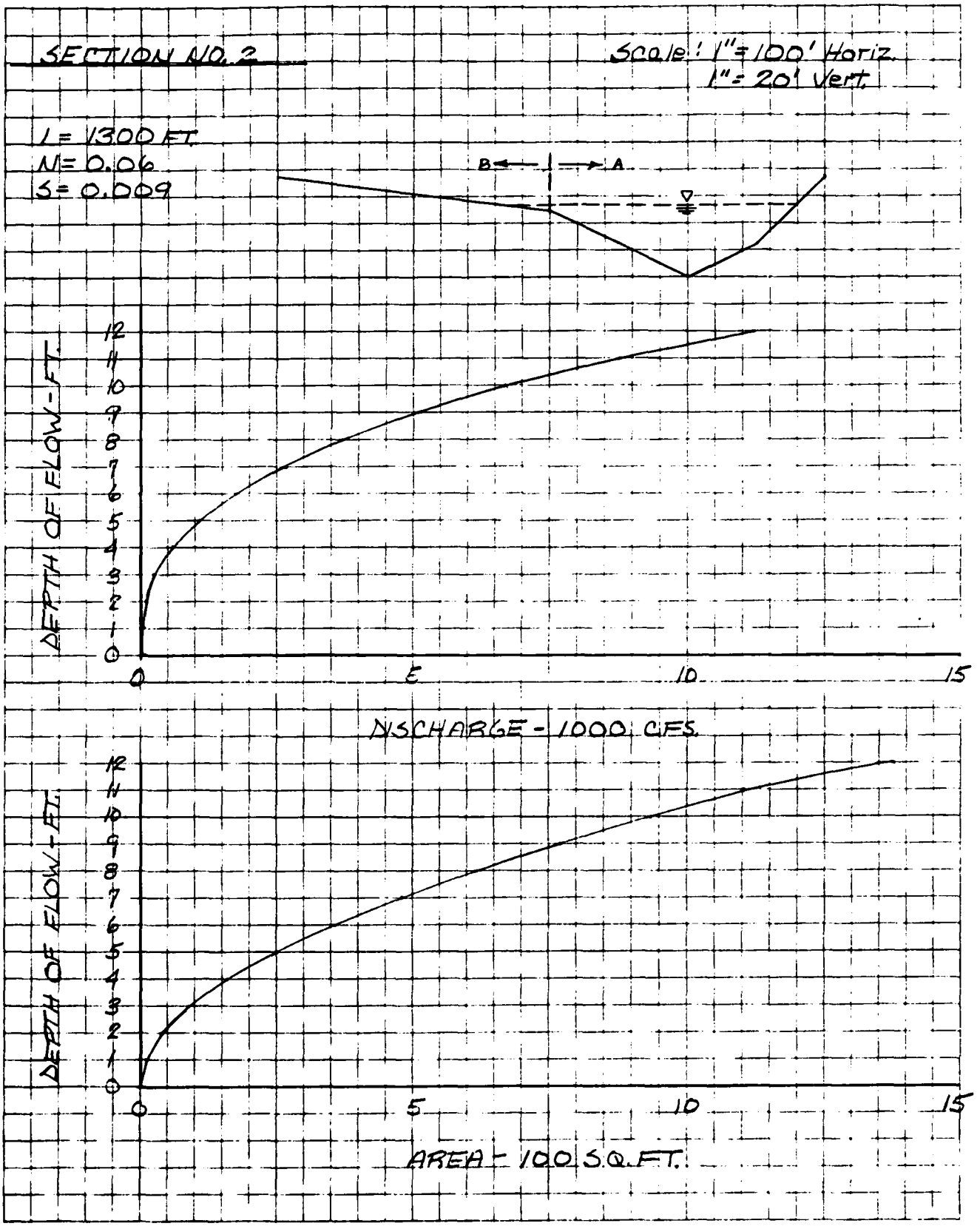
TRIAL REACH OUTFLOW=QP(TRIAL)= 8123 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 10.7 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 1072 SQ. FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 32.0 AC. FT.

REACH OUTFLOW=QP2= 8180 CFS
DEPTH OF FLOW=H2= 10.7 FT.

BY LBG DATE 8/15/80 **ROALD HAESTAD, INC.** SHEET NO 14 OF 37

CKD BY DLS DATE 8/20/80 CONSULTING ENGINEERS 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - FLOOD ROUTING



BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 15 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-DEPTH OF FLOW

SECTION NUMBER 3

TOTAL SECTION

HEIGHT ABOVE INVERT (FEET)	D I S C H A R G E C A P A C I T Y CONDUIT (CFS)	SPILLWAY (CFS)	TOTAL (CFS)
1.0	119	0	119
2.0	238	0	238
3.0	405	0	405
4.0	571	0	571
5.0	821	0	821
6.0	1071	0	1071
7.0	1357	0	1357
8.0	1642	0	1642
9.0	1940	0	1940
10.0	2237	0	2237
11.0	2535	0	2535
12.0	2832	0	2832
13.0	3094	0	3094
14.0	3380	290	3670
15.0	3641	940	4582
16.0	3879	1939	5818
17.0	4165	3273	7438
18.0	4355	4896	9252
19.0	4522	6758	11280
20.0	4760	8826	13586

REACH OUTFLOW=QP2= 8180 CFS

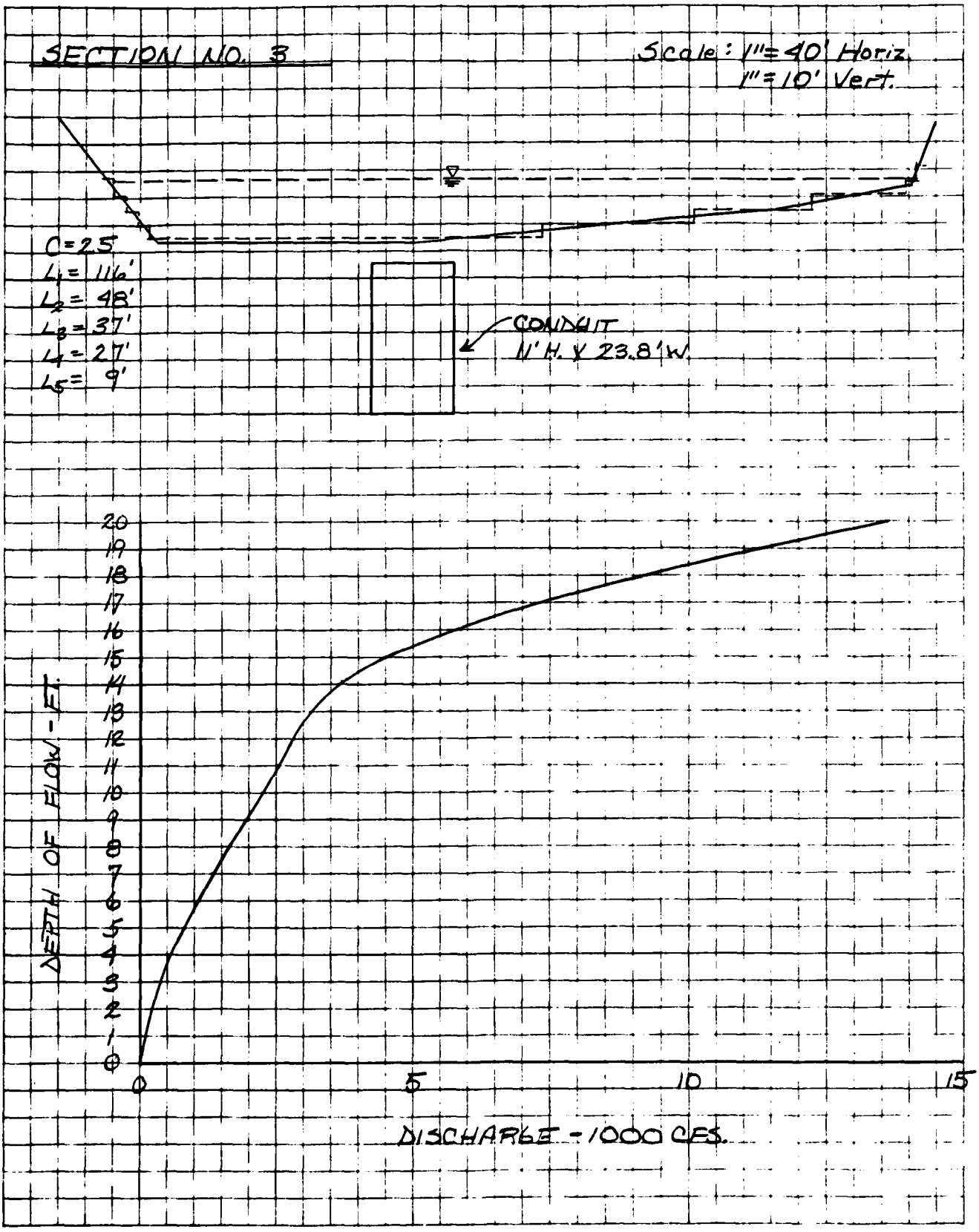
HEIGHT ABOVE CONDUIT INVERT=H2= 17.4 FT.

BY LRG DATE 8/28/80 **ROALD HAESTAD, INC.** SHEET NO 16 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 9/16/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - DEPTH OF FLOW



SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 4

TOTAL SECTION

H	W	A	R	S	V	Q
1.0	18	9	.50	.0125	1.04	9
2.0	35	35	.99	.0125	1.65	58
3.0	53	79	1.49	.0125	2.17	171
4.0	70	140	1.99	.0125	2.63	368
5.0	88	219	2.48	.0125	3.05	666
6.0	106	315	2.98	.0125	3.44	1084
7.0	123	429	3.48	.0125	3.81	1635
8.0	141	560	3.97	.0125	4.17	2334
9.0	159	709	4.47	.0125	4.51	3195
10.0	176	875	4.97	.0125	4.84	4232
11.0	185	1054	5.69	.0125	5.30	5586
12.0	194	1243	6.40	.0125	5.73	7114
13.0	203	1439	7.08	.0125	6.13	8819
14.0	212	1645	7.75	.0125	6.51	10703
15.0	221	1859	8.40	.0125	6.87	12768
16.0	230	2083	9.04	.0125	7.21	15017
17.0	239	2314	9.67	.0125	7.54	17453
18.0	248	2555	10.29	.0125	7.86	20080

MANNING COEFFICIENT=N=.1000
STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 1500 FT.

INFLOW INTO REACH=QP1= 8180 CFS
DEPTH OF FLOW=H1= 12.6 FT.
CROSS SECTIONAL AREA=A1= 1366 SQ. FT.
STORAGE IN REACH=V1= 47.0 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 6796 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 11.8 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 1203 SQ. FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 41.4 AC. FT.

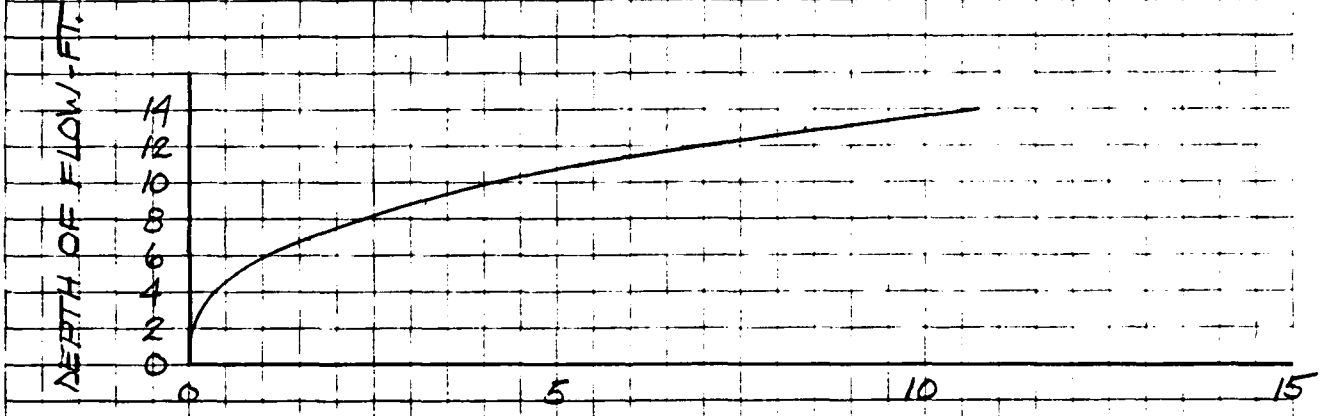
REACH OUTFLOW=QP2= 6879 CFS
DEPTH OF FLOW=H2= 11.8 FT.

SUBJECT SWAN LAKE DAM - FLOOD ROUTING

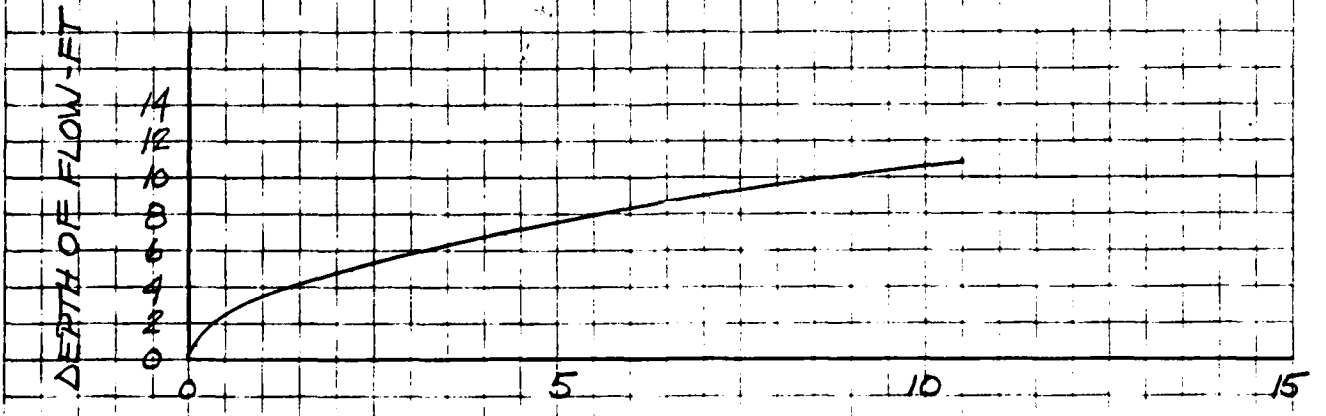
SECTION NO. 4

Scale: 1" = 50' Horiz
1" = 20' Vert.

L = 1500 FT.
N = 0.1
S = 0.0125



DISCHARGE - 1000 CFS.



AREA - 100 SQ. FT.

BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 19 OF 37

CKD BY DLS DATE 9/19/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 5

TOTAL SECTION

H	W	A	R	S	V	Q
1.0	10	5	.49	.0154	1.15	6
2.0	20	20	.98	.0154	1.82	36
3.0	31	45	1.47	.0154	2.39	107
4.0	41	80	1.96	.0154	2.89	231
5.0	51	125	2.45	.0154	3.35	419
6.0	61	180	2.94	.0154	3.79	681
7.0	71	245	3.43	.0154	4.20	1028
8.0	82	320	3.92	.0154	4.59	1468
9.0	92	405	4.41	.0154	4.96	2009
10.0	102	500	4.90	.0154	5.32	2661
11.0	110	604	5.48	.0154	5.73	3462
12.0	119	716	6.04	.0154	6.12	4380
13.0	127	836	6.59	.0154	6.49	5422
14.0	135	964	7.14	.0154	6.84	6591
15.0	143	1100	7.68	.0154	7.18	7894
16.0	152	1244	8.21	.0154	7.50	9335
17.0	160	1396	8.74	.0154	7.82	10919
18.0	168	1556	9.26	.0154	8.13	12651
19.0	176	1724	9.78	.0154	8.43	14536
20.0	185	1900	10.29	.0154	8.73	16579

MANNING COEFFICIENT=N=.1000
STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 2000 FT.

INFLOW INTO REACH=QP1= 6879 CFS
DEPTH OF FLOW=H1= 14.2 FT.
CROSS SECTIONAL AREA=A1= 994 SQ. FT.
STORAGE IN REACH=V1= 45.6 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 5750 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 13.3 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 872 SQ. FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 40.0 AC. FT.

REACH OUTFLOW=QP2= 5819 CFS
DEPTH OF FLOW=H2= 13.3 FT.

BY LBG DATE 8/15/80. **ROALD HAESTAD, INC.** SHEET NO 20 OF 37

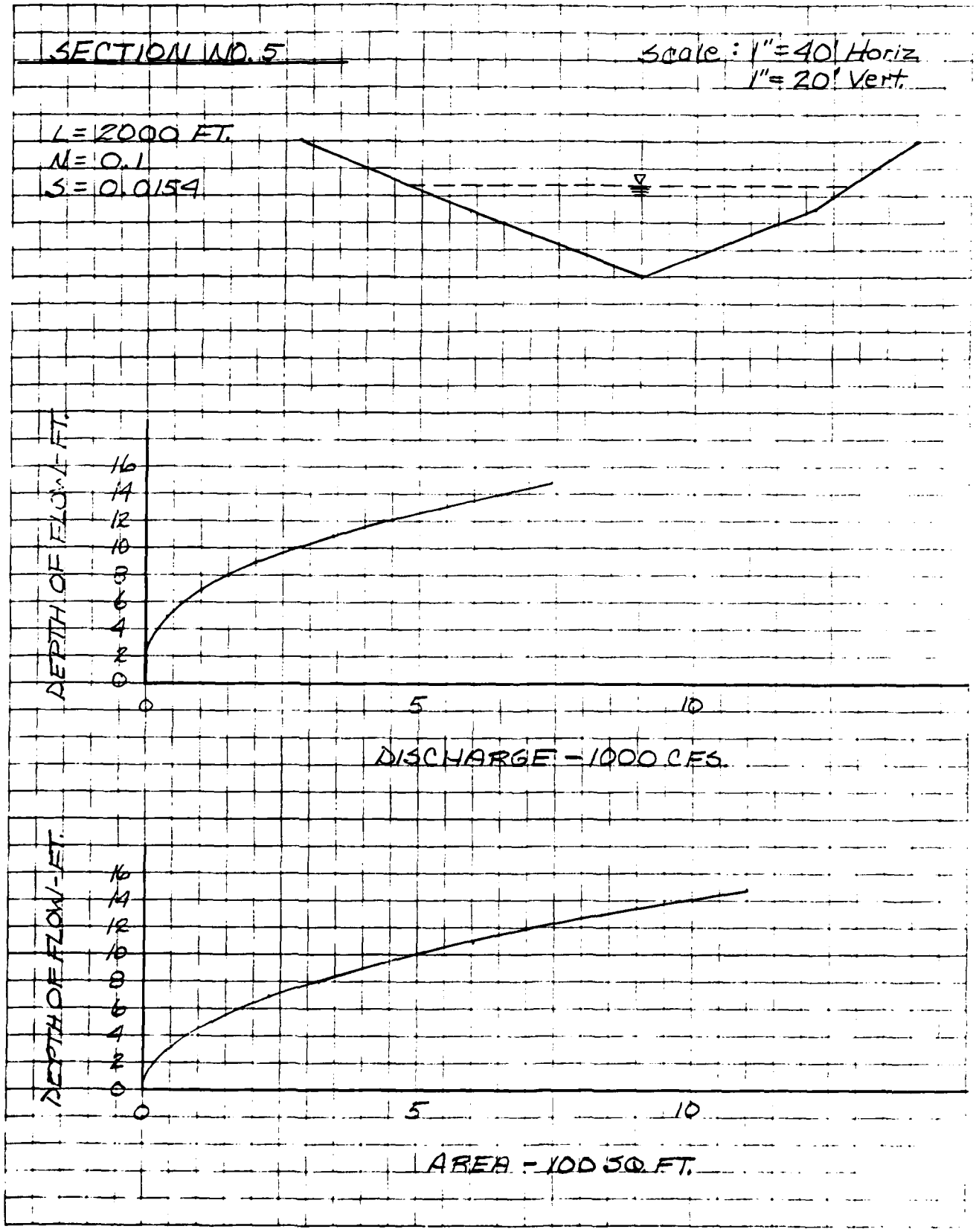
CONSULTING ENGINEERS

CKD BY DLS DATE 8/20/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - FLOOD ROUTING

SECTION NO. 5

Scale: 1"=40' Horiz.
1"=20' Vert.



SUBJECT SWAN LAKE DAM-DEPTH OF FLOW

SECTION NUMBER 6

PARK ROAD

HEIGHT ABOVE INVERT (FEET)	DISCHARGE CONDUIT #1 (CFS)	DISCHARGE CONDUIT #2 (CFS)	CAPACITY SPILLWAY (CFS)	CAPACITY TOTAL (CFS)
1.0	75	0	0	75
2.0	150	21	0	171
3.0	225	42	0	267
4.0	300	74	0	374
5.0	413	106	0	519
6.0	525	154	0	679
7.0	675	201	0	876
8.0	825	254	0	1079
9.0	990	307	0	1297
10.0	1155	366	0	1521
11.0	1343	424	0	1767
12.0	1530	477	0	2007
13.0	1740	530	100	2370
14.0	1950	570	508	3028
15.0	2138	610	1381	4128
16.0	2325	647	2806	5777
17.0	2513	684	4878	8074

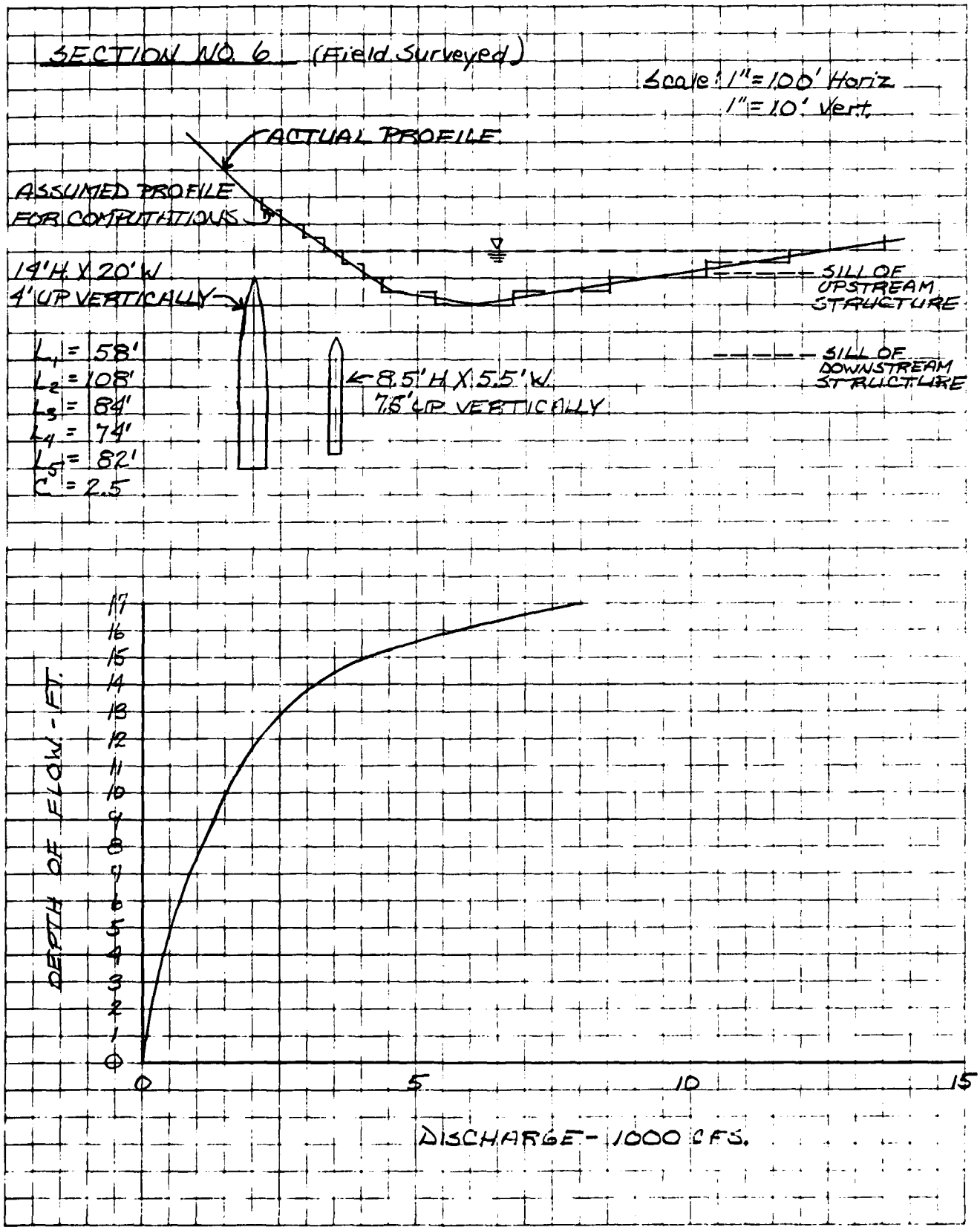
REACH OUTFLOW=QP2= 5819 CFS
HEIGHT ABOVE CONDUIT INVERT=H2= 16.0 FT.

BY LBG DATE 8/18/80 **ROALD HAESTAD, INC.** SHEET NO 22 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 8/21/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 79-026

SUBJECT SWAN LAKE DAM - DEPTH OF FLOW



SECTION NUMBER 7

STORAGE CAPACITY WITHIN REACH

HEIGHT (FEET)	SURFACE AREA (ACRES)	STORAGE VOLUME (ACRE-FEET)
1.0	2.73	1.4
2.0	5.46	5.5
3.0	8.19	12.3
4.0	10.92	21.8
5.0	13.65	34.1
6.0	16.38	49.1
7.0	19.11	66.9
8.0	21.84	87.4
9.0	24.57	110.6
10.0	27.30	136.5
11.0	30.08	165.2
12.0	32.86	196.7
13.0	35.64	230.9
14.0	38.42	267.9
15.0	41.20	307.8
16.0	43.98	350.3
17.0	46.76	395.7
18.0	49.54	443.9
19.0	52.32	494.8
20.0	55.10	548.5

STORAGE CAPACITY CALCULATED FROM SURFACE AREAS AT KNOWN ELEVATIONS.

SECTION NUMBER 7

ROUTE-67

HEIGHT ABOVE INVERT (FEET)	D I S C H A R G E C A P A C I T Y CONDUIT (CFS)	SPILLWAY (CFS)	TOTAL (CFS)
1.0	85	0	85
2.0	170	0	170
3.0	325	0	325
4.0	480	0	480
5.0	660	0	660
6.0	840	0	840
7.0	990	0	990
8.0	1140	0	1140
9.0	1270	425	1695
10.0	1400	1877	3277
11.0	1500	4543	6043
12.0	1600	8309	9909
13.0	1700	12926	14626
14.0	1800	18507	20307
15.0	1900	24921	26821
16.0	2000	32317	34317
17.0	2070	40572	42642
18.0	2140	49841	51981

STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 2000 FT.

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 7

ROUTE-67

TIME (MIN.)	AVERAGE INFLOW (AC-FT)	TRIAL DEPTH OF FLOW (FEET)	AVERAGE OUTFLOW FOR, ΔT (AC-FT)	INCREMENTAL STORAGE, ΔS (AC-FT)	TOTAL STORAGE (AC-FT)	DEPTH OF FLOW END OF, ΔT (FEET)
2.0	16.0	3.4	1.1	15.0	15.0	3.3
4.0	16.0	4.6	1.6	14.4	29.4	4.6
6.0	16.0	5.6	2.1	13.9	43.3	5.6
8.0	16.0	6.4	2.5	13.5	56.8	6.4
10.0	16.0	7.1	2.8	13.2	70.1	7.2
12.0	16.0	7.8	3.0	13.0	83.1	7.8
14.0	16.0	8.3	3.6	12.4	95.5	8.3
16.0	16.0	8.8	4.3	11.7	107.2	8.9
18.0	16.0	9.3	5.9	10.1	117.3	9.3
20.0	16.0	9.6	7.4	8.7	126.0	9.6
22.0	16.0	9.9	8.7	7.4	133.3	9.9
24.0	16.0	10.2	10.2	5.9	139.2	10.1
26.0	16.0	10.3	11.5	4.5	143.7	10.3
28.0	16.0	10.5	12.5	3.5	147.2	10.4
30.0	16.0	10.6	13.3	2.7	149.9	10.5
32.0	16.0	10.6	13.9	2.1	152.1	10.5
34.0	16.0	10.6	13.6	2.4	154.5	10.6
36.0	0.0	10.2	10.7	- 10.7	143.8	10.3
38.0	0.0	10.0	9.1	- 9.1	134.7	9.9
40.0	0.0	9.7	7.7	- 7.7	127.0	9.6

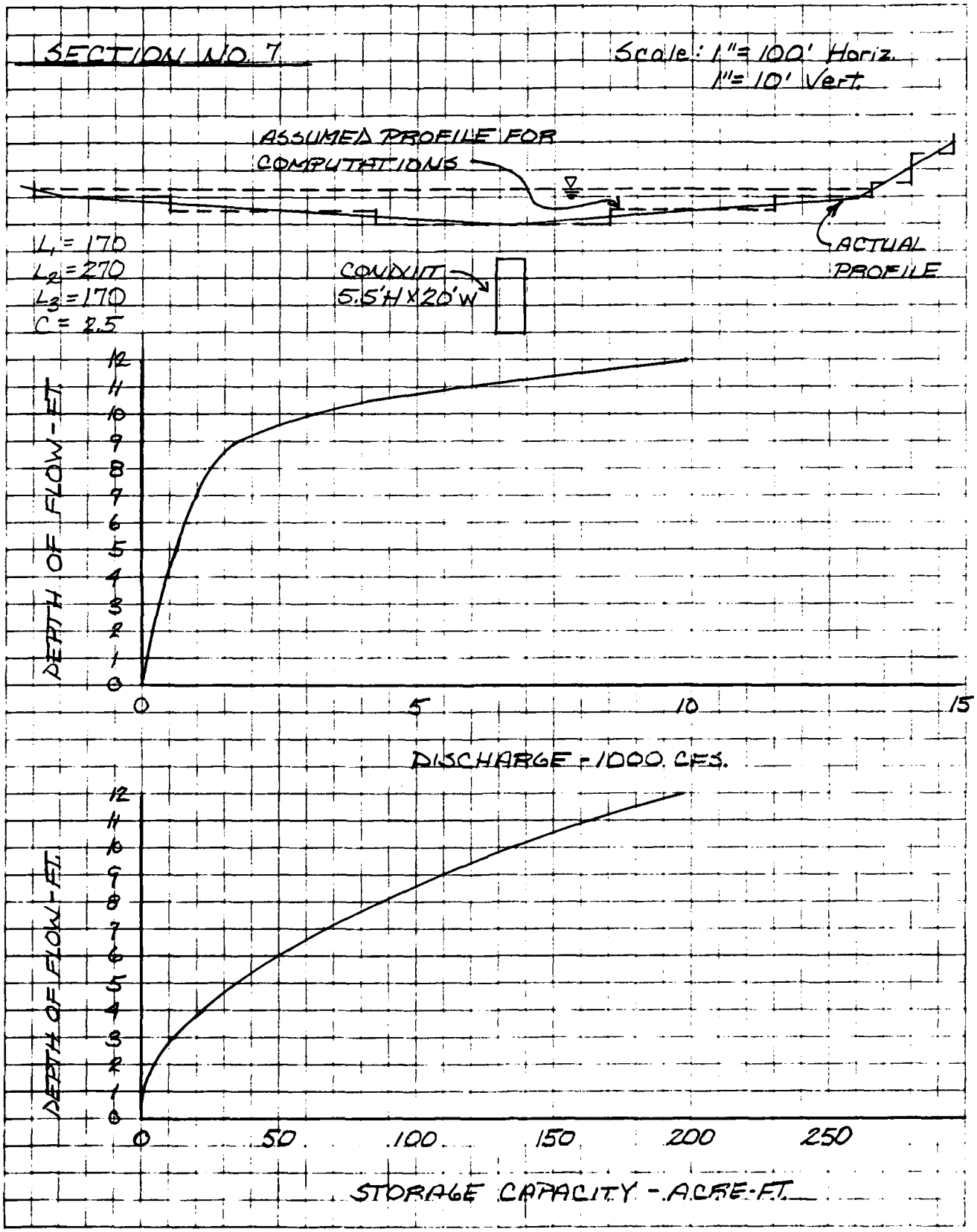
REACH OUTFLOW=QP2= 5046 CFS
HEIGHT ABOVE CONDUIT INVERT=H2= 10.6 FT.

BY LBG DATE 8/19/80. **ROALD HAESTAD, INC.** SHEET NO. 26 OF 37

CONSULTING ENGINEERS

CKD BY DLS DATE 9/18/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - FLOOD ROUTING



SECTION NUMBER 8

STORAGE CAPACITY WITHIN REACH

HEIGHT (FEET)	SURFACE AREA (ACRES)	STORAGE VOLUME (ACRE-FEET)
1.0	7.80	7.4
2.0	8.60	15.6
3.0	9.40	24.6
4.0	10.20	34.4
5.0	11.00	45.0
6.0	12.60	56.8
7.0	14.20	70.2
8.0	15.80	85.2
9.0	17.40	101.8
10.0	19.00	120.0
11.0	20.60	139.8
12.0	22.20	161.2
13.0	23.80	184.2
14.0	25.40	208.8
15.0	27.00	235.0

STORAGE CAPACITY CALCULATED FROM SURFACE AREAS AT KNOWN ELEVATIONS.

SECTION NUMBER 8

HOADLEY POND DAM

HEIGHT ABOVE SPILLWAY LEVEL (FEET)	SPILLWAY DISCHARGE CAPACITY (CFS)
1.0	228
2.0	644
3.0	1184
4.0	1822
5.0	2567
6.0	3633
7.0	4985
8.0	6564
9.0	8340
10.0	10289
11.0	12407
12.0	14679
13.0	17104
14.0	19671
15.0	22382

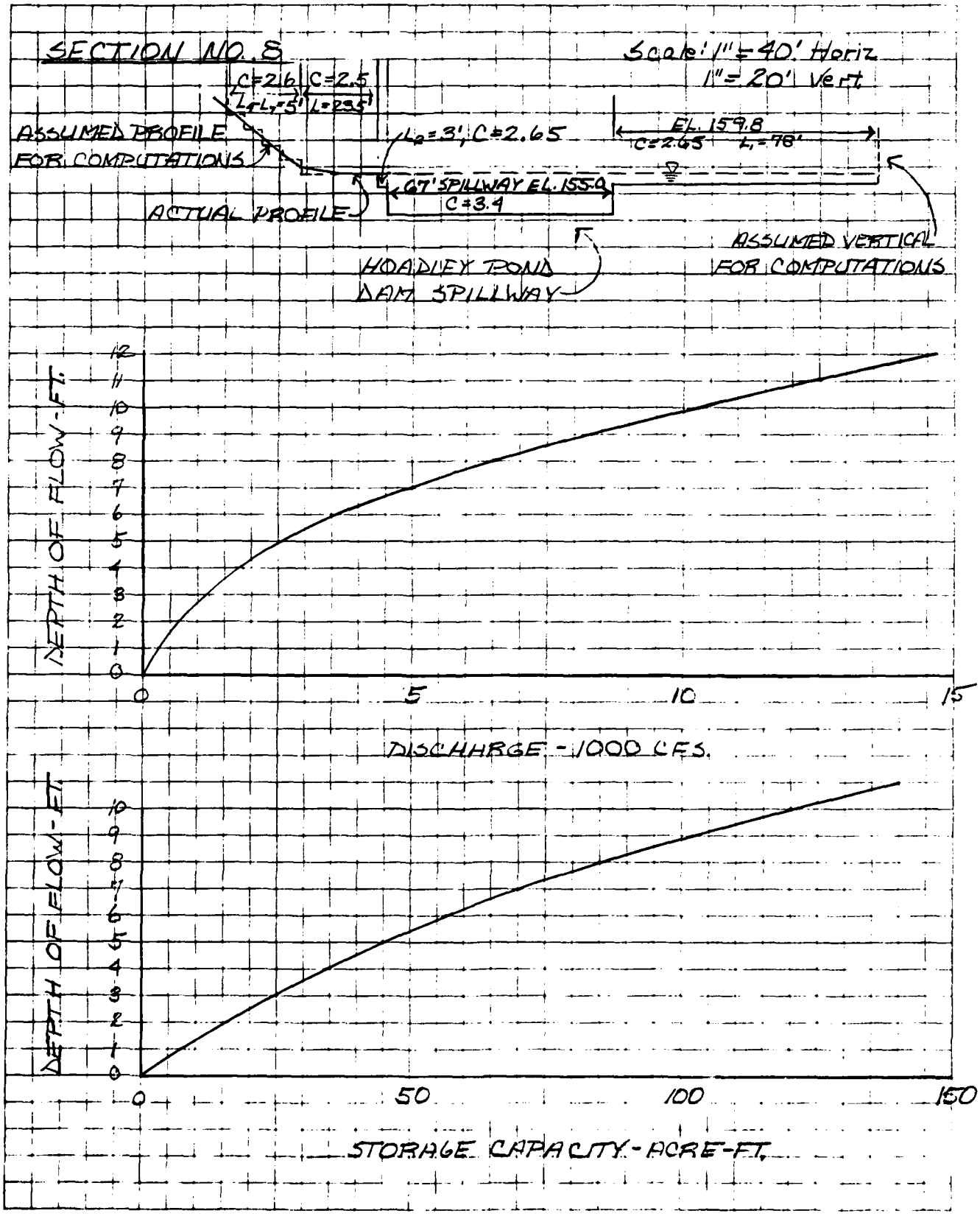
STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 3500 FT.

INFLOW INTO REACH=QP1= 5046 CFS
HEIGHT ABOVE SPILLWAY LEVEL=H1= 7.0 FT.
STORAGE IN REACH=V1= 70.8 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 3761 CFS
TRIAL HEIGHT ABOVE SPILLWAY LEVEL=H(TRIAL)= 6.1 FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 58.1 AC. FT.

REACH OUTFLOW=QP2= 3877 CFS
HEIGHT ABOVE SPILLWAY LEVEL=H2= 6.2 FT.

ROALD HAESTAD, INC.
CONSULTING ENGINEERS
37 Brookside Road - Waterbury, Conn. 06708



BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 30 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 9A

MAIN CHANNEL

H	W	A	R	S	V	Q
1.0	13	6	.48	.0125	2.89	18
2.0	26	25	.95	.0125	4.59	113
3.0	33	53	1.61	.0125	6.53	347
4.0	38	86	2.29	.0125	8.24	710
5.0	42	123	2.91	.0125	9.67	1189
6.0	47	164	3.49	.0125	10.91	1788
7.0	52	209	4.04	.0125	12.03	2510
8.0	55	256	4.70	.0125	13.32	3415
9.0	57	305	5.38	.0125	14.57	4444
10.0	59	354	6.02	.0125	15.70	5561
11.0	61	404	6.62	.0125	16.73	6757
12.0	63	454	7.19	.0125	17.68	8027
13.0	65	505	7.73	.0125	18.56	9367
14.0	67	556	8.25	.0125	19.38	10771

MANNING COEFFICIENT=N=.0350

BY SAL DATE 9/18/80 ROALD HAESTAD, INC. SHEET NO 31 OF 37

CKD BY DLS DATE 9/18/80 CONSULTING ENGINEERS JOB NO 49-026

SUBJECT SWAN LAKE DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 9B

LEFT OVERBANK

H	W	A	R	S	V	Q
11.0	4	1	.14	.0125	1.11	1
12.0	18	11	.60	.0125	2.96	31
13.0	31	33	1.06	.0125	4.32	144
14.0	39	67	1.72	.0125	5.96	398

MANNING COEFFICIENT=N=.0400

SECTION NUMBER 9

TOTAL SECTION

	AREA			DISCHARGE		
H	A	B	TOTAL	A	B	TOTAL
1.0	6	0	6	18	0	18
2.0	25	0	25	113	0	113
3.0	53	0	53	347	0	347
4.0	86	0	86	710	0	710
5.0	123	0	123	1189	0	1189
6.0	164	0	164	1788	0	1788
7.0	209	0	209	2510	0	2510
8.0	256	0	256	3415	0	3415
9.0	305	0	305	4444	0	4444
10.0	354	0	354	5561	0	5561
11.0	404	1	404	6757	1	6758
12.0	454	11	465	8027	31	8059
13.0	505	33	538	9367	144	9511
14.0	556	67	623	10771	398	11169

STORAGE AT TIME OF FAILURE=S= 278 AC. FT.
LENGTH OF REACH=L= 2500 FT.

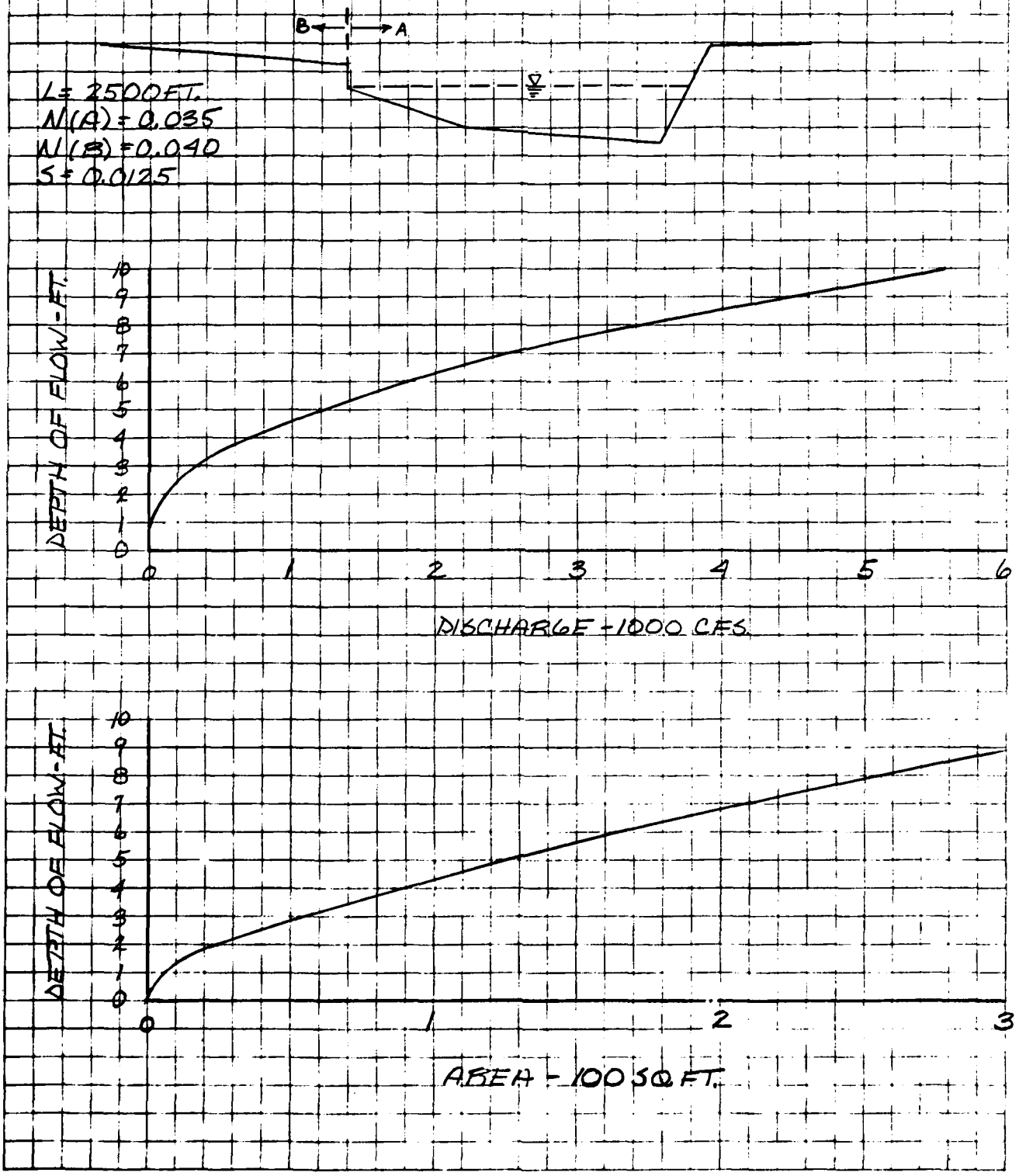
INFLOW INTO REACH=QP1= 3877 CFS
DEPTH OF FLOW=H1= 8.5 FT.
CROSS SECTIONAL AREA=A1= 279 SQ. FT.
STORAGE IN REACH=V1= 16.0 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 3654 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 8.2 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 268 SQ. FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 15.4 AC. FT.

REACH OUTFLOW=QP2= 3658 CFS
DEPTH OF FLOW=H2= 8.2 FT.

SECTION NO. 9 (Plaza) (Field Surveyed) (See Figure 5)

Scale: 1"=20' Horiz.
1"=20' Vert.



SECTION NUMBER 10

SWAN COMPANY DAM

HEIGHT ABOVE SPILLWAY LEVEL (FEET)	SPILLWAY DISCHARGE CAPACITY (CFS)
1.0	197
2.0	558
3.0	1025
4.0	1578
5.0	2260
6.0	3183
7.0	4265
8.0	5477
9.0	6804

REACH OUTFLOW=QP2= 3658 CFS
HEIGHT ABOVE SPILLWAY LEVEL=H2= 6.4 FT.

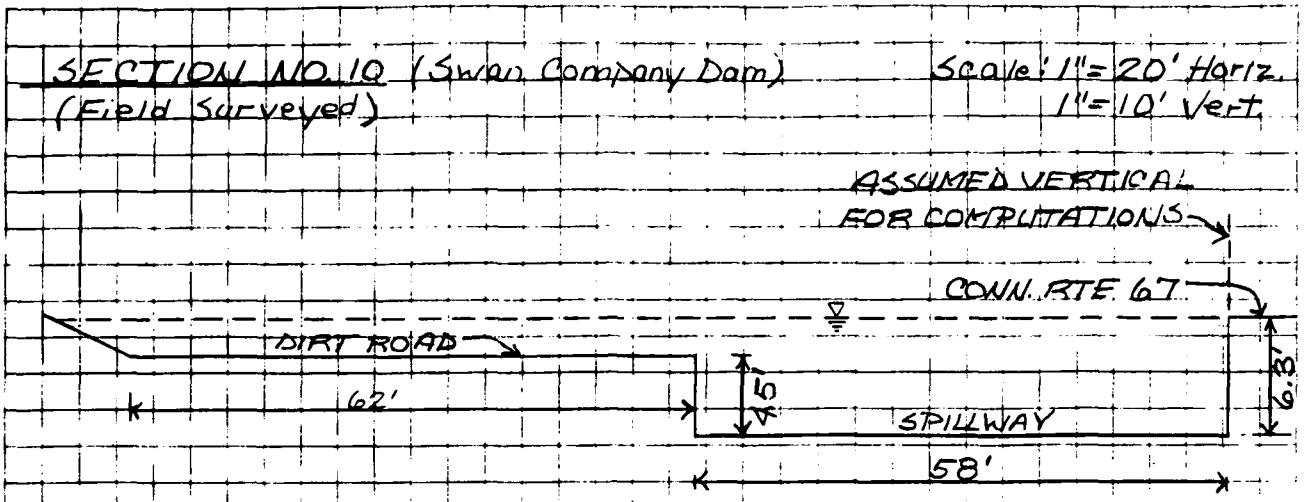
BY LBG DATE 8/20/80 **ROALD HAESTAD, INC.** SHEET NO 35 OF 37

CONSULTING ENGINEERS

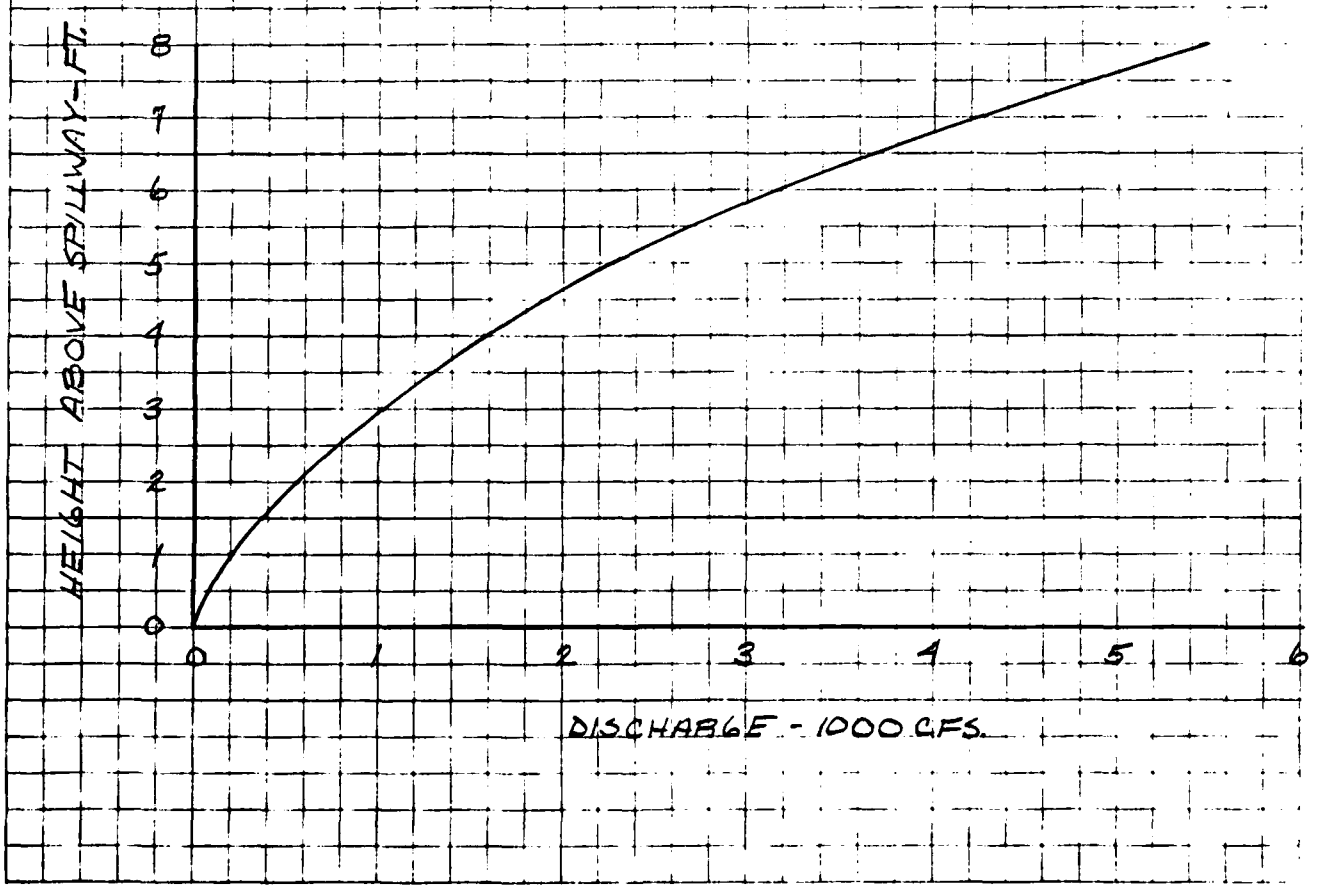
CKD BY DLS DATE 9/18/80 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-026

SUBJECT SWAN LAKE DAM - DEPTH OF FLOW

SECTION NO. 10 (Swan Company Dam) Scale: 1"=20' Horiz.
(Field Surveyed) 1"=10' Vert.



SPILLWAY DISCHARGE COEFFICIENT = 3.4
DIRT ROAD DISCHARGE COEFFICIENT = 2.5



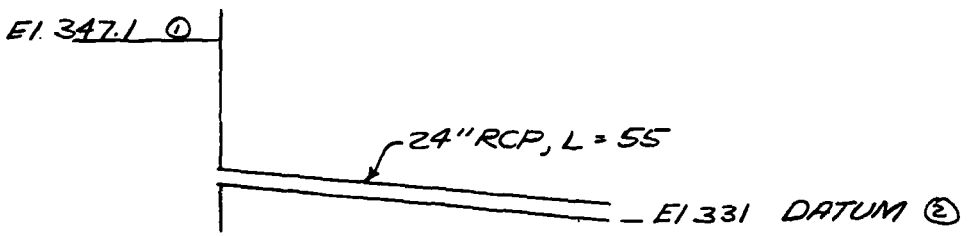
SUBJECT SWAN LAKE DAM - Blowoff Capacity

Assume: the blowoff is a 24" RCP approximately 55 feet in length.

Top of dam El. 347.1
Inv. of blowoff El. 331.0

Head losses: 1) friction = $f\frac{L}{D}\frac{V_2^2}{2g}$
2) Entrance - flush = $0.5\frac{V_2^2}{2g}$

Note: Sluice gate controlling the outlet is assumed not to cause any head loss in the open position.



$$P_1 + Z_1 + V_1^2/2g = P_2 + Z_2 + V_2^2/2g + H_{L\,1-2}$$

$$0 + 16.1 + 0 = 0 + 0 + V_2^2/2g + H_{L\,1-2}$$

$$16.1 = (27.5f + 0.5 + 1)\,V_2^2/2g$$

Solve by trial and error:

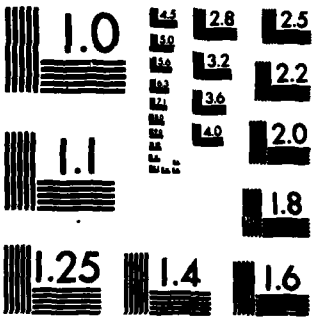
Assume $V_2 = 15$ ft/sec $\rightarrow f = 0.0355$ $\therefore V_2 = 24$ ft/sec
" $V_2 = 24$ ft/sec $\rightarrow f = 0.0348$ $\therefore V_2 = 20.5$ ft/sec
" $V_2 = 21$ ft/sec $\rightarrow f = 0.03505$ $\therefore V_2 = 20.5$ ft/sec

Discharge Capacity at top of dam:

$$Q = V_2 A$$
$$= 20.5 \text{ ft/sec} \times \pi(2)^2/4$$
$$= 64.4 \text{ use } 64 \text{ ft}^3/\text{sec}$$

AD-A144 165 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
SWAN LAKE DAM (CT 003..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV SEP 80

UNCLASSIFIED F/G 13/13 NL



SUBJECT SWAN LAKE DAM - SURFACE AREAS

PLANIMETER READINGS:
(SCALE: 1" = 2000')

1.) WATERSHED (AREA 1): THIRD 15.68 SQ. IN. 4.03
FIRST 7.64 SQ. IN. 4.04
START 3.60 SQ. IN.

2.) WATERSHED (AREA 2): THIRD 49.06 SQ. IN. 2.83
FIRST 43.40 SQ. IN. 2.84
START 40.56 SQ. IN.

TOTAL WATERSHED = AREA 1 + AREA 2 = 4.03 + 2.83 = 6.86 SQ. IN.

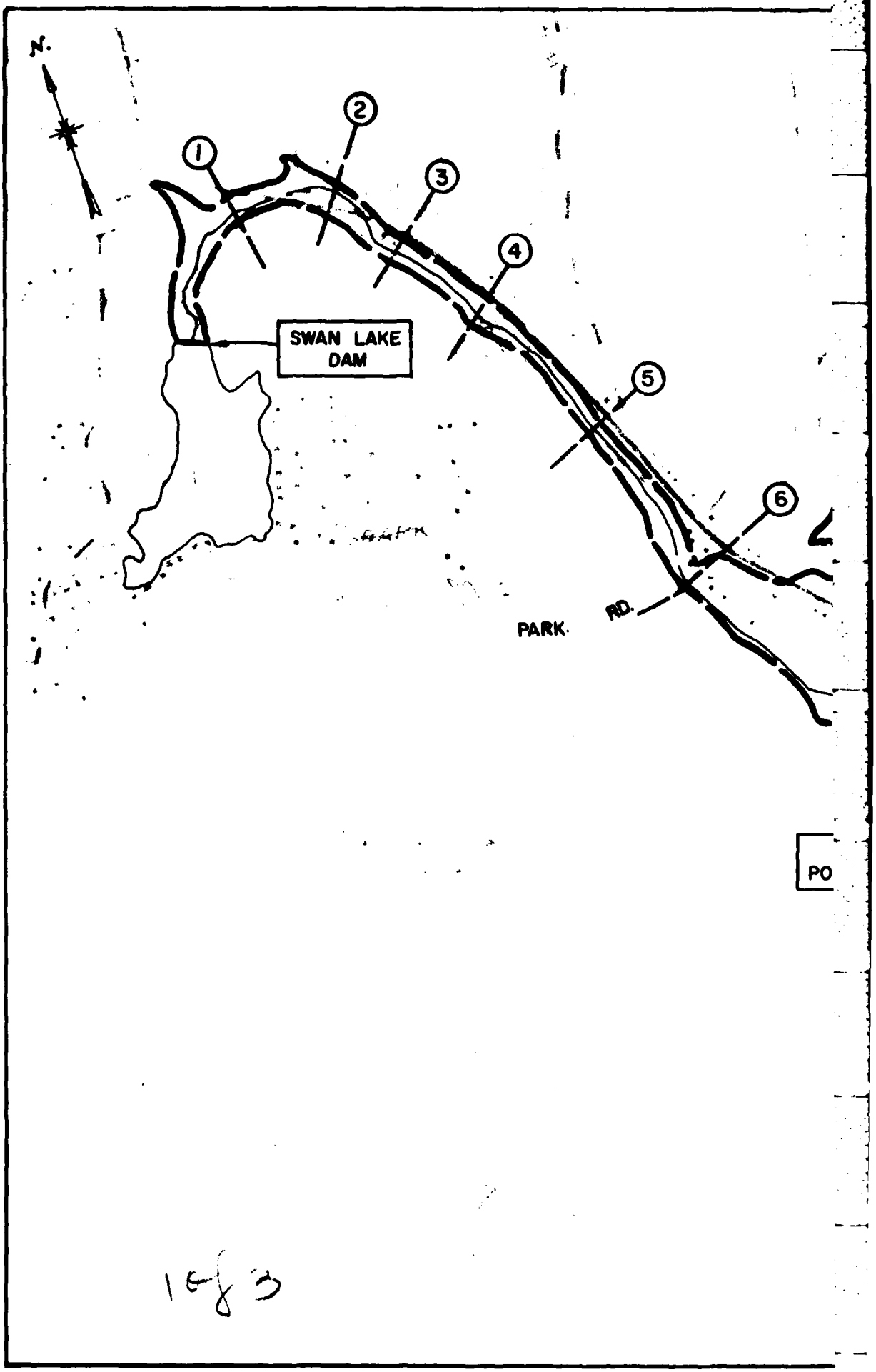
$$6.86\ IN^2 \times \frac{(2000\ FT.)^2}{IN.^2} \times \frac{1\ ACRE}{43{,}560\ FT.^2} = 630\ ACRES$$

3.) ELEV. 345 (WATER SURFACE): THIRD 2.37 SQ. IN. 0.29
FIRST 1.79 SQ. IN. 0.30
START 1.49 SQ. IN.

$$0.29\ IN.^2 \times \frac{(2000\ FT.)^2}{IN.^2} \times \frac{1\ ACRE}{43{,}560\ FT.^2} = 26.6\ ACRES$$

4.) CONTOUR 350: THIRD 3.63 SQ. IN. 0.42
FIRST 2.80 SQ. IN. 0.43
START 2.37 SQ. IN.

$$0.42\ IN.^2 \times \frac{(2000\ FT.)^2}{IN.^2} \times \frac{1\ ACRE}{43{,}560\ FT.^2} = 38.6\ ACRES$$



1 of 3

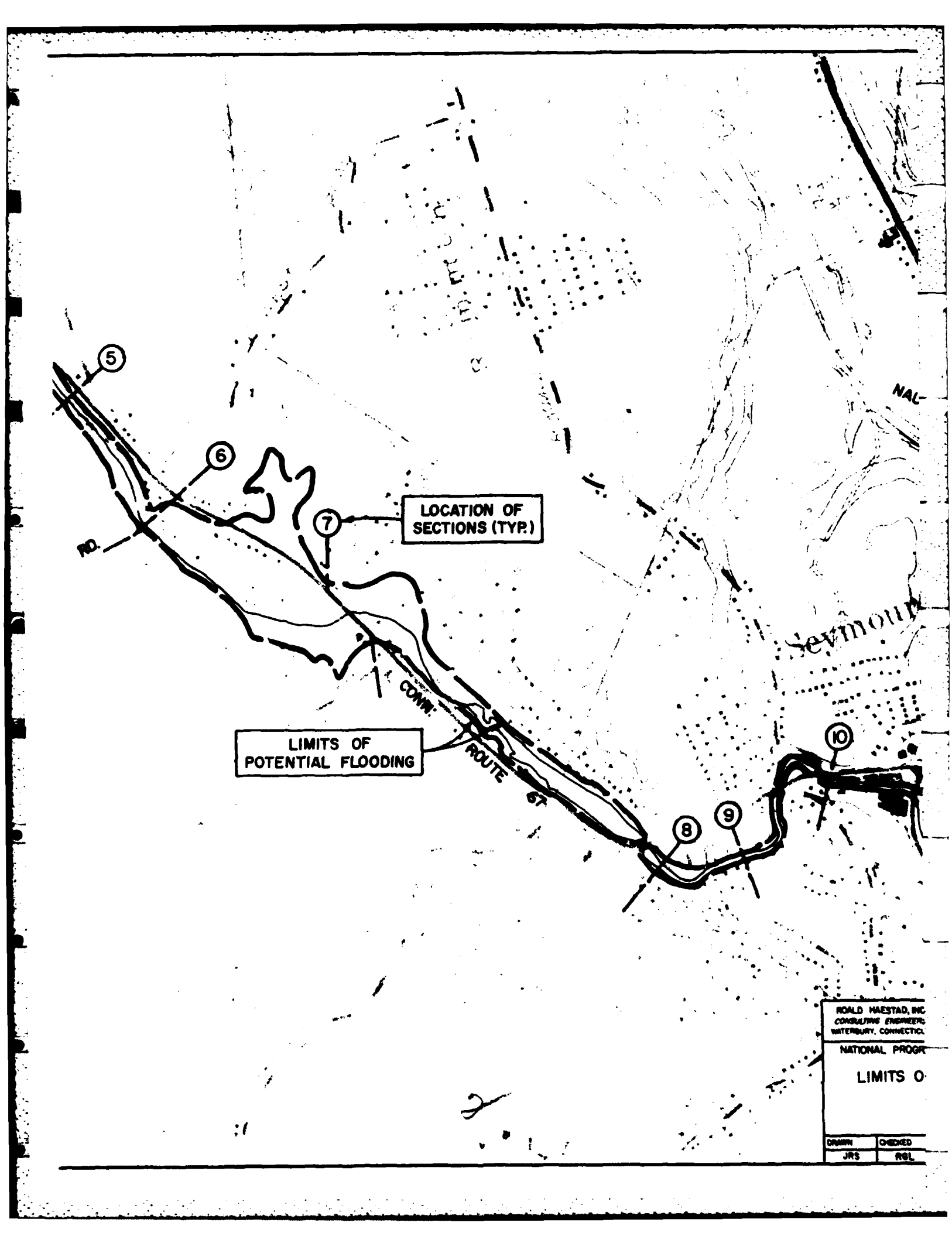
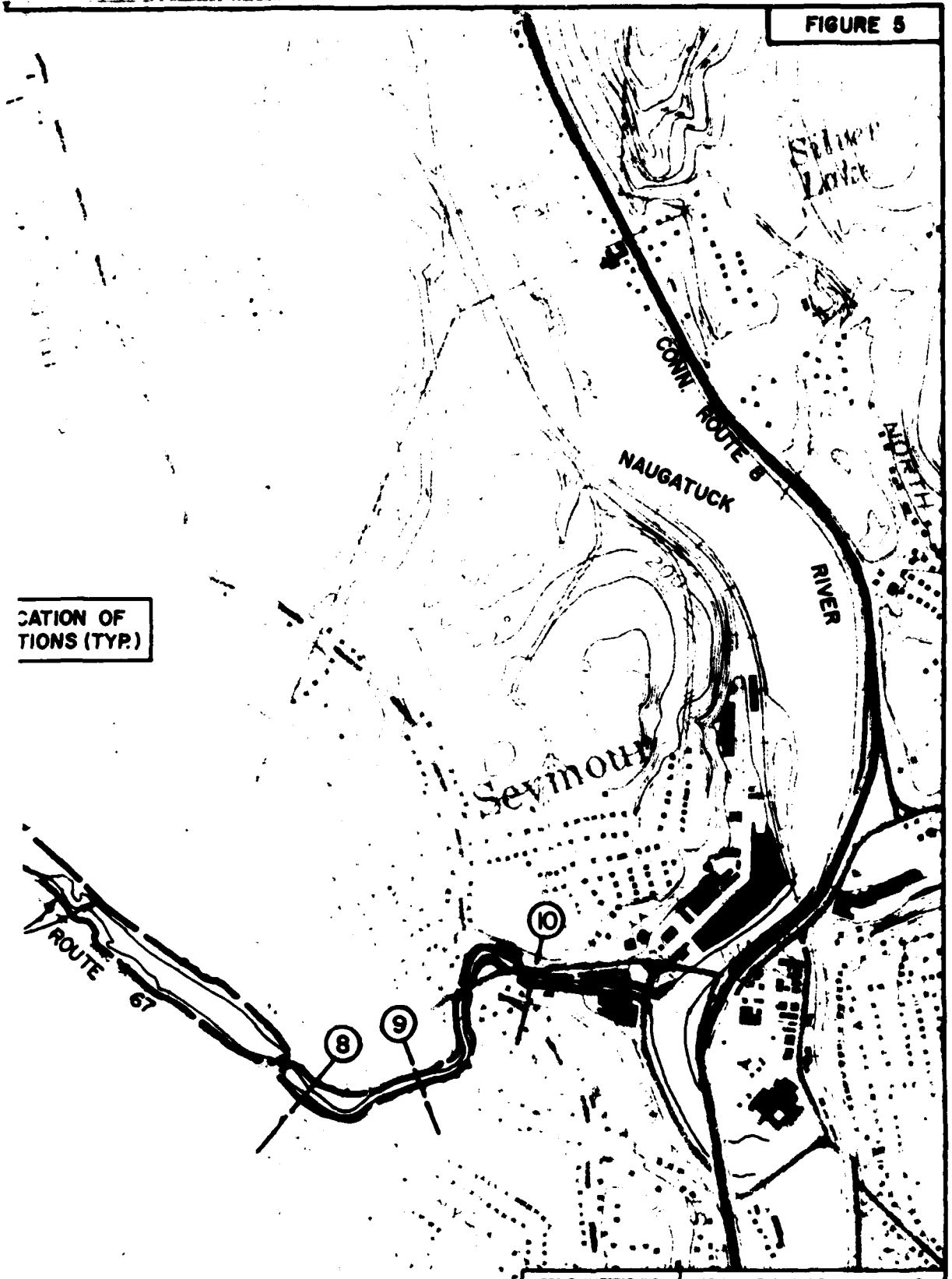

5
6
7
LOCATION OF SECTIONS (TYP.)
LIMITS OF POTENTIAL FLOODING
RD.
CONN.
ROUTE 67
8
9
10
NAL-
Vermont
ROALD HAESTAD, INC
CONSULTING ENGINEERS
WATERBURY, CONNECTICUT
NATIONAL PROGR
LIMITS O
DRAWN
JRS
CHECKED
RGL

FIGURE 5



RONALD MAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LIMITS OF POTENTIAL FLOODING

SWAN LAKE DAM

OXFORD, CONNECTICUT

DRAWN	CHECKED	APPROVED	SCALES 1" = 1000'
JRS	RGL	RH	DATE SEPT. 1980 PAGE D - 38

3 of 3

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

END

FILMED

DTIC