AD-A142 708 HOUSATONIC RIVER BASIN DANBURY CONNECTICUT LOWER KOHANZA DAM (CT 00064) N..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV MAY 81 1/2

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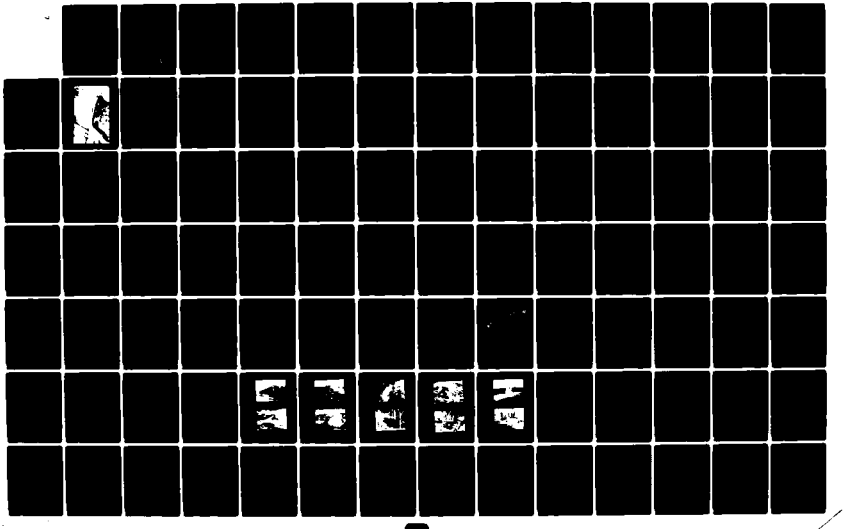

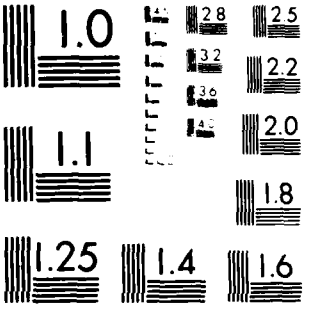

HOUSATONIC RIVER BASIN

DANBURY, CONNECTICUT

LOWER KOHANZA DAM
CT 00064

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

MAY 1981

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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4. TITLE (and Subtitle): Housatonic River Basin Danbury, Conn., Lower Kohanza Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS	5. TYPE OF REPORT & PERIOD COVERED: INSPECTION REPORT
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9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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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,

Housatonic River Basin Danbury, Conn.,
Lower Kohanza Dam

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

The original Lower Kohanza Dam was constructed about 1860 for the Town of Danbury to provide a public water supply. The existing structure is a 336-foot-long and 27-foot-high earthfill dam. The upstream slope is inclined at approx. 3H:1V and is protected with riprap except for a 12-foot-wide strip near the crest of the dam. The downstream face of the dam has a 2H:1V slope and is completely covered with tall grasses, thicket and brush. A 16-inch diameter cast iron water supply conduit passing through the dam approx. 125 ft. from the left abutment is used to draw water from the reservoir. Flow from this conduit is pumped to West Lake Reservoir where it enters the Danbury water supply system.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

JUL 17 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Lower Kohanza Dam (CT-00064) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis.

The preliminary hydrologic analysis indicated that the spillway capacity for the Lower Kohanza Dam would likely be exceeded by floods greater than 19 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam classified as high hazard with a spillway capacity insufficient to discharge fifty percent of the PMF be judged as having a seriously inadequate spillway. As a result, this dam is assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

We recommend that within twelve months from the date of this report the owner of the dam engage the services of a qualified registered engineer to determine further the potential of overtopping the dam and the need for and the means to increase project discharge capacity. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed and round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge.

NEDED
Honorable William A. O'Neill

I approve the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the program.

Copies of this report have been forwarded to the Department of Environmental Protection and to the owner, City of Danbury, Public Utilities, 155 Deerhill Avenue, Danbury, CT 06810. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

LOWER KOHANZA DAM

CT 00064

HOUSATONIC RIVER BASIN

DANBURY, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: CT 00064

Name of Dam: Lower Kohanza Dam

Town: Danbury

County and State: Fairfield, Connecticut

Stream: Kohanza Brook

Date of Inspection: January 21 and February 19, 1981

BRIEF ASSESSMENT

The original Lower Kohanza Dam was constructed about 1860 for the Town of Danbury to provide a public water supply. The existing structure is a 336-foot-long and 27-foot-high earthfill dam. The upstream slope is inclined at approximately 3H:1V and is protected with riprap except for a 12-foot-wide strip near the crest of the dam. The downstream face of the dam has a 2H:1V slope and is completely covered with tall grasses, thicket and brush. A 16-inch diameter cast iron water supply conduit passing through the dam approximately 125 feet from the left abutment is used to draw water from the reservoir. Flow from this conduit is pumped to West Lake Reservoir where it enters the Danbury water supply system.

The spillway is separated from the dam by a rocky knoll at the right abutment of the dam. The spillway is a masonry structure and has a crest length of 14 feet (El. 571 NGVD) and is shaped on the right bank by a natural rock outcrop and on the left by an earth and masonry dike extending from the adjacent knoll.

The visual inspection of the dam indicated that the structure is in poor condition. Several seepage points and wet areas were observed at the toe of the dam, and the spillway and the adjacent dike were in a state of disrepair.

The Lower Kohanza Dam has a maximum potential storage capacity of 100 acre-feet (ac-ft) and is approximately 27 feet in height. Since the dam is within the Corps' criteria for the small size category for storage (50 to 1000 ac-ft), the dam is considered to be SMALL in size. The failure of the dam could potentially cause the loss of more than a few lives; therefore, the dam has been classified as having a HIGH hazard potential.

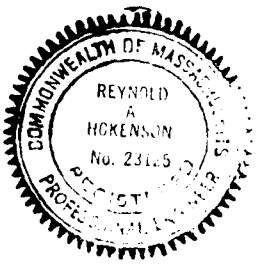
In accordance with the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", the size classification (SMALL), and the hazard classification (HIGH) of the dam, the test flood will be between one-half the Probable Maximum Flood (1/2 PMF) and the Probable Maximum Flood (PMF). Since the size and storage capacity for the dam are within the lower limits of the small size category the smaller test flood was selected. Therefore, the test flood for the Lower Kohanza Dam will be equivalent to one-half the Probable Maximum Flood. As a result, the peak inflow to the reservoir will be 965 cubic feet per second per square mile (cfs/sq. mi.) or 930 cubic feet per second (cfs) and the peak outflow is 800 cfs. The capacity of the spillway, with the water surface at the top of the dam, is 300 cfs or 38 percent of the routed test flood outflow.

It is recommended that the owner retain the services of a qualified registered professional engineer to investigate the areas where seepage was observed and remedy the situation if necessary, determine if piping has occurred along the water supply conduit, develop a program for the repair of the spillway, dike, and eroded areas on the embankment and provide the means of emergency closure of the water supply conduit at the upstream intake.

The recommendations and remedial measures outlined above and discussed in Section 7 should be instituted within one (1) year of the owner's receipt of this report unless immediate action is specified.

Reynold A. Hokenson, P.E.

Reynold A. Hokenson, P.E.
Project Manager
International Engineering Company, Inc.



This Phase I Inspection Report on Lower Kohanza 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 judgement and practice, and is hereby submitted for approval.

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

ARAMAST MAHTESIAN, MEMBER
Geotechmical Engineering Branch
Engineering Division

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

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 to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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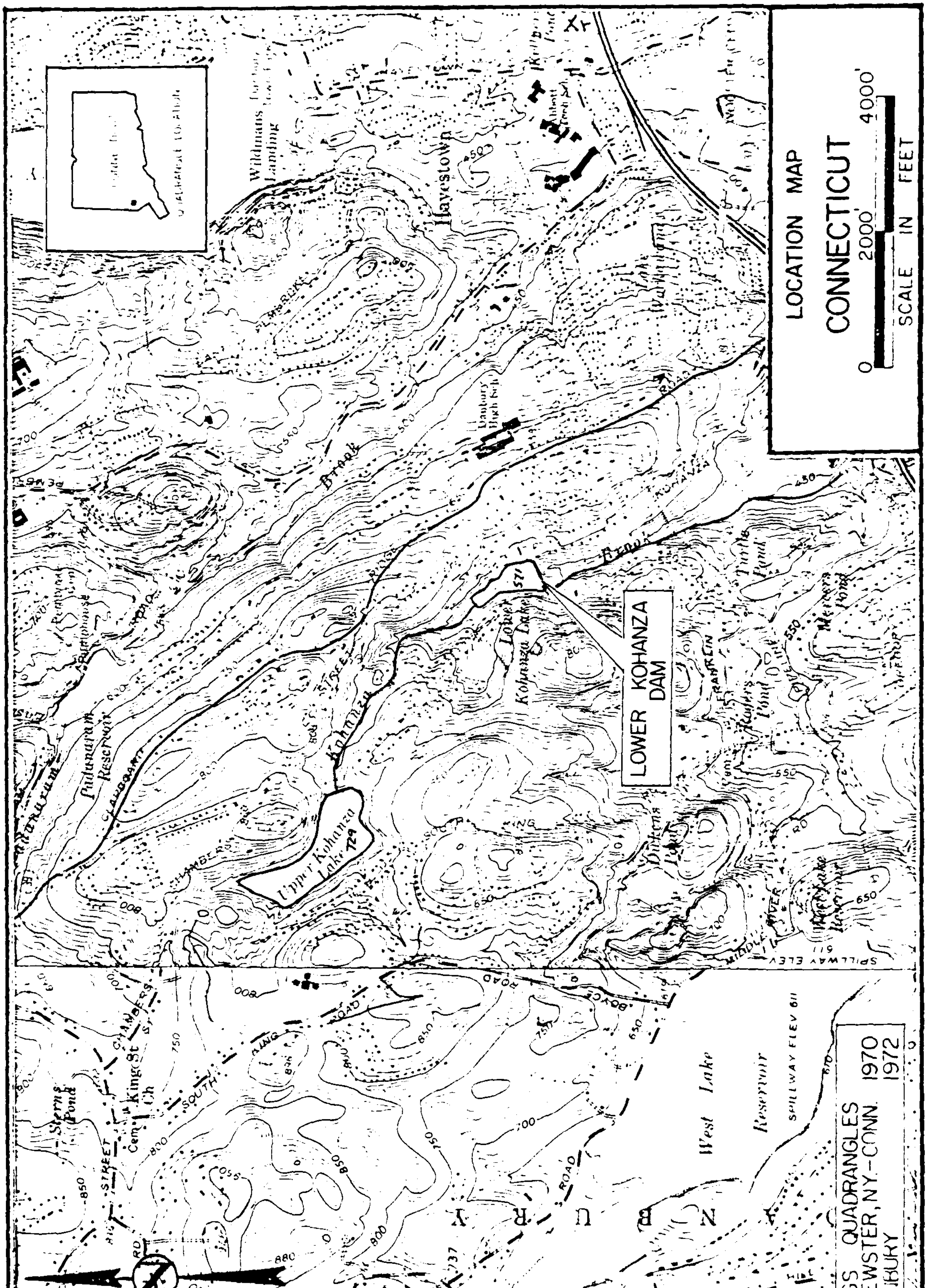
OVERVIEW PHOTO-LOWER KOHANZA DAM
FEBRUARY 3, 1981


LOCATION MAP
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2000'
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SCALE IN FEET
LOWER KOHANZA DAM
Upper Kohanza Lake
Lower Kohanza Lake
West Lake Reservoir
Hayestown
USGS QUADRANGLES
BREWSTER, NY-CONN. 1970
DANBURY 1972

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

LOWER KOHANZA DAM

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 Natonal Program of Dam Inspection. 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. International Engineering Company, Inc., has been retained by the Corps' New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to International Engineering Company in a letter dated November 5, 1980, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-81-C-0015 has been designated by the Corps for this work.

b. Purpose of Inspection Program — The purposes of the program are to:

(1) Perform technical inspections and evaluations of non-Federal dams to identify conditions requiring correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for the non-Federal dams.

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

c. Scope of Inspection Program — The scope of this Phase I Inspection Report includes:

(1) Gathering, reviewing, and presenting all available data as can be obtained from the owners, previous owners, the state, and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments, and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The purpose of the inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location — The dam is located on Kohanza Brook in the City of Danbury, Fairfield County, Connecticut, approximately 2 miles upstream from the confluence with Still River which is a tributary of the Housatonic River. The location of the dam is defined by latitude N41°24.9' and longitude W73°28.7' on the Danbury, Connecticut, USGS Quadrangle Map.

b. Description of Dam and Appurtenances — The facility consists of a 336-foot-long, 27-foot-high earthfill dam, a 14-foot-wide masonry spillway located approximately 100 feet west of the right abutment of the dam, and the appurtenances required to utilize the reservoir as a public

water supply (see Appendix B, Sheet B-1). The appurtenances include an upper masonry gatehouse located within the reservoir approximately 50 feet from the top of the dam and 136 feet from the left abutment, a 16 inch diameter cast iron conduit that connects the upper gatehouse with an abandoned lower masonry gatehouse on the downstream toe, and a brick pumphouse adjacent to the lower gatehouse. Water is drawn from the reservoir via the 16-inch conduit and pumped approximately 1.5 miles to West Lake Reservoir.

The dam is approximately 13 feet wide at the top (El. 575 NGVD; Note: All elevations are referenced to the National Geodetic Vertical Datum), and the upstream and downstream slopes have inclinations of 3H:1V and 2H:1V, respectively. The upstream slope is protected by a layer of riprap to an elevation of 571 NGVD, while the remainder of the upstream slope, the downstream slope, and the top of the dam have been overgrown by a dense layer of groundcover.

The spillway channel is formed on the left side by a short dike that extends out from the knoll located between the spillway and the dam and on the right side by a rock outcrop in the adjacent hillside. The spillway crest (El. 571) is defined by a 14-foot-long stone wall extending between the dike and the rock outcrop. Flow from the reservoir is diverted to the spillway through a 135-foot-long approach channel. The width of this channel varies from 70 feet at the entrance to less than 40 feet near the spillway. The spillway discharges directly into Kohanza Brook. This reach of the brook, extending 200 feet downstream of the spillway, has a bottom width of approximately 15 feet and 1H:1V side slopes.

c. Size Classification - SMALL — The size classification is based on the height of the dam above the natural streambed or the maximum storage potential, which is considered to be the storage resulting from the water surface elevation within the impoundment being equal to the elevation of the top of the dam. The size of the dam is then determined by either storage or height depending on which criteria yields the larger size category. Lower Kohanza Dam has a maximum potential storage capacity of 100 ac-ft, which is within the established limits for the

small size category (50 ac-ft to 1,000 ac-ft), and the height of the dam (27 feet) is also within the limits for the small size category (25 feet to 40 feet). Consequently, the dam is considered to be SMALL in size.

d. Hazard Classification - HIGH — The hazard classification is based on the estimated loss of life and the anticipated property damage due to a dam breach when the water surface, within the impoundment, is at the top of the dam. The failure of Lower Kohanza Dam would cause the water level within the impact area to rise from 0.7 feet at a prefailure outflow of 300 cfs to 10.7 feet after the failure. The potential impact area encompasses 4 homes which are located along Kohanza Brook between 400 and 600 feet from the dam. Two homes (400 feet downstream from the dam) have first floor elevations that are approximately 8 feet above the streambed. The remaining 2 homes (600 feet downstream from the dam) have first floor elevations that are 10 to 12 feet above the streambed. Consequently, 2 homes will be flooded to a depth of approximately 3 feet while the remaining 2 homes will experience less than 1 foot of flooding. Since there is the potential for the loss of more than a few lives, the dam has been classified as having a HIGH hazard potential.

e. Ownership - City of Danbury
Public Utilities
155 Deerhill Avenue
Danbury, Connecticut 06810

f. Operator - Daniel Garamella
Director of Public Works
(203) 797-4537

g. Purpose — The Lower Kohanza Lake Reservoir is used in conjunction with the Upper Kohanza Lake Reservoir to supplement the public water supply in Danbury. Water flows from the Upper to the Lower Reservoir via Kohanza Brook where it is pumped to West Lake Reservoir before entering the public water supply system.

h. Design and Construction History — The original dam was constructed about 1860 by the Town of Danbury to impound a water supply reservoir. In February 1869, the dam was destroyed by a flood wave, which resulted from the breach of the Upper Kohanza Dam. According to the available records, restoration of the two dams began immediately after the incident (see Appendix B, pgs. B-11 & B-12). No information was available regarding the original or the reconstructed Lower Kohanza Dam.

i. Normal Operational Procedures — The water level within the reservoir is normally maintained at the spillway crest (El. 571). Discharge from the reservoir may occur over the spillway crest or through the water supply conduit. However, the water supply outlet is only operated as necessary during dry periods.

1.3 PERTINENT DATA

a. Drainage Area — The drainage area consists of 0.96 square miles (sq. mi.) of rolling terrain; however, approximately half (0.41 sq. mi.) of the watershed drains into Upper Kohanza Lake before it reaches Lower Kohanza Lake.

b. Discharge of the Dam Site — Discharges from the dam site normally occur through the spillway but may also be released through the 16-inch-diameter water supply conduit.

(1) Discharge from the water supply conduit (invert El. 548) occurs independent of the water surface elevation within the impoundment since it is regulated by an electrically operated pump.

(2) The maximum known flood at the dam site destroyed the original dam in February 1869.

(3) Ungated capacity of the spillway is 300 cfs with the water surface at elevation 575.

(4) Ungated spillway capacity at test flood elevation 576 is 405 cfs.

(5) Gated spillway capacity at normal pool elevation - N/A.

(6) Gated spillway capacity at test flood elevation - N/A.

(7) Total spillway capacity at test flood elevation 576 is 405 cfs.

(8) Total project discharge at top of dam (elevation 575) is 300 cfs.

(9) Total project discharge at test flood (elevation 576) is 800 cfs.

c. Elevation (feet above NGVD)

(1) Streambed at the toe of dam	548
(2) Bottom of cutoff	Unknown
(3) Maximum tailwater	Unknown
(4) Normal pool	571
(5) Flood-control pool	N/A
(6) Spillway crest	571
(7) Design surcharge (original design)	Unknown
(8) Top of dam	575
(9) Test flood surcharge	576

d. Reservoir (length in feet)

(1) Normal pool	1,000

(2) Flood-control pool	N/A
(3) Spillway crest pool	1,000
(4) Top of dam	1,150
(5) Test flood pool	1,200

e. Storage (acre-feet)

(1) Normal pool	55
(2) Flood-control pool	N/A
(3) Spillway crest pool	55
(4) Top of dam	100
(5) Test flood pool	115

f. Reservoir Surface (acres)

(1) Normal pool	10
(2) Flood-control pool	N/A
(3) Spillway crest	10
(4) Top of dam	11
(5) Test flood pool	12

g. Dam

(1) Type	Earthfill embankment

(2) Length	336 ft
(3) Height	27 ft
(4) Top Width	13 ft
(5) Side Slopes	3H:1V upstream and 2H:1V downstream
(6) Zoning	Unknown
(7) Impervious Core	Unknown
(8) Cutoff	Unknown
(9) Grout Curtain	Unknown
(10) Other	None

h. Diversion Canal — N/A

i. Spillway

(1) Type	Broad-crested masonry weir
(2) Length of weir	14 ft
(3) Crest elevation	571 ft
(4) Gates	None
(5) U/S Channel	Stone masonry
(6) D/S Channel	Kohanza Brook

j. Regulating Outlets — Water supply conduit

(1) Invert Elevation	548
(2) Size	16-inch diameter
(3) Description	Cast Iron
(4) Control Mechanism	Electrically operated pumps
(5) Other	None

SECTION 2 _ ENGINEERING DATA

2.1 DESIGN DATA

No design data were available for the Lower Kohanza Dam.

2.2 CONSTRUCTION DATA

There are no provisions for monitoring the reservoir level or the condition of the dam. According to the representative from the City of Danbury, the water supply equipment is only engaged during dry periods. The only account of the operation of this equipment is maintained in the daily work records; however, the amount of discharge is not measured.

2.4 EVALUATION OF DATA

a. Availability — The State of Connecticut Water Resources Department provided a data inventory sheet and an inspection report which had been submitted by Clarence Blair Associates, Civil and Sanitary Engineers, on November 29, 1965 (see Appendix B). The City of Danbury provided the Plan and Profile of the Kohanza Pipe Line that was prepared by Chester M. Everett (8/26/36). In addition, the City of Danbury made the site accessible and provided a representative for consultation during the inspection.

b. Adequacy — The available data was supplemented by field measurements performed by International Engineering Company engineers. However, since there was no information available concerning the dam design and construction, the assessment of the dam was based on the visual inspection, performance history, hydraulic computations of spillway capacity, and approximate hydrologic judgements.

c. Validity — Several discrepancies between the findings presented by Clarence Blair Associates in 1965 and the measurements and

observations performed during the field inspection were revealed regarding the external features of the structure. The field inspection identified a 336-foot-long, 27-foot-high earthfill structure that is 13 feet wide at the top. The upstream and downstream slopes were approximately 3H:1V and 2H:1V, respectively. In addition, it was determined that the spillway section was separated from the embankment by a 100-foot-wide knoll. The report submitted by Clarence Blair Associates described the earth dam as a 30-foot-high, 500-foot-long structure that is about 12 feet wide at the top. The slope of the downstream face was estimated to be 1H:1V.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General — The field inspection of the Lower Kohanza Dam was conducted on January 21 and February 19, 1981 and areas requiring repair, maintenance, and monitoring were identified. As a result, the general condition of the facility has been determined to be poor. At the time of the first inspection, the reservoir level was at 569 NGVD, and there was no flow over the existing spillway crest.

b. Dam — The dam is entirely covered by vegetation with the exception of those portions of the upstream slope that are covered by riprap (Photos 1 and 2). The growth on the dam primarily consists of tall grass and brush; however, there are a number of trees ranging from 4 to 16 inches in diameter growing on the downstream toe. The only signs of trespassing were narrow footpaths along the top of the dam and on the downstream slope.

The crest and slopes of the dam appear to have maintained their original alignment, and there were no signs of excessive settlements. However, indications of the deterioration of the embankment, spillway, and appurtenances were observed (Photos 3, 7 and 8). Erosion and sloughing has occurred on the upstream slope directly behind the upper gatehouse, resulting in the formation of a 10-foot-long, 10-foot-wide, and 2-foot-deep hole (Photo 4). Seepage flows totaling approximately 10 to 20 gallons per minute (gpm) were noted between the pumphouse and the left abutment along the toe of the dam. Flow from this area collects in two small streams and enters Kohanza Brook approximately 350 feet downstream of the dam (Photo 6). The presence of these streams, which have been eroded into the wooded area immediately downstream of the dam, suggests that seepage through the dam has occurred over an extended period of time. Seepage was also noted emanating from between the pumphouse and the gatehouse at a rate of about 5 gpm; however, it is unclear whether the flow originates within the dam or from the conduit

connecting these two structures (Photo 5). A small immeasurable quantity of seepage was also noted at the toe of the dam approximately 90 feet from the right abutment. The seepage flows on the left side of the dam and from between the pumphouse and lower gatehouse have deposited, to varying degrees, a fine brown residue on the downstream toe of the dam (Photo 5). However, the seepage flow observed at the toe of the dam in the vicinity of the right abutment was relatively clear (see Appendix C, pg. C-1, Photo Location Plan for the location of all seepage flows).

The masonry spillway structure is in a state of extreme disrepair (Photos 7 and 8). Many of the stones that had defined the spillway crest were displaced and have accumulated immediately downstream of the spillway. As a result, the spillway crest is irregular and its length is no longer clearly defined. The dike that had apparently formed the left spillway abutment has also deteriorated. The upstream slope of the dike, adjacent to the spillway approach channel, has been eroded and the displaced earthfill deposited in the approach channel. Several stones along the top of the vertical masonry retaining wall, forming the downstream face of the dike, have fallen into the spillway discharge channel (Kohanza Brook) thus adding to the accumulation of debris. The remainder of this wall also shows signs of movement in the downstream direction.

The banks of the spillway approach and discharge channels are wooded, and several trees ranging from 4 to 16 inches in diameter were noted overhanging the channels.

c. Appurtenant Structures — The original upper and lower masonry gatehouses are in place but are no longer used to regulate flow from the reservoir (Photos 9 and 10). Flow through the conduit connecting these structures is diverted to the pumphouse adjacent to the lower gatehouse (Photo 10). Currently, the regulation of discharge from the water supply conduit is performed with the equipment contained in the pumphouse. There is no upstream control on the water supply conduit.

The inspection of the piping within the pumphouse revealed a pipe flange leaking onto an adjacent electric motor at a rate of 1 to 2 gpm. The proximity of the motor and the leaky flange present a potentially hazardous situation that could result in the short circuiting of the motor and/or the delivery of an electrical shock to the operator.

d. Reservoir Area – The area immediately surrounding the reservoir is largely undeveloped and wooded. The banks of the reservoir appeared to be stable, even with drawdown of the reservoir pool.

e. Downstream Channel – The downstream channel originates at the spillway and follows the natural path of Kohanza Brook. The banks of the channel are, for the most part, rocky and wooded. The only channel constriction within the impact area is a small bridge supporting a private driveway. Two steel culverts measuring 24 inches and 18 inches in diameter have been employed to channel Kohanza Brook beneath the structure.

3.2 EVALUATION

Based on the visual inspection of Lower Kohanza Dam, it has been determined that the facility is in poor condition. The following may influence the future condition and/or stability of the dam:

(1) The sloughing and displaced riprap on the upstream face may induce further deterioration of the dam, thus weakening the structure.

(2) The seepage flows and fine brown residue observed on the downstream toe of the dam may be an indication of the internal deterioration of the dam.

(3) The condition of the old iron conduit through the dam should be evaluated, possibly by inspection of the abandoned lower gatehouse which was boarded up at the time of the inspection. It should be determined if the seepage near the pumphouse is due to pipe leakage or seepage through the dam. Seepage along the outside of the conduit could lead to a piping failure of the dam.

(4) The condition of the spillway and dike and obstructions in the approach and discharge channels could significantly decrease the spillway discharge capacity. This could cause the dam to be overtopped during periods of high project discharge.

(5) The absence of an upstream control on the water supply conduit prohibits emergency closure in the event the conduit should rupture within the dam.

(6) The leaky flanges in the pumphouse may short circuit the electric motor and/or deliver an electric shock to the operator.

(7) The growth of tall grass and brush on the embankment and the current state of the spillway indicate a lack of regular maintenance.

(8) Trees growing on or close to the downstream toe may damage the embankment in the event they are uprooted.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General — The reservoir that is impounded by the Lower Konanza Dam is used to supplement the Danbury public water supply. As a result, water is only drawn from the reservoir during dry periods. Discharge from the site normally occurs through the spillway located approximately 100 feet west of the right abutment of the dam.

b. Description of any Warning System in Effect — There is no formal downstream warning system currently in effect at the site.

4.2 MAINTENANCE PROCEDURES

a. General — Currently, no regularly scheduled maintenance is performed at the dam. However, the dam is normally checked weekly by the Danbury Water Company and problem areas are noted. Maintenance is usually scheduled during the warmer months and may include: mowing, clearing brush, repairs of the dam and/or appurtenances, and clearing the spillway of debris. However, at the time of the inspection there were no indications that any maintenance had been performed at the site recently.

b. Operational Facilities — The water supply pump within the pumphouse is the only operable mechanism currently in existence at the site. Water is drawn from Lower Kohanza Lake Reservoir and pumped to West Lake Reservoir by activating the electrically operated pump.

4.3 EVALUATION

The operation and maintenance procedures currently employed at the site are poor. Records documenting the operation and maintenance of the facility and providing a detailed account of the work and/or operations performed should be kept for future reference. In addition, a formal downstream warning system and emergency operations guidelines should be established. Remedial measures and maintenance recommendations are presented in Section 7.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The watershed consists of 0.96 square miles (sq. mi.) of rolling, wooded terrain; however, approximately half (0.41 sq. mi.) of the watershed drains into Upper Kohanza Lake before it reaches Lower Kohanza Lake. Consequently, the inflow hydrograph peak for the lower reservoir will be attenuated. The peak inflow at Lower Kohanza Lake is a function of the outflow from Upper Kohanza Lake and, therefore, was calculated as a percentage reduction of this inflow (Appendix D).

The facility is in generally poor condition. There are several areas along the toe of the dam where seepage is evident. Erosion and sloughing has occurred near the crest on the upstream slope of the dam, resulting in the displacement of the fill to a 2-foot depth in a 10-foot by 10-foot area. The spillway is in a state of extreme disrepair, and both the approach and discharge channels are obstructed by large quantities of debris.

5.2 DESIGN DATA

There were no design data available for the original dam construction.

5.3 EXPERIENCE DATA

The original dam, constructed in 1860, was breached as a result of the failure of the Upper Kohanza Dam in February 1869. The restoration of the structure reportedly commenced later that same year (Appendix B, pgs. B-11 & B-12).

5.4 TEST FLOOD ANALYSIS

The maximum potential storage capacity (100 ac-ft) and the height (27 feet) of the Lower Kohanza Dam are within the limits established by the Corps in the "Recommended Guidelines for Safety Inspection of Dams", dated September 1979, for the SMALL size category. The hazard classification for the dam is HIGH, since there is the potential for the loss of more than a few lives due to the breach of the dam. Based on the storage capacity, height, and hazard, the recommended test flood for this dam is between one-half the Probable Maximum Flood (1/2 PMF) and the Probable Maximum Flood (PMF). Since the height and storage capacity are within the lower limits of the small size category the smaller test flood was selected. Therefore, the test flood will be equivalent to one-half the Probable Maximum Flood (1/2 PMF). The inflow to the reservoir has been reduced to account for the attenuation of the peak inflow caused by the Upper Kohanza Dam (Appendix D, D-2). Therefore, the peak inflow to the reservoir is 965 cfs/sq. mi. The inflow due to the test flood (930 cfs) and outflow (800 cfs) will cause the water surface within the impoundment to rise to elevation 576 or 1.0 foot above the top of the dam. The capacity of the spillway with the water surface, within the impoundment, at the top of the dam is 300 cfs or 38 percent of the routed test flood outflow.

5.5 DAM FAILURE ANALYSIS

Utilizing the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, the failure outflow due to the water surface within the impoundment at the top of the dam was calculated to be 22,000 cfs. The resulting breach width (95 feet) did not include the spillway and; therefore, the spillway discharge at the time of failure was included in the failure outflow. The flood wave caused by the dam failure will cause the water surface within the impact area to rise from 0.7 feet at a prefailure outflow of 300 cfs to 10.7 feet after the failure. As a result, two homes will be flooded to a

depth of approximately 3 feet and two additional homes will experience less than a foot of flooding. Since the dam breach would damage 4 homes and could potentially cause the loss of more than a few lives, the dam has been classified as having a HIGH hazard potential.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION

The visual inspection of the dam did not reveal any indications of immediate stability problems. However, localized erosion and sloughing near the center of the dam on the upstream slope has resulted in the displacement of embankment material in a 10-foot by 10-foot area to a depth of approximately 2 feet. The riprap slope protection has been overgrown near the crest of the dam and displaced in several areas exposing the embankment fill. Seepage was noted emanating at several locations near the toe of the dam between the pumphouse and the left abutment and at one location near the right abutment. In addition, the spillway crest and the short dike forming the left spillway abutment are in a state of extreme disrepair.

6.2 DESIGN AND CONSTRUCTION DATA

Design and construction data were not available to perform an in-depth assessment of the structural stability of the dam.

6.3 POST-CONSTRUCTION CHANGES

The dam was breached in February 1869 and reconstruction of the dam commenced that same year. No documentation pertaining to the reconstruction of the dam was available.

6.4 SEISMIC STABILITY

The dam is in Seismic Zone 1 and, according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition – The visual inspection of the facility and an evaluation of its past performance reveal that the dam is in poor condition. No evidence of immediate structural instability was observed in the earthfill embankment. However, both the embankment and spillway are in generally poor condition with many areas requiring maintenance and/or monitoring.

Based on the "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs", dated April 1978, and the hydraulic/ hydrologic computations, the peak inflow and outflow for the test flood are 930 cfs and 800 cfs, respectively. The spillway capacity with the water surface at the top of the dam (El. 575 NGVD) is 300 cfs or 38 percent of the routed test flood outflow.

b. Adequacy of Information – The information available is such that an assessment of the condition and stability of the dam must be based largely on the visual inspection, past performance, and sound engineering judgement.

c. Urgency – It is recommended that the measures presented in Sections 7.2 and 7.3 be implemented within one (1) year of the owner's receipt of this report except where noted.

7.2 RECOMMENDATIONS

It is recommended that the following be undertaken by a registered professional engineer qualified in dam design and inspection:

(1) Perform a detailed hydrologic-hydraulic investigation to access further the potential of overtopping the dam and the need for and

means to increase project discharge capacity. In addition, access the spillway's structural ability to withstand high flows.

(2) Evaluate the condition of the 16-inch water supply conduit and determine if piping has or might could occur along the conduit.

(3) Provide a means of emergency closure of the water supply conduit on the upstream side of the dam. The upper gatehouse should be considered as a potential location for this device.

(4) Remove trees, saplings, and root systems at and within 20 feet of the toe of the dam and backfill the resulting voids with a suitable compacted material. Grass should be planted over the repaired areas to prevent future erosion.

(5) The eroded areas on the upstream slope of the embankment should be repaired with a suitable compacted material. Riprap slope protection should be placed on those areas subject to wave action and grass should be planted on all other repaired areas of the embankment.

(6) Establish a program to monitor the seepage flows on the downstream toe of the dam on a weekly basis. In addition, a follow-up investigation should be conducted to accurately define the cause of the seepage and the source of the fine brown residue carried by the seepage flows. Upon the completion of this investigation an evaluation of the influence of the seepage on the structural stability of the dam should be conducted. If warrented remedies for this situation should be formulated and instituted.

(7) Perform a detailed topographical survey of the structure with preparation of a drawing(s) for future reference. On this drawing(s) the locations of seepage and wet areas, eroded slopes, and tree-covered areas should be noted.

The Owner should implement the recommendations of the Engineer.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures – The following measures should be undertaken within one (1) year of the owner's receipt of this report, except where noted, and continued on a regular basis.

(1) A formal program of operation and maintenance procedures should be instituted with regular documentation to provide accurate records for future reference.

(2) An "Emergency Action Plan" should be developed that will include an effective preplanned downstream warning system; locations of emergency equipment, materials, and manpower; authorities to contact; potential areas that require evacuation; and monitoring the project during periods of intense rainfall.

(3) Institute a program of annual technical inspection by a qualified registered engineer.

(4) The cutting of grass and brush on the crest, slopes, and toe of the embankment should be instituted as part of routine maintenance procedures.

(5) Institute a program of annual technical inspection by a qualified registered professional engineer.

(6) The owner should immediately repair the leaky pipe flanges in the pumphouse and assess the condition of the electric motor to determine if any premature deterioration of the mechanism has occured due to the leak.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Lower Kohanza Dam

DATE 1/21 & 2/19/81

TIME 11:00 a.m.

WEATHER Sunny, Cold, 25°F

W.S. ELEV. 569

PARTY:	INITIALS:
1. Jeffrey T. Klaucke	JK
2. Miron B. Petrovsky	MP
3. Ernst H. Buggisch	EB
4. Jerry R. Waugh	JW
5. Jasvinder S. Florah	JF
6. Harold Farnham	HF

PROJECT FEATURE:	INSPECTED BY:
1. Dam Embankment	JK, MP, EB, JW
2. Spillway	JK, MP, EB, JF
3. Upper Gatehouse	JK, MP, EB
4. Lower Gatehouse	JK, MP, EB
5. Pumphouse	JK, MP, JW, JF, HF

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Dam Embankment NAME: JK, MP, EB, JW

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	575
Current Pool Elevation	569
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A, Tall grass on top
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Appears Good
Horizontal Alignment	Appears Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Embankment	Foot path along top and downstream slope
Sloughing or Erosion of Slopes	Erosion on top and upstream slope at mid-section. 10-foot X 10-foot area, 2-feet deep.
Rock Slope Protection - Riprap Failures	Upstream riprap displacement
Unusual Movement or Cracking at or near Toes	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Dam Embankment (Continued) NAME: JK, MP, EB, JW

AREA EVALUATED	CONDITION
Unusual Embankment or Downstream Seepage	Four seepage sources at downstream toe of embankment
Piping or Boils	None
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Intake Channel and Intake Structure NAME:

AREA EVALUATED	CONDITION
OUTLETS WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	N/A
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Upper Gatehouse NAME: JK, MP, EB

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Masonry Structure
General Condition	Fair
Condition of Joints	Good
Spalling	Minor
Visible Reinforcing	N/A
Rusting or Staining of Concrete	N/A
Any Seepage or Efflorescence	None
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate	None Observed
Cracks	None Observed
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

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Upper Gatehouse (Continued) NAME: JK, MP, EB

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (Continued)	
b. Mechanical and Electrical (Continued)	
Service Gates	None observed, 2-foot-wide opening for sluice gate
Emergency Gates	N/A
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Lower Gatehouse NAME: JK, MP, EB

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Stone masonry structure
General Condition	Good
Condition of Joints	Good
Spalling	None
Visible Reinforcing	N/A
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None Observed
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate	None Observed
	Seepage was present between the gatehouse and pumphouse near the C.I. pipe.
Cracks	None
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

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Lower Gatehouse (Continued) NAME: JK, MP, EB

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (Continued)	
b. Mechanical and Electrical (Continued)	
Service Gates	None Observed
Emergency Gates	N/A
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Pumphouse NAME: MP, JW, JF, HF

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Brick House on Concrete Foundation
General Condition	Good
Condition of Joints	N/A
Spalling	None
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate	None Observed
Cracks	None
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Pumphouse NAME: MP, JW, JF, HF

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (Continued)	
b. Mechanical and Electrical (Continued)	
Service Gates	16-inch Gate valve
Emergency Gates	N/A
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	Water leaking from pipe joints and falling on to the pump's electrical motor.

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Transition and Conduit NAME:

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

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Outlet Structure and Outlet Channel NAME:

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Masonry	N/A
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Spillway NAME: JK, MP, EB, JF

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair to Poor
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Right Side
Floor of Approach Channel	Rocks and wood debris
b. Weir and Training Walls	Stone masonry structure
General Condition of Masonry	Poor
Rust or Staining	N/A
Spalling	Severely deteriorated crest
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	Seepage through masonry
Drain Holes	N/A
c. Discharge Channel	
General Condition	Poor
Loose Rock Overhanging Channel	None visible
Trees Overhanging Channel	Both channel sides
Floor of Channel	Boulders, rocks and uprooted trees.
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Lower Kohanza Dam DATE: 1/21 & 2/19/81

PROJECT FEATURE: Service Bridge NAME:

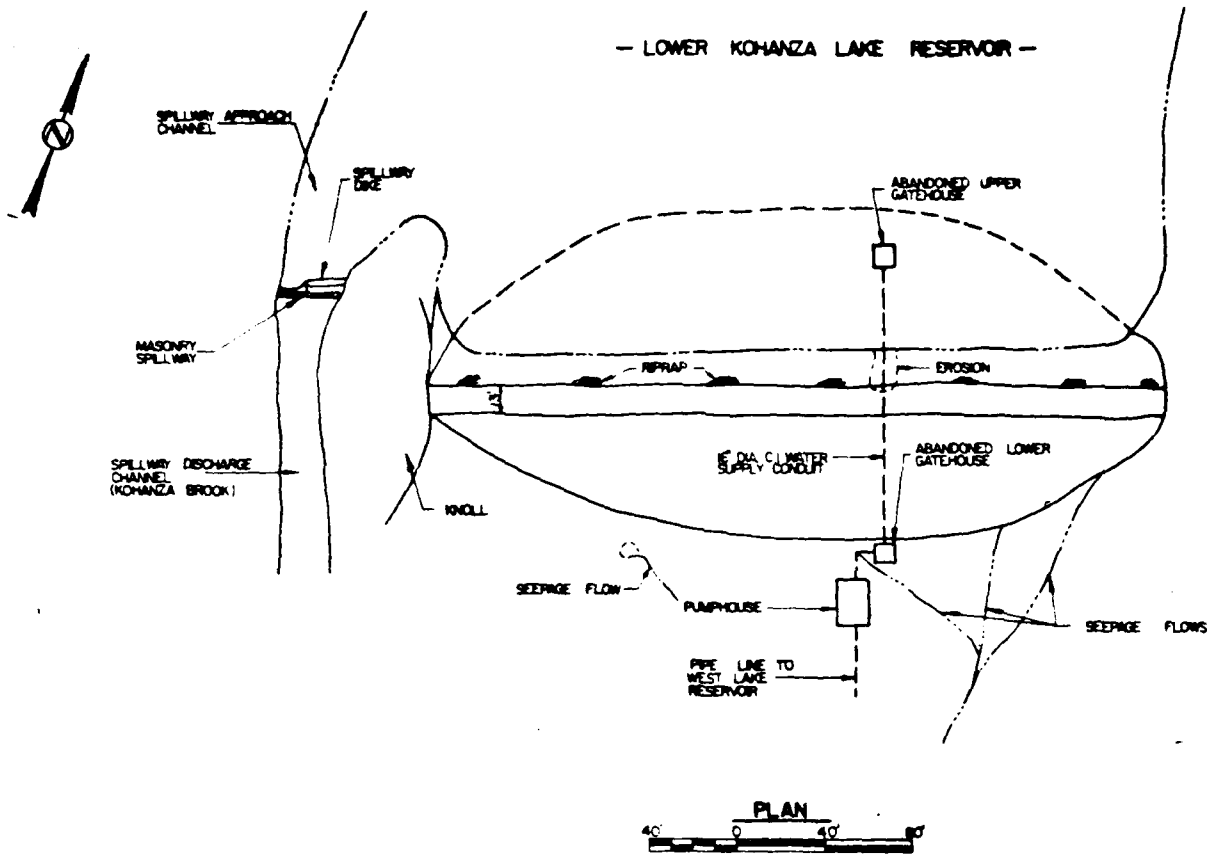
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	N/A
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	N/A
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

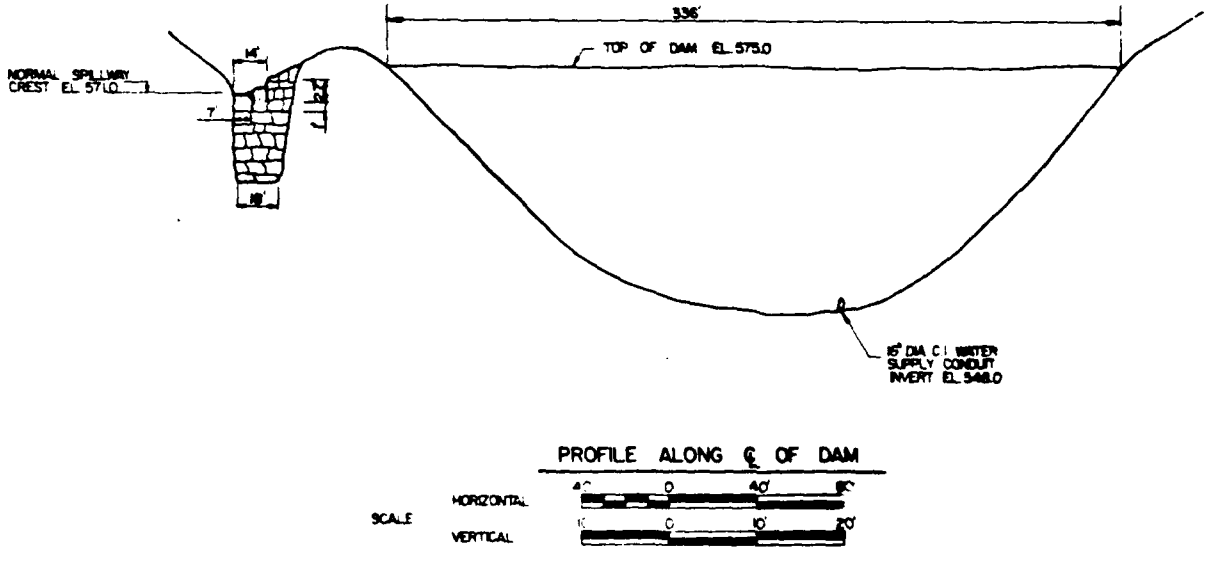
APPENDIX B

ENGINEERING DATA

SUMMARY OF DATA AND CORRESPONDENCE

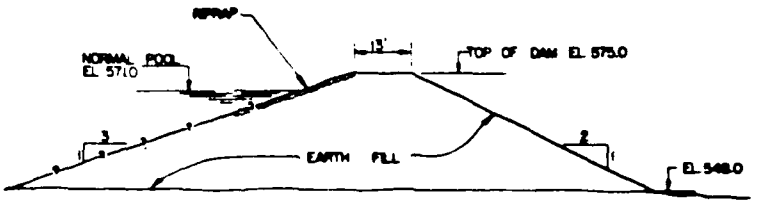
DATE	TO	FROM	SUBJECT	PAGE
2/81	----	----	Plan, Profile and Sections	B-2
---	----	----	Water Resource Inventory Data	B-3
11/29/65	State of Connecticut Water Resources Commission	Clarence Blair Associates Civil and Sanitary Engineers	Inspection of dam	B-4
8/26/36	Danbury Water Works	Chester M. Everett Civil Engineer	Kohanza Pipe Line Plan and Profile	B-9
2/2/1869		New York Times	Dam Failure	B-11
2/3/1869		New York Times	Dam Failure	B-12





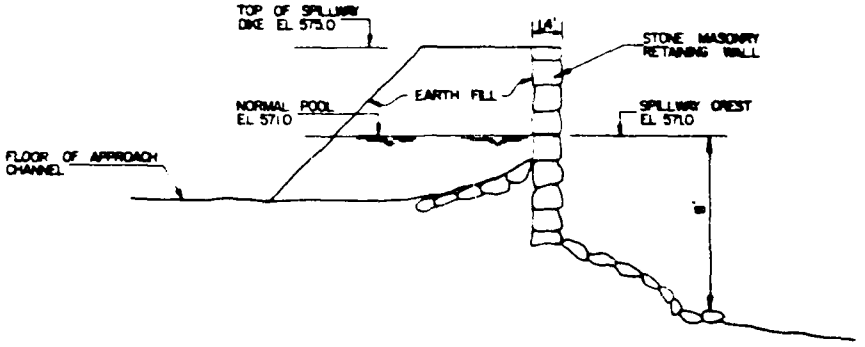
PROFILE ALONG ℄ OF DAM

SCALE
HORIZONTAL 40' 0 40' 80'
VERTICAL 10' 0 10' 20'

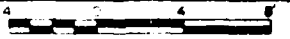


TYPICAL DAM SECTION

FLOWS



TYPICAL SPILLWAY SECTION



NOTES:

1. THE PLAN, PROFILE AND SECTIONS SHOWN ARE BASED ON FIELD MEASUREMENTS MADE BY IECO ENGINEERS AND SUPPLEMENTARY INFORMATION ACQUIRED FROM THE PLAN AND PROFILE OF "THE KOHANZA PIPE LINE" PREPARED BY CHESTER M EVERETT, CIVIL ENGINEER (1936), FOR THE DANBURY WATER WORKS.

2. ALL ELEVATIONS ARE REFERENCED TO THE NORMAL SPILLWAY CREST ELEVATION WHICH WAS ASSUMED TO CORRESPOND TO THE WATER SURFACE ELEVATION SHOWN ON THE DANBURY, CONNECTICUT, USGS QUADRANGLE MAP

INTERNATIONAL ENGINEERING CO DARIEN CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

PLAN, PROFILE AND SECTIONS

LOWER KOHANZA DAM

KOHANZA BROOK — DANBURY, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
[illegible]	JT [illegible]	F Hoffmann	DATE MARCH 1981	SHEET B-2

CT 64

No. _____

Inventoried By _____

Date _____

WATER RESOURCES UNIT
SUPERVISION OF DAMS
INVENTORY DATA

Lat: 41° 24.9'
Long: 73° 28.9'

Name of Dam or Pond LOWER KOHANZA LAKE

Code No. _____

Nearest Street Location Kohanza; take Dogwood off Route 39

Town Danbury

U.S.G.S. Quad. _____

Name of Stream Kohanza Brook

Owner City of Danbury

Address _____

1860 rebuilt 1869

Pond Used For _____ Drainage Area .95 sq.mi.

Dimensions of Pond: Width _____ Length _____ Area 8.5 ac.

Total Length of Dam 400' Length of Spillway 10'

Location of Spillway Separate - to west

Height of Pond Above Stream Bed 20'

Height of Embankment Above Spillway 3'

Type of Spillway Construction 3' vertical stone on ledge

Type of Dike Construction fill

Downstream Conditions City of Danbury

Summary of File Data _____

Remarks Slight leak at east end; slight leaks at toe at middle

Would Failure Cause Damage? Yes Class B

CLARENCE BLAIR ASSOCIATES

Civil and Sanitary Engineers

93 WHITNEY AVENUE
P. O. BOX 236
NEW HAVEN 2, CONNECTICUT

TEL. 777-7379

ROGER C. BROWN
JAMES C. BEACH
FRANK RAGAINI

CLARENCE M. BLAIR
(1904-1944)

CHARLES E. AUGUR, JR
GORDON BILIDES
JOHN M. BREST
DONALD L. DISBROW
NICHOLAS PIPERAS, JR.

November 29, 1965

State of Connecticut
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Re: LOWER KOHANZA DAM
DANBURY

Gentlemen:

Herewith is a report on Lower Kohanza Dam in Danbury, Connecticut.

1. IDENTIFICATION

This report was made at the request of Mr. William P. Sander in a letter dated May 7, 1965.

An inspection of the structure was made by the writer and an assistant engineer on October 21, 1965.

A profile of the spillway and photographs were taken on July 6, 1965.

The dam is located on Kohanza Brook, north westerly of the city of Danbury at

Latitude	41-24-55
Longitude	73-28-45

The owner is the City of Danbury, this lake being a part of the city water supply system.

2. FACTORS OF HAZARD

Conditions downstream from this dam are favorable to the lateral spreading of the flood resulting from a failure of the dam.

Immediately downstream from the dam for about 2000 feet is a wooded valley and below that a golf course. There are no dwellings adjacent to the stream for a distance of approximately a mile downstream from the dam.

A failure of the dam would undoubtedly result in considerable property damage, particularly below the golf course,and possible loss of life.

3. STRUCTURE

This is an earth dam approximately 30 feet high and 500 feet long. Top width is about 12 feet. The upstream slope is covered with riprap to above the flow line. The downstream face is well sodded and has a slope of approximately 1 on 1. From the steepness of the slopes I infer that the dam probably has a masonry core wall although there was no visible evidence of such a wall.

The spillway is at the west end, separated from the main dam by a rocky knoll. It is irregular in cross section, being in part excavated from ledge rock.

Freeboard from the lowest part of the spillway to the top of the embankment is 6.1 feet.

Some evidence of seepage was visible along the toe of the downstream slope on the east side of the valley. Seepage was not sufficient to be considered a potential hazard.

Otherwise the dam is in good condition. The intake gate house in the upstream slope is in a delapidated condition but this does not affect the safety of the dam.

4. HYDROLOGY

Approximately 3500 feet upstream from the Lower Kohanza Dam there is another dam, the Upper Kohanza Dam.

The drainage area tributary to the upper dam is 0.41 square miles and the drainage area below the upper dam and tributary to the lower dam is 0.53 square miles.

The total drainage area tributary to the Lower Kohanza Dam is 0.94 square miles.

The upper lake has a water surface constituting 10% of its drainage area and therefore has a considerable delaying effect on storm runoff at the lower lake.

Design discharge at the Lower Kohanza Dam is estimated at 600 cfs.

The irregular rock spillway is estimated to have a capacity of 600 cfs at a depth of 5 feet over the lowest section.

This depth would leave a freeboard of 1.1 feet below the top of the embankment of the dam.

5. SAFETY

In my opinion the dam is safe at the present time.

It would be my opinion that, this being a dam of the City of Danbury Water Department, periodic inspection by your Commission would not be necessary.

6. REQUIREMENTS

No work is required at present to put the dam in a safe condition.

7. SUMMARY OF FACTS

Lower Kohanza Dam is a unit of the water supply system of the City of Danbury.

It is an earth embankment dam approximately 500 feet long and is in good condition.

There are no hazardous conditions immediately downstream from the dam. A giving away of the dam would probably cause property damage to homes located approximately a mile below the dam.

Drainage area tributary to the dam is 0.94 square miles and includes an upstream dam and lake with an appreciable capacity to restrain storm runoffs.

Design discharge for a 100 year frequency storm is estimated at 600 cfs and the spillway has capacity to pass that discharge with a freeboard of 1.1 feet to the top of the dam.

8. CONCLUSION

In my opinion the dam is safe at the present time and no action is required.

9. RECOMMENDATION

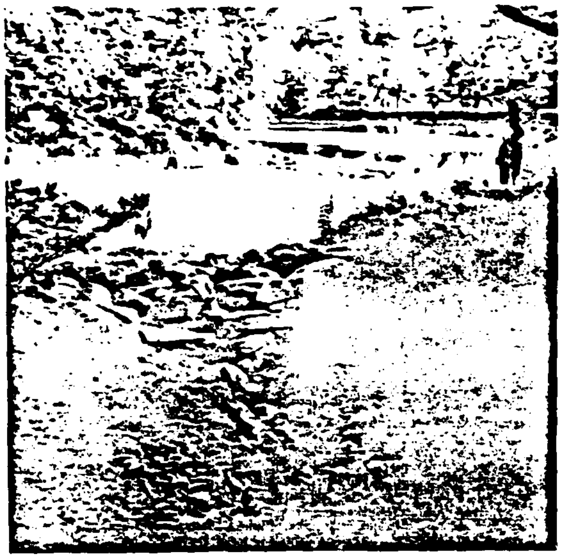
No action necessary.

Respectfully submitted,

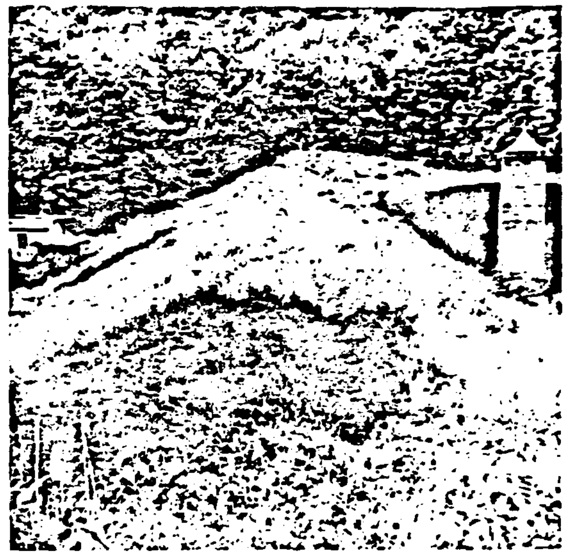
Roger C Brown

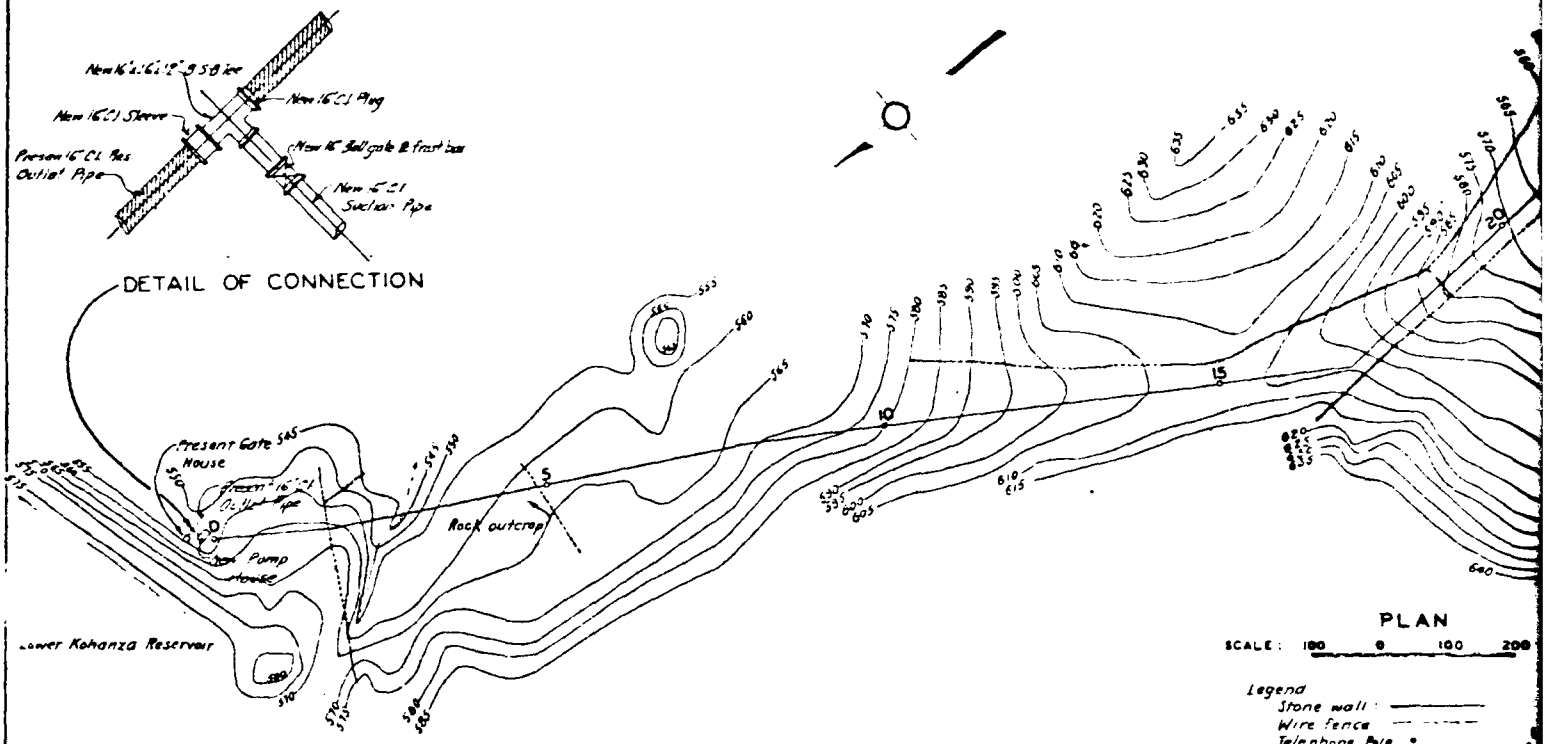
Roger C. Brown
Consulting Engineer

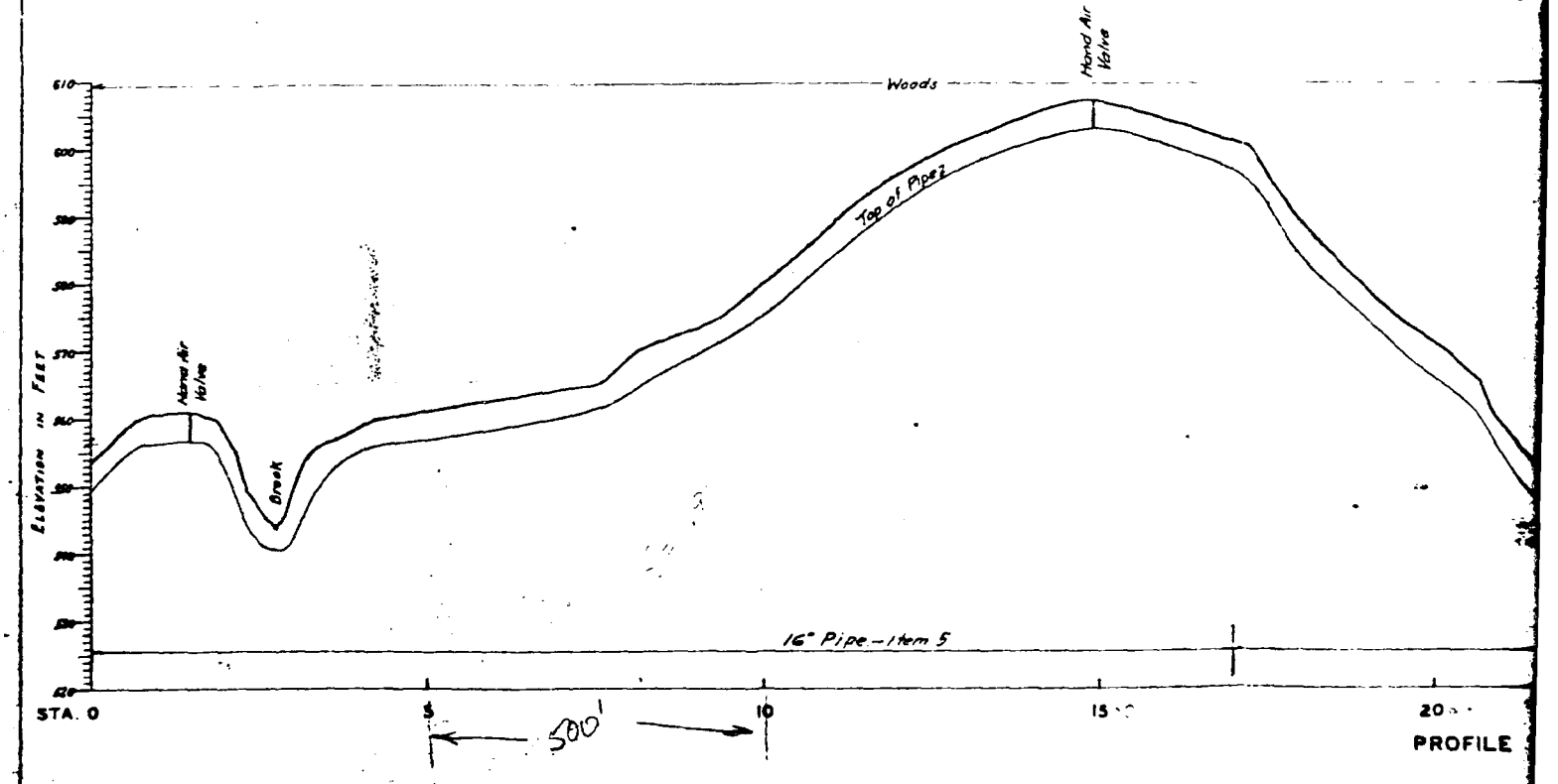
JUNE 1965



JUNE 1965

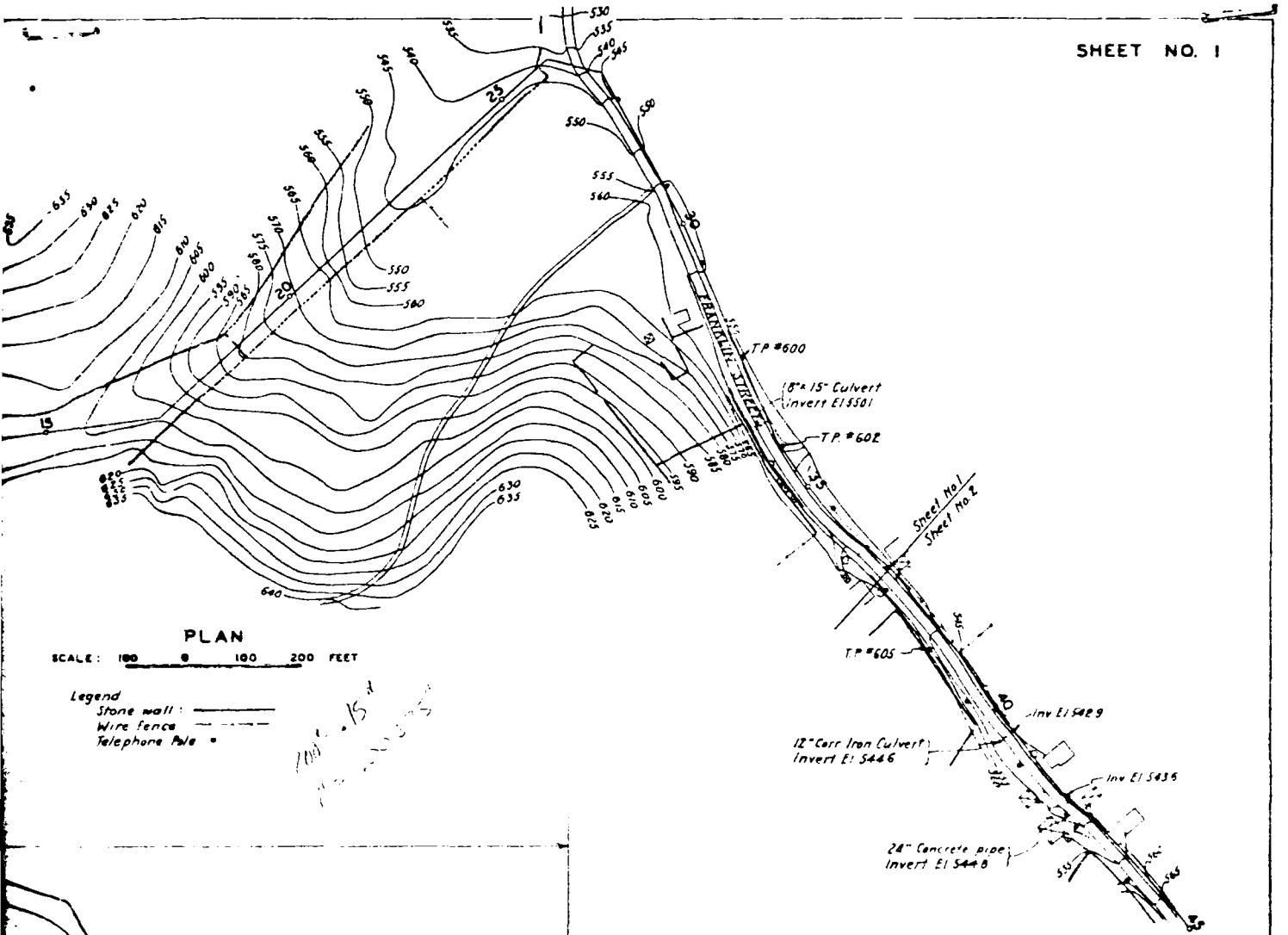






Chester M Everett
Civil Engineer
22 E. 40th St. NYCity
August 26, 1936

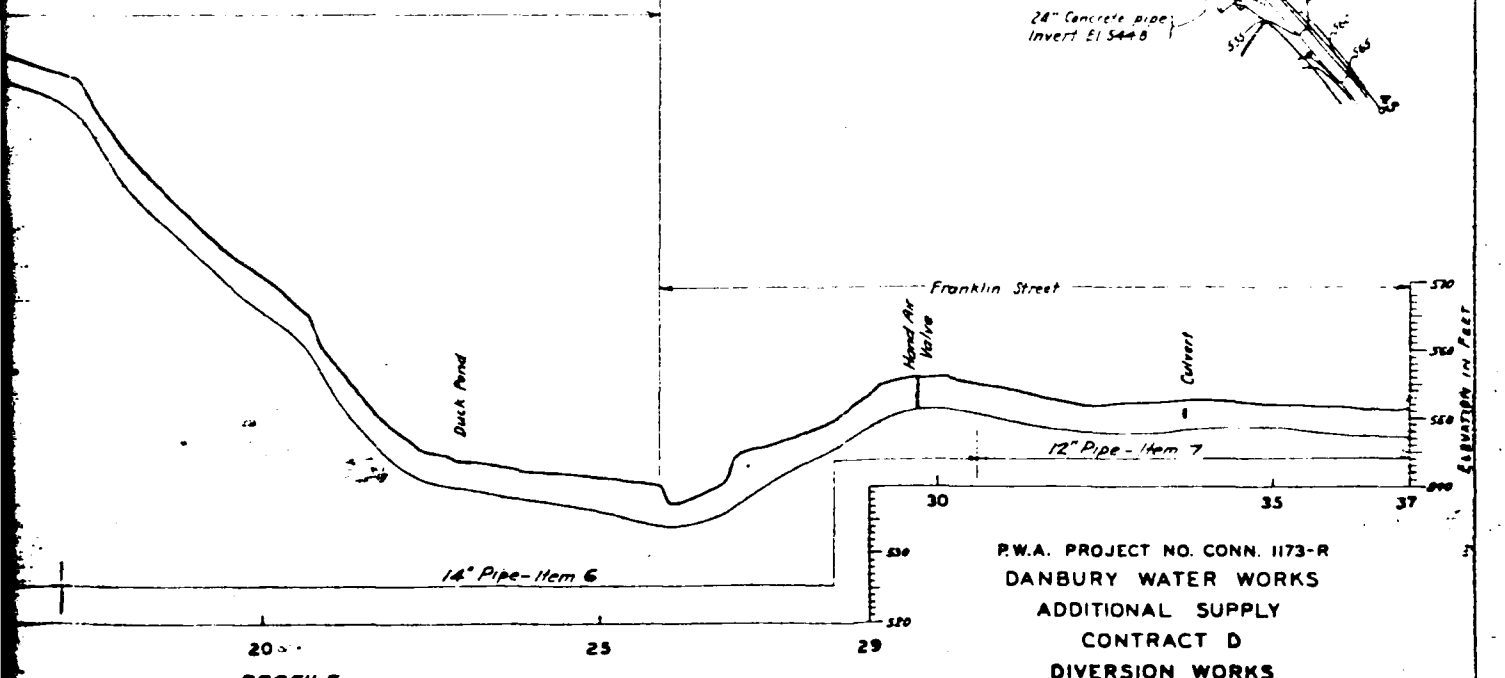
SHEET NO. 1



PLAN

SCALE: 100 0 100 200 FEET

Legend
Stone wall
Wire fence
Telephone Pole



PROFILE

P.W.A. PROJECT NO. CONN. 1173-R

DANBURY WATER WORKS

ADDITIONAL SUPPLY

CONTRACT D

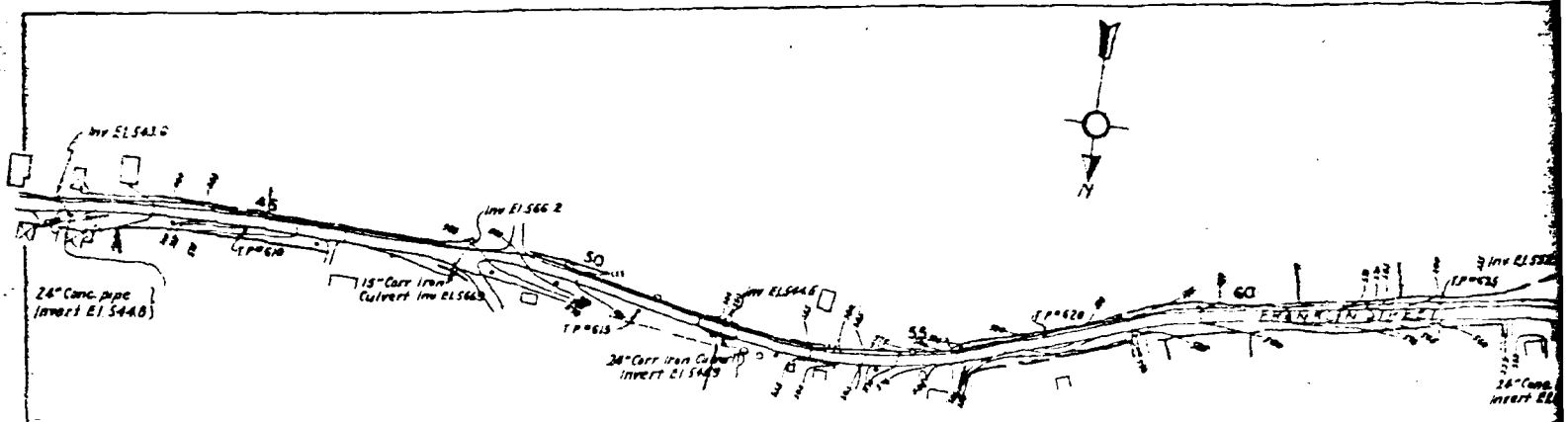
DIVERSION WORKS

KOHANZA PIPE LINE

PLAN AND PROFILE

SCALES AS INDICATED

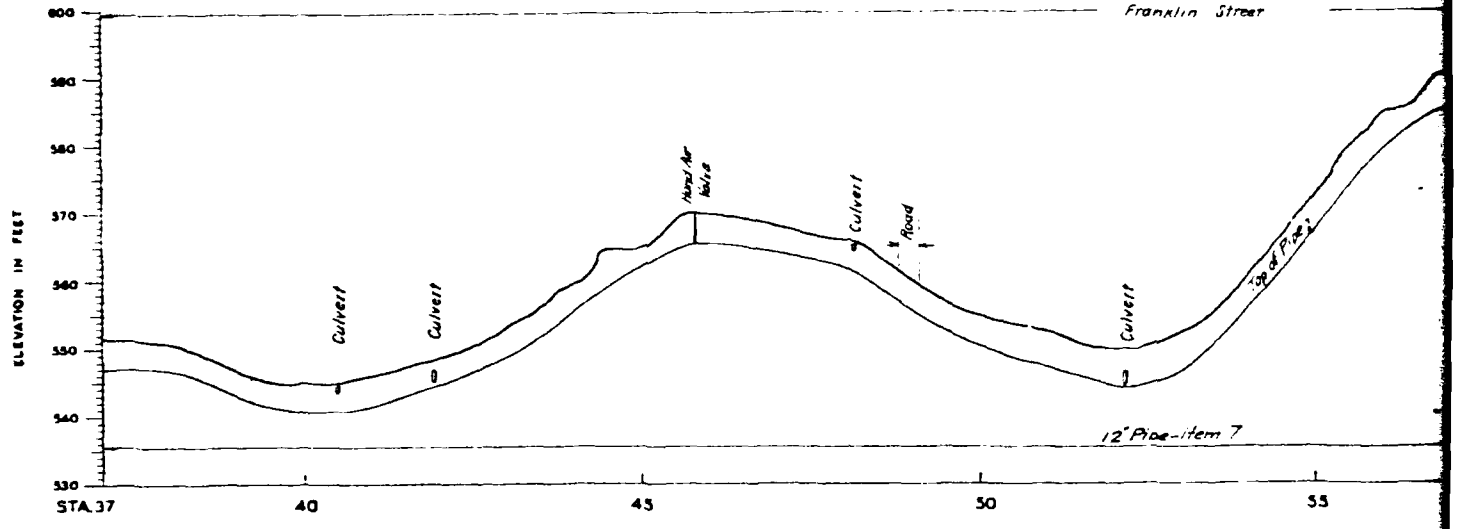
Beatty McEvenue
CONSULTING ENGINEER



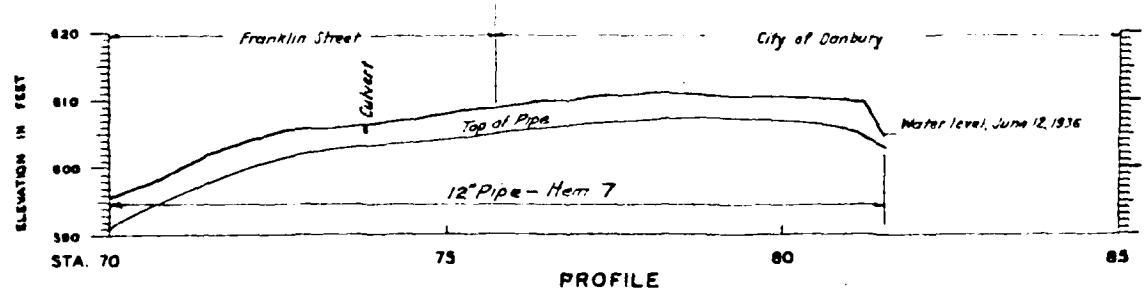
PLAN

SCALE: 100 0 100 200 FEET

Legend:
Stone wall: ————
Wire fence: - - - - - -
Telephone pole •



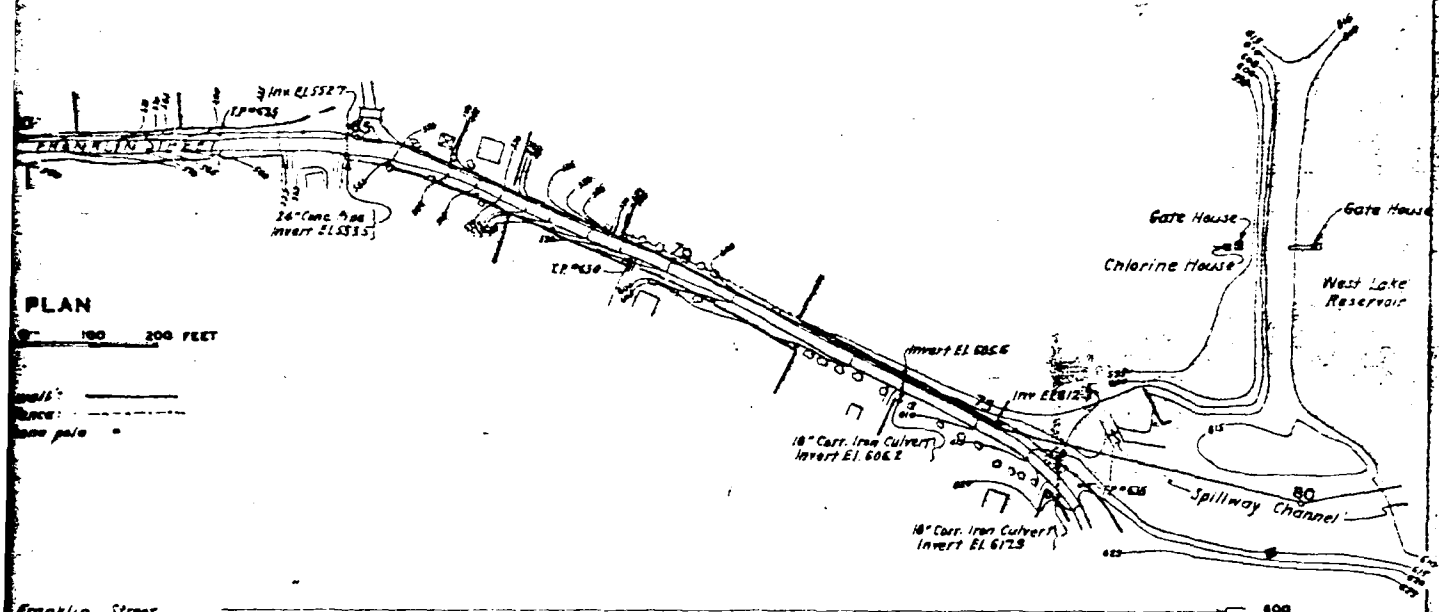
PROFILE

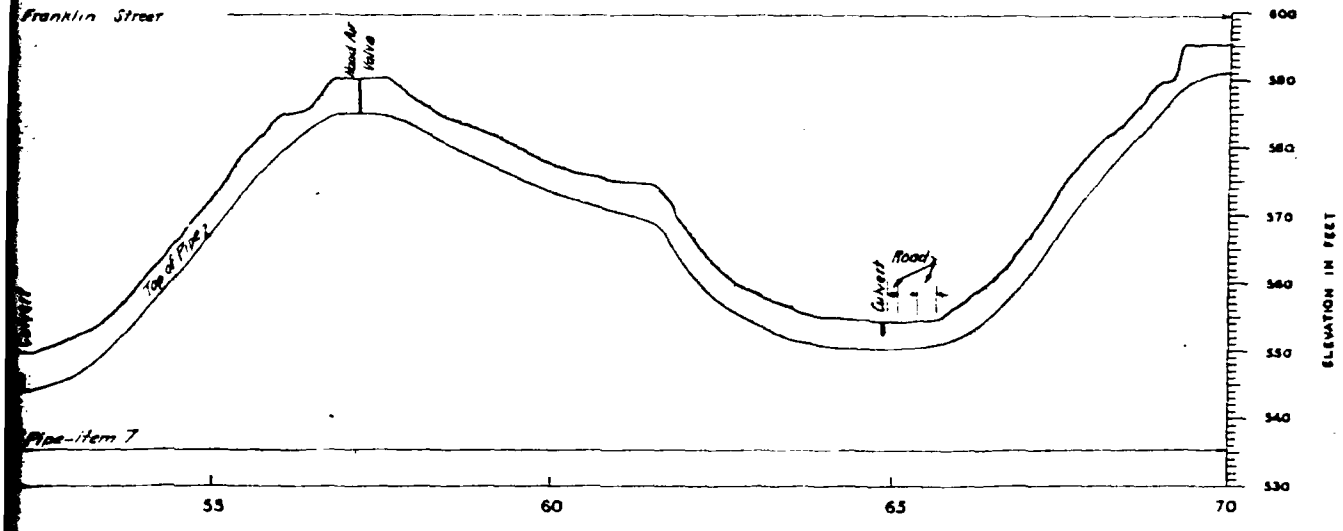


PROFILE

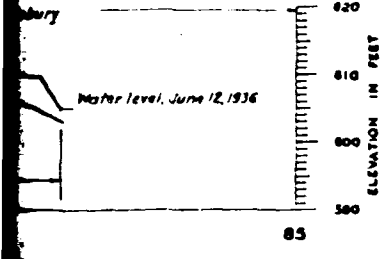
Chester M. Everett
Civil Engineer
22 E. 40th St. N.Y.City
August 17, 26, 1938

SHEET NO. 2





PROFILE



P.W.A. PROJECT NO. CONN. 1173-R

DANBURY WATER WORKS

ADDITIONAL SUPPLY

CONTRACT D

DIVERSION WORKS

KOHANZA PIPE LINE

PLAN AND PROFILE

SCALES AS INDICATED

CONSULTING ENGINEER

"FRIGHTFUL DISASTER

"Breaking of Dam at Danbury, Conn.—
"Houses and Bridges Swept Away—Ten or Twelve Persons Drowned.

"DANBURY, Conn., Monday, Feb. 1

"The most terrible disaster that has ever occurred in Danbury happened last night, destroying a number of lives and much property. About 7 o'clock in the evening the upper Kohanza dam, which supplies the borough with water, gave way, letting down the water with such force as to carry away the lower dam also. The water of the two dams thus let loose formed an irresistible force and carried away all before it. Flint's dam, which was carried away by a flood last Summer, was again destroyed. The upper Main-street bridge was carried away; also the Balmforth-avenue and White-street bridges, while the Patch-street bridge and the one at LACY, HOYT & CO.'S shop are rendered almost impassable. Houses and small buildings were carried down stream and destroyed. Immense cakes of ice, with rocks, trees, Etc., were carried a great distance. A house in the north end of the town, occupied by the family of Mr. A. CLARK, was carried away with the inmates—a man, his wife and a boy—and all were drowned. The wife and child were found in the stream, near Myrtle-avenue, and the husband was picked up near Peck's ditch. At the latter place the body of a Miss HUMPHREY was found, and near at hand the bodies of Miss HUSTED and Mr. CHARLES ANDREWS' mother was recovered. Thus far five bodies have been found, but as a number of persons are missing it is feared they have been drowned. It is supposed that twelve or fifteen lives were lost."

"THE FLOOD AT DANBURY.

"Great Destruction of Life and Property — Twelve Persons Drowned.

"We take the following account of the damage done by the flood at Danbury, Conn., on Sunday night, from an extra issued by the Danbury Times on Monday:

"Sunday evening, January 31, 1869, will long be remembered by the people of Danbury. Just as the bells ceased to ring the people to their evening worship, the dam of the Upper Kohanzie Reservoir gave way, and the immense body of water therein contained came sweeping down upon our unconscious citizens. Those who lived at the upper part of the town were startled by a sudden rushing, roaring sound, like the driving of a heavy gale of wind. Those indoors could not understand it, as their buildings were not racked, as they would be in such a gale. Many left their houses and went out to listen better, and then discovered before their very doors a boiling, hurling mass of water. The water came upon the village through the gorge above Flint's dam, bringing with it huge masses of ice, and heavy masses of timber. It came with fearful velocity, striking the houses on Main-street, near the river bank, and sweeping them from their foundation in an instant, it swept down the flats along the stream north and east of Main-street, carrying destruction to everything in its reach, and bringing terror to all within its hearing. The amount of property lost cannot be less than fifty thousand dollars, and will probably exceed that amount. The loss of life has been terrible. In the house destroyed in the upper part of Main-street, there were fourteen persons. The terrible scenes and incidents of the night and this morning beggar description. The people have turned out in masses, and at this hour are going over the pathway of the calamity. The scene now is one of great desolation, especially on the site of the houses of those lost. Hardly a trace of where they stood is visible.

"One building is deposited a little way back, badly shattered; the other is a complete wreck, the larger portion lying just south of Patch-street, and some distance below its foundations. The Main, North and White street bridges were destroyed, and the Patch-street bridge so racked as to be unsafe to walk over. CHARLES CHASES'S carriage manufactory, on North-street, was demolished, being struck by the building removed from Main-street. SUNDERLAND'S carpenter-shop, on White-street, was torn from its place. A horse stabled at one end of the building, in some unaccountable way, got out and, swimming to land, came off unharmed. The office and builder's hardware store of the IVES Brothers was flooded, and considerable damage done to the stock. ISAAC W. IVES' lumber-yard was also flooded, and a large lot of lumber swept down the stream, or thrown about the yard in confused shape. Loss was also sustained by STEVENS Brothers and A. ELY, carpenters; P. ROBINSON & CO., flour dealers; LACEY, HOYT & CO., hat manufacturers, and BRADLEY & MANSFIELD, livery stable-keepers. Great cakes of ice, weighing a ton or more, were scattered along the course of the water in great profusion, fences were swept down, outhouses, sheds, &c., damaged.

"The following is a list of the persons killed:
Mrs. HUESTED, an old lady, mother-in-law of CHARLES E. ANDREWS—body recovered; EDWARD CLARK—body recovered; Mrs. EDWARD CLARK, (a body supposed to be her, but badly disfigured, was recovered;) three children of Mr. and Mrs. EDWARD CLARK—bodies not recovered; wife of JAMES BROTHWELL—body not recovered; two children of JAMES BROMWELL—body of one recovered.

"A body was found near Hurlbutt's factory, which was identified by Mrs. HANFORD B. FAIRCHILD as that of Miss FANNY HUMPHREYS, a lady who had left Mrs. FAIRCHILD'S house, on White-street, just before the coming of the flood, and was overtaken by it before she could get across the bridge.

"Right after the water reached White-street, two women were seen clinging to a tree. They cried for help, but the huge cakes of ice and masses of timber surging between them and those who endeavored to help, rendered all attempts ineffectual, and after a few moments they loosed their hold to the tree and were swept from sight. One of these two was undoubtedly Miss HUMPHREYS, but the other is not yet known.

"The damage done the reservoir is very great. About 100 feet of the upper dam and the entire length of the lower dam is swept away. Men are already at work upon the dams, and the waterpipes will be filled in a few days. The foundation of FLINT'S foundry is undermined, and two tenements belonging to HENDRICK BARNUM, on North-street, are somewhat damaged."

APPENDIX C

PHOTOGRAPHS

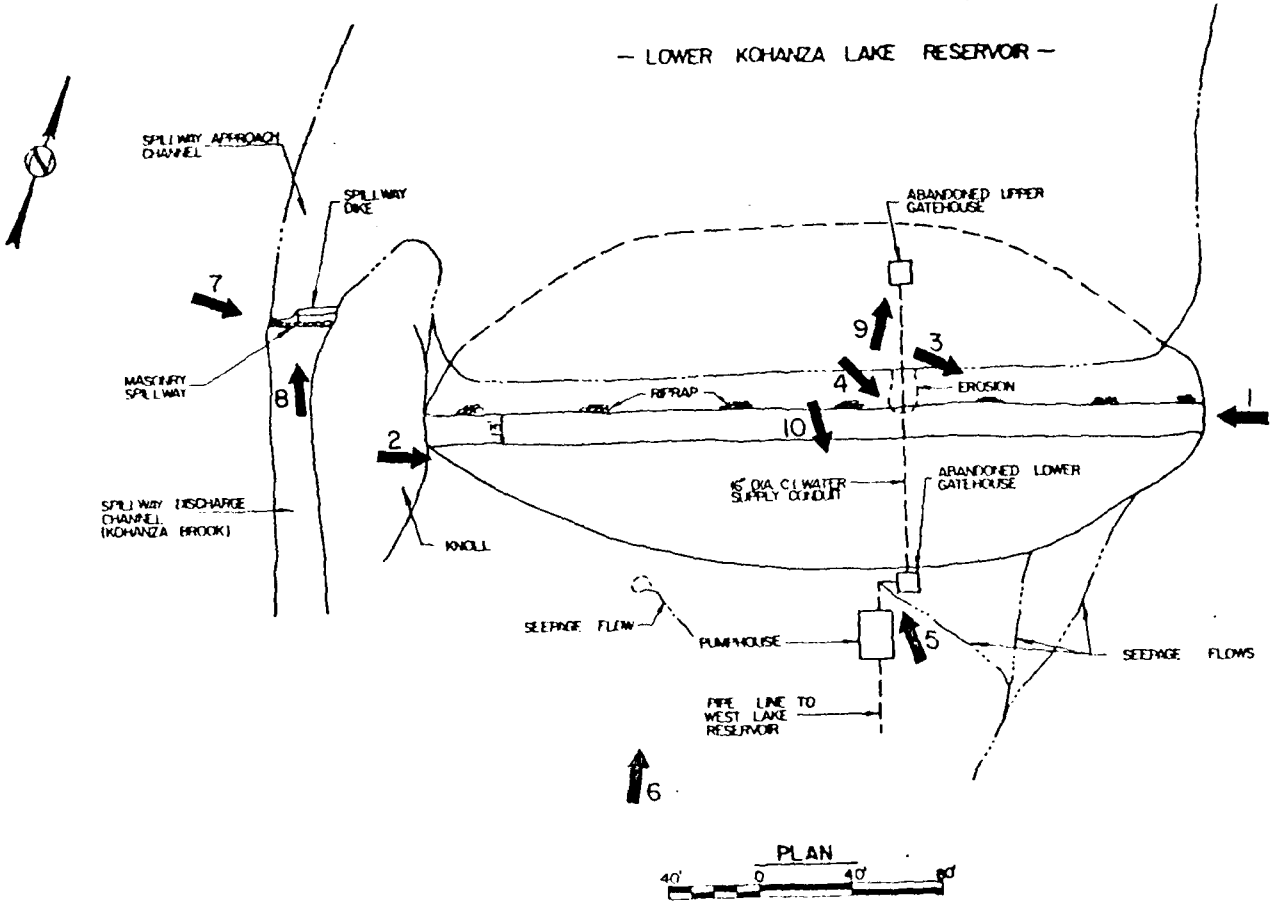


PHOTO LOCATION PLAN

LOWER KOHANZA LAKE DAM

Photo 1. Top and upstream slope of embankment, upper and lower gatehouses and pumphouse at toe of dam.

Photo 2. Top and slopes of embankment and upper gatehouse.

Photo 3. Erosion and displaced riprap on upstream slope of embankment.

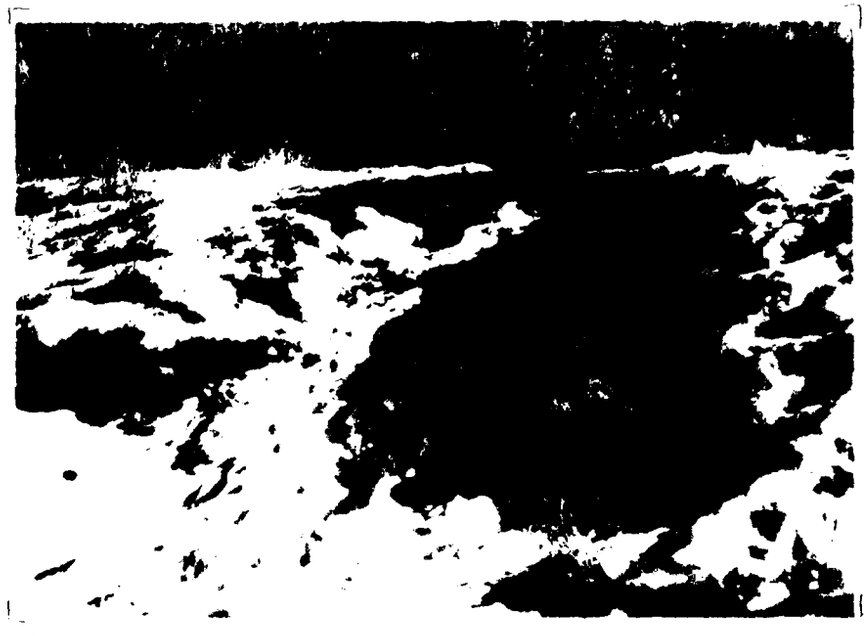


Photo 4. Erosion on upstream slope of embankment.

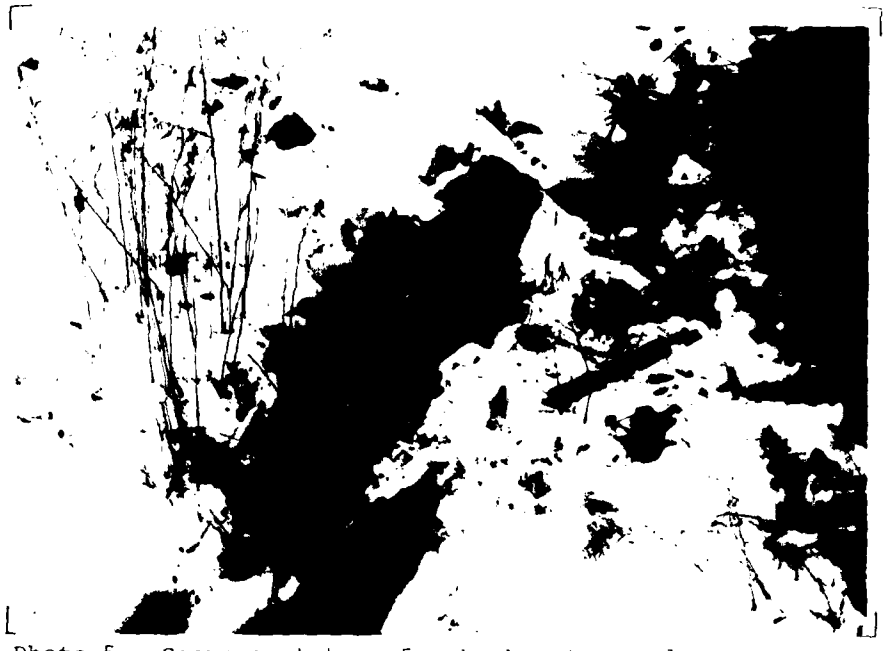


Photo 5. Seepage at toe of embankment near lower gatehouse.

Photo 6. Left and right seepage streams at toe of embankment.

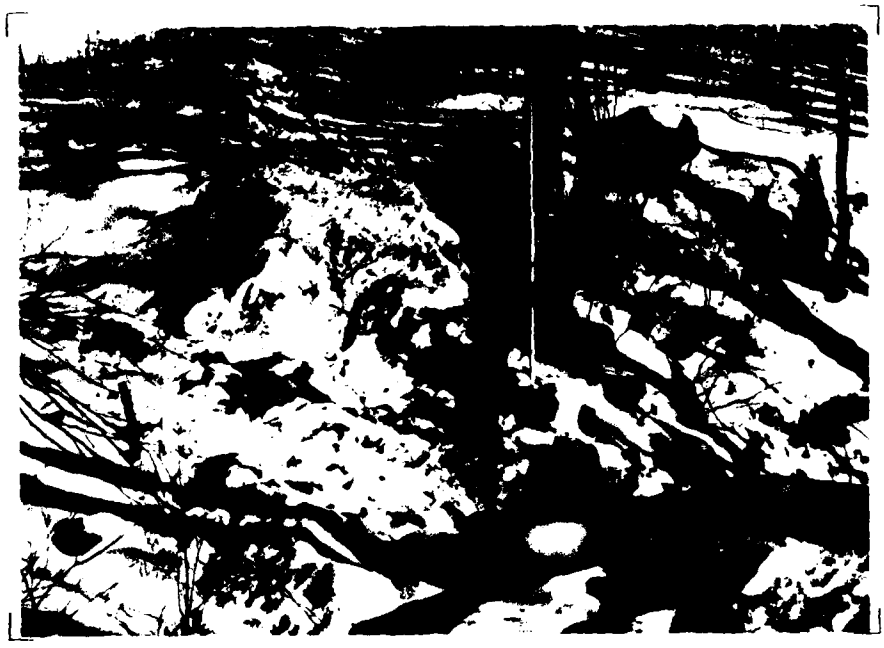


Photo 7. Spillway crest, spillway dike and approach channel.

Photo 8. Downstream spillway face, masonry retaining wall of spillway dike and discharge channel.

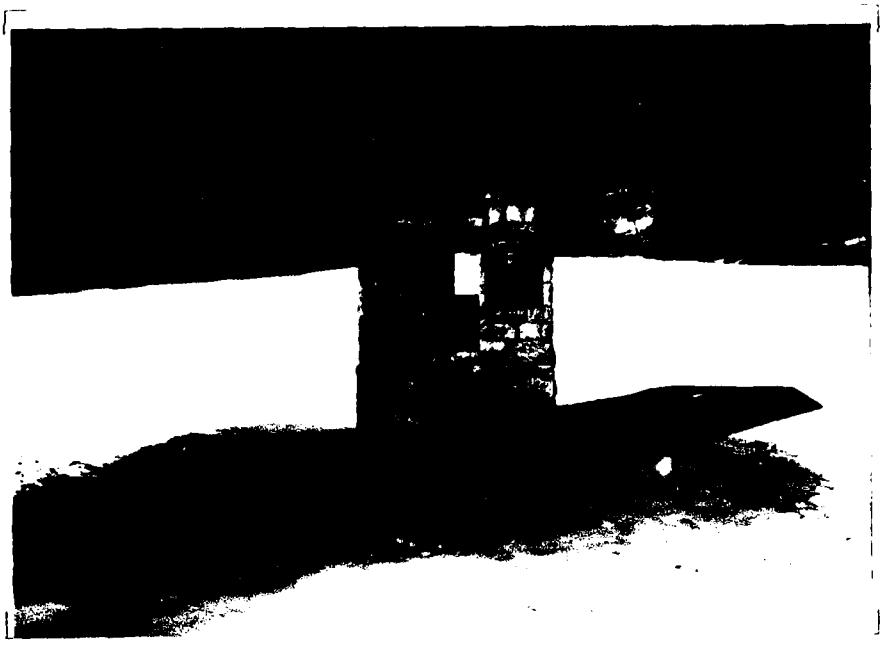


Photo 9. Upper gatehouse.

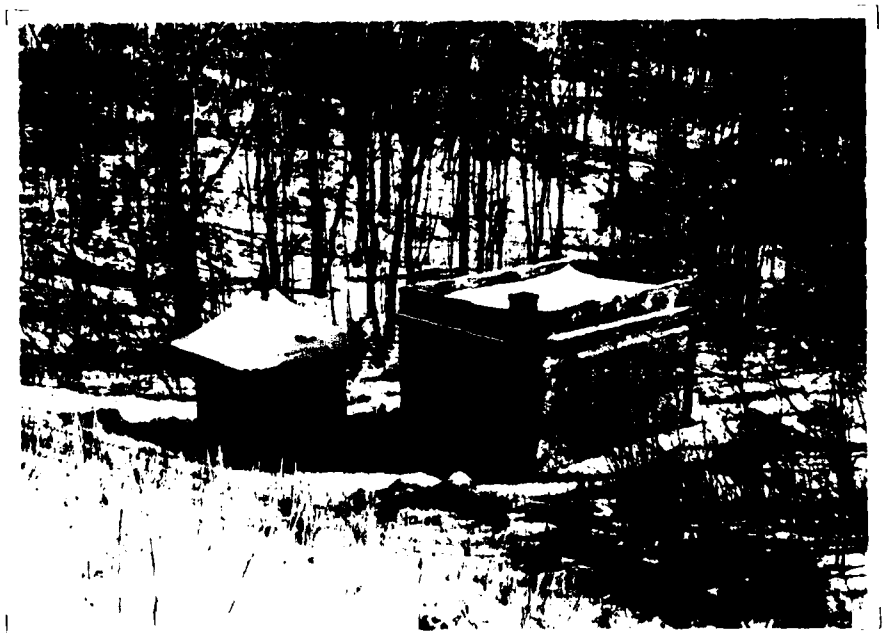
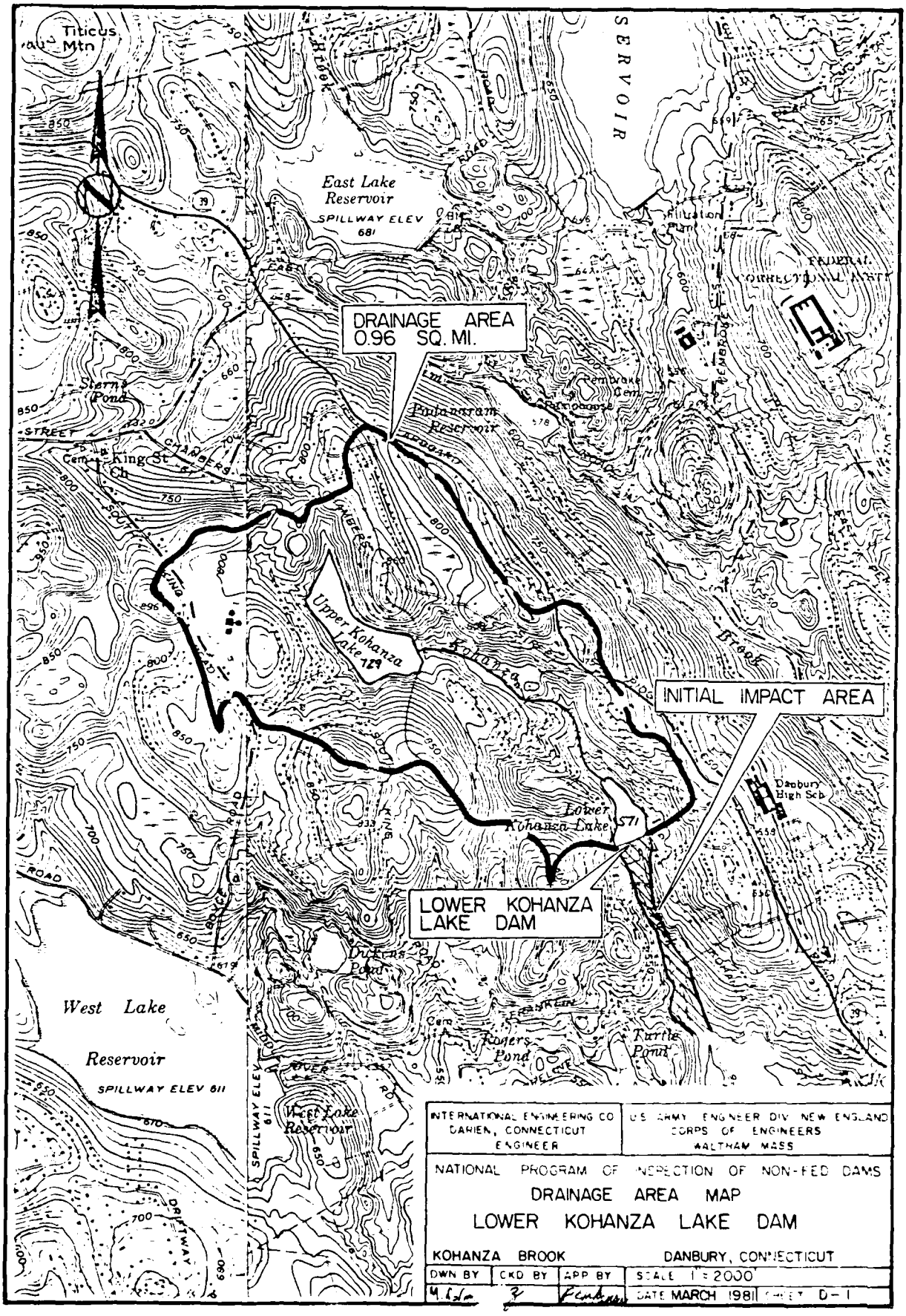


Photo 10. Masonry lower gatehouse and brick pumphouse at toe of embankment.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



INTERNATIONAL ENGINEERING CO DARIEN, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

DRAINAGE AREA MAP

LOWER KOHANZA LAKE DAM

KOHANZA BROOK DANBURY, CONNECTICUT

DWN BY	CKD BY	APP BY	SCALE 1" = 2000'
M.Lda			DATE MARCH 1981 SHEET D-1

HYDROLOGIC/HYDRAULIC INSPECTION

LOWER KOHANZA DAM, DANBURY, CT

1) PERFORMANCE AT PEAK FLOOD CONDITIONS

a) WATERSHED CLASSIFIED AS MOUNTAINOUS - ROLLING

b) WATERSHED AREA:

LOWER KOHANZA LAKE IS LOCATED ON KOHANZA BROOK DOWNSTREAM FROM UPPER KOHANZA LAKE. THE TOTAL WATERSHED IS SUBDIVIDED AS FOLLOWS:*

i) D.A. TO UPPER KOHANZA LAKE DAM	0.41 SQ. MI.
ii) INCREMENT TO LOWER KOHANZA LAKE DAM	0.55 SQ. MI.
iii) TOTAL DA TO LOWER KOHANZA LAKE DAM	0.96 SQ. MI.

c) PEAK FLOODS (FROM NED-ACE GUIDELINES - GUIDE CURVES FOR PMF)

FROM UPPER KOHANZA LAKE DAM (CT 00062) PHASE I INSPECTION REPORT, PRESENTLY APPROACHING COMPLETION, THE SURCHARGE

* NOTE: DRAINAGE AREAS PLANIMETERED FROM USGS 7.5 MINUTE QUADRANGLES, ENTITLED BREWSTER NY-CT, AND DANBURY, CT.

STORAGE OF THIS RESERVOIR REDUCES THE PMF PEAK INFLOW OF Q_{P_1} = 1150 TO Q_{P_3} = 550 cfs. SIMILARLY, THE ½ PMF PEAK INFLOW TO UPPER KOHANZA LAKE, Q_{P_1}' = 575 IS REDUCED TO AN OUTFLOW OF Q_{P_3}' = 240 cfs BY SURCHARGE STORAGE.

BECAUSE THE WATERSHED AREA REGULATED BY UPPER KOHANZA LAKE IS 43% OF THE LOWER KOHANZA LAKE WATERSHED, THE EFFECT OF UPPER KOHANZA LAKE IN REDUCING PEAK FLOWS WILL BE MEASUREABLE IN TERMS OF PEAK INFLOWS AT LOWER KOHANZA LAKE.

THE PEAK INFLOW AT LOWER KOHANZA LAKE WILL THEREFORE BE DETERMINED AS FOLLOWS:

i) THE AREAL DISCHARGE FROM THE GUIDE CURVES WILL BE PROPORTIONATELY REDUCED BY THE PERCENTAGE REDUCTION OF THE INFLOW PEAK AT THE OUTFLOW OF UPPER KOHANZA LAKE DAM.

ii) AN AREA WEIGHTED AVERAGE OF THE UNIT ARKAL DISCHARGES FOR BOTH UPPER AND LOWER KOHANZA WILL BE COMPUTED BASED ON i).

iii) UNIT AREAL DISCHARGE UPPER KOHANZA: (EXTRAPOLATED FROM "MAXIMUM PROBABLE FLOOD PEAK FLOW RATES".)

INTERNATIONAL ENGINEERING COMPANY, INC.

Project DAM INSPECTION . KOHANZA
Feature SURCHARGE AT PEAK INFLOWS
Item PEAK FLOODS

Contract No. 2616
Designed BJ
Checked BJ

Sheet D-3
File No.
Date
Date

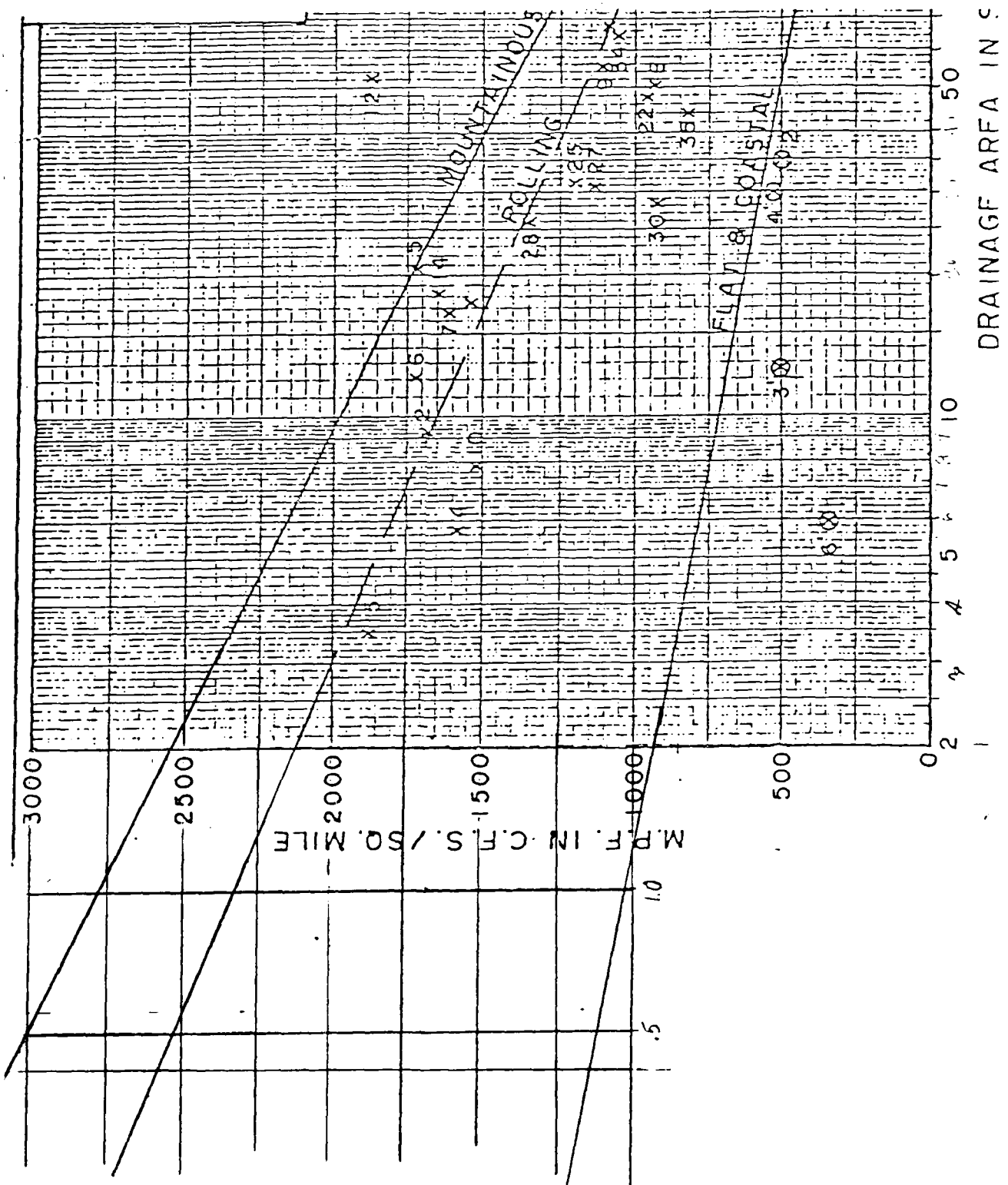


FIGURE EXTRAPOLATED GUIDE CURVES FOR DA ≥ 0.41 sq. mi.

1.c.iii continued

2800 CSM ; PERCENTAGE DECREASE IN INFLOW HYDROGRAPH PEAK RESULTING FROM RESERVOIR ROUTING, 52 %. $\left(= \frac{1150-550}{1150}(100)\right)$

iv) UNIT AREAL DISCHARGE TRIBUTARY TO LOWER KOHANZA LAKE:

(FROM "MAXIMUM PROBABLE FLOOD PEAK FLOW RATE" GRAPH, LINEAR EXTRAPOLATION : 2500 CSM.

v) ADJUSTED CSM FROM GUIDE CURVES AND ATTENUATION OF PEAKS U.S.

$$\frac{PMF}{mi^2} = 2800(.41)\frac{550}{.96}\frac{}{1150} + \frac{2500(.55)}{.96} \cong 2000 \text{ csm}$$

$$\tfrac{1}{2}\frac{PMF}{mi^2} = 1400(.41)\frac{240}{.96\ 575} + \frac{2500(.55)/2}{.96} = 966 \text{ csm}$$

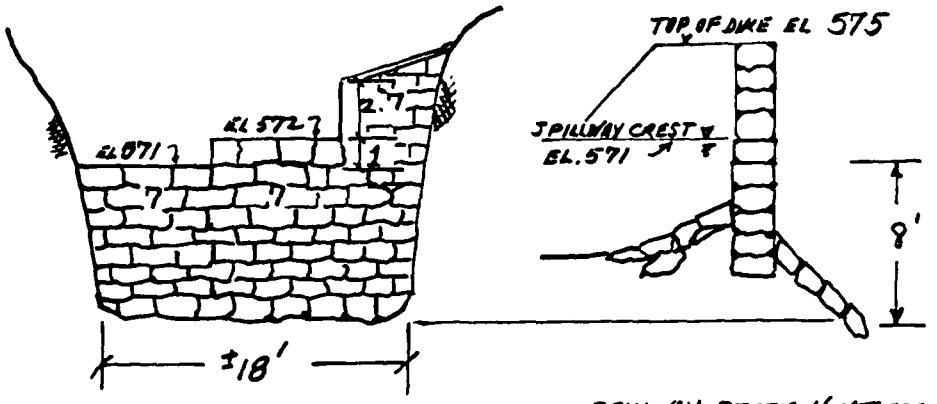
$\therefore$ PMF = .96(2000) = 1920 ; $\frac{1}{2}$PMF = .96(1190) = 927

2) SURCHARGE AT PEAK INFLOWS (PMF AND $\frac{1}{2}$ PMF)

a) OUTFLOW RATING CURVE

i) SPILLWAY

LOWER KOHANZA LAKE SPILLWAY IS A MASONRY SPILLWAY SITUATED AT THE RIGHT DAM ABUTMENT. IT IS ABOUT $1\frac{1}{3}$ FEET BROAD, AND HAS A NOTCHED CREST IN TWO LEVELS EACH 7 FEET IN LENGTH (SEE SKETCH, PP D-5). THE UP AND DOWNSTREAM SPILLWAY FACES ARE ESSENTIALLY VERTICAL. THE CREST WIDTH IS APPROXIMATELY $1\frac{1}{3}$ FOOT AND THEREFORE, THE CREST WILL



SPILLWAY SECTION (NOT TO SCALE)

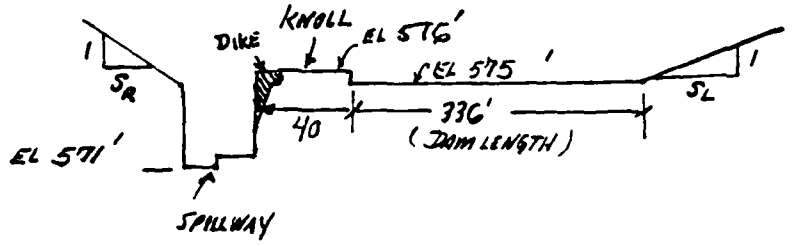
LOWER KOHANZA LAKE SPILLWAY PROFILE (NOT TO SCALE)

DISCHARGE AS A SHARP CRESTED WEIR WHEN THERE IS OVER 1→2 FEET OF WATER ON THE CREST. TAKING THE CREST OF THE LOWEST WEIR AS DATUM THE DISCHARGE FORMULA FOR THE SPILLWAY IS;

$$Q = 3.2(7)\left[H^{\frac{3}{2}} + (H-1)^{\frac{3}{2}}\right] \cong 44.8\,H^{\frac{3}{2}}\left[1 - \frac{3}{4H}\left(1 - \frac{1}{4H}\right)\right], H \geq 2$$

(ii) EXTENSION OF THE CURVE FOR SURCHARGES OVERTOPPING THE DAM AND/OR ADJACENT TERRAIN:

A WEIR DISCHARGE COEFFICIENT OF 3.2 IS USED FOR THE SPILLWAY; A COEFFICIENT OF 2.3 IS SELECTED FOR WEIR FLOW OVER THE TOP OF DAM AND KNOLL AND LEFT AND RIGHT ADJACENT TERRAIN. AN EXTENDED PROFILE OF THE DAM IS SHOWN BELOW.



PROFILE OF COMPOSITE WEIR CONSIDERING OVERTOPPING

— DISCHARGE OVER ADJACENT TERRAIN:

$$Q_{LR} = 2.3\left(\frac{2}{5}\right)(S_L + S_R)(H-4)^{\frac{5}{2}}$$

$$S_L = 10 \quad ; \quad S_R = 6.7$$

— DISCHARGE OVER LENGTH OF EMBANKMENT:

$$Q_{EMB} = 2.3(336)(H-4)^{\frac{3}{2}}$$

— DISCHARGE OVER KNOLL SEPARATING EMBANKMENT AND SPILLWAY

$$Q_k = 2.3(40)(H-5)^{\frac{3}{2}}$$

— DISCHARGE OVER SPILLWAY:

$$Q_{SP} = 44.8\,H^{\frac{3}{2}}\left[1 - \frac{3}{4H}\left(1 - \frac{1}{2H}\right)\right]$$

TOTAL DISCHARGE:

$$Q_T = Q_{LR} + Q_{EMB} + Q_k + Q_{SP}$$

(b) SURCHARGE HEIGHT TO PASS PEAK INFLOWS

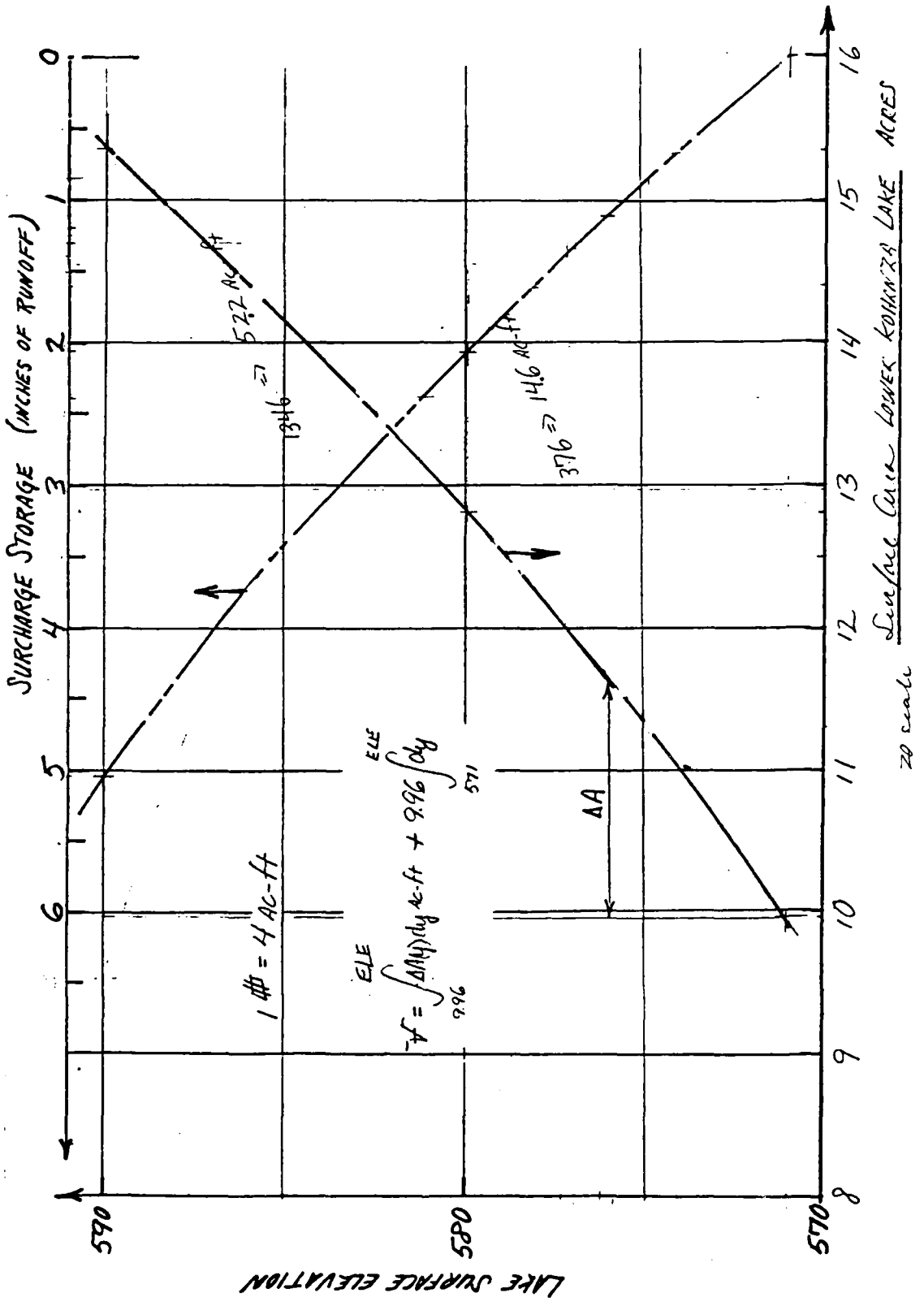
(i) Q_{P_1} = PMF = 1920 cfs * $H_1 = 6.0'$

(ii) $Q_{P_1}' = \frac{1}{2}$ PMF = 927 cfs * $H_1' = 5.1'$

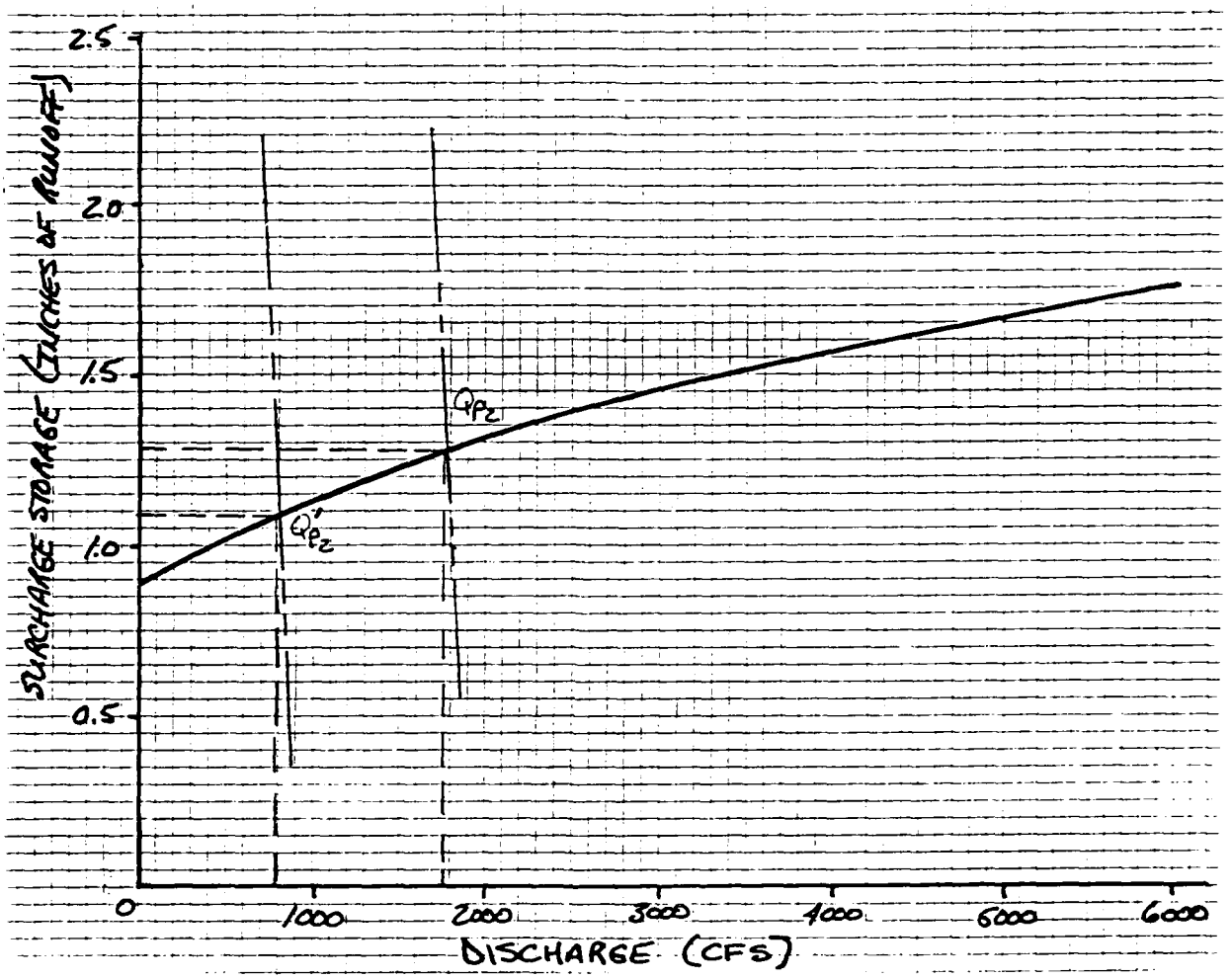
* NOTE: COMPUTED BY MULTIPLYING CSM VALUES IN (I.C.V.) BY DA. OF 0.96 SM

(c) EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOWS

(i) A DISCHARGE-SURCHARGE STORAGE CURVE WAS DEVELOPED FROM I.2.a.ii, ABOVE AND THE STAGE-STORAGE CURVE,


SURCHARGE STORAGE (INCHES OF RUNOFF)
0
1
2
3
4
5
6
590
580
570
LAKE SURFACE ELEVATION
16
15
14
13
12
11
10
9
8
20 acre
Surface Area LOWER KOHANZA LAKE ACRES
522 Ac-ft
1316 =
376 = 1496 Ac-ft
ΔA
1 # = 4 Ac-ft
ELE
-A = ∫ ΔA(y)dy Ac-ft + 9.96 ∫ dy
9.96
571
ELE

(I.2.c.i). PAGE D-7 . IT IS INCLUDED BELOW:



(ii) SURCHARGE STORAGE IN THE FIGURE ABOVE IS DEFINED TO BE THAT STORAGE ABOVE THE SPILLWAY CREST ELEVATION. THE PMF INFLOW IS, FROM I.2.b.i, 1920 cfs. THE AVERAGE STORAGE INCREASE OVER THE PERIOD OF ROUTING, WHICH IS ABSTRACTED FROM UNDER THE INFLOW HYDROGRAPH, EQUALS THE AVERAGE INFLOW RATE TIMES THE PERIOD MINUS THE OUTFLOW AVERAGE TIMES THE PERIOD:

$$\frac{Q_{P1}}{2} T_R - \frac{Q_{P_2}}{2} T_R = \Delta S \text{ , WHERE } T_R = \frac{2(19)}{Q_{P_1}} \text{ FOR}$$

A TRIANGULAR HYDROGRAPH.

iii) D.A. USED TO CONVERT ACRE-FT TO INCHES OF STORAGE : 0.96 Sq. mi

(I.2.c.ii CONTINUED)

$$\therefore \frac{19Q_{P_2}}{Q_{P_1}} = 19 - \Delta S \quad \text{OR} \quad Q_{P_2} = Q_{P_1}\left(1 - \frac{\Delta S}{19}\right).$$

A PLOT OF Q_{P_2} AS A FUNCTION OF ΔS YIELDS A STRAIGHT LINE WHICH MUST INTERSECT THE DISCHARGE-STORAGE CURVE OF ΔS VERSUS Q_{P_2}. THE STRAIGHT LINE IS DENOTED A-A, PAGE D-8.

$$Q_{P_{2_1}} = 1920\left(1 - \frac{3}{19}\right) \cong 1620 \text{ cfs}; \quad Q'_{P_{2_1}} = 634 \text{ cfs}$$

$$Q_{P_{2_2}} = 1920\left(1 - \frac{2}{19}\right) \cong 1720; \quad Q'_{P_{2_2}} = 732$$

$$Q_{P_{23}} = 1920\left(1 - \frac{1}{19}\right) \cong 1820; \quad Q'_{P_{23}} = 829$$

a) PEAK OUTFLOW FROM THE CURVE, PAGE D-8 IS 1800 cfs : PMF

" " " " " " " 800 cfs : ½ PMF

3) SPILLWAY CAPACITY RATIO TO PEAK INFLOW AND OUTFLOW

SPILLWAY CAPACITY IS 296 cfs.

% CAP. OF INFLOW PMF : 15

" OUTFLOW " : 16

" INFLOW ½ PMF: 32

" OUTFLOW ½ PMF: 37

II DOWNSTREAM FAILURE HAZARD

1) POTENTIAL IMPACT AREA

THE POTENTIAL IMPACT AREA IS LOCATED 1000-1500 FEET D/S OF THE DAM. FOUR HOUSES HAVE FIRST FLOOR ELEVATIONS APPROXIMATELY 8-12 FEET ABOVE THE STREAMBED. IMPACT AREAS UP TO ROUTE 84 WERE CONSIDERED. THE MOST SEVERELY IMPACTED AREAS WERE DETERMINED AFTER ROUTING THE DAM-BREAK FLOOD TO ROUTE 84, 1.5 MILES D/S FROM THE DAM. THE FIRST D/S CONFLUENCE IS 4600 FEET FROM THE DAM.

2) FAILURE AT LOWER KOHANZA LAKE DAM

FAILURE WAS PRESCRIBED TO OCCUR INDEPENDENTLY OF UPSTREAM CONDITIONS BY ACE DIRECTIVE. RATHER THAN AS A RESULT OF THE UPPER KOHANZA DAM-BREAK FLOOD IN DOMINO FASHION. THE LATTER OCCURED HISTORICALLY IN 1869 AND IS A MATTER OF PUBLIC RECORD. A ONE-HUNDRED FOOT BREACH IN THE OLD UPPER KOHANZA DAM COMPLETELY BREACHED THE LOWER KOHANZA DAM. ONLY THE FIRST CASE WAS CONSIDERED IN THIS APPENDIX.

a) BREACH WIDTH

(i) HEIGHT OF DAM = 26.5

ELEVATION OF STREAM BED AT TOE = 548.5
ELEVATION OF TOP OF DAM = 575

(ii) MID HEIGHT OF DAM = 28/2 = 13.3

(II. 2. a. iii) APPROXIMATE MID-HEIGHT LENGTH = 235'

(iv) BREACH WIDTH = 0.4 x 235 = 94'

b) PEAK FAILURE OUTFLOW

(i) HEIGHT AT TIME OF FAILURE = 575 − 548.5 = 26.5

(ii) SPILLWAY DISCHARGE AT TIME OF FAILURE:

$$Q_S = 296 \text{ cfs}$$

(iii) BREACH OUTFLOW:

$$Q_B = \frac{8}{27}\sqrt{g}\, W_b\, Y_o^{\frac{3}{2}} = 21{,}560 \text{ cfs}$$

(iv) PEAK FAILURE OUTFLOW

THE BREACH WILL NOT INCLUDE THE SPILLWAY AND THEREFORE THE PEAK OUTFLOW WILL BE THE SUM OF THE SPILLWAY AND BREACH DISCHARGES:

$$Q_P = Q_S + Q_B = 296 + 21{,}560 \cong 22{,}000 \text{ cfs}$$

c) FLOOD DEPTH IMMEDIATELY D/S FROM DAM

$$d = 0.44\, Y_o = 11.7'$$

d) ESTIMATE OF D/S FAILURE CONDITIONS AT POTENTIAL IMPACT AREA:

THE PEAK FAILURE OUTFLOW WAS ROUTED THROUGH ONE REACH OF CHANNEL (SEE PROFILE, PAGE D-14); THE COMPUTATIONS AND STAGE-DISCHARGE, STORAGE-DISCHARGE

(II. 2. d, CONTINUED)

CURVES APPEAR ON PAGES D-15 THROUGH D-21. ATTENUATION OF THE PEAK FAILURE OUTFLOW ARISING FROM CHANNEL NET STORAGE WAS COMPUTED BY SUBTRACTING OUT STORAGE ABSTRACTED FROM THE CHANNEL DUE TO THE SPILLWAY DISCHARGE AT FAILURE. THE RESULTS OF THE ANALYSIS ARE:

% ATTENUATION OF PEAK FAILURE OUTFLOW AT POTENTIAL IMPACT AREA: (*NOTE: SEE SHEETS D-15 & D-19 FOR DETAILS)

$$(Q_{P_1} - Q_{P_2}) / Q_{P_1} \times 100 = (\underline{\quad} - 15.3)/\underline{\quad} 100 = \underline{\quad}$$

STAGE AT POTENTIAL IMPACT AREA: 10.7'

e) APPROXIMATE STAGE BEFORE FAILURE: 0.7'

f) RISE IN STAGE AT IMPACT AREA: 10'

III SELECTION OF TEST FLOOD

1) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES

a) SIZE: VOLUME = 116 AC-ft > 50

HEIGHT: 26.5 > 25'

SMALL

b) HAZARD POTENTIAL: BASED UPON DAM BREAK FAILURE FLOOD HAZARD CLASSIFICATION IS HIGH.

2) TEST FLOOD IS ½ PMF

Summary of Routing Computations

Routing of Lower Kohanza Lake Dam Breach Peak Failure Out Flow

$S = 55^{*} + 1.2''(.96)\frac{160}{3} = 116$ ac-ft ; initial storage abstraction = .5 ac-ft

Plotting positions :

$Q_{P_{21}} = 22{,}000\left(1 - \frac{(50 - .5)}{116}\right) = 12{,}300$

$Q_{P_{22}} = 22{,}000\left(1 - \frac{(34 - .5)}{116}\right) = 16{,}030$

$Q_{P_{23}} = 22{,}000\left(1 - \frac{(14 - .5)}{116}\right) = 19{,}820$

Initial stage in channel before failure : 0.7'

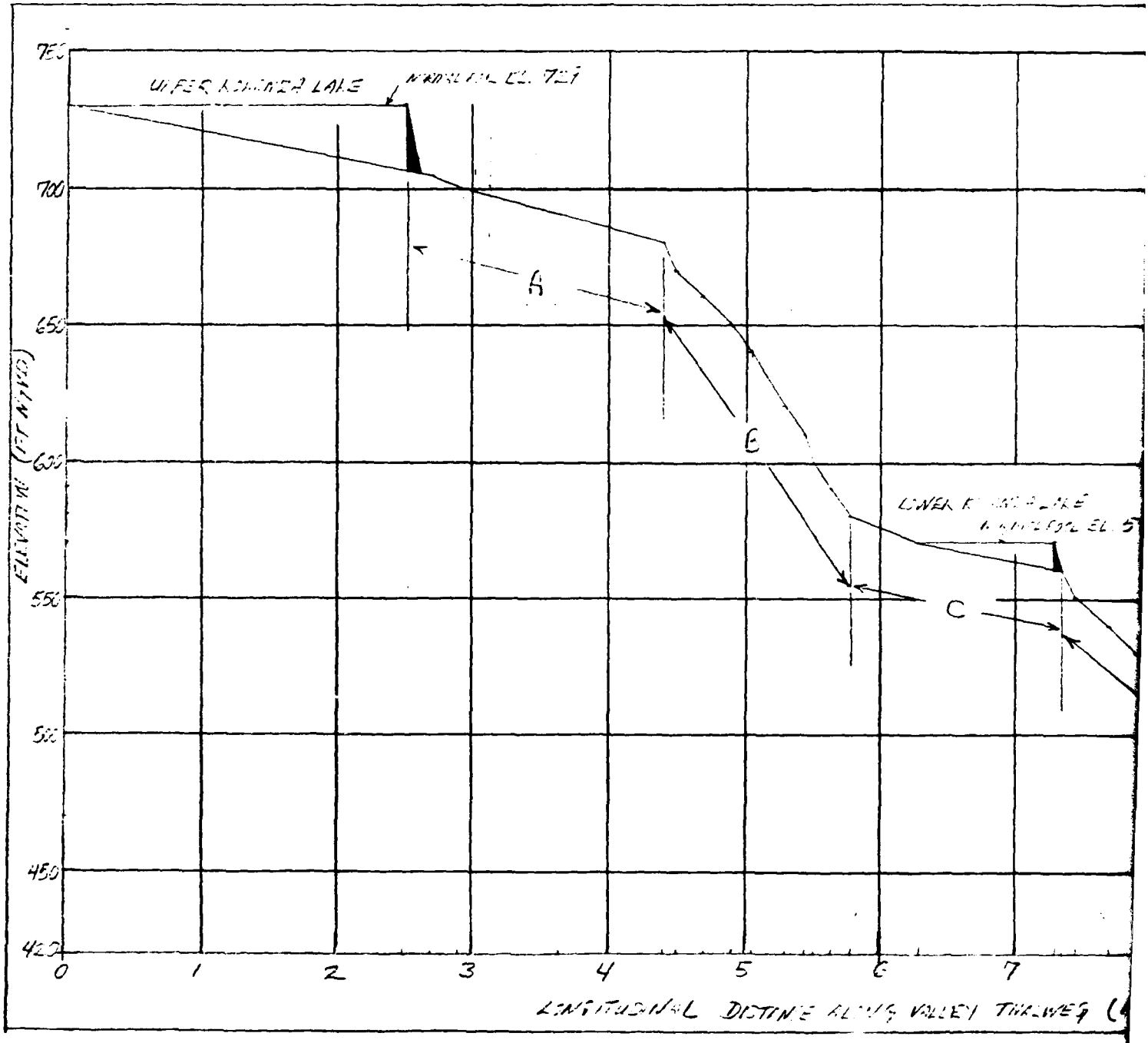
Routed peak failure outflow : 15,300

Storage in channel : 36 . ac.ft

Stage required to pass dam-break flood : 10.7'

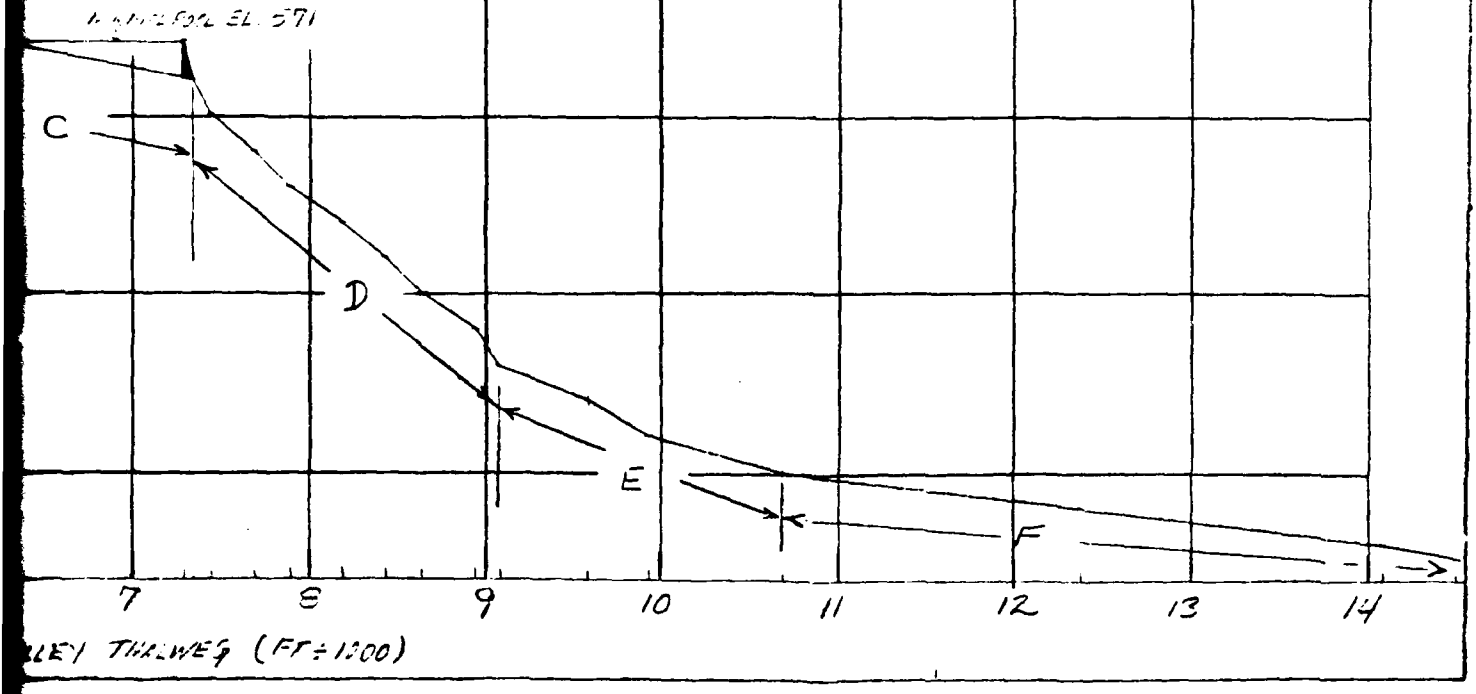
Increase in stage : 10.7 - .07 = 10'

* Storage volume below spillway crest approximated by $\frac{1}{4}AH = .25(9.96)22 = 55$ ac-ft.

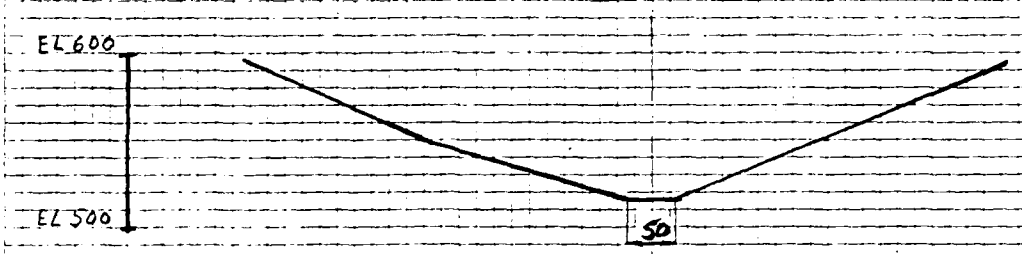

UPPER KINZUA LAKE
NORMAL POOL EL. 721
A
B
C
LOWER KINZUA LAKE
NORMAL POOL EL. 5
ELEVATION (CONTOUR) IN FEET
700
650
600
550
500
450
400
0
1
2
3
4
5
6
7
LONGITUDINAL DISTANCE ALONG VALLEY THALWEG

PROFILE OF KONKAPOT BROOK UPSTREAM OF INITIAL INVERT AREA

ROUTING REACH	LENGTH	AVERAGE SLOPE
A	1900	0.0142
B	1400	0.0714
C	1550	0.0129
D	1750	0.0457
E	1600	0.0188
F	3800	0.0053

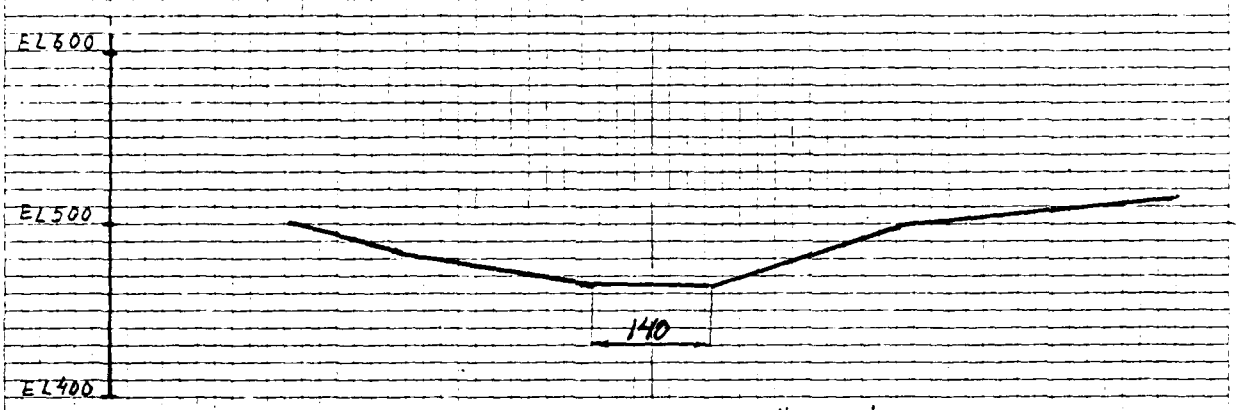


AVERAGE SECTION "D"



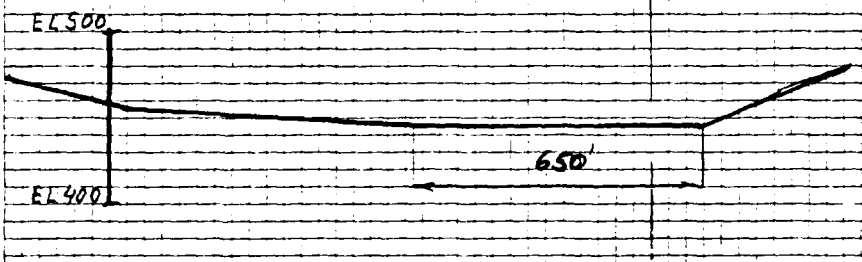
SCALE H 1"=200'
V 1"=100'

AVERAGE SECTION "E"

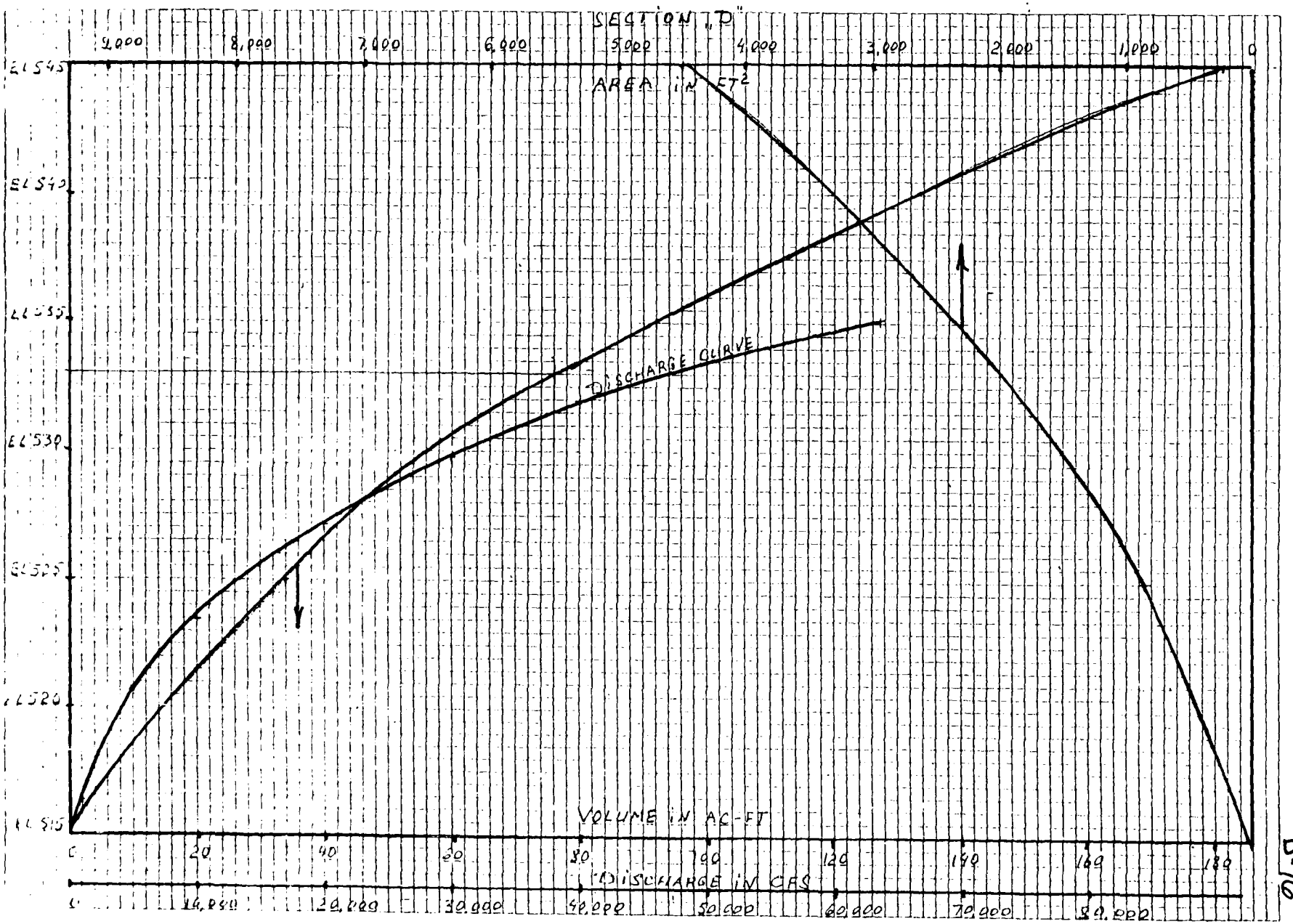


SCALE: H 1"=200'
V 1"=100'

AVERAGE SECTION "F"



SCALE: H 1"=400'
V 1"=100'


SECTION "D"
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
AREA IN FT²
EL 545
EL 540
EL 535
EL 530
EL 525
EL 520
EL 515
DISCHARGE CURVE
VOLUME IN AC-FT
0
20
40
60
80
100
120
140
160
180
DISCHARGE IN CFS
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000

D-16

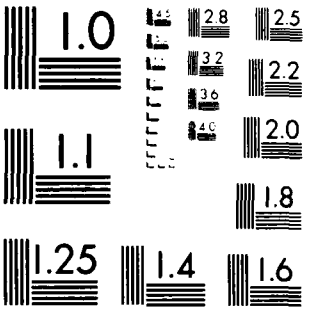
AD-A142 708 HOUSATONIC RIVER BASIN DANBURY CONNECTICUT LOWER KOHANZA DAM (CT 00064) N..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV MAY 81

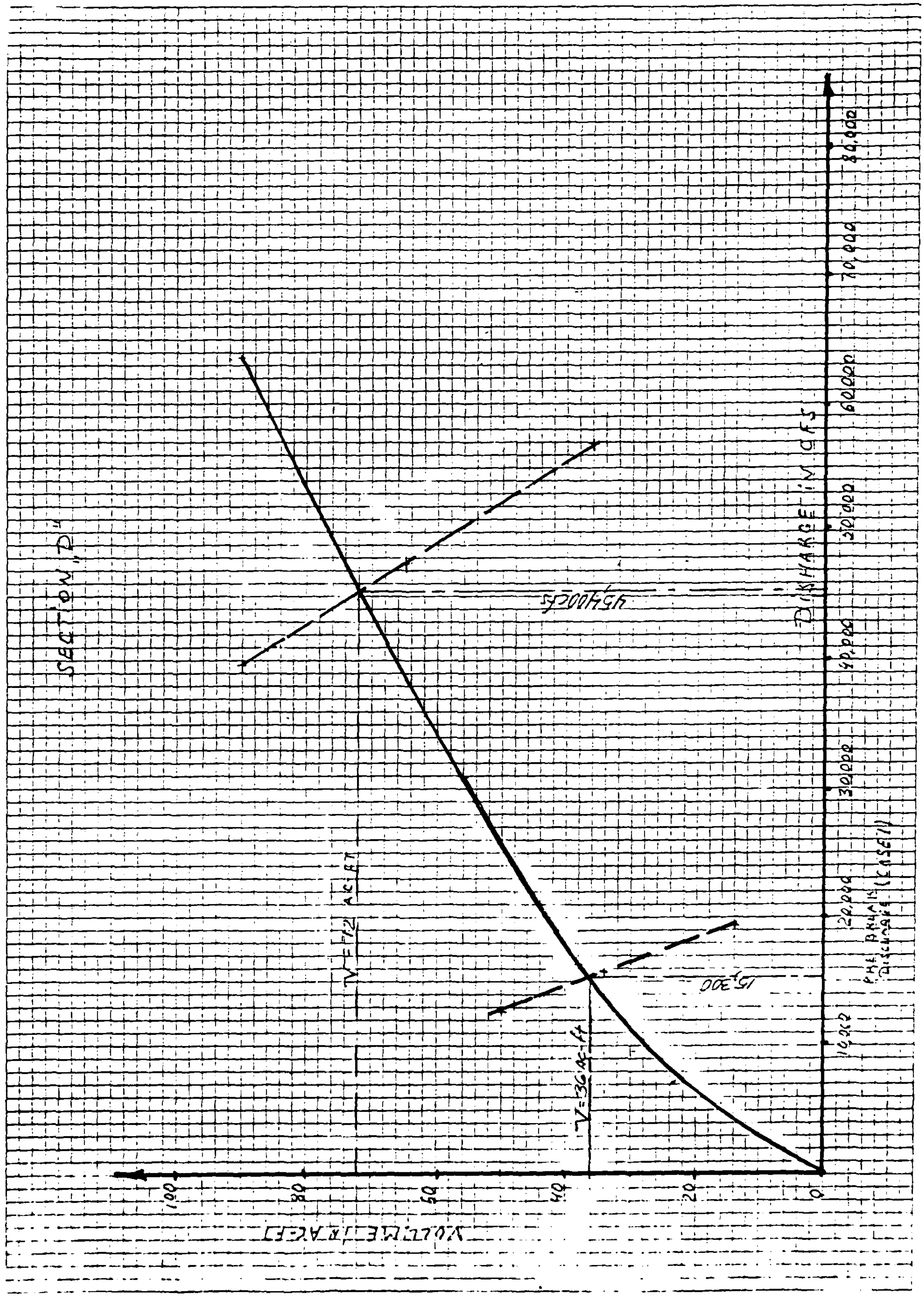
2/2

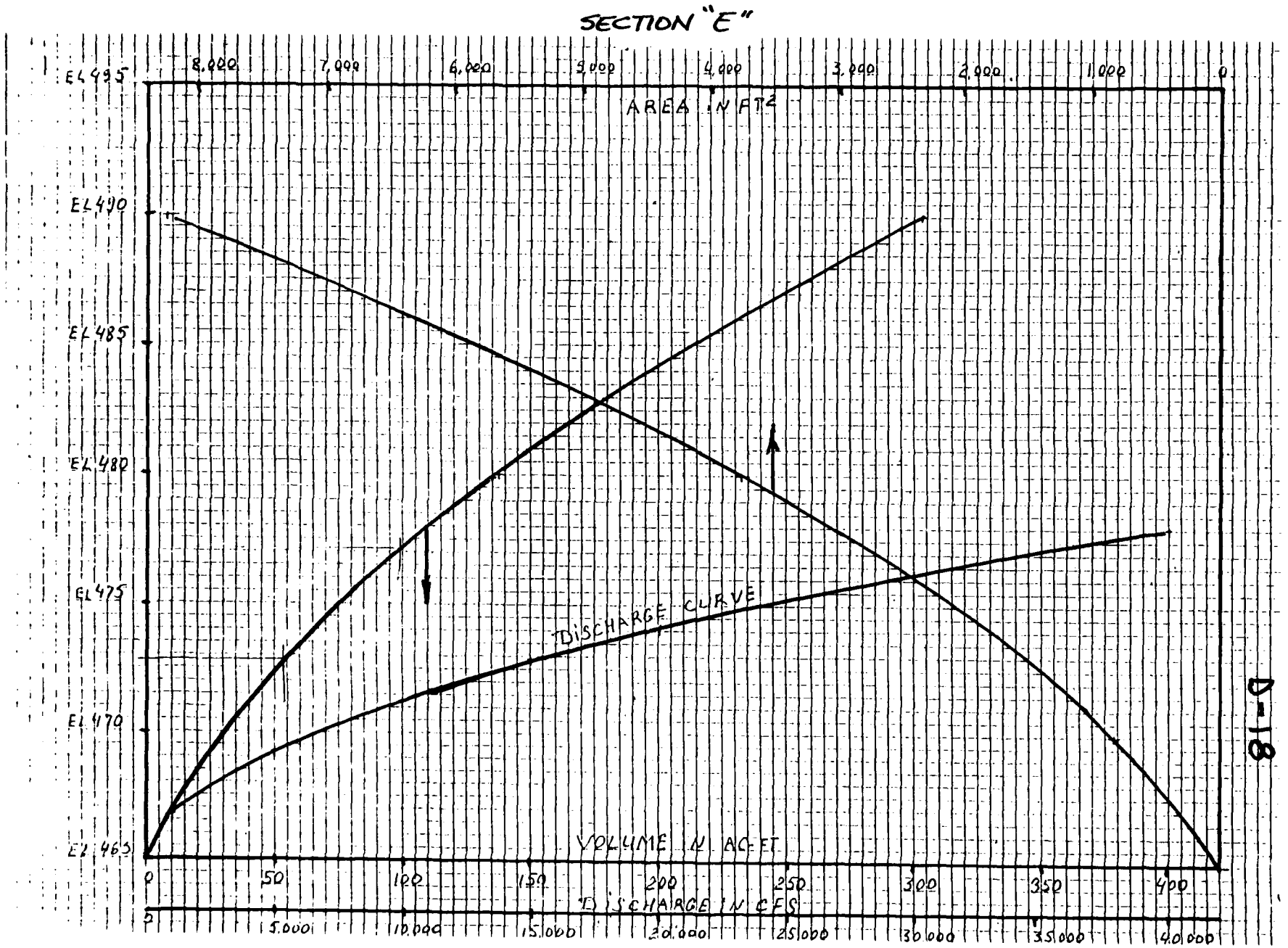
UNCLASSIFIED

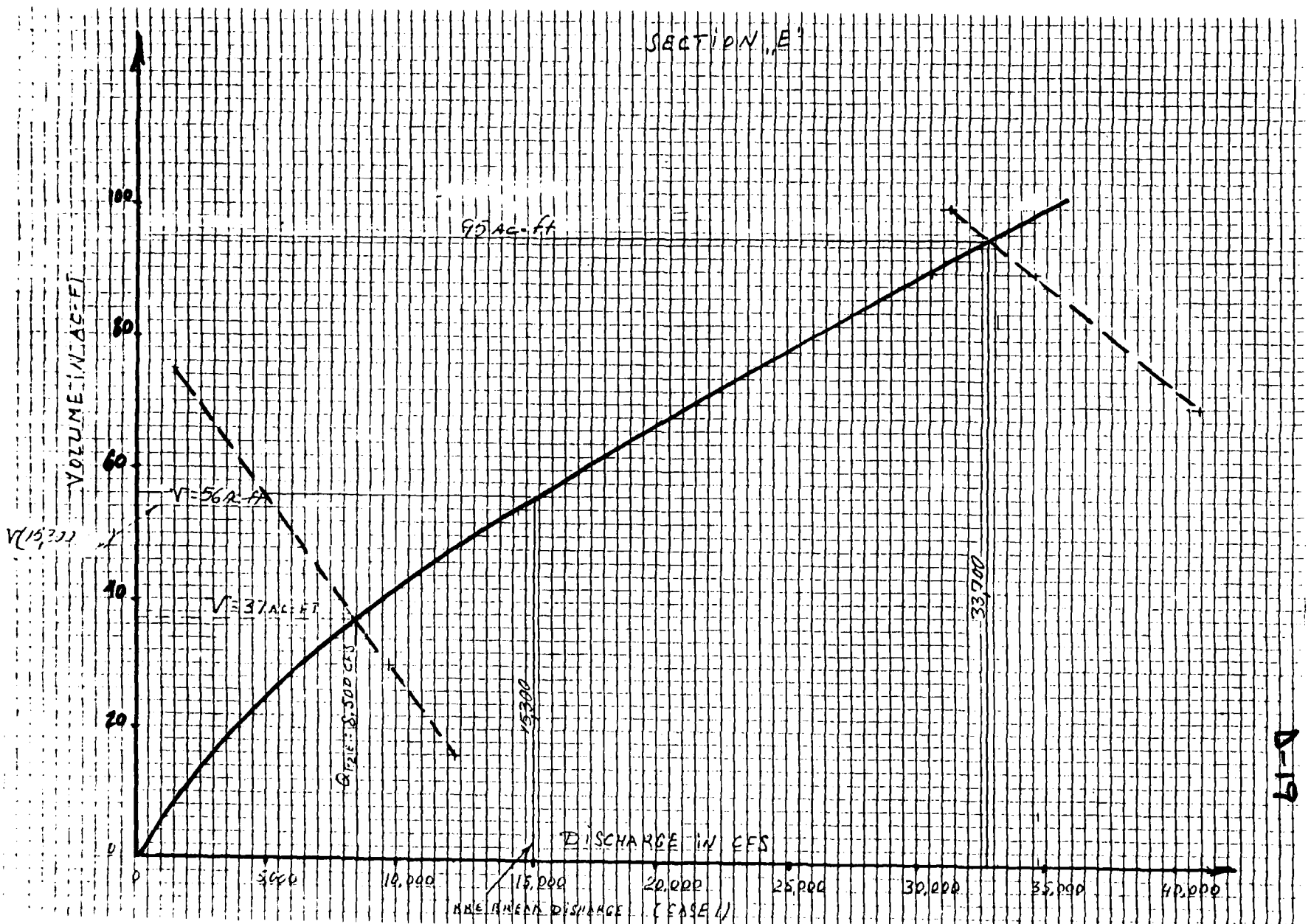
F/G 13/13 NL

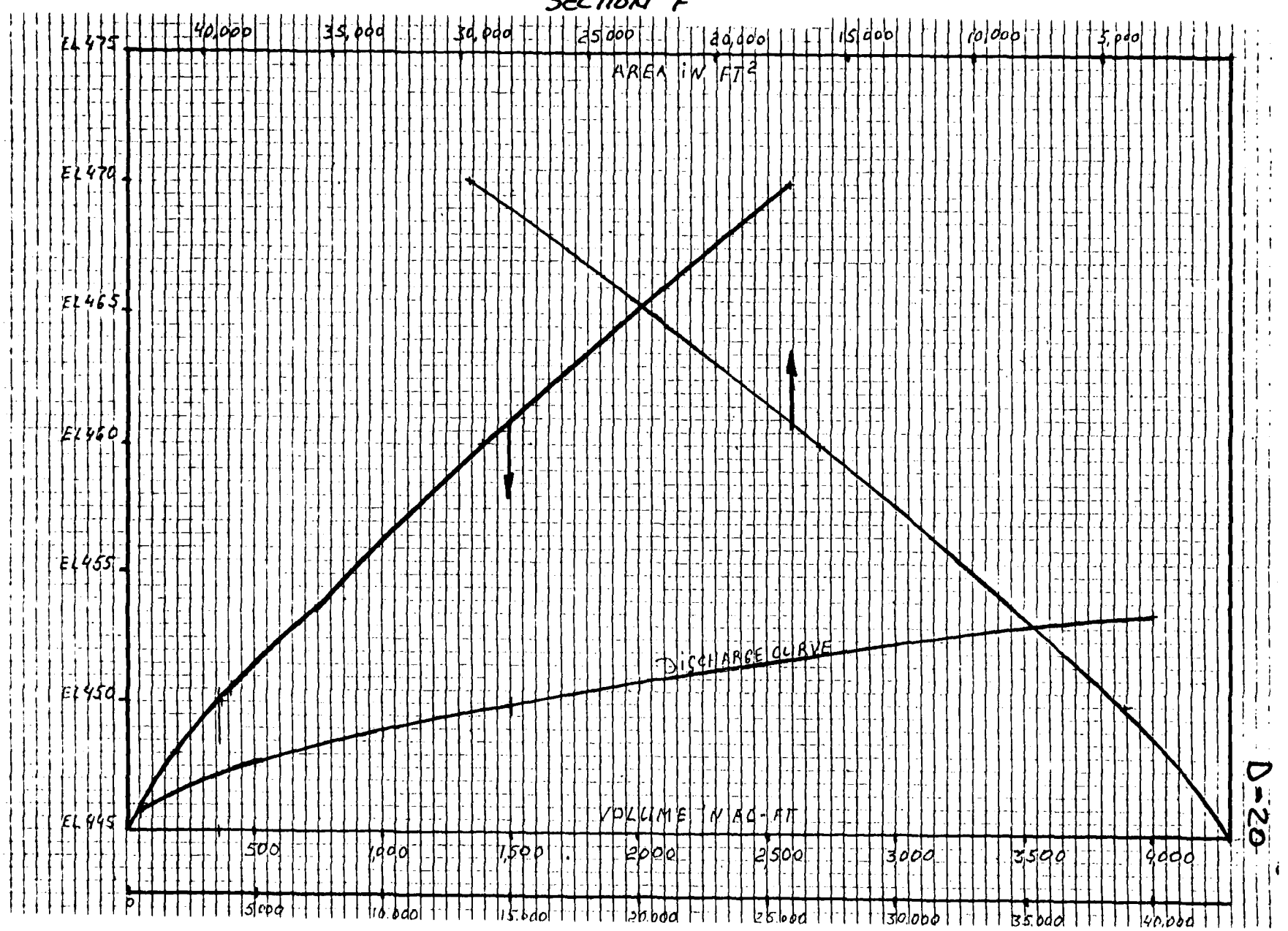
END
DATE FILMED
8 84
DTIC

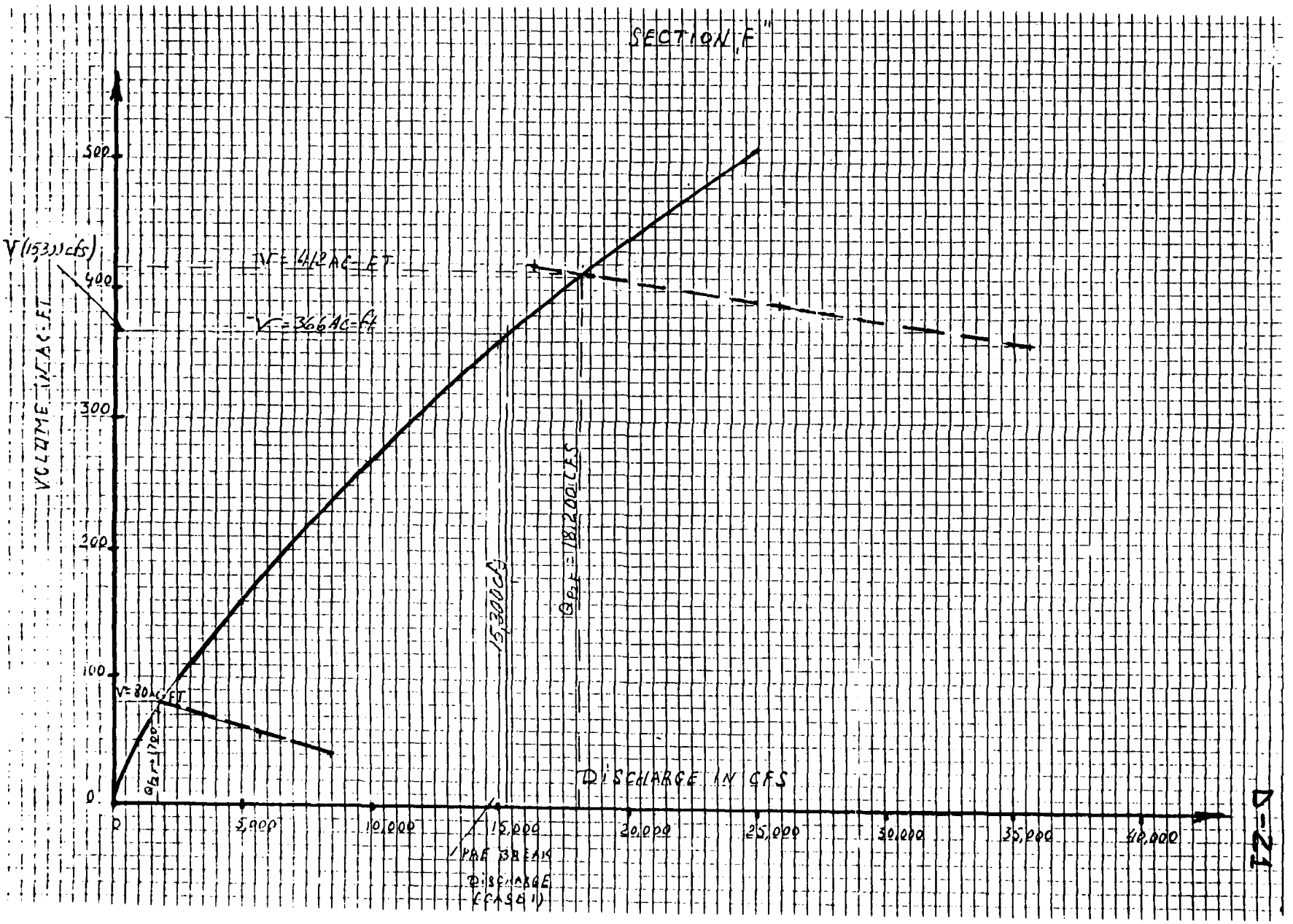



SECTION 'D'
DISCHARGE IN CFS
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
PRE BREACH DISCHARGE (CASE II)
45,400 cfs
15,300
V=72 AC-FT
V=36 AC-FT
0
20
40
60
80
100
VOLUME (AC-FT)


SECTION "E"
EL 495
EL 490
EL 485
EL 480
EL 475
EL 470
EL 465
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
AREA IN FT²
DISCHARGE CURVE
VOLUME IN ACFT
0
50
100
150
200
250
300
350
400
DISCHARGE IN CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000


SECTION "E"
VOLUME IN AC-FT
95 AC-FT
V=56 AC-FT
V=37 AC-FT
V(15,300)
Q(15,300 CFS)
15,300
33,700
DISCHARGE IN CFS
100
80
60
40
20
0
5000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
ALLOWABLE DISCHARGE (CASE 1)


SECTION "F"
EL 475
EL 470
EL 465
EL 460
EL 455
EL 450
EL 445
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
AREA IN FT²
DISCHARGE CURVE
VOLUME IN AC-FT
500
1,000
1,500
2000
2,500
3,000
3,500
4,000
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000


SECTION "F"
VOLUME IN AC-FT
V (15331 cfs)
500
400
300
200
100
0
V = 446 AC-FT
V = 366 AC-FT
V = 80 AC-FT
Qin = 1700
15,300 CFS
QPF = 18200 CFS
DISCHARGE IN CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
PEAK STREAM DISCHARGE (CFS)
D-23

APPENDIX E

INFORMATION AS CONTAINED IN THE

NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NED	CT	001	05				LOWER KOHANZA DAM	4124.9	7328.7			

POPULAR NAME	NAME OF IMPOUNDMENT
	LOWER KOHANZA LAKE

REG/SUBBASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY – TOWN – VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 10	KOHANZA BROOK	DANBURY	1	50781

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE FT.)	NORMAL (ACRE FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RE	1850	S	27	27	100	55	NED	N	N	N	N	

REMARKS

25 LOCATION OF FOUNDATION BOTTOM UNKNOWN

D S HAS	SPILLWAY LGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PRESENT (MW)	NAVIGATION LOCKS LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	450	U	14	296	27000										

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF DANBURY	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	CT DEP	CT DEP

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
INTERNATIONAL ENGINEERING CO INC	21	JAN	81	PL 92-367

REMARKS

33-34 ESTIMATES